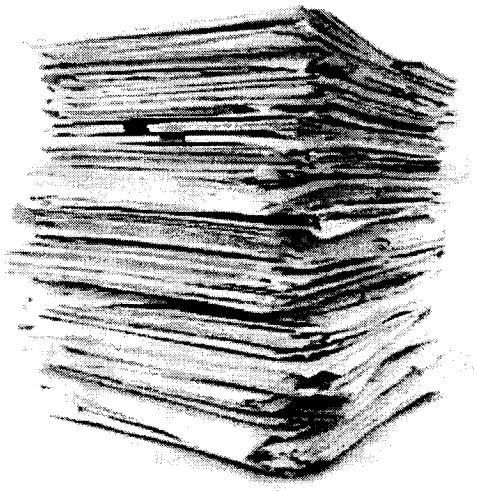

BULKY DOCUMENTS

(Exceeds 300 pages)

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Part 3 of 3

Processed by Duane Foster

United States Patent [19]

Evensen

[11] **Patent Number: 5,067,291**

[45] **Date of Patent: Nov. 26, 1991**

[54] **PASS-THROUGH ROOF SEAL SYSTEM**

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[21] Appl. No.: **534,989**

[22] Filed: **Jun. 8, 1990**

[51] Int. Cl.[5] E04D 13/14

[52] U.S. Cl. 52/219; 52/199; 52/218; 285/42

[58] Field of Search 52/219, 218, 198, 199; 285/42, 43, 44

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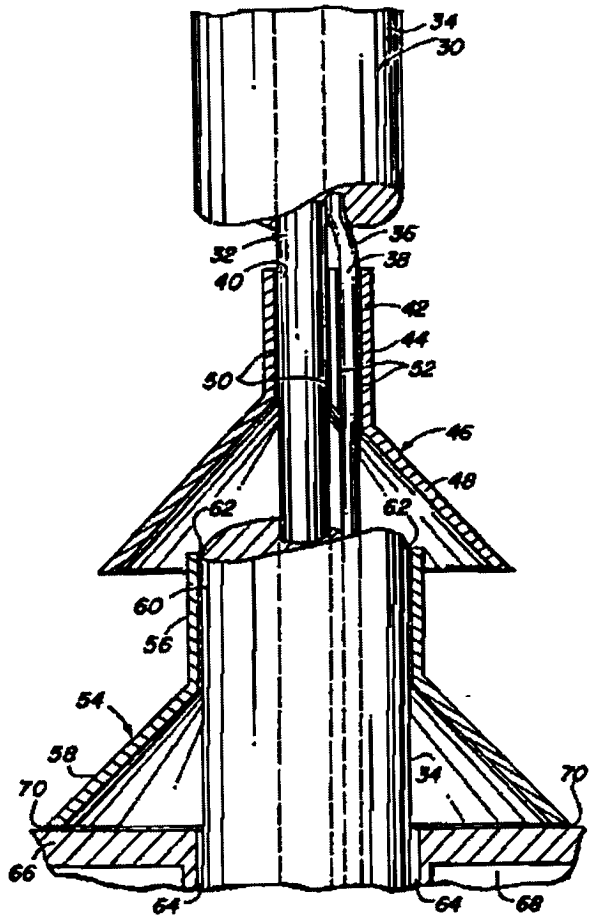
Primary Examiner—Michael Safavi

Attorney, Agent, or Firm—John J. Posta, Jr.

[57] **ABSTRACT**

The pass-through roof pipe seal system includes an adapter in the form of an inverted funnel with a vertical upper tube and integral lower flared skirt defining a central cavity through which a coolant pipe from a roof air-conditioning unit or the like passes. The pipe has an external layer of insulation around it except for a cut-away portion in the area of the funnel tube, which tube adheres directly and sealingly to the coolant pipe itself to prevent moisture from penetrating the system. The funnel skirt flares out over the lower edge of the cut-away portion of the invention and thus protects it from moisture and also overlies an inverted funnel-shaped vent cup having an upper vertical tube and lower skirt. The vent cup tube is adhered to the outside of the insulation layer around the coolant pipe below the adapter and is protected by the adapter skirt. The vent cup overlies the roof hole of a building upon which an air-conditioning unit is installed and prevents moisture from entering the building. The system is simple, durable and efficient.

