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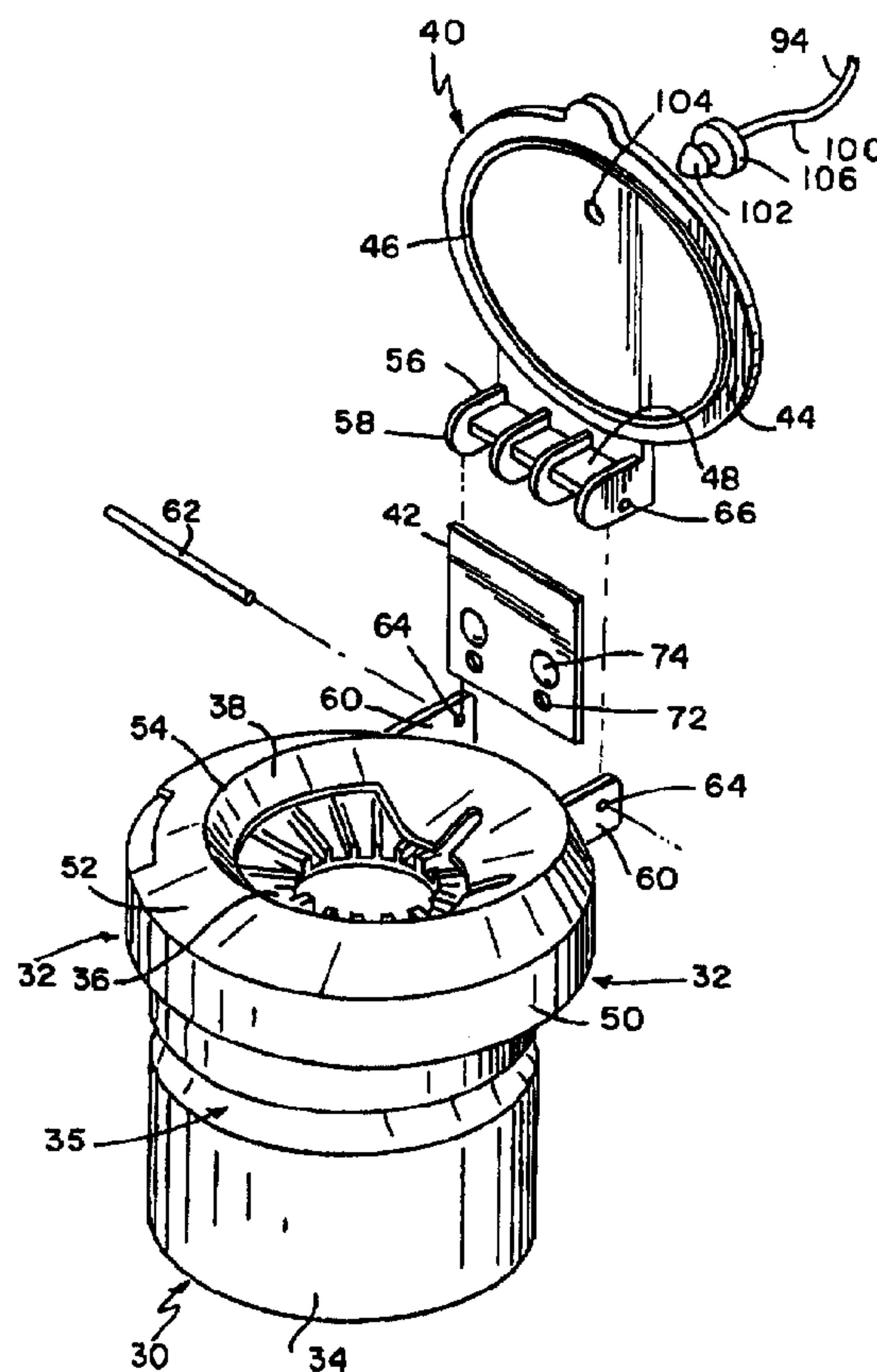
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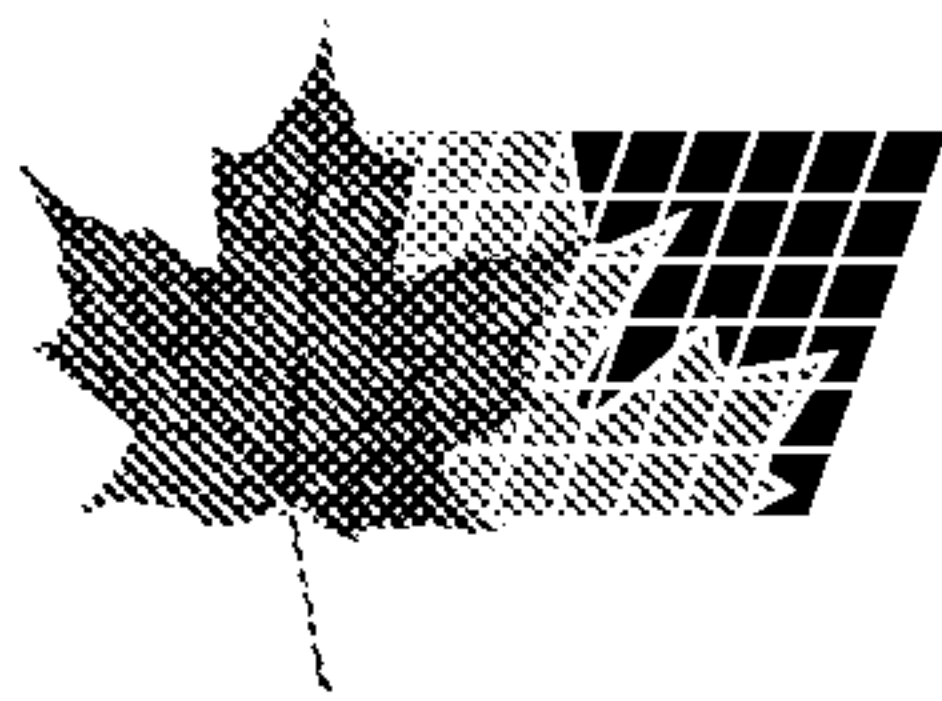
(54) **COUVERCLE ANTI-CONTAMINANTS POUR FERMETURE DU
GOULOT DE REMPLISSAGE D'UN RESERVOIR**

(54) **CONTAMINANT COVER FOR TANK FILLER NECK CLOSURE**



(57) Cette invention se rapporte à un ensemble fermeture de goulot de remplissage (30), qui comprend un dispositif de fermeture (32) conçu de façon à comporter un orifice (36) de réception de la lance de pompe à carburant et prévu pour être monté sur l'embouchure ouverte du goulot de remplissage (24). Un couvercle (40), monté pivotant sur le dispositif de fermeture (32), peut passer d'une première position couvrant l'orifice (36) de réception de la lance, afin d'obturer hermétiquement le goulot de remplissage (24), à une seconde position découvrant l'orifice (36) de réception de la lance, pour permettre l'accès à cet orifice. Un

(57) A filler neck closure assembly (30) includes a closure apparatus (32) formed to include a pump nozzle-receiving opening (36) and adapted to be mounted on an open mouth of a filler neck (24). A cover (40), pivotally mounted to the closure apparatus (32), is movable between a first position covering the nozzle-receiving opening (36) to seal the filler neck (24) and a second position uncovering the nozzle-receiving opening (36) to allow access thereto. An overcenter leaf spring (42) normally biases the cover (40) toward its first closed position. A tether (94) coupled to the cover (40) has its other end (96) coupled to a filler neck access door (90) so



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ressort à lame à bascule (42) sollicite en position normale le couvercle (40) dans sa première position fermée. Un lien souple (94) couplé au couvercle (40) est relié par son autre extrémité (96) à une porte d'accès (90) du goulot de remplissage, pour que cette porte d'accès (90) passe d'une position fermée bloquant l'accès au goulot de remplissage (24) à une position ouverte libérant l'accès audit goulot de remplissage (24), ledit couvercle (40) se déplaçant de la première position couvrant l'orifice (36) de réception de la lance à la seconde position découvrant ledit orifice (36) de réception de la lance.

that as the access door (90) is moved from a closed position blocking access to the filler neck (24) to an open position unblocking access to the filler neck (24), the cover (40) is moved from the first position covering the nozzle-receiving opening (36) to the second position uncovering the nozzle-receiving opening (36).

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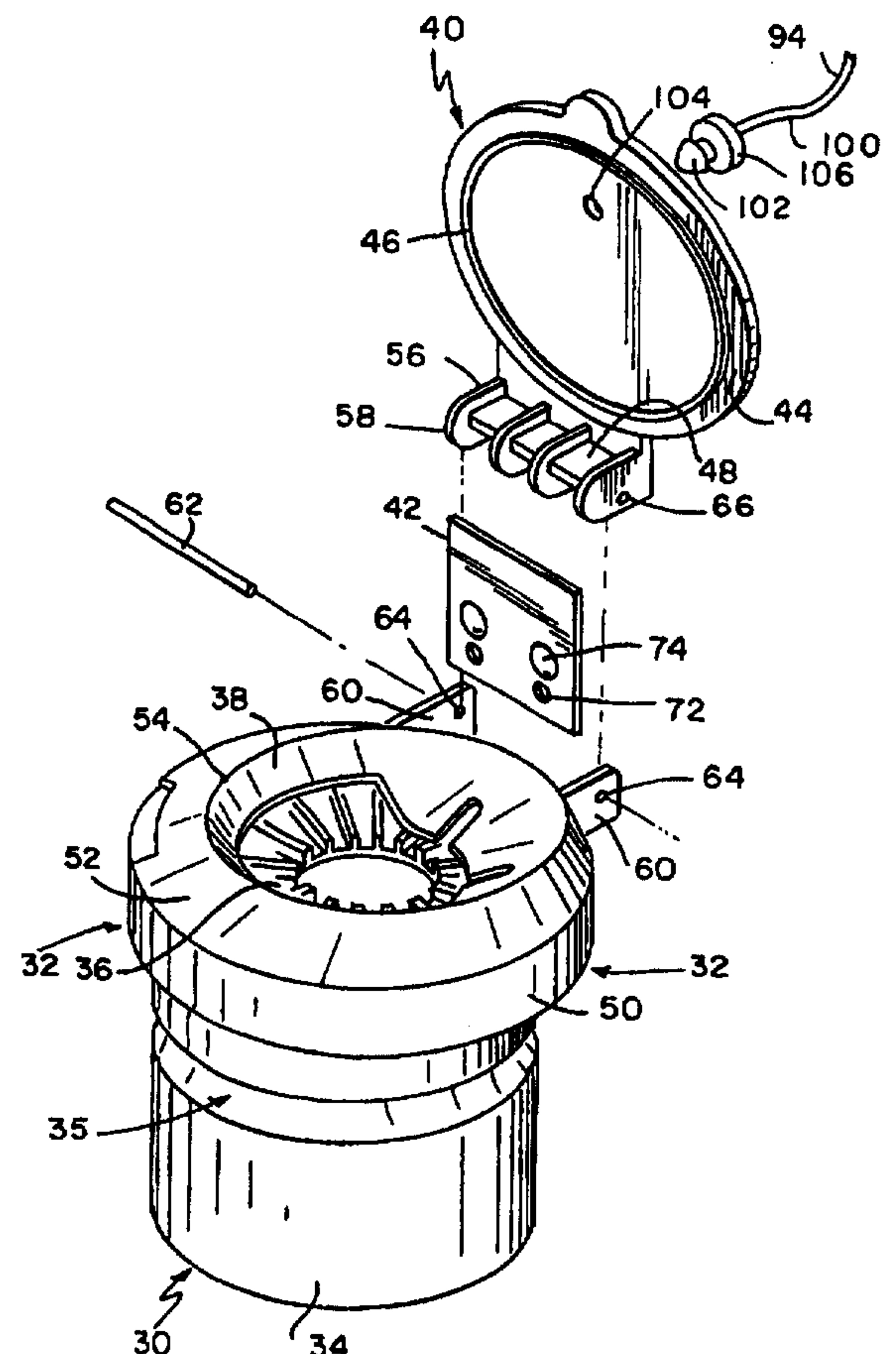
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(21) International Application Number: PCT/US98/07147 (22) International Filing Date: 8 April 1998 (08.04.98) (30) Priority Data: 60/042,713 8 April 1997 (08.04.97) US (71) Applicant (for all designated States except US): STANT MANUFACTURING INC. [US/US]; 1620 Columbia Avenue, Connersville, IN 47331-1696 (US). (72) Inventor; and (75) Inventor/Applicant (for US only): FOLTZ, Dean, C. [US/US]; 2016 Culbertson Road, Shelbyville, IN 46176 (US). (74) Agent: REZEK, Richard, A.; Barnes & Thornburg, 11 South Meridian Street, Indianapolis, IN 46204 (US).		(81) Designated States: CA, JP, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report.</i>

(54) Title: CONTAMINANT COVER FOR TANK FILLER NECK CLOSURE

(57) Abstract

A filler neck closure assembly (30) includes a closure apparatus (32) formed to include a pump nozzle-receiving opening (36) and adapted to be mounted on an open mouth of a filler neck (24). A cover (40), pivotally mounted to the closure apparatus (32), is movable between a first position covering the nozzle-receiving opening (36) to seal the filler neck (24) and a second position uncovering the nozzle-receiving opening (36) to allow access thereto. An overcenter leaf spring (42) normally biases the cover (40) toward its first closed position. A tether (94) coupled to the cover (40) has its other end (96) coupled to a filler neck access door (90) so that as the access door (90) is moved from a closed position blocking access to the filler neck (24) to an open position unblocking access to the filler neck (24), the cover (40) is moved from the first position covering the nozzle-receiving opening (36) to the second position uncovering the nozzle-receiving opening (36).



CONTAMINANT COVER FOR TANK FILLER NECK CLOSURE

Background and Summary of the Invention

The present invention generally relates to a filler neck closure assembly for a vehicle fuel tank, and particularly to a containment cover for closing a capless fuel tank filler neck. More particularly, the present invention relates to a closure assembly suitable for use with a robotic refueling system.

A removable fuel cap with a sealing gasket is typically used to close the open end of a fuel tank filler neck. It has been observed that fuel caps are often lost or damaged over time and, as a result, the open end of the filler neck might not be closed and sealed in accordance with the original equipment specifications during operation of the vehicle.

A robotic refueling system operates to detect a vehicle arriving at a vehicle-refueling station, open the vehicle fuel tank filler neck access door, locate a fuel tank filler neck in the vehicle, insert a fuel-dispensing nozzle automatically into the filler neck to introduce fuel in the fuel tank of the vehicle, withdraw the fuel dispensing nozzle after refueling and close the filler neck access door, all without any intervention by an attendant. The filler neck closure assembly of the present invention is particularly suited for use with such robotic refueling systems.

According to the present invention, a filler neck closure assembly is provided for a vehicle fuel tank filler neck. The filler neck closure assembly includes a closure apparatus formed to include a pump nozzle-receiving opening and adapted to be mounted on an open mouth of a filler neck. A cover, coupled to the closure apparatus, is movable between a closed position covering the nozzle-receiving opening to close the filler neck and an opened position uncovering the nozzle-receiving opening to allow access thereto. The cover is coupled to a tether that, when moved away from the filler neck and away from the closure apparatus, moves the cover from the closed position to the opened position.