5 Claims, 1 Drawing Sheet



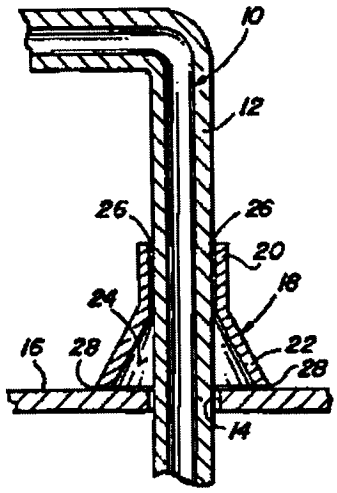


FIG. 1
(PRIOR ART)

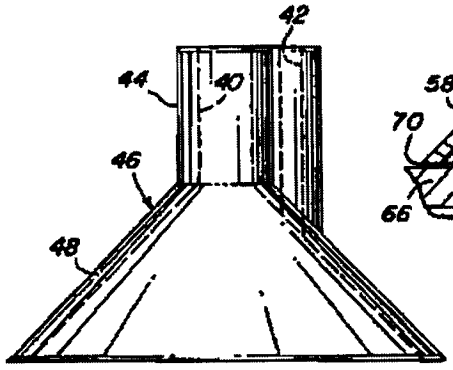


FIG. 2

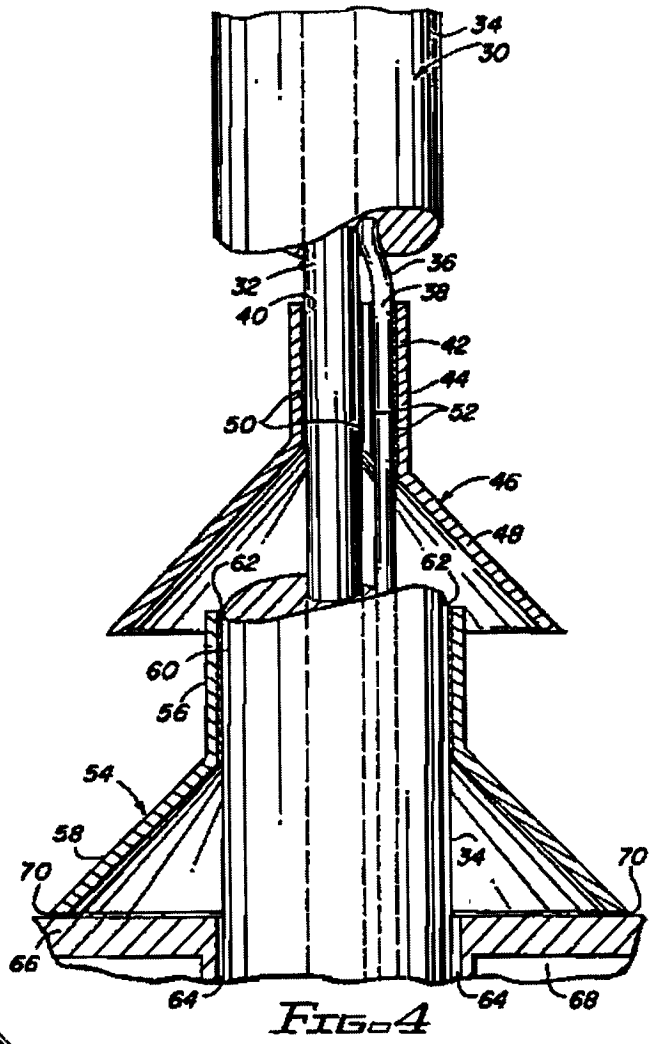


FIG. 4

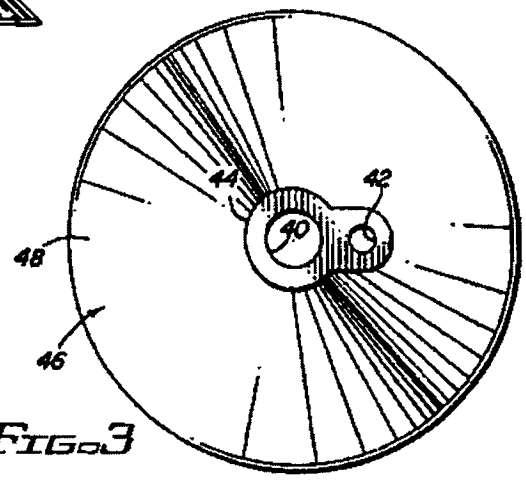


FIG. 3

PASS-THROUGH ROOF SEAL SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention generally relates to seals and more particularly to an improved roof pipe sealing system.

2. Prior Art

Air-conditioning units for buildings are frequently placed on the roof, with coolant pipes passing through the roof to and from the air-conditioning units. Many types of roof pipe seals have been devised for this and other similar situations. See, for example, U.S. Pat. Nos. 4,280,305 for roof flashing for solar collectors, U.S. Pat. No. 4,211,423 for a generally conical flashing unit and U.S. Pat. No. 3,871,145 for flashing for a pitch pocket. Most commonly used is an inverted funnel-shaped vent cup, the upper tube portion of which is adhesively connected to the outside of the insulation layer around a coolant pipe or the like. The problem with such a device is breaking of the moisture seal with the insulation layer as the insulation and/or adhesive deteriorates due to weathering. Once this seal is broken, moisture can penetrate the insulation and run down the exterior of the pipe, through the roof hole which is covered by the vent cup and into the building, ruining the interior of the building. There remains a need for a simple, durable and inexpensive system to overcome this problem and thus prevent moisture penetration through roof pipe holes.

SUMMARY OF THE INVENTION

The improved pass-through roof pipe seal system of the present invention satisfies all the foregoing needs. The system is substantially as set forth in the Abstract of the Disclosure. Thus, it includes an upper adapter in the form of an inverted funnel with an upper vertical tube and an integral lower flared