In preferred embodiments, the closure apparatus includes an outer shell formed to include the nozzle-receiving opening and a conduit coupled to the outer shell to communicate with the nozzle-receiving opening and adapted to be coupled to a vehicle fuel tank filler neck. The closure apparatus further includes a sealable closure

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in the conduit that is normally closed to block discharge of fuel vapor from the filler neck to the atmosphere through the nozzle-receiving opening and that can be moved to an opened position by a fuel-dispensing nozzle during an initial stage of refueling. The cover is arranged to engage the outer shell and lie in spaced-apart relation to the sealable closure when the cover lies in the closed position.

Also in preferred embodiments, the cover is spring-loaded to "snap" to its closed or opened position. The closure apparatus includes an overcenter spring configured to bias the cover toward the closed position when the cover is positioned to lie between the closed position and a transition position between the closed and opened positions. The overcenter spring is also configured to bias the cover toward the opened position when the cover is positioned to lie between the transition position and the opened position.

The tether has its other end coupled to an inner wall of a pivotable filler neck access door mounted in the body panel of a vehicle. When the access door is opened by a vehicle owner, service station attendant, or robotic refueling system during a first stage of vehicle refueling, the filler neck cover is moved to the opened position uncovering the nozzle-receiving opening. A fuel-dispensing pump nozzle can then be inserted manually or robotically into the nozzle-receiving opening in the filler neck to open the sealable closure in the conduit and to dispense fuel into the filler neck for delivery to the fuel tank of the vehicle.

Additional features and advantages of the invention will become apparent to those skilled in the art upon consideration of the following detailed description of the preferred embodiments exemplifying the best mode of carrying out the invention as presently perceived.

Brief Description of the Drawings

The detailed description particularly refers to the accompanying figures in which:

Fig. 1 is a perspective view of a vehicle showing an outer filler neck access door moved to an opened position relative to a vehicle body panel to expose a filler neck closure assembly and showing a fuel-dispensing pump nozzle arranged for insertion into a filler neck through the filler neck closure assembly to dispense fuel into

a filler neck (shown in phantom) coupled to a fuel tank (shown in phantom) of the vehicle;

Fig. 2 is an enlarged perspective view of the filler neck closure assembly of Fig. 1 showing a closure apparatus including an outer shell configured to form a nozzle-guiding surface defining a nozzle-receiving opening and showing a tethered cover arranged to lie in an opened position away from the nozzle-receiving opening in the outer shell to allow the pump nozzle to be inserted through the nozzle-receiving opening into a conduit coupled to the outer shell and adapted to be coupled to the filler neck (shown in phantom);

Fig. 3 is an exploded perspective view of the filler neck closure assembly of Fig. 2 showing the outer shell, the conduit coupled to the outer shell, the cover, an overcenter leaf spring for biasing the cover, and a tether for connecting to the cover;

Fig. 4 is a side view of the filler neck closure assembly, taken along line 4-4 of Fig. 2, with a portion broken away, showing the cover coupled to tabs appended to the outer shell and showing the leaf spring (in phantom) arranged to bias the cover into a closed position;

Fig. 5 is a sectional side view of the filler neck closure assembly, taken along the line 5-5 in Fig. 4, showing the overcenter spring fully inserted into the slot in the outer shell, and further showing the overcenter spring being captured in place by a pair of molded-in posts disposed on the interior wall of the slot;

Fig. 6 is a sectional side view of the filler neck closure assembly of Fig. 4 showing the insertion of the overcenter leaf spring into a slot in the outer shell;

Fig. 7 is an exploded isometric view showing an alternative embodiment filler neck closure assembly including an outer shell, a pair of tabs appended to the outer shell, a cover, a pin for pivotably coupling the cover to the tabs, a leaf spring formed to include a pair of apertures, and a pair of screws arranged for insertion through respective apertures into threaded engagement with the outer shell to mount the leaf spring to the outer shell between the tabs;

Fig. 8 is a perspective view of the filler neck closure assembly of Fig. 2 showing the cover in the closed position, the outer access door (shown in phantom) of

the vehicle overlying the cover and also lying in a closed position, and a tether extending from the cover toward the access door;

Fig. 9 is a perspective view of the filler neck closure assembly similar to Fig. 8 showing the access door (shown in phantom) after it has been moved to an
5 opened position and showing the tethered cover positioned to lie in the opened position uncovering the nozzle-receiving opening formed in the outer shell to allow insertion of the fuel-dispensing pump nozzle into the filler neck through the nozzle-receiving opening;

Fig. 10 is a top plan view of the closure assembly of Figs. 1-3 and 8-9,
10 with portions broken away, showing the access door in a closed position blocking access to the filler neck, the cover also in the closed position blocking access to the nozzle-receiving opening, and the tether in a slack configuration lying between the cover and the access door;

Fig. 11 is a top plan view of the closure assembly similar to Fig. 10
15 showing the access door and the cover in a partly opened position and the tether in a taut condition lying between the cover and the access door;

Fig. 12 is a top plan view of the closure assembly similar to Fig. 11
showing the access door in an opened position allowing access to the filler neck, the cover in the opened position allowing insertion of the fuel-dispensing pump nozzle into
20 the filler neck through the nozzle-receiving opening, and the tether in a slack condition lying between the cover and the access door;

Fig. 12a is an enlarged sectional view of a portion of the closure assembly of Fig. 12 showing the overcenter spring biasing the cover toward the open position thereof;

Fig. 13 is a top plan view of the closure assembly similar to Fig. 12
25 showing the access door being moved from the opened position to a first partly closed position, the tether in a slack condition lying between the cover and the access door, and the cover being urged toward the opened position by the leaf spring to resist movement of the access door to its closed position;

Fig. 14 is a top plan view of the closure assembly similar to Fig. 13
30 showing the access door moved further toward the closed position to a second partly closed position, and showing the leaf spring now acting to bias the cover away from

the access door through an intermediate position (shown in phantom) and toward the closed position so as not to resist movement of the access door to its closed position;

Fig. 14a is an enlarged sectional view of a portion of Fig. 14 closure assembly showing the overcenter spring biasing the cover toward the closed position thereof;

Fig. 15 is a perspective view of another embodiment of the filler neck closure assembly in accordance with the present invention showing a compressible doughnut-shaped dust cover mounted on an inner wall of a filler neck access door, which has been moved to an opened position away from the filler neck;

Fig. 16 is a sectional view of the filler neck closure assembly of Fig. 15 showing the dust cover and the access door arranged to lie in a closed position so that the dust cover engages the outer shell of the filler neck closure assembly to prevent dust and debris from entering the filler neck through the nozzle-receiving opening;

Fig. 17 is a perspective view of a yet another embodiment of the filler neck closure assembly of the present invention showing a rectangular gasket mounted on the side wall of a vehicle and positioned to lie around an opening normally closed by the access door;

Fig. 18 is a sectional view of the filler neck closure assembly of Fig. 17 showing the filler neck access door pressing against the rectangular gasket to close the filler neck access opening to prevent dust from entering the filler neck through the nozzle-receiving opening;

Fig. 19 is a perspective view of still another embodiment of the filler neck closure assembly of the present invention, similar to the embodiment of Figs. 15 and 16, showing a resilient dust cover mounted on the filler neck access door and further showing the access door in an opened position away from the outer shell;

Fig. 20 is a side elevation view of the filler neck closure assembly of Fig. 19, with portions broken away, showing the access door in a closed position so that the dust cover engages an outer shell of the filler neck closure assembly to prevent dust and debris from entering the filler neck through a nozzle-receiving opening in the outer shell.

Detailed Description of the Drawings

As shown in Figs. 1 and 2, a vehicle 20 includes a fuel tank 22, a filler neck 24 extending from the fuel tank, and an opening 26 in the side wall 28 of the vehicle for providing access to a filler neck closure assembly 30. The closure assembly 30 includes an outer shell 32 mounted on a base 34 coupled to the open mouth of filler neck 24. In preferred embodiments, base 34 is substantially cylindrical and is formed to include a circumferential groove 35 that receives a radially inwardly extending annular bead 37 formed in filler neck 24 to couple closure assembly 30 to filler neck 24. However, it is within the scope of the invention as presently perceived for closure assembly 30 and filler neck 24 to have other structures or apparatus, such as, for example, threads, cams, or flanges, that mate to couple closure assembly 30 to filler neck 24.

A robotic refueling system 200 includes a pump nozzle 202 adapted for insertion into a nozzle-receiving opening 36 formed in outer shell 32, so that fuel can be pumped into fuel tank 22 through filler neck 24. Outer shell 32 has an inner, funnel-shaped nozzle-guiding surface 38 formed to define nozzle-receiving opening 36. Nozzle-guiding surface 38 facilitates insertion of nozzle 202 into filler neck 24 for refueling. Reference is made to a PCT Patent Application filed on February 11, 1998 (designating U.S.), Serial No. PCT/US 98/02876, incorporated by reference herein, for a more detailed description of a robotic refueling system of this type.

A cover 40 is pivotally mounted to outer shell 32 for motion between a closed position covering nozzle-receiving opening 36 (as shown in Figs. 8 and 10) and an opened position uncovering nozzle-receiving opening 36 (as shown in Figs. 9 and 12). As shown in Fig. 3, an overcenter leaf spring 42 in the form of a rectangular plate is secured to outer shell 32 to normally bias cover 40 toward the closed position. Cover 40 includes a circular seating portion 44, an annular rim portion 46 extending from the circular seating portion 44, and an offset hinge portion 48. Outer shell 32 has a cylindrical side wall 50, a sloping front wall 52, and a ridge-like seating surface 54 connecting front wall 52 with funnel-shaped nozzle-guiding surface 38. When cover 40 is arranged to lie in the closed position, leaf spring 42 urges seating portion 44 of cover 40 into engagement with seating surface 54 of outer shell 32, with rim portion 46 of cover 40 arranged to lie inside seating surface 54 of outer shell 32. Leaf spring

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42 is sufficiently stiff to ensure a tight seal between cover 40 and outer shell 32 to prevent dust from entering nozzle-receiving opening 36. Seating portion 44 of the cover 40 may be provided with a resilient foam pad (not shown) made, for example, from neoprene material) to provide a more secure sealing between cover 40 and outer
5 shell 32.

The mounting of cover 40 to outer shell 32 will now be described in more detail in conjunction with Fig. 3. The hinge portion 48 of cover 40 has a plurality of perpendicularly disposed arms 56 having arcuate cam surfaces 58 adapted for engagement with leaf spring 42, which leaf spring 42 is secured to side wall 50 of
10 outer shell 32 in the manner described below. Side wall 50 of outer shell 32 is provided with a pair of spaced-apart tabs 60 outwardly extending therefrom for receiving arms 56 of cover 40. A pin 62 is inserted through apertures 64 formed in the spaced-apart tabs 60 of outer shell 32 and through apertures 66 formed in arms 56 of cover 40 for pivotally mounting cover 40 to outer shell 32, with the leaf spring 42
15 engaging the cam surfaces 58 normally to bias cover 40 toward the closed position.

The mounting of overcenter leaf spring 42 to outer shell 32 will next be described in more detail with reference to Figs. 4-6. Side wall 50 of outer shell 32 is provided with a rectangular slot 68 into which leaf spring 42 is inserted. The rectangular slot 68 is dimensioned to ensure a tight seating of leaf spring 42 therein.
20 An interior wall 69 which defines slot 68 has a pair of molded-in posts 70 arranged for reception in the respective apertures 72 in leaf spring 42 when leaf spring 42 is inserted into slot 68. Leaf spring 42 is formed to include a pair of bumps 74 sized to take up the clearance between the walls of leaf spring 42 and the interior walls of the slot 68. The molded-in posts 70 have ramp portions 76 to facilitate insertion of leaf spring 42
25 into slot 68 and perpendicularly disposed edge portions 78 that snap into apertures 72 in leaf spring 42 to secure leaf spring 42 to outer shell 32. Although leaf spring 42 is secured to outer shell 32 in the particular manner described above, it will be seen from Fig. 7 that other suitable securing means, such as screws 80, can easily be substituted therefor and are within the scope of the invention.

30 An outer appearance or access door 90 is pivotally mounted to the side wall 28 of vehicle 20 (as shown in Figs. 10 through 14) for motion between closed and opened positions, respectively, blocking access to the filler neck access opening 26 (as

shown in Figs. 8 and 10) and allowing access to the filler neck access opening for refueling (as shown in Figs. 9 and 12). An overcenter spring 92 (shown in Figs. 10 through 14) extending between bosses 93 biases access door 90 toward the closed position if the access door 90 is positioned to lie between the closed position and an intermediate (or transition) position and toward the opened position if access door 90 is positioned to lie between the intermediate position and the second opened position. As can be seen in Figs. 10 through 14, an axis of rotation 91 of access door 90 is disposed in parallel and spaced-apart relationship with respect to an axis of rotation 41 of cover 40. However, it is within the scope of the invention as presently perceived for axis 41 to be somewhat non-parallel with axis 91.

Cover 40 and access door 90 are coupled to each other by a tether 94 of a suitable length and made from a flexible material. One end 96 of the tether 94 is fastened securely to the inside wall 98 of access door 90. As can be seen more clearly in Fig. 3, the other end 100 of tether 94 has an enlarged, frustoconical portion 102 that is passed through an opening 104 formed in cover 40 to secure tether 94 to cover 40 in a "releasable" manner. Tether 94 has a disc-shaped further portion 106 adjacent to frustoconical portion 102 to close opening 104 in cover 40 when frustoconical portion 102 is inserted therein to prevent dust from entering into the nozzle-receiving opening 36.

As shown diagrammatically in Figs. 10 through 14, the base 34 of the closure assembly 30 further includes a flapper door 110 pivotally mounted in an interior region 112 thereof in fluid communication with nozzle-receiving opening 36. Flapper door 110 is mounted for motion between first and second positions respectively closing and opening a nozzle-receiving aperture 114 disposed in the interior region 112 of the closure assembly 30. A torsion spring 116 biases the flapper door 110 toward the first position, thereby urging flapper door 110 against a seating surface 118 of the base 34 defining nozzle-receiving aperture 112. As can be seen from the drawings, the seating surfaces 54 and 118, respectively, for cover 40 and flapper door 110 are spaced apart and disposed in substantially opposite directions. When the pump nozzle 202 is inserted into filler neck 24 through closure assembly 30, tip 204 of the pump nozzle 202 engages flapper door 110 to displace it to the second position thereof against the bias of the torsion spring 116. The flapper door 110 serves

to prevent dust from entering the filler neck 24 and to prevent fuel vapor or fuel from escaping into the atmosphere. The afore-mentioned PCT Patent Application, Serial No. PCT/US 98/02876 illustratively describes a flapper door of this type and is incorporated herein by reference.

5 The operation of closure assembly 30 will now be described in more detail in conjunction with Figs. 10 through 14. As shown in Fig. 10, when cover 40 and access door 90 are in the closed position, tether 94 is slack. By allowing tether 94 to be slack, the independent movement of cover 40 is allowed with respect to access door 90. This, in turn, allows cover 40 to remain shut if access door 90 vibrates or
10 moves relative to cover 40 as vehicle 20 travels down, for example, a bumpy road. In addition, having cover 40 spaced apart from access door 90 prevents noise between access door 90 and cover 40 that would otherwise occur while vehicle 20 is driven.

As shown in Fig. 11, when access door 90 is opened in direction 82 against the bias of overcenter spring 92, tether 94 becomes taut and forces cover 40 to
15 open against a biasing force produced by leaf spring 42. As access door 90 continues opening in direction 82, leaf spring 42 resists opening so that tether 94 remains taut. This resistance continues until cover 40 and access door 90 reach "a transition" position. When cover 40 and access door 90 are moved beyond the transition position, leaf spring 42, in engagement with cam surfaces 58 (as shown in Fig. 12a), and the
20 overcenter spring 92 respectively force cover 40 and access door 90 to spring into a fully opened position, as shown in Fig. 12. At this point, tether 74 is once again slack.

When access door 90 is closed in direction 83, it engages cover 40 and pushes cover 40 to close in direction 83 against the bias of leaf spring 42 as shown in Fig. 13. When cover 40 is beyond the transition position, as shown in Figs. 14 and
25 14a, the overcenter spring 92 and leaf spring 42, respectively, urge access door 90 and cover 40 to snap into their respective closed positions.

When cover 40 is in the closed position, leaf spring 42 is in a straight, undeflected configuration as shown in Fig. 10. When cover 40 is in any position away from the closed position, cam surfaces 58 of arms 56 deflect leaf spring 42 as shown in
30 Figs. 11-14. Thus, leaf spring 42 includes a cover-driven portion 43 that engages arms 56, an anchor portion 45 that is retained in slot 68 between interior wall 69 and cylindrical side wall 50 of outer shell 32, and a bend or hinge portion 47

interconnecting portions 43, 45 as shown in Figs. 12a and 14a. Deflection of leaf spring 42 by arms 56 inherently creates internal stresses in leaf spring 42 which act to return leaf spring 42 back to its undeflected configuration. Thus, cover-driven portion 43 of leaf spring 42 exerts a force on arms 56 when leaf spring 42 is deflected.

5 Cam surfaces 58 of arms 56 are configured so that the force exerted on arms 56 due to deflection of leaf spring 42 produces a torque on cover 40 having a tendency to rotate cover 40 either toward the closed position or toward the opened position depending upon whether cover 40 is between the transition position and the closed position or between the transition position and the opened position,
10 respectively. For example, when the cover 40 is at a first intermediate point (shown in Fig. 13) disposed between the opened position shown in Fig. 12 and the transition position (not shown), the overcenter spring 42 in engagement with the cam surfaces 58 of the cover exerts a force 84 producing a clockwise torque 85 on cover 40 as shown in Fig 12a to urge cover 40 toward the opened position. In contrast, when cover 40 is
15 at a second intermediate point (shown in Fig. 11) disposed between the closed position shown in Fig. 10 and the transition position (not shown), overcenter spring 42 in engagement with cam surfaces 58 of cover 40 exerts a force 86 producing a counterclockwise torque 87 on the cover as shown in Fig. 14a to urge the cover 40 toward the closed position.

20 A reference plane 88, shown in Figs. 12a and 14a, that passes through axis 41 of cover 40 demarcates the point at which the force exerted by leaf spring 42 on cover 42 switches from producing one of torques 84, 88 to producing the other of torques 84, 88. When the force exerted by leaf spring 42 is coincident with reference plane 88, cover 40 is in the transition position.

25 Another embodiment of the closure assembly 130 of the present invention is shown in Figs. 15 and 16. Closure assembly 130 includes an outer shell 132 mounted on a base 134 attached to the open mouth of filler neck 124. Outer shell 132 has an inner, funnel-shaped nozzle-guiding surface 138 formed to define a nozzle-receiving opening 136. A flapper door 1110 is pivotally mounted in an interior region
30 1112 of base 134 for motion between first and second positions respectively closing and opening a nozzle-receiving aperture 1114. A torsion spring 1116 normally biases

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flapper door 1110 against a seating surface 1118 of base 134 defining the nozzle-receiving aperture 1114.

An access door 190 is pivotally mounted to a side wall 128 of the vehicle (not shown) for motion between first and second positions respectively
5 blocking access to a filler neck access opening 126 (as shown in Fig. 16) and unblocking access to the filler neck access opening (as shown in Fig. 15). An overcenter spring 192 (shown in Fig. 15) extends between bosses 193 and biases the access door 190 toward either the fully closed position or the fully open position depending on the position of the access door. A doughnut-shaped dust cover 140 is
10 mounted on the access door 190. The dust cover 140 has seating portions 142 and 144 adapted to respectively mate with seating surfaces 152 and 154 of the outer shell 132 when the access door 190 is closed in direction 191 to securely block the nozzle-receiving opening 136 as shown in Fig. 16.

When the access door is closed in direction 191, the overcenter spring
15 192 presses the dust cover 140 against the outer shell 132 to achieve a tight seal between the dust cover and the outer shell to prevent dust and debris from entering into the nozzle-receiving opening 136. An opening 148 in the dust cover 140, made from a resilient material, allows it to expand both inwardly and outwardly to further improve the tight seal between the dust cover and the outer shell 132. A suitable
20 material for the dust cover 140 is open-cell foam pad made from neoprene material.

Yet another embodiment of the closure assembly 230 of the present invention is shown in Figs. 17 and 18. The closure assembly 230 includes an outer shell 232 mounted on a base 234 attached to the open mouth of a filler neck 224. Outer shell 232 has an inner, funnel-shaped nozzle-guiding surface 238 formed to
25 define a nozzle-receiving opening 236. A flapper door 2110 is pivotally mounted in an interior region 2112 of the base 234 for motion between first and second positions respectively closing and opening a nozzle-receiving aperture 2114. A torsion spring 2116 normally biases the flapper door 2110 against a seating surface 2118 of the base 134 defining the nozzle-receiving aperture 2114.

30 A gasket 240, made of a resilient and continuous material such as rubber or closed cell foam, is secured to a side wall 228 of the vehicle (not shown) around a filler neck access opening 226. An access door 290 is pivotally mounted to

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the side wall 228 for motion between first and second positions respectively blocking access to the filler neck access opening 226 (as shown in Fig. 18) and unblocking access to the filler neck access opening (as shown in Fig. 17).

An overcenter spring 292 (shown in Fig. 17) extends between bosses
5 293 and biases the access door 290 toward either the fully closed position or the fully open position depending on the position of the access door. When the access door 290 is closed in direction 291, the overcenter spring 292 presses the access door against a seating surface 242 of the gasket 240 to achieve a tight seal between the gasket and the access door to prevent dust and debris from entering into the nozzle-
10 receiving opening 236.

Still another embodiment of the closure assembly 330 of the present invention, similar to the embodiment of Figs. 15 and 16, is shown in Figs. 19 and 20. The closure assembly 330 includes an outer shell 332, a base 334 to which outer shell 332 couples, and an O-ring seal 333 mounted on base 332. Closure assembly 330 is of
15 the type that mounts to a threaded portion 325 of a filler neck 324 so that O-ring seal 333 contacts and seals against an open mount 327 of portion 325, which also includes an unleaded discriminator opening 399 through which a pipe 398 of filler neck 324 is accessed.

An access door 390 is pivotally mounted to a side wall 328 of the
20 vehicle (not shown) for motion between first and second positions respectively blocking access to a filler neck access opening 326 (as shown in Fig. 20) and unblocking access to the filler neck access opening (as shown in Fig 19). An overcenter spring 392 (shown in Fig. 19) extends between bosses 393 and biases the access door 390 toward either the fully closed position or the fully open position
25 depending on the position of the access door.

A dust cover 340, made from a resilient closed cell foam material is mounted on the access door 390. The dust cover 340 has a seating portion 344 adapted to mate with a seating surface 354 of an outer shell 332 when the access door 390 is closed in direction 391 to block the nozzle-receiving opening 336. When the
30 access door 390 is closed in direction 391, the overcenter spring 392 presses the dust cover 340 against the outer shell 332 to achieve a tight seal between the dust cover

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and the outer shell to prevent dust and debris from entering into the nozzle-receiving opening 336.

Although the present invention has been described in detail with reference to certain preferred embodiments, variations and modifications exist within
5 the scope and spirit of the present invention as described and as defined in the following claims.



CLAIMS

1. A closure assembly for closing the open mouth of a filler neck,
the closure assembly comprising
5 closure apparatus formed to include a pump nozzle-receiving opening
and adapted to mount on an open mouth of the filler neck, and
a cover coupled to the closure apparatus and movable between a first
position covering the nozzle-receiving opening and a second position uncovering the
nozzle-receiving opening, the cover being adapted to couple to a tether that, when
10 moved away from the filler neck and away from the closure apparatus, moves the
cover from the first closed position to the second open position.
2. The assembly of claim 1, wherein the cover is formed to include
an aperture sized to receive a portion of the tether.
3. The assembly of claim 2, wherein the cover includes a
15 substantially circular portion and the aperture is formed in the circular portion.
4. The assembly of claim 1, wherein the cover is coupled to the
closure apparatus for pivoting movement.
5. The assembly of claim 4, wherein the cover pivots through a
transition position during movement between the first and second positions and further
20 comprising an overcenter spring coupled to the closure apparatus and engaging the
cover, the overcenter spring being configured to bias the cover toward the first
position when the cover is positioned to lie on a first side of the transition position, and
the overcenter spring being configured to bias the cover toward the second position
when the cover is positioned to lie on a second side of the transition position.
- 25 6. The assembly of claim 4, wherein the cover includes a seating
portion and a hinge portion appended to the seating portion and further comprising a
spring plate coupled to the closure apparatus and engaging the hinge portion to bias
the seating portion into contact with a seating surface of the closure apparatus when
the cover is in the first position.
- 30 7. The assembly of claim 6, wherein the closure assembly includes
a base and an outer shell coupled to the base, the outer shell includes a side wall and a
pair of spaced-apart tabs appended to the side wall and extending therefrom, the spring

plate is positioned to lie between the tabs, and the hinge portion of the cover is pivotally coupled to the tabs.

8. The assembly of claim 7, wherein the side wall of the outer shell includes a slot formed therein between the tabs to securely receive the spring plate.

5 9. The assembly of claim 8, wherein the interior wall of the slot has a portion arranged for engagement with a corresponding portion disposed on the spring plate when the spring plate is inserted into the slot to secure the spring plate to the outer shell.

10 10. The assembly of claim 8, wherein the interior wall of the slot has a post arranged for reception in an aperture disposed in the spring plate when the spring plate is inserted into the slot to secure the spring plate to the outer shell, and wherein the spring plate has a bump disposed thereon for engagement with the interior wall of the slot to take up any slack between the walls of the spring plate and the interior walls of the slot.

15 11. The assembly of claim 10, wherein the post formed on the interior wall of the slot has a ramp portion for facilitating insertion of the spring plate into the slot and a perpendicularly disposed edge portion that engages the walls of the aperture in the spring plate to lock the spring plate in place.

20 12. The assembly of claim 6, wherein the hinge portion of the cover is formed to include a cam surface that bends the spring plate during movement of the cover between the first and second positions.

13. The assembly of claim 4, wherein the closure apparatus includes a side wall and a pair of spaced-apart tabs appended to the side wall and extending therefrom and the cover is pivotally coupled to the tabs.

25 14. The assembly of claim 1, wherein the closure apparatus includes a side wall and a front wall appended to the side wall, the front wall is formed to include a ridge, and the cover abuts the ridge when the cover is in the first position.

30 15. The assembly of claim 14, wherein the cover includes a seating portion and a rim portion extending from the seating portion, the seating portion abuts the ridge when the cover is in the first position, and the rim is positioned to lie adjacent to the ridge when the cover is in the first position.

16. The assembly of claim 1, wherein the closure apparatus includes an interior region in fluid communication with the nozzle-receiving opening and the cover is positioned to lie outside the interior region.

17. The assembly of claim 16, further comprising a flapper door
5 coupled to the closure apparatus and positioned to lie in the interior region, the flapper door being movable between first and second positions respectively closing and opening a nozzle-receiving aperture disposed in the interior region.

18. The assembly of claim 17, wherein the closure assembly
10 includes a seating surface in the interior region defining the nozzle-receiving aperture, the flapper door is biased against the seating surface when in the respective first position, and the cover is biased against the closure apparatus when in the respective first position.

19. A closure assembly for closing the open mouth of a filler neck
of a vehicle, the closure assembly comprising
15 closure apparatus formed to include a pump nozzle-receiving opening and adapted to mount on an open mouth of the filler neck,
a cover coupled to the closure apparatus and movable between a first position covering the nozzle-receiving opening and a second position uncovering the
nozzle-receiving opening, and
20 a coupler coupled to the cover and adapted to couple to a filler neck access door of the vehicle so that, as the coupler is moved by the access door during movement of the access door from a closed position blocking access to the filler neck to an open position allowing access to the filler neck, the cover is moved from the first position to the second position by the coupler.

20. The assembly of claim 19, wherein the coupler is a tether.

21. The assembly of claim 20, wherein the tether includes a first end
coupled to the cover and a second end adapted to be coupled to the access door of the
vehicle.

22. The assembly of claim 21, wherein the cover is formed to
30 include an aperture and a portion of the first end of the tether is received in the aperture.

23. The assembly of claim 19, wherein the cover has a transition position between the first and second positions and further comprising an overcenter spring coupled to the closure apparatus and engaging the cover, the overcenter spring being configured to bias the cover toward the first position when the cover is
5 positioned to lie on a first side of the transition position, and the overcenter spring being configured to bias the cover toward the second position when the cover is positioned to lie on a second side of the transition position.

24. A closure door system for a filler neck of a vehicle, the system comprising
10 a closure apparatus formed to include a pump nozzle-receiving opening, the closure apparatus being mounted on an open mouth of the filler neck,
a first door coupled to the closure apparatus and movable between a first position covering the nozzle-receiving opening and a second position uncovering the nozzle-receiving opening,
15 a filler neck access door coupled to the vehicle and movable between a closed position blocking access to the filler neck and an open position allowing access to the filler neck, and
a link coupled to the first door and coupled to the access door so that, as the access door is moved from the closed position to the open position, the first
20 door is moved from the first position to the second position.

25. The system of claim 24, wherein the access door pivots relative to the vehicle about a first pivot axis and the first door is pivotally coupled to the closure apparatus for movement about a second pivot axis that is substantially parallel to and spaced from the first pivot axis.

25 26. The system of claim 24, wherein the first door has a transition position between the first and second positions and further comprising a spring coupled to the closure apparatus and engaging the first door, the spring being configured to bias the first door away from the access door when the first door is on a first side of the transition position and the overcenter spring being configured to bias
30 the first door toward the access door when the first door is on a second side of the transition position.

27. The system of claim 24, further comprising a flapper door coupled to the closure apparatus and movable between a first position closing a nozzle-receiving aperture and a second position opening the nozzle-receiving aperture.

28. The system of claim 27, wherein the closure apparatus includes
5 an interior region in fluid communication with the nozzle-receiving aperture, the flapper door is positioned to lie in the interior region, and the first door is positioned to lie outside the interior region.

29. The system of claim 27, wherein the closure assembly includes a seating surface, the flapper door engages the seating surface when in the respective
10 first position, and the seating surface is positioned to lie between the flapper door and the first door.