skirt defining a central cavity through which a coolant pipe passes from a roof air-conditioning unit or the like. The pipe has an external layer of insulation around it except in a cut-away portion in the area of the adapter funnel tube, which tube is permanently bonded directly to the pipe to prevent moisture from penetrating the system.

The funnel flares out to overlie the lower edge of the cut-away portion of pipe insulation and thus protects it from moisture penetration. It also overlies an inverted funnel-shaped vent cup having an upper cup tube and a lower flared cup skirt. The cup tube is bonded to the exterior of the insulation layer around the coolant pipe below the adapter and is protected by the adapter skirt.

The vent cup overlies the roof of a building upon which an air-conditioning unit employing the pipe is installed and prevents moisture from entering through a pipe hole in the roof which the cup covers. The system is simple, durable and inexpensive, as well as being efficient in preventing passage of moisture into the building upon which it is mounted. Further advantages of the system are set forth in the following detailed description and accompanying drawings.

DRAWINGS

FIG. 1 is a schematic vertical cross-section of a conventional prior art roof pipe seal vent cup in place on a roof;

FIG. 2 is a schematic side elevation of a preferred embodiment of the roof seal adapter of the present system;

FIG. 3 is a schematic top plan view of the adapter of FIG. 2; and,

FIG. 4 is a schematic side elevation, partly in section, of a preferred embodiment of the present system, employing the adapter of FIGS. 2 & 3, along with a vent cup.

DETAILED DESCRIPTION

FIG. 1

Referring more particularly to FIG. 1 of the drawings, a prior art vent cup for an air-conditioning roof pipe is shown in sealing engagement with the insulated layer around the pipe and positioned to cover a roof pipe hole.