30. The system of claim 27, wherein the closure assembly includes first and second seating surfaces spaced apart from each other, the first door engages the first seating surface when in the respective first position, and the flapper door
15 engages the second seating surface when in the respective first position.

31. The system of claim 30, wherein the first and second seating surfaces face in substantially opposite directions.

32. The system of claim 30, wherein the first seating surface faces toward the access door and the second seating surface faces away from the access
20 door.

33. A closure door system for a filler neck of a vehicle, the system comprising

a closure apparatus formed to include a passage in the interior region thereof in communication with a nozzle-receiving opening therein, the closure
25 apparatus being mounted on an open mouth of the filler neck,

a first door coupled to the vehicle and movable between a closed position blocking access to the closure apparatus and an open position allowing access to the closure apparatus,

a second door coupled to the closure apparatus and movable between a
30 first position blocking access to the nozzle-receiving opening and a second position allowing access to the nozzle-receiving opening,

a third door mounted in the interior region of the closure apparatus and movable between a first position closing access to the interior passage and a second position allowing access to the interior passage, and

a link coupled to the first and second doors so that, as the first door is
5 moved from the closed position to the open position, the second door is moved from the access-blocking position to the access-unblocking position.

34. The system of claim 33, wherein the link is a tether.

35. The system of claim 34, wherein the tether has first and second ends respectively coupled to the first and second doors.

10 36. The system of claim 33, wherein the first door is pivotally mounted to the vehicle for rotation about a first axis and the second door is pivotally mounted to the closure apparatus for rotation about a second axis that is substantially parallel to and spaced from the first axis.

37. The system of claim 36, wherein the second door has a
15 transition position between the first and second positions thereof and further comprising an overcenter spring coupled to the closure apparatus and engaging the second door, the overcenter spring being configured to bias the second door toward the first position when the second door is positioned to lie on a first side of the transition position, and the overcenter spring being configured to bias the second door
20 toward the second position when the second door is positioned to lie on a second side of the transition position.

38. The system of claim 33, wherein the closure assembly includes first and second seating surfaces spaced apart from each other, the second door engages the first seating surface when in the respective first position, and the third
25 door engages the second seating surface when in the respective first position.

39. The system of claim 38, wherein the first and second seating surfaces face in substantially opposite directions.

40. The system of claim 38, wherein the first seating surface faces toward the first door and the second seating surface faces away from the first door.

30 41. A closure door system for a filler neck of a vehicle, the system comprising:

a closure apparatus including a base mounted on an open mouth of the filler neck and an outer shell mounted on the base, the base having a passage in the interior region thereof in communication with a nozzle-receiving opening formed in the outer shell,

5 a filler neck access door coupled to the vehicle and movable between a closed position blocking access to the nozzle receiving opening and an open position allowing access to the nozzle receiving opening,

a spring for biasing the access door toward the closed position,

10 a flapper door mounted in the interior region of the base and movable between a first position closing access to the interior passage and a second position allowing access to the interior passage, and

a resilient dust cover mounted on the access door for sealingly engaging the outer shell when the access door is closed, with the spring pressing the dust cover against the outer shell.

15 42. The system of claim 41, wherein the outer shell has a seating surface facing toward the access door, and wherein the dust cover has a seating portion adapted to sealingly engage the seating surface of the outer shell when the access door is closed.

20 43. The system of claim 42, wherein the dust cover has an opening therein to allow the dust cover to expand both inwardly and outwardly when the dust cover is pressed against the outer shell to ensure a tight seal between the dust cover and the outer shell.

25 44. The system of claim 43, wherein the base has a seating surface disposed in the interior passage thereof facing away from the access door, and wherein the flapper door and the dust cover respectively engage the seating surfaces of the base and the outer shell in the respective first positions thereof.

45. A closure door system for a filler neck of a vehicle, the system comprising:

30 a closure apparatus formed to include a passage in the interior region thereof in communication with a nozzle-receiving opening formed therein, the closure apparatus being mounted on an open mouth of the filler neck,

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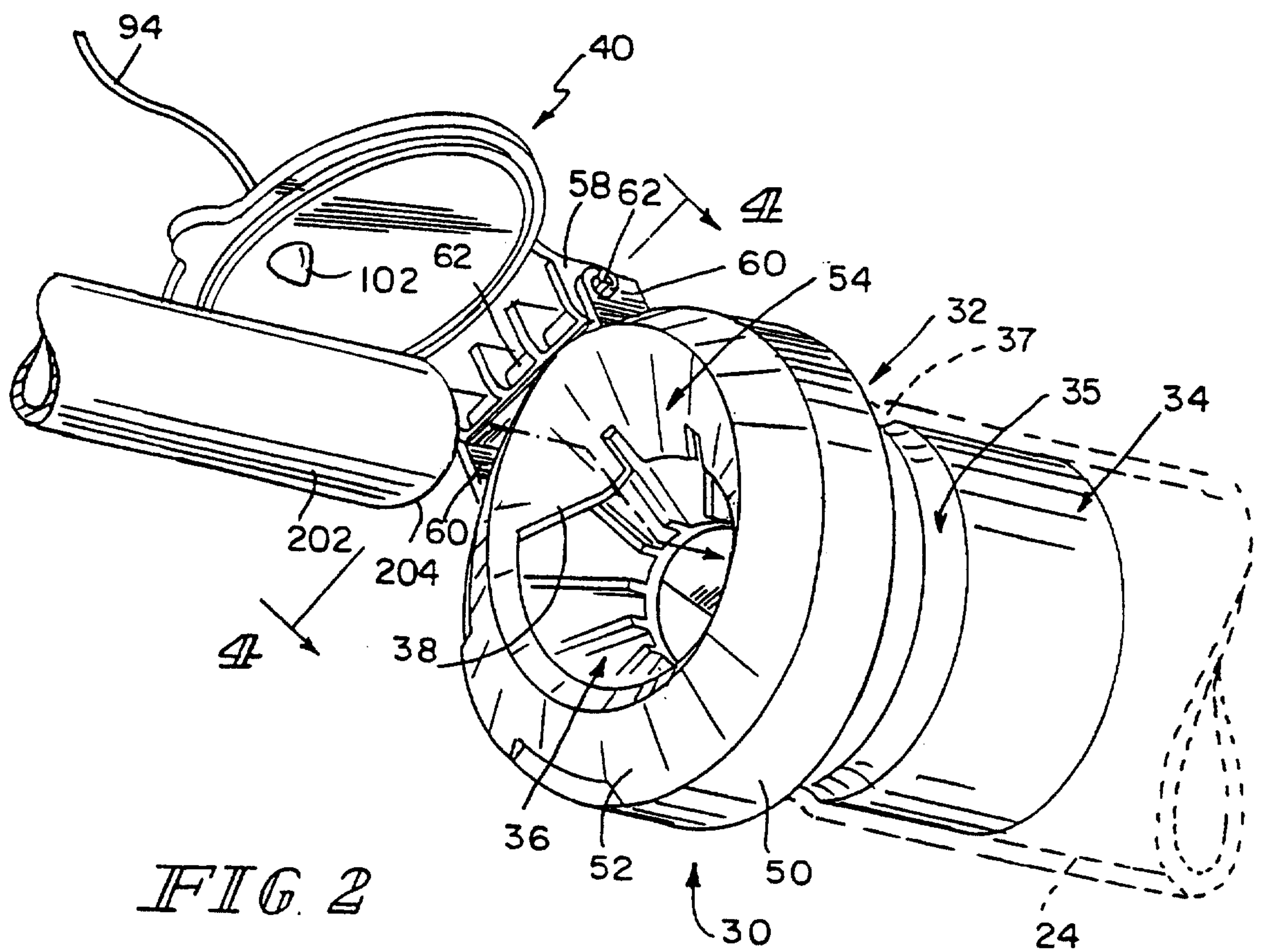
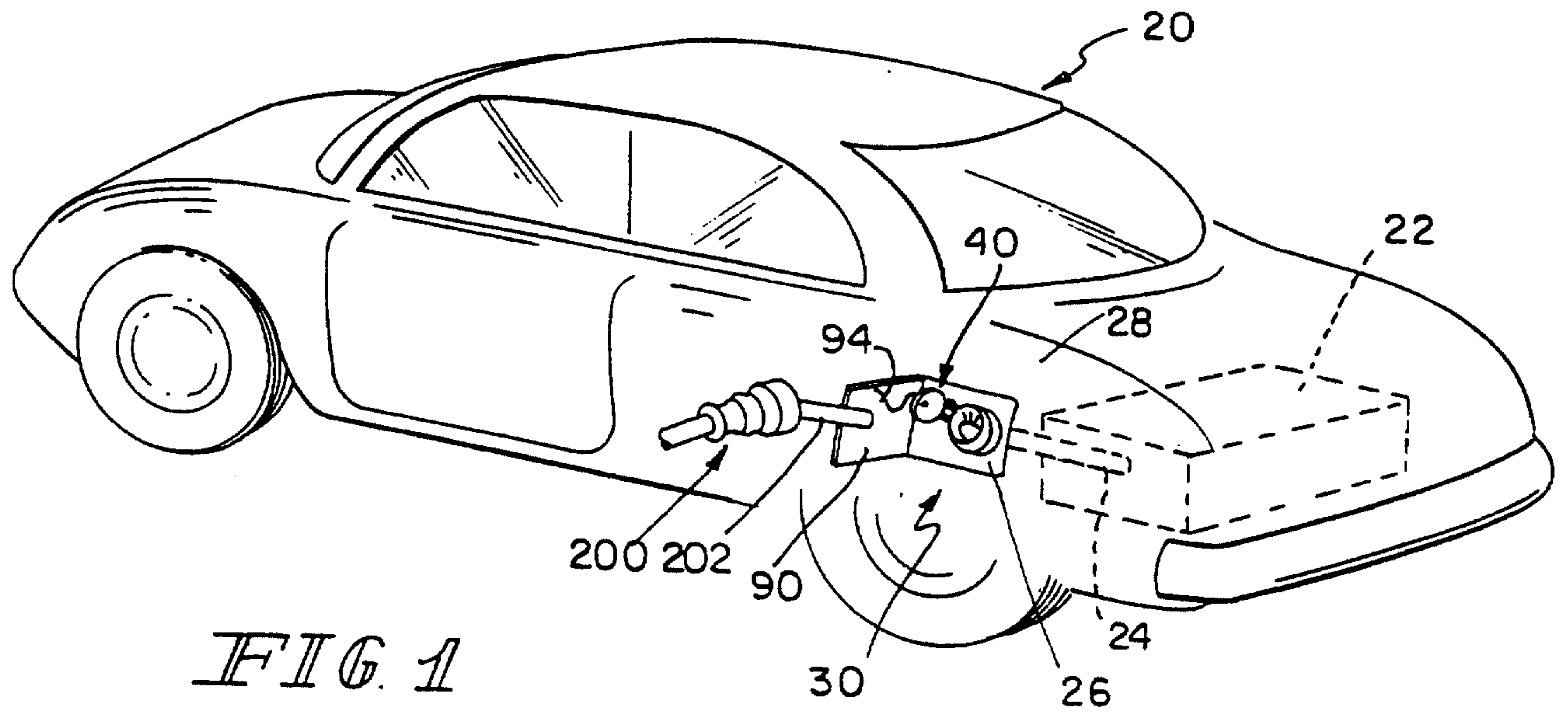
an access door mounted to a side wall of the vehicle and movable between a first closed position blocking access to the closure apparatus and a second open position allowing access to the closure apparatus through a filler neck access opening in the side wall,

5 a spring for biasing the access door toward the closed position,
 a flapper door mounted in the interior region of the closure apparatus and movable between a first position closing access to the interior passage and a second position allowing access to the interior passage, and

 a resilient gasket secured to the side wall around the filler neck access
10 opening therein for sealingly engaging the access door when closed, with the spring biasing the access door against the gasket.

46. The system of claim 45, wherein the resilient gasket is made from a rubber material.

47. The system of claim 45, wherein the resilient gasket has a
15 seating surface facing toward the access door and the closure apparatus has a seating surface facing away from the access door, and wherein the access door and the flapper door respectively engage the seating surfaces of the gasket and the closure apparatus in their respective first positions.



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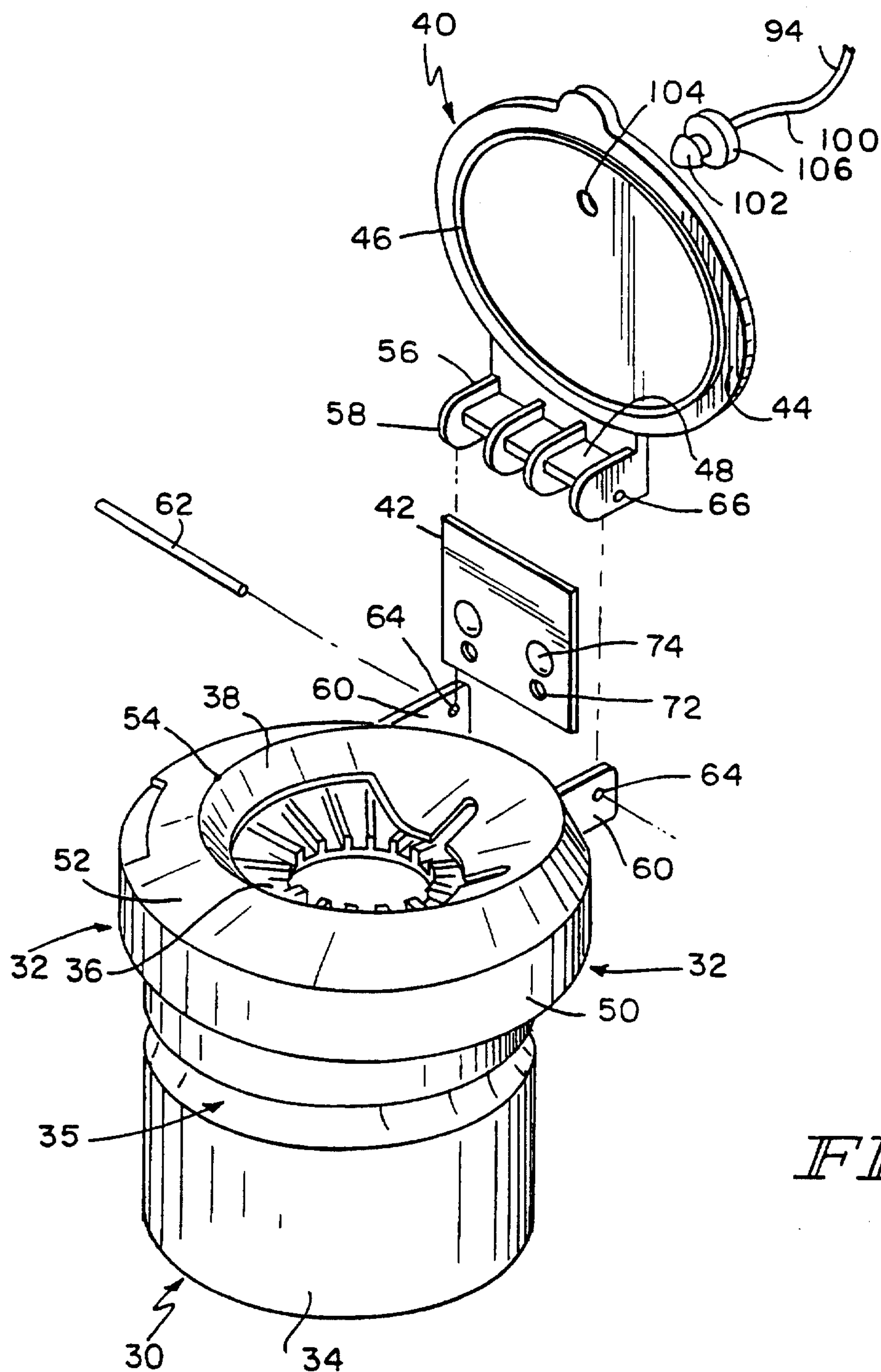


FIG. 3

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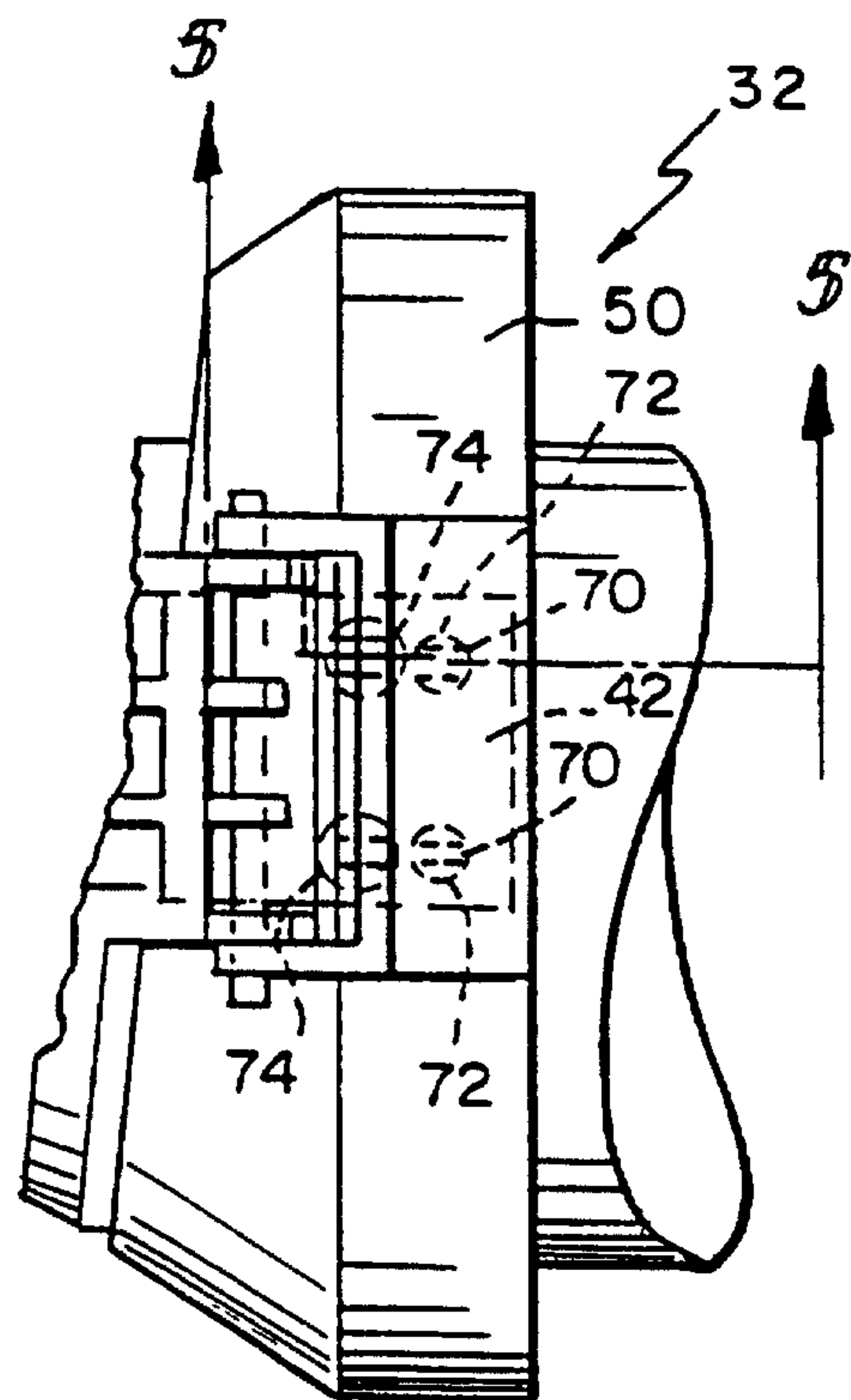


FIG. 4

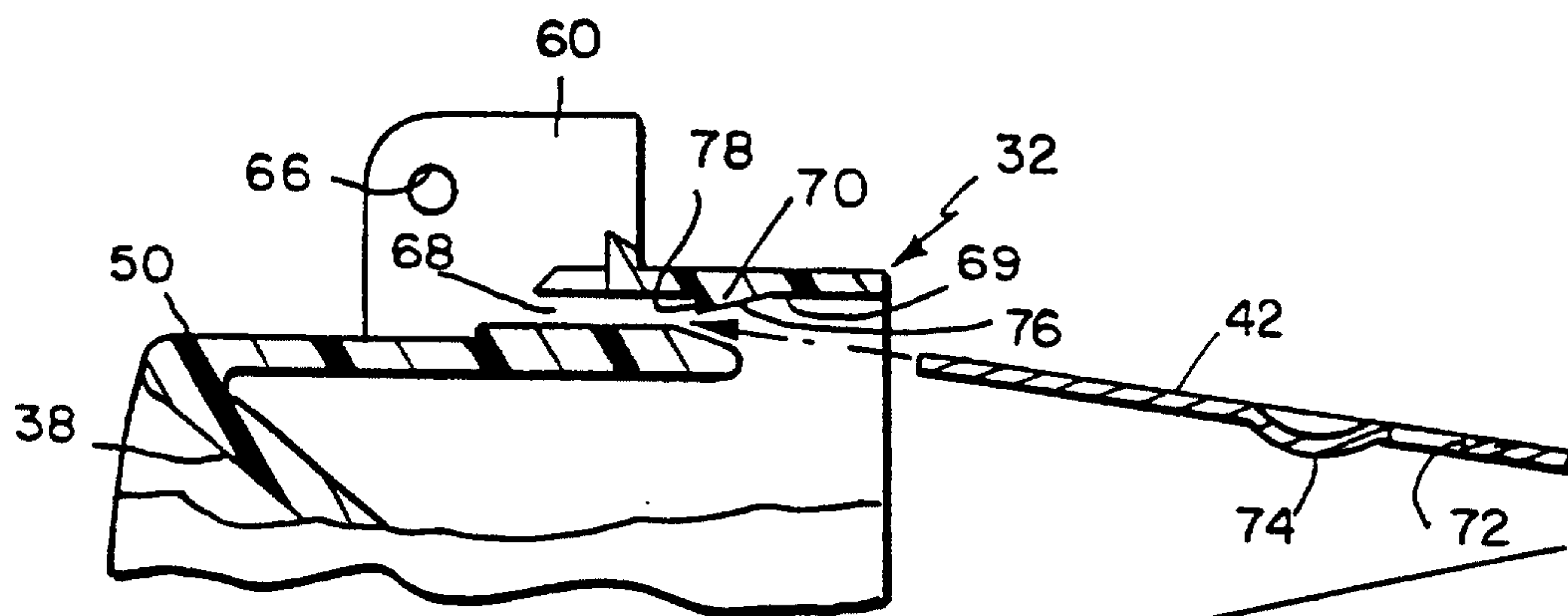


FIG. 6

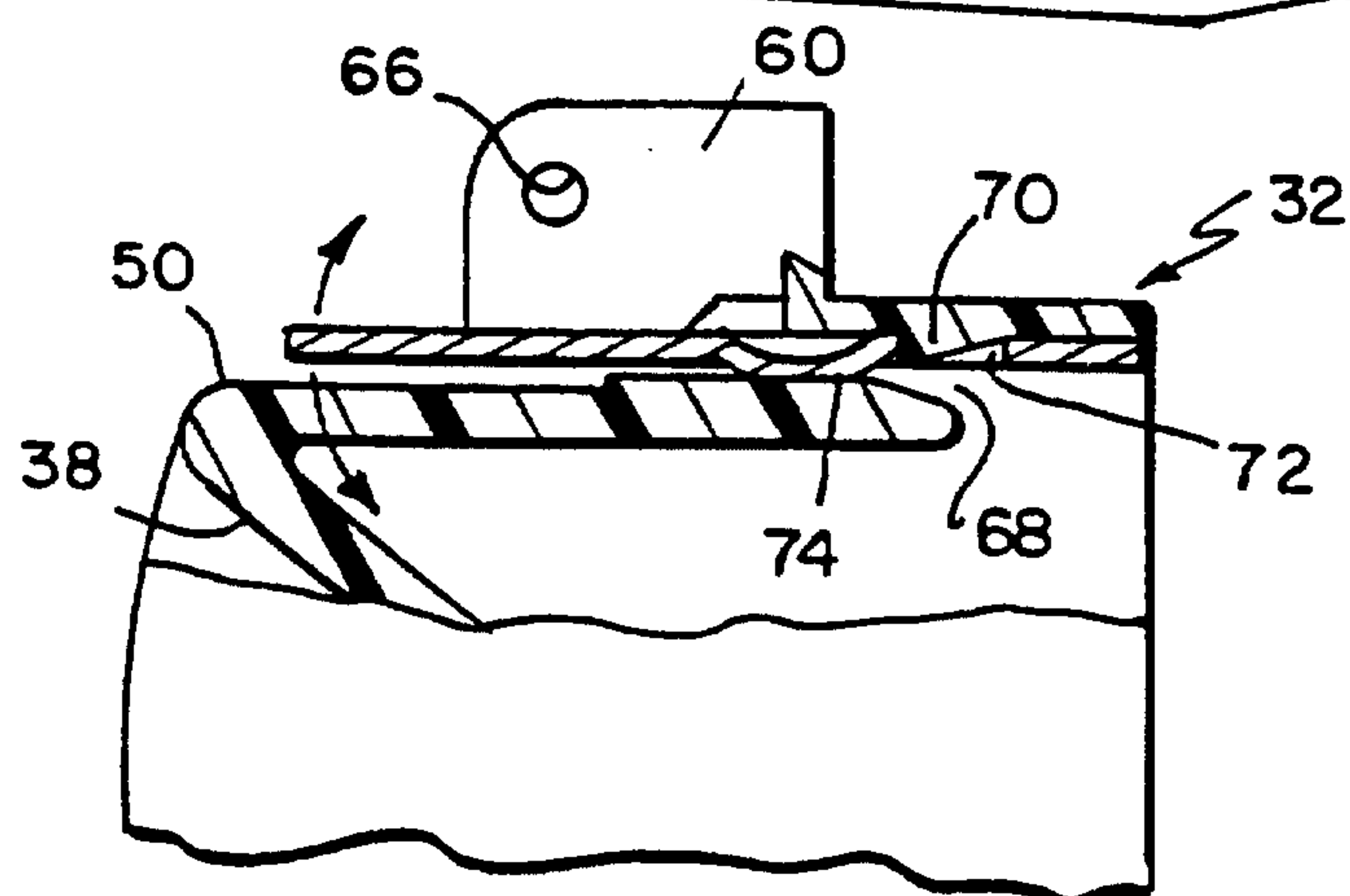
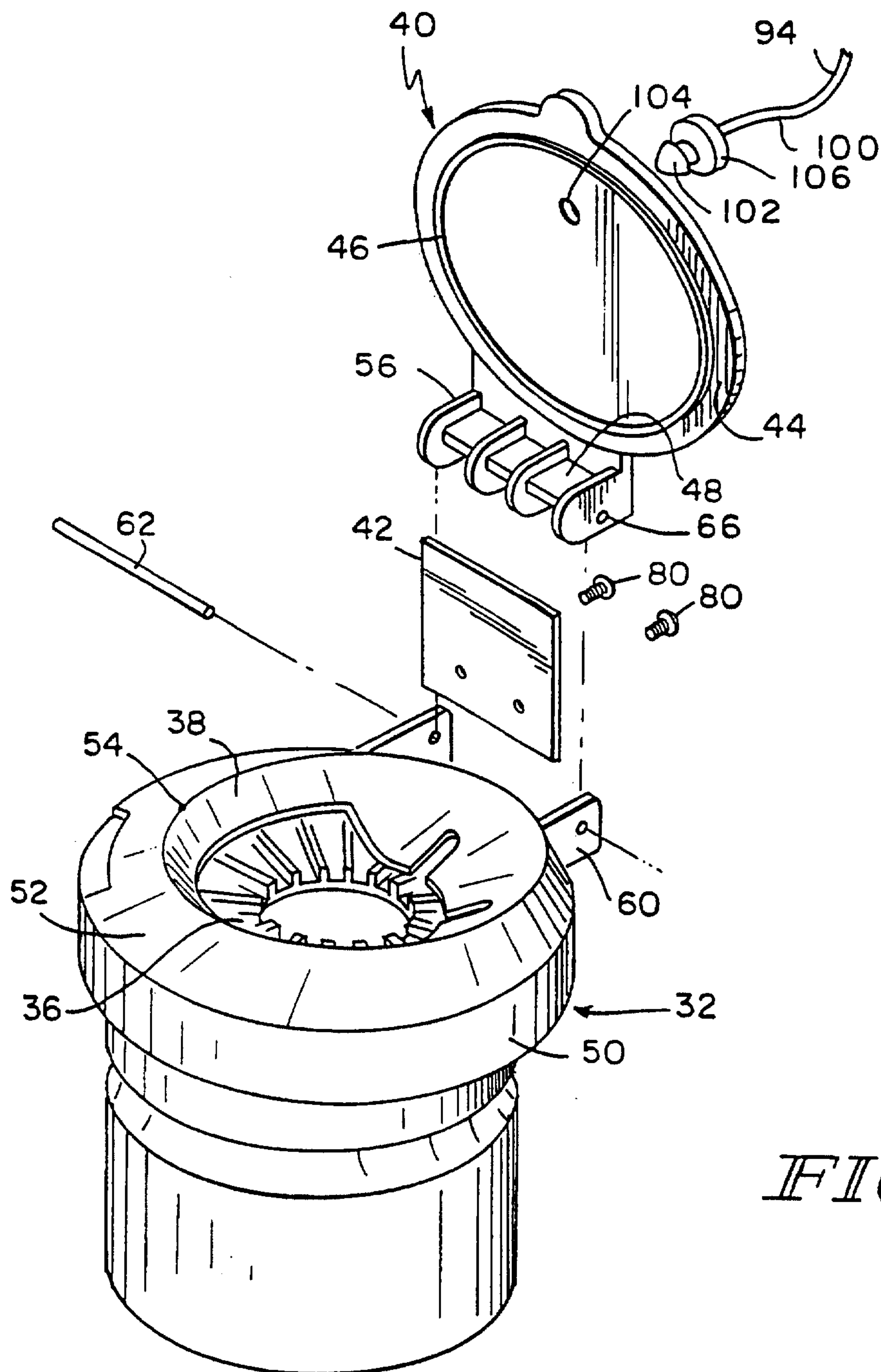
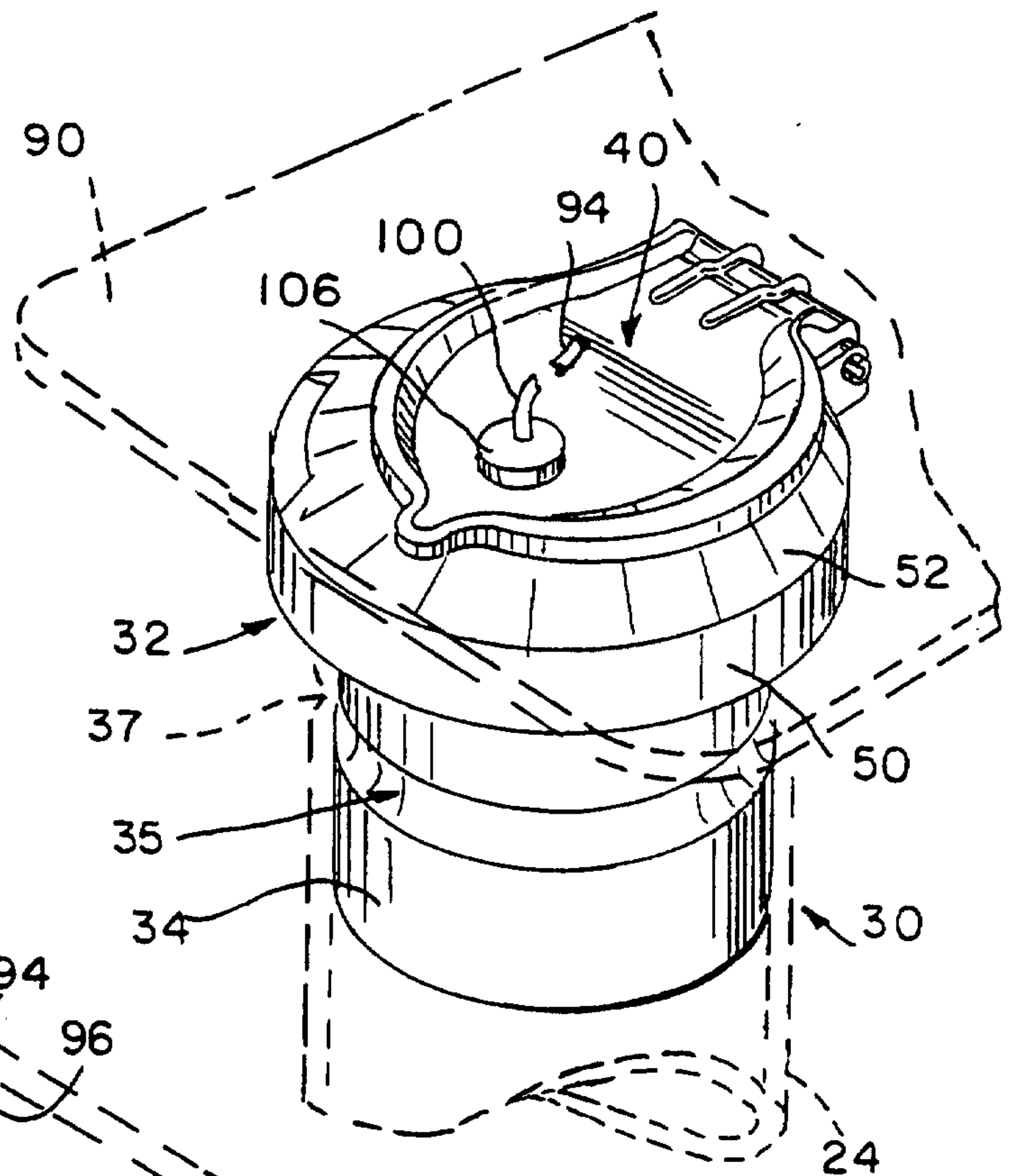
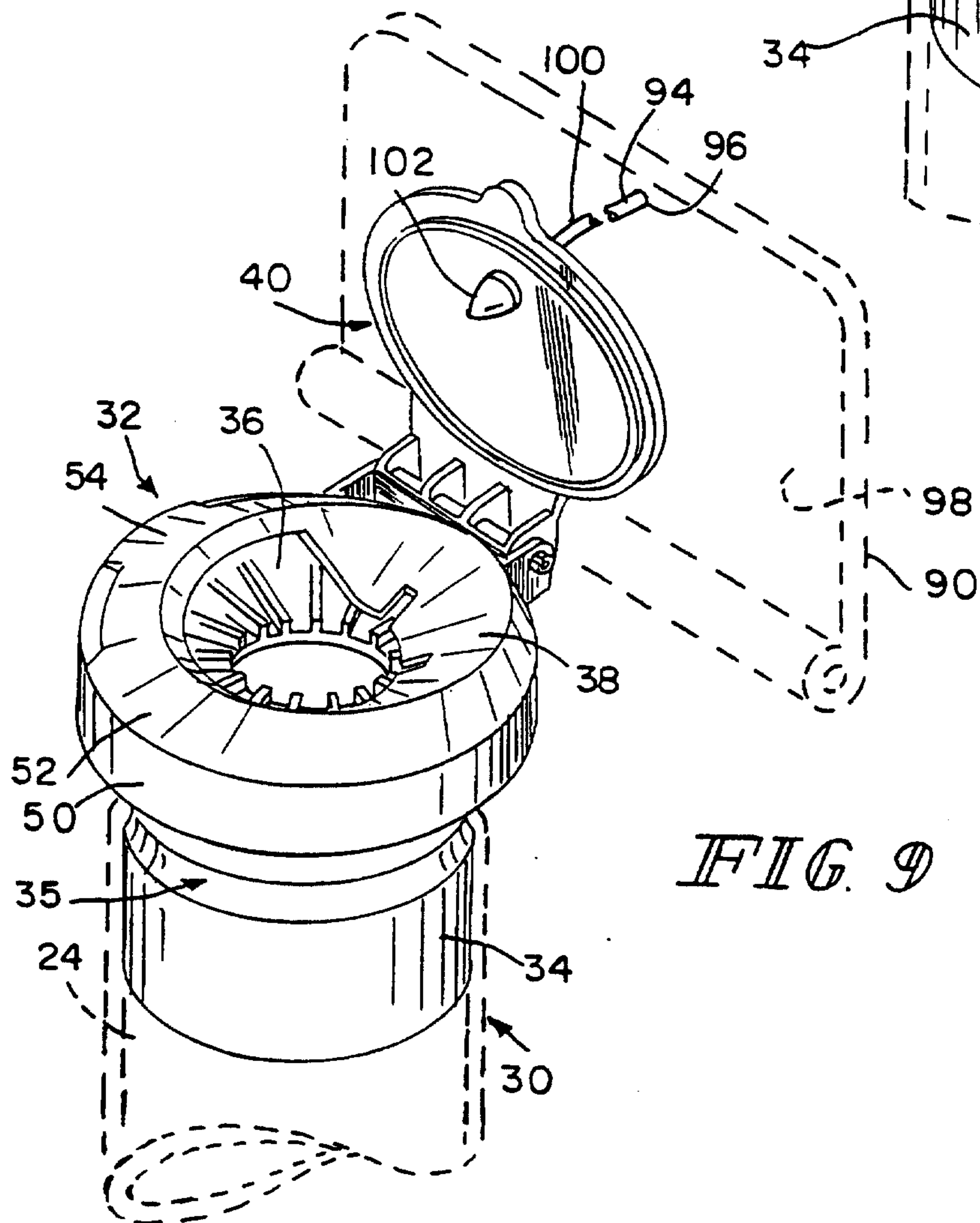