Thus, an air-conditioning unit roof pipe 10 is shown which has an insulated external layer 12 therearound. Pipe 10 extends vertically down through an opening 14 in roof 16 into a building (not shown) covered by roof 16. An inverted funnel-shaped vent cup 18 comprises an upper narrow tubular portion 20 and a lower depending integral skirt 22 defining therewith a central space 24. Portion 20 is sealed, as by adhesive layer 26, directly to the outside of insulative layer 12 and the bottom of skirt 22 may be sealed, as by an adhesive layer 28 to roof 16. When layer 12 or 26 breaks down due to weathering where adhesive layer 26 is applied to layer 12, moisture can penetrate into space 24 and migrate freely through hole 14 into the building coverfed by roof 16, defeating the purpose of vent cup 18, and causing damage to the interior of such building.

FIGS. 2, 3 and 4

The improved system of FIGS. 2, 3 & 4 prevents moisture from penetrating through the roof of a building upon which the system is mounted. Thus, system 30 (FIG. 4) is shown which comprises a coolant roof pipe or other roof pipe 32 bearing an external insulated layer 34, except in a cut-away portion 36. In system 30, a second smaller return pipe 38 may be disposed also within insulated layer 34. Pipes 32 and 38 pass vertically down through openings 40 & 42 (FIGS. 3 & 4) in the upper tubular portion 44 of adapter 46 which is in the form of an inverted funnel, having an integral lower flared skirt 48. It will be noted that tube 44 is directly and permanently sealed against moisture to pipes 32 and 38, as by adhesive layers 50 & 52, respectively. Adapter 46 may be split into two equal hinged halves together, or two integral halves, soldered or otherwise secured in place around pipes 32 and 38 (FIG. 3).

Skirt 48 overlies and moisture protects the lower edge of cut-away portion 36 against ingress of moisture. Below that cut-away portion 36, an inverted funnel-shaped vent cup 54 is provided having an upper vertical tube 56 and integral lower flared skirt 58. Tube 56 may be split into two equal hinged or unhinged halves, subsequently soldered or otherwise secured around pipes 32 & 38. Tube 56 has a central opening 60 down through which pipes 32 & 38 fully insulated with layer 34 pass, being sealed thereto by adhesive layer 62 against layer 34. Pipes 32 & 38 pass down through an opening 62 in roof 64 into a roofed building 66.

The lower end of skirt 58 may be sealed, as by adhesive layer 70, directly to roof 66, or otherwise attached thereto (e.g., nails, not shown). Skirt 48 protects system

30 against moisture penetration if adhesive layer 62 separates from insulated layer 34 in tube 56, because skirt 48 physically overlies or covers this part of system 30. Accordingly, system 30 remains moisture proof and prevents moisture from passing into building 68 through opening 64.

One or more of pipes 32 & 38, adapter 46 and vent cup 54 may be metal, plastic, rubber, ceramic, etc., or mixtures thereof, as desired, for durability and functionality. It will be understood that adapter 46 and vent cup 54 can be any suitable size and proportions.

Various other modifications, changes, alterations and additions can be made in the improved system of the present invention, its components and parameters. All such modifications, changes, alterations and additions as are within the scope of the appended claims form part of the present invention.

What is claimed is:

1. An improved pass-through roof pipe seal system, said system comprising, in combination:

a) an adapter comprising an inverted funnel having an upstanding vertical upper tube and an integral lower skirt flaring downwardly and outwardly therefrom, said tube and skirt defining a central cavity;

b) an air-conditioning coolant pipe assembly comprising an external, flexible insulated jacket disposed around a pipe, said assembly including a vertical pipe portion from which said jacket has ben cut-away to form a cut-away pipe portion, which pipe portion passes down through said adapter cavity and wherein said pipe is directly sealed to said tube, said skirt covering the lower edge of said cut-away pipe portion for maximum moisture protection;

c) an inverted funnel-shaped vent cup having an upper vertical tube and lower skirt, said cup being secured directly to the outside of said jacket below said adapter, such that said cup is displaced from said coolant pipe by said insulated jacket; and

d) wherein said adapter funnel tube has a pair of spaced vertical openings parallel to each other and extending down to said skirt, wherein said coolant pipe assembly includes a return pipe parallel to said coolant pipe, and wherein said pipes are disposed in and sealed directly to said openings in said tube.