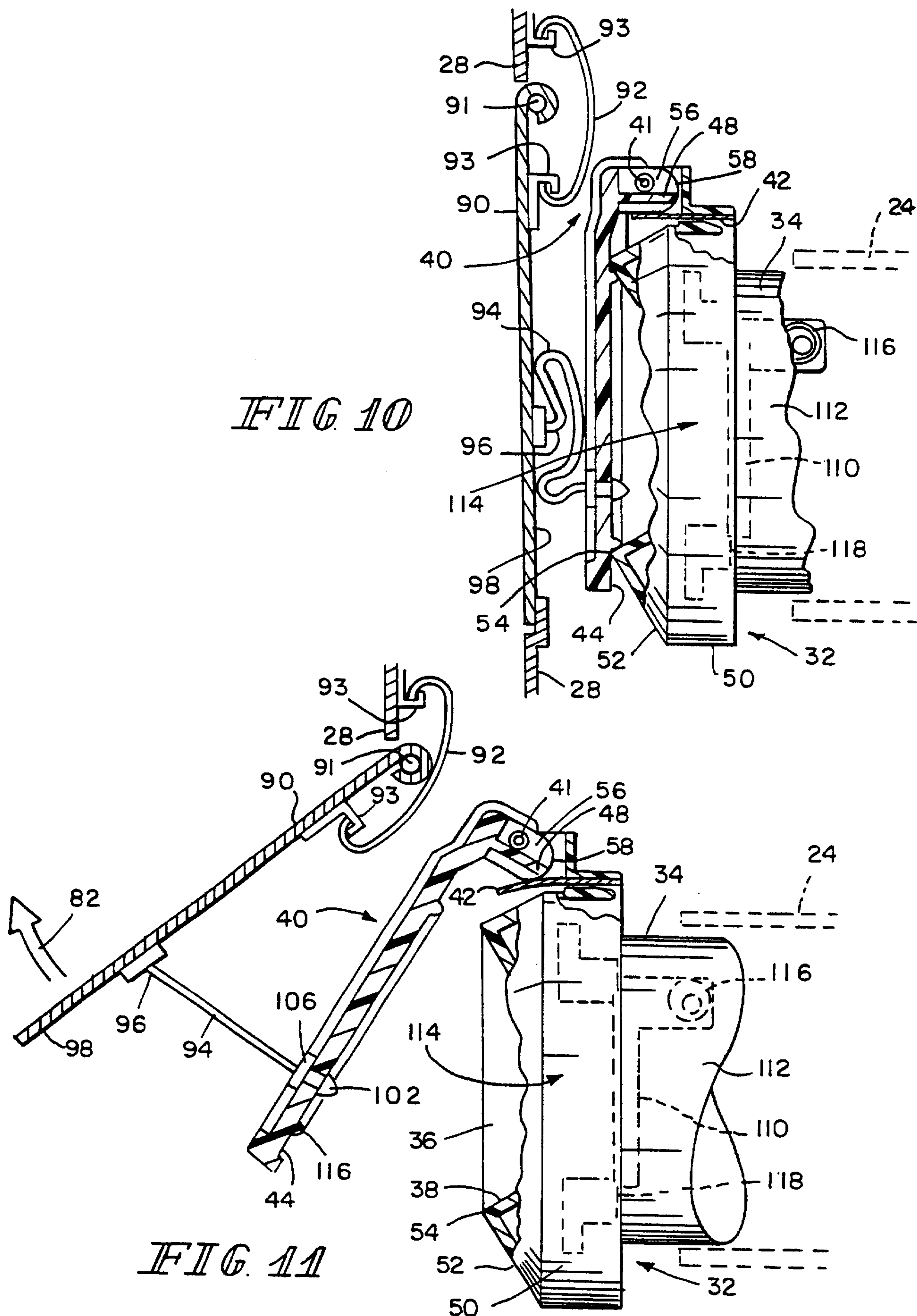
FIG. 5

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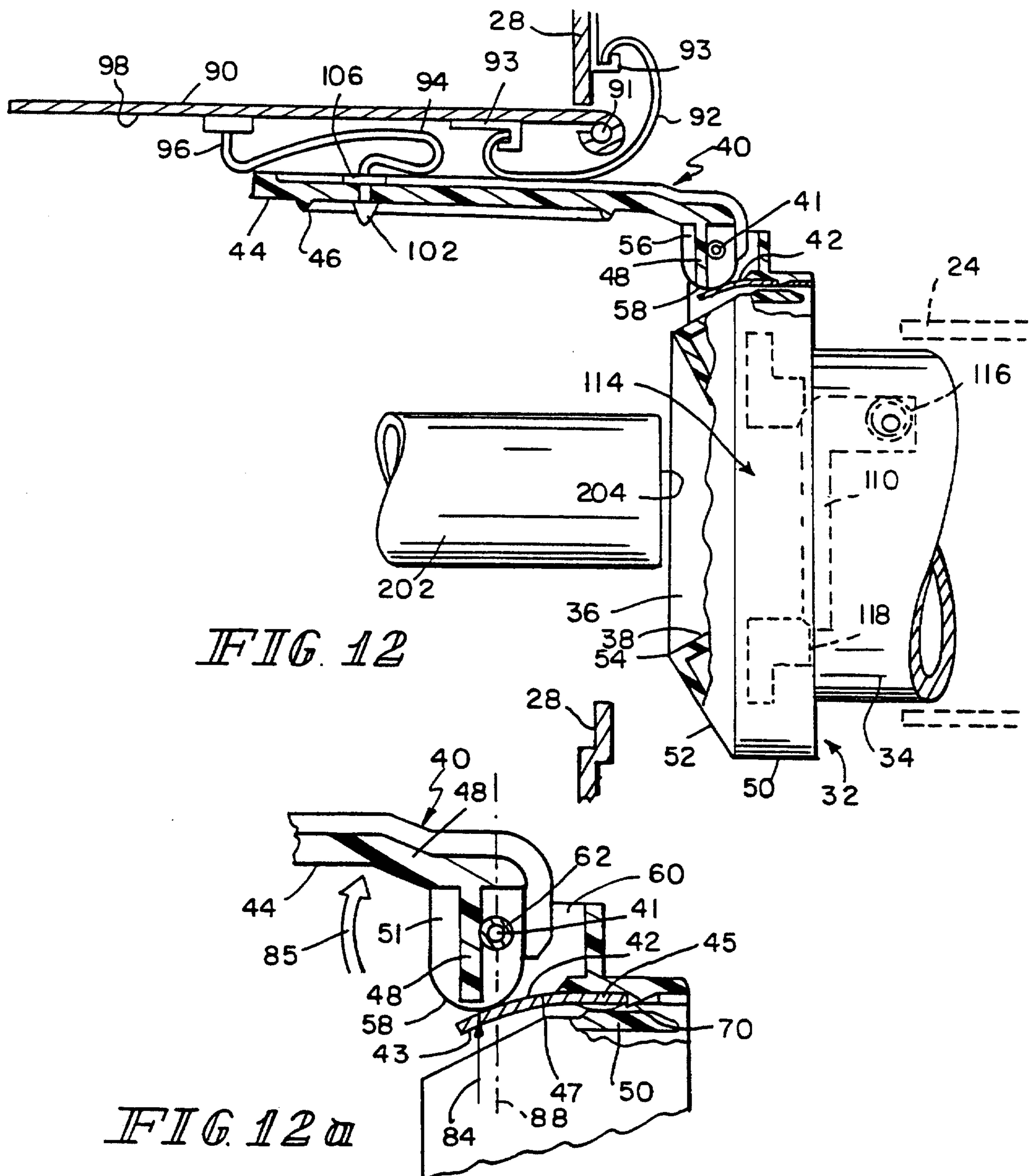
*FIG 7*