2. The improved system of claim 1 wherein said vent cup tube is below said adapter skirt.

3. An adapter for preventing moisture from passing through a roof having an opening therein and having a pipe with insulation thereon pass through said opening, and also having a vent cup which includes a vertical tube disposed about said pipe and insulation and secured to said insulation, comprising,

a) an inverted funnel portion having an upper vertical tube section and a lower downwardly and outwardly extending skirt portion,

b) said tube section having an opening therein with an inner diameter which is substantially identical to the outside diameter of said pipe,

c) wherein said tube section is secured directly to said pipe,

d) wherein said roof has an opening therein adapted to have a plurality of pipes with insulation thereon pass therethrough,

e) wherein said tube section has a plurality of openings therein which have inner diameters corresponding, respectively, to substantially the outside diameters of said plurality of pipes, and

f) wherein said tube section is secured directly to said plurality of pipes.

4. The adapted of claim 3 which is comprised of two substantially equal unhinged parts adapted to be mated and secured together.

5. The adapter of claim 3 which is comprised of two substantially equal hinged parts adapted to be mated and secured together.

* * * * *

US005176408A

United States Patent [19]

Pedersen

[11] Patent Number: 5,176,408

[45] Date of Patent: Jan. 5, 1993

[54] SEAL DEVICE FOR PIPES PASSING THROUGH ROOF STRUCTURES

[76] Inventor: Raymond J. Pedersen, 12 Fallons Way, Bayswater, Victoria 3153, Australia

[21] Appl. No.: 632,617

[22] Filed: Dec. 26, 1990

Related U.S. Application Data

[63] Continuation of Ser. No. 328,223, Feb. 27, 1989, abandoned.

[30] Foreign Application Priority Data

Jun. 4, 1987 [AU] Australia PI2345

[51] Int. Cl.[5] F16L 5/00

[52] U.S. Cl. 285/42; 285/43; 285/44; 285/419

[58] Field of Search ..... 285/42, 43, 44, 419; 24/136 R

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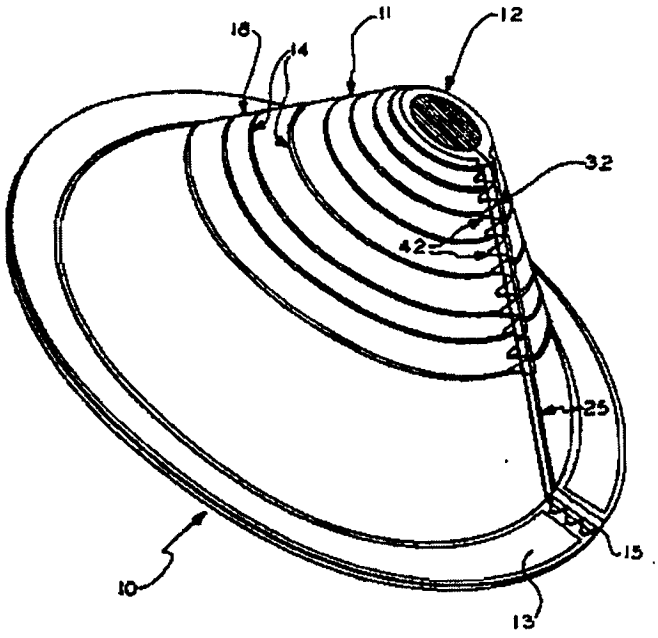
Primary Examiner—Randolph A. Reese
Assistant Examiner—Timothy Aberle
Attorney, Agent, or Firm—Ribis, Graham & Curtin

[57] ABSTRACT

A seal device for providing a weather seal between an elongated member such as a pipe, and a surface, such as a roof of a building, through which the pipe extends. The seal device has an apertured base member of resilient material with one end in contact with the roof and the opposite end with an aperture through which the pipe extends. The base member has a sleeve of resilient material integral and projecting from one surface thereof and includes the aperture on the opposite end of the sleeve. A rib formed integral with the sleeve and base member projecting outwardly from the external surface thereof. The rib extends generally down the length of the sleeve and across the base member whereby in use the wall of the sleeve and base member may be slit adjacent to and for the full length of the rib to permit opening of the sleeve and base member to allow fitting around the pipe. The rib has clamp means for holding it closed.