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*FIG. 8**FIG. 9*



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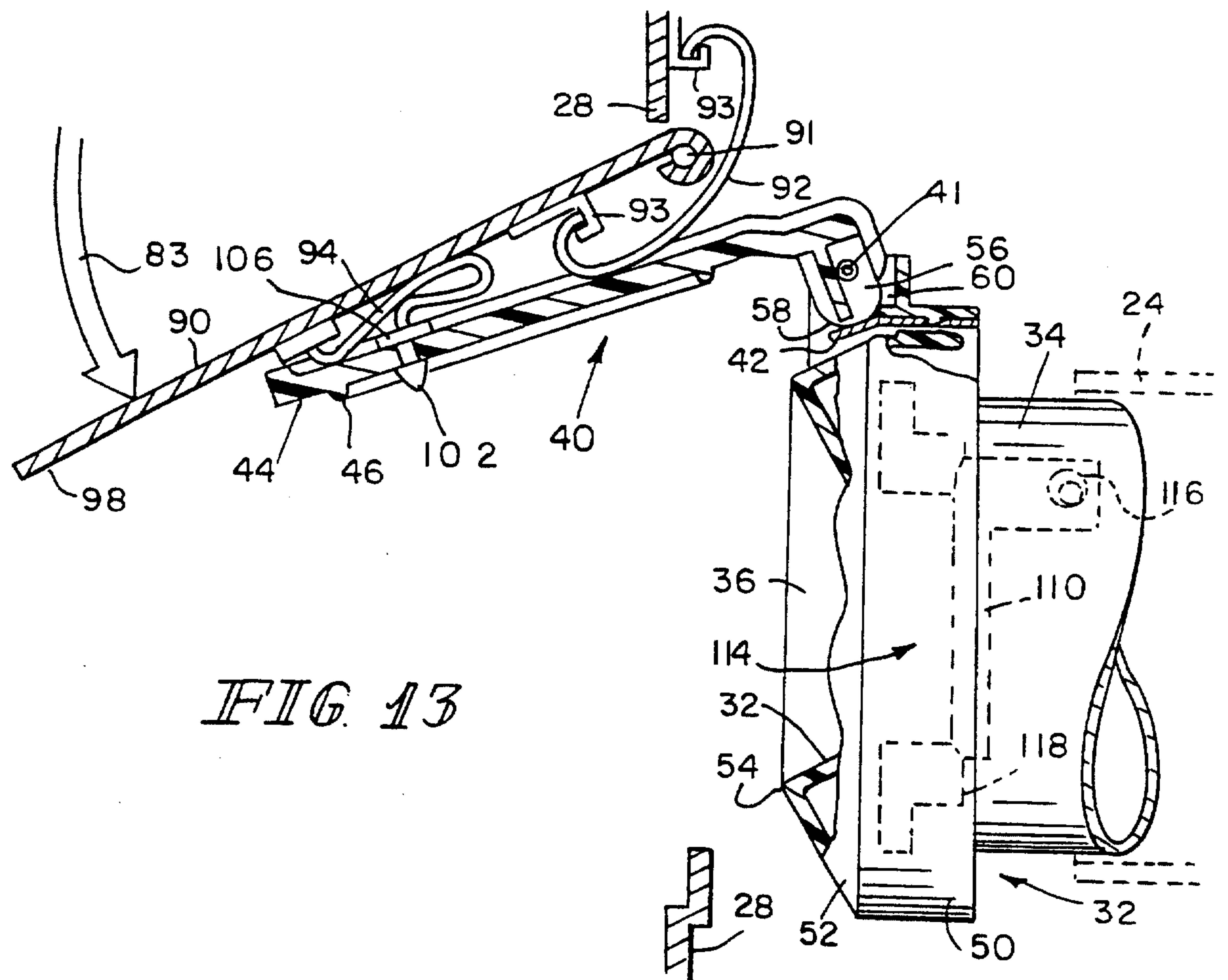


FIG. 13

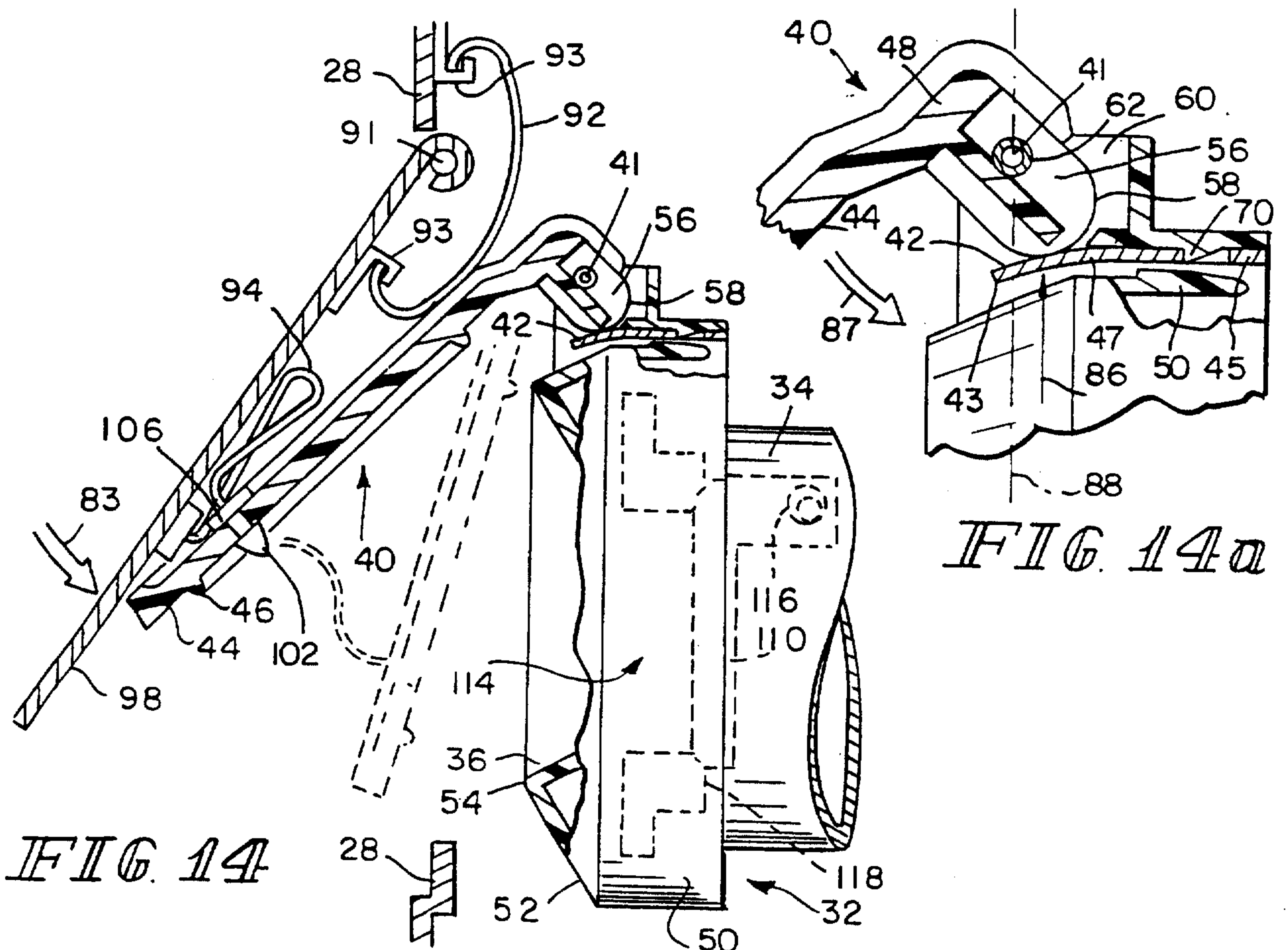
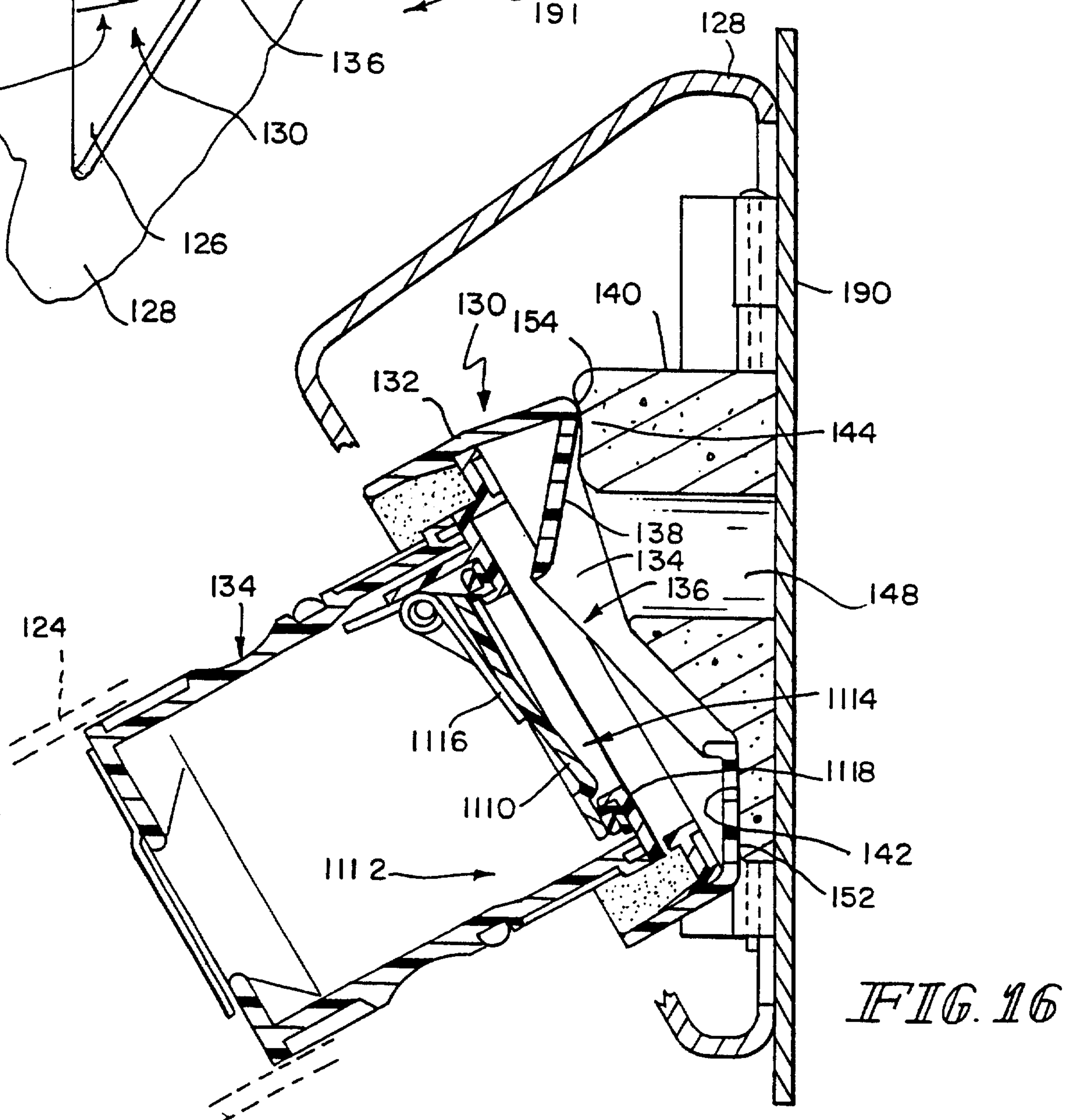
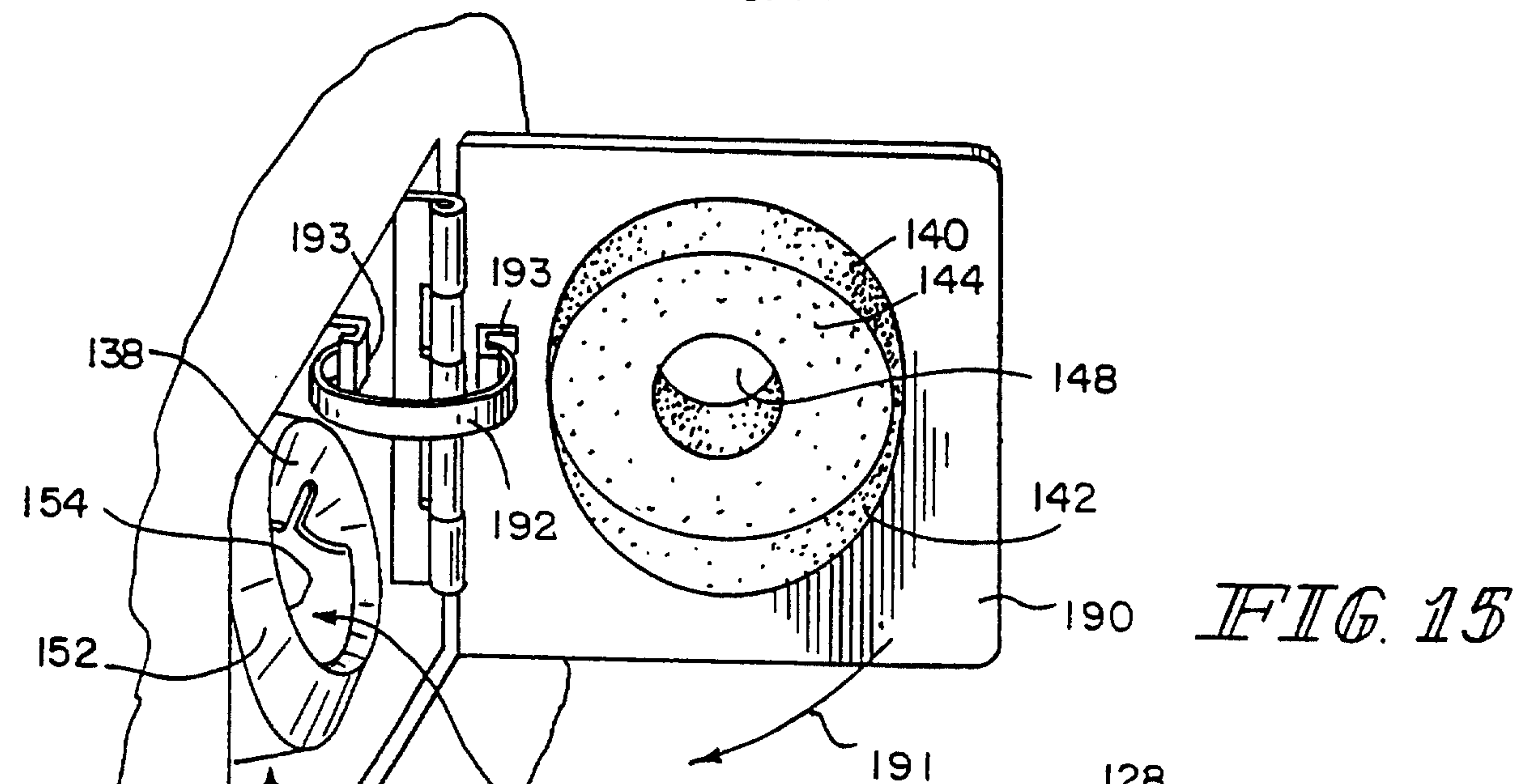
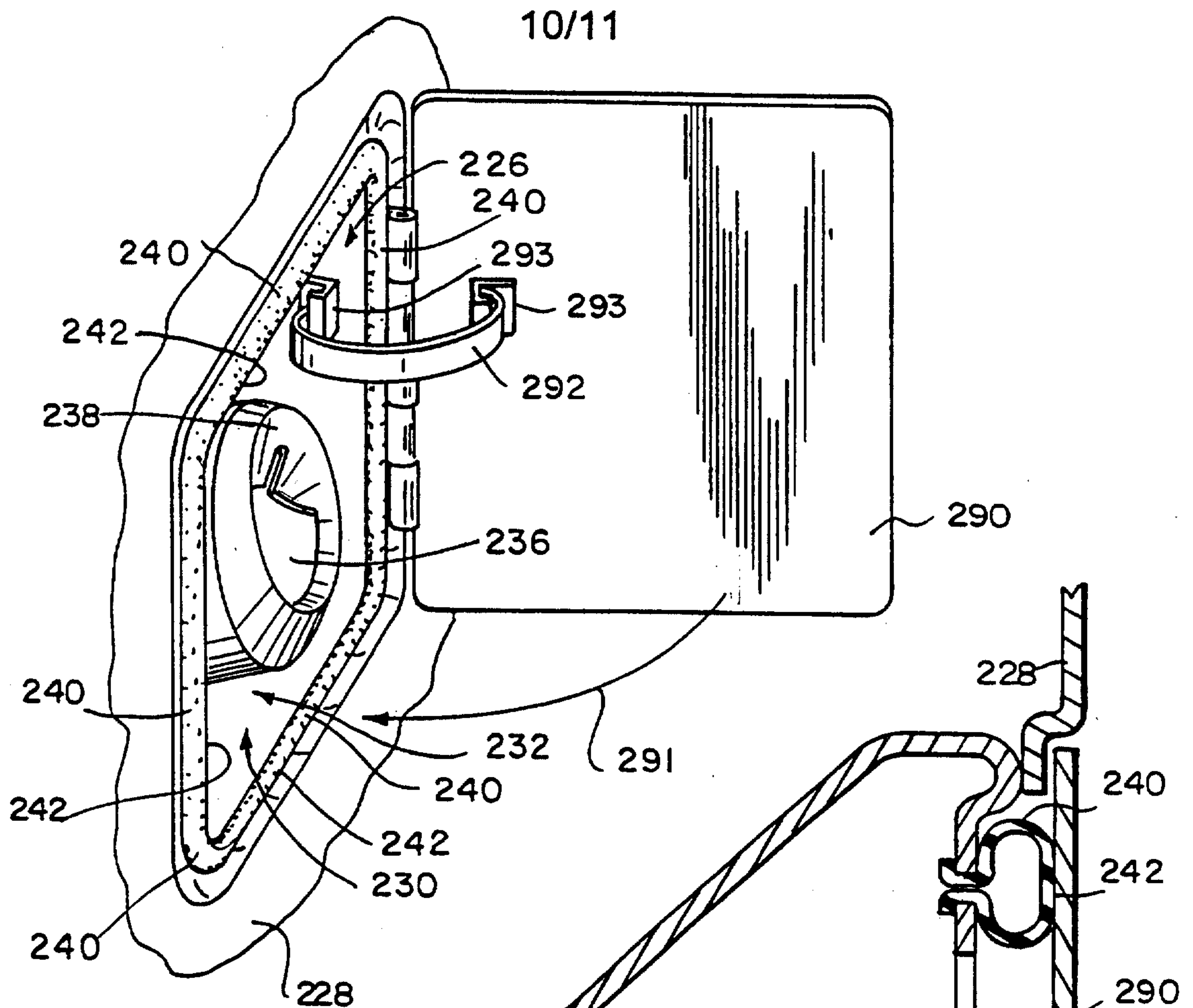
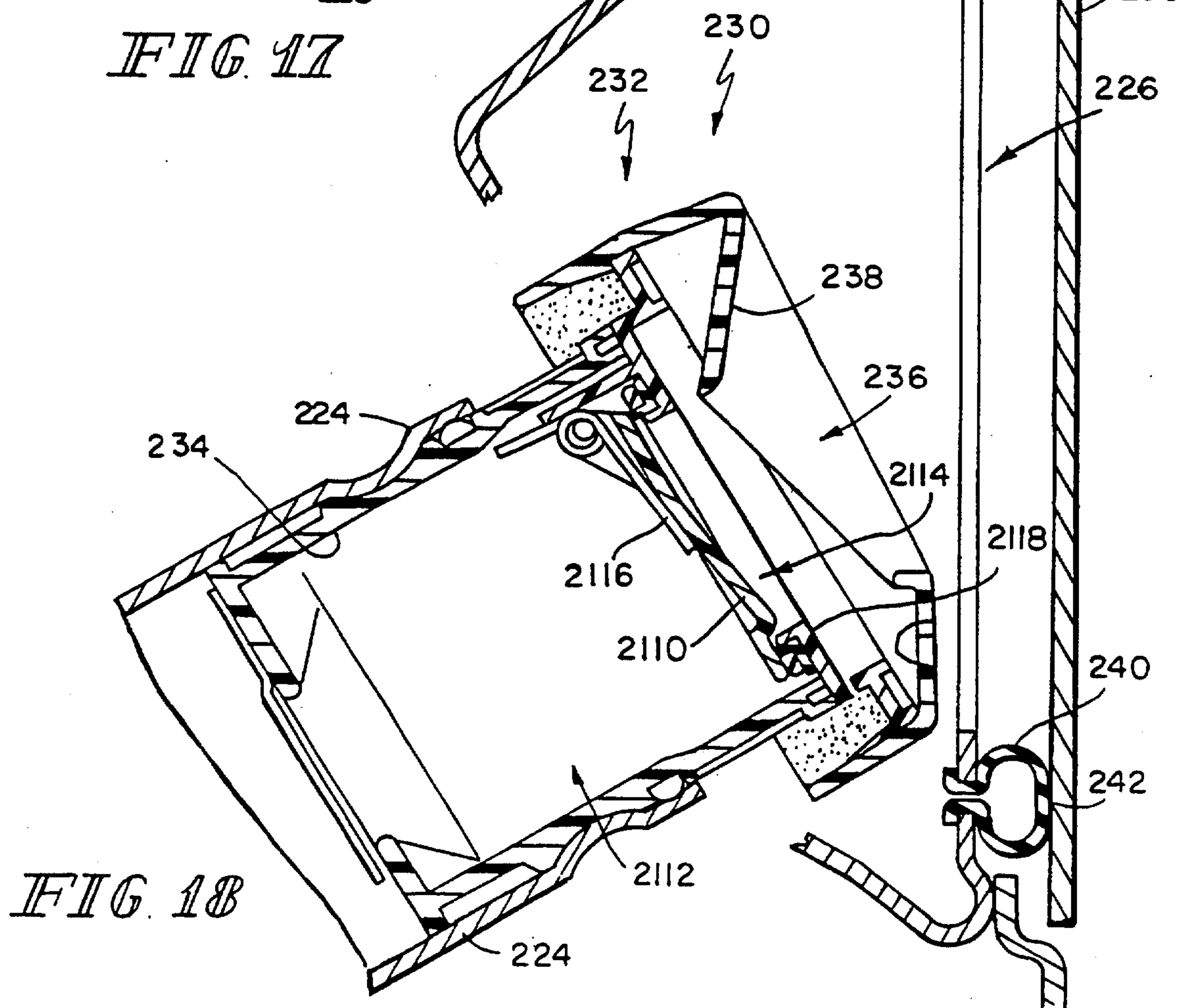