21 Claims, 4 Drawing Sheets



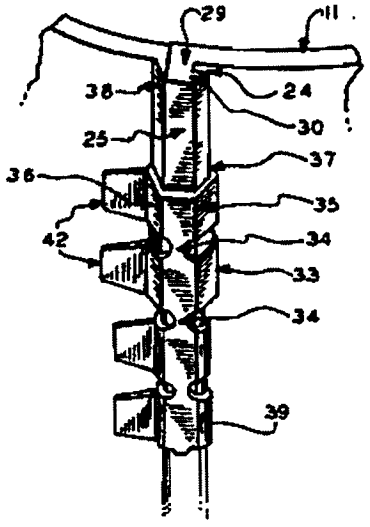


FIG. 1

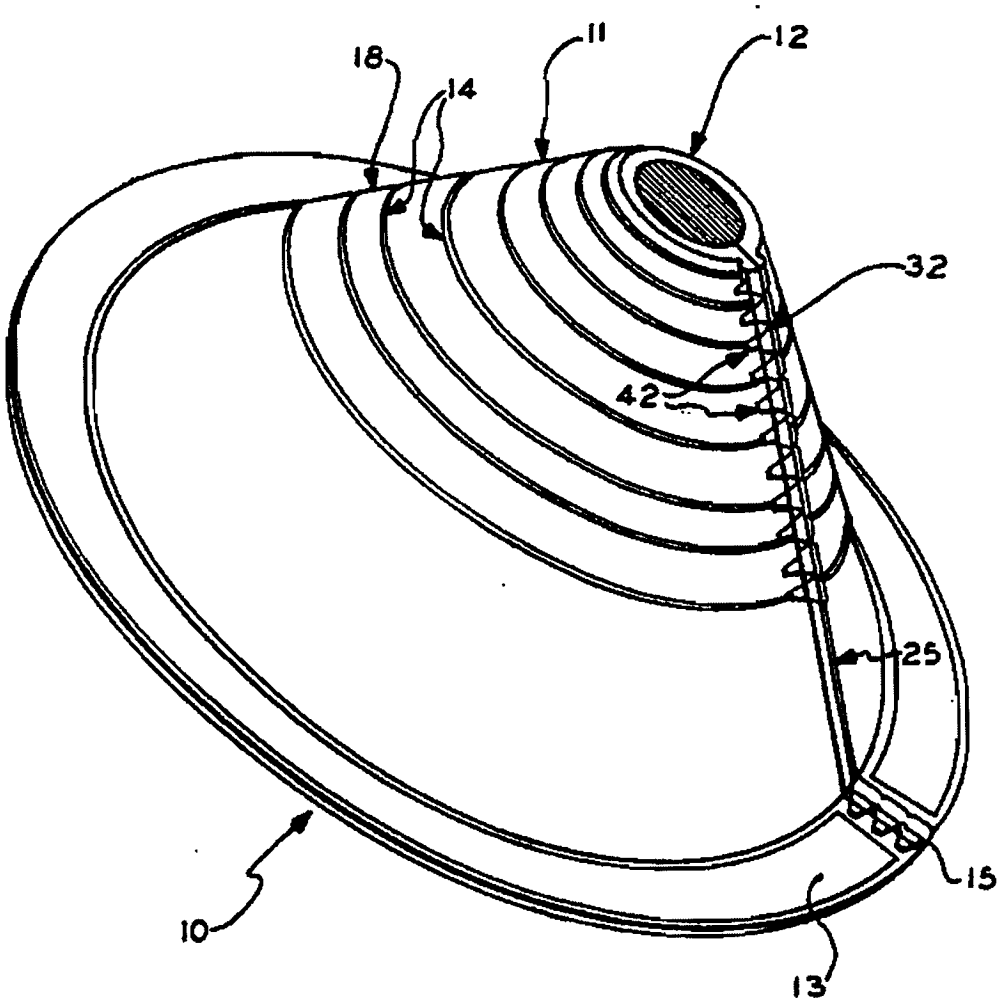