FIG. 14

FIG. 14a

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*FIG. 17**FIG. 18*

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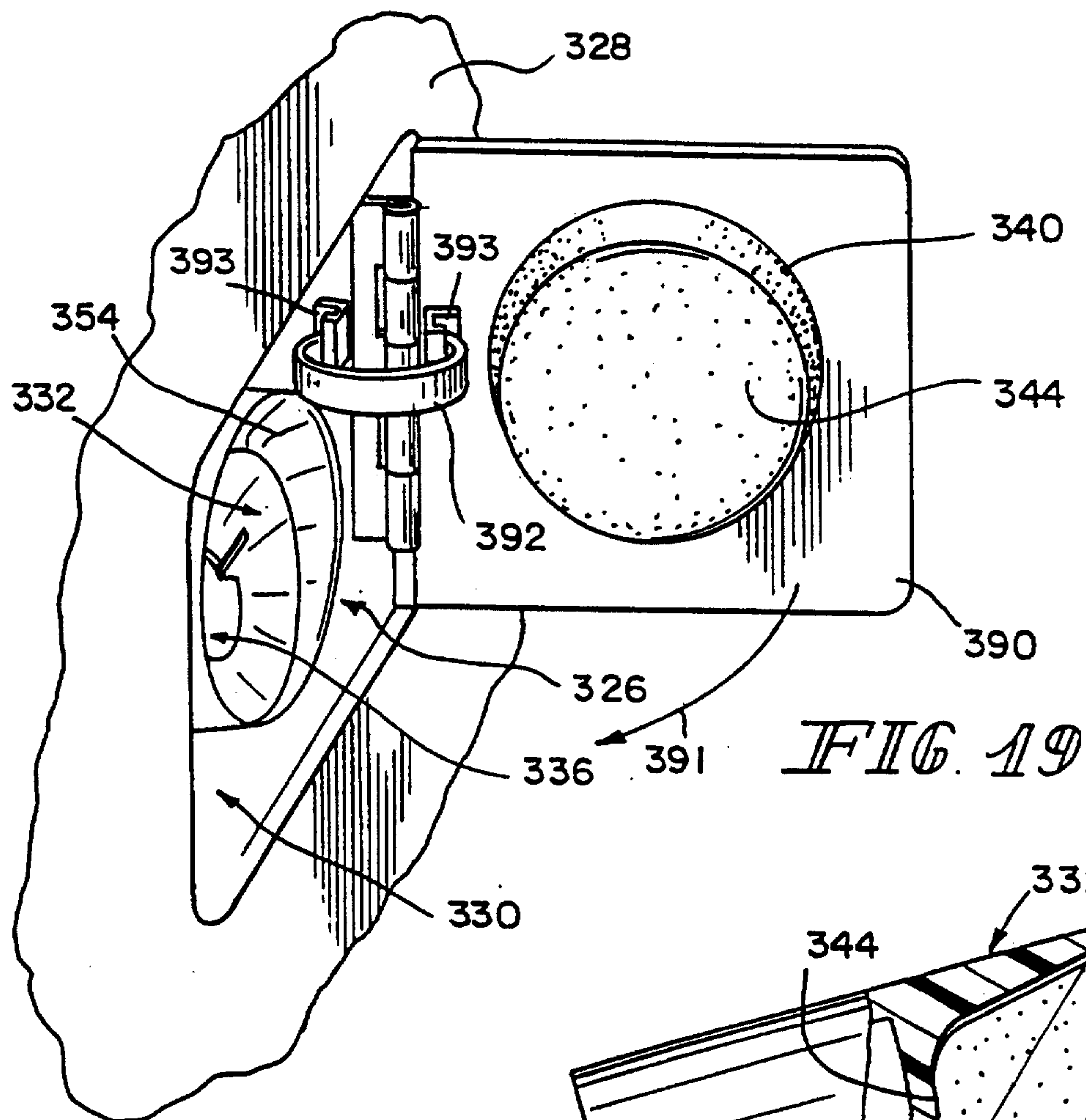


FIG. 19

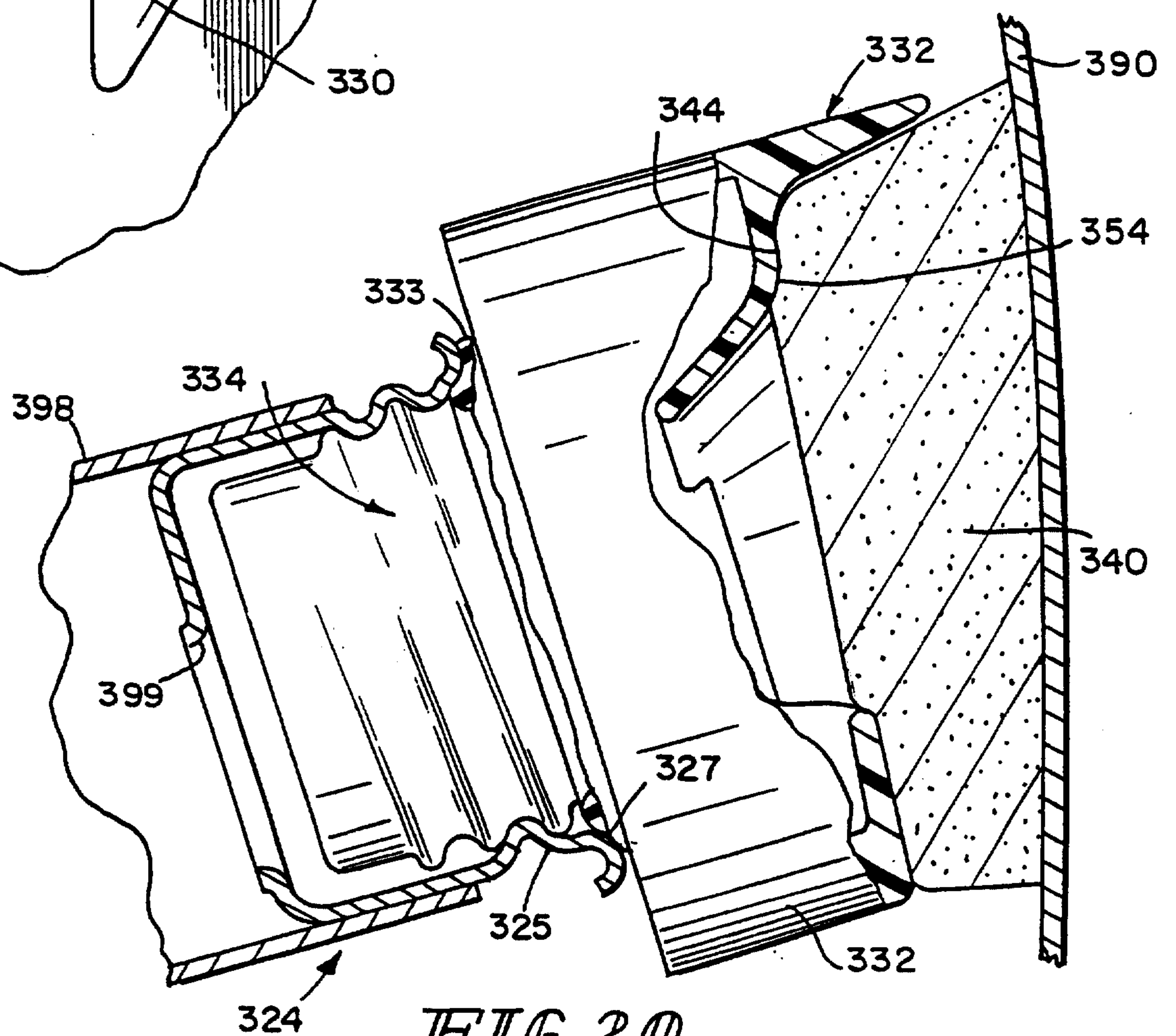


FIG. 20