FIG. 2

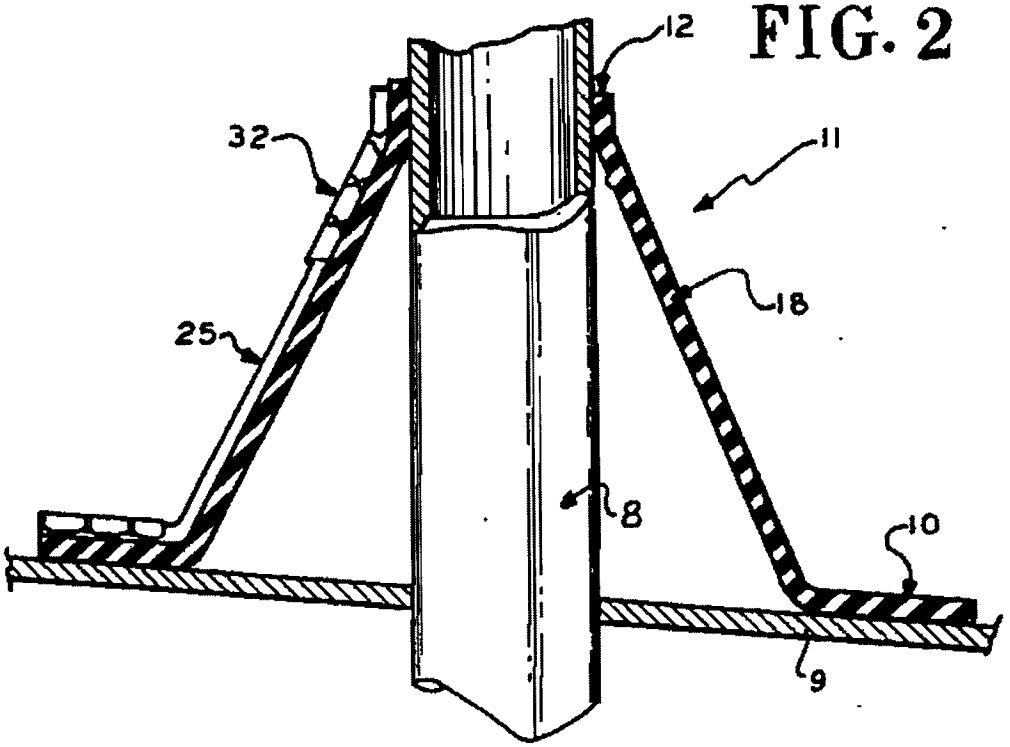


FIG. 3

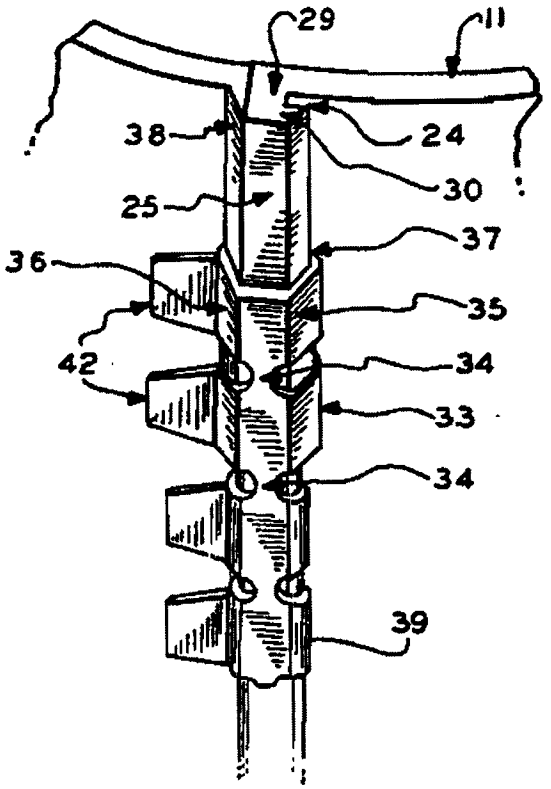


FIG. 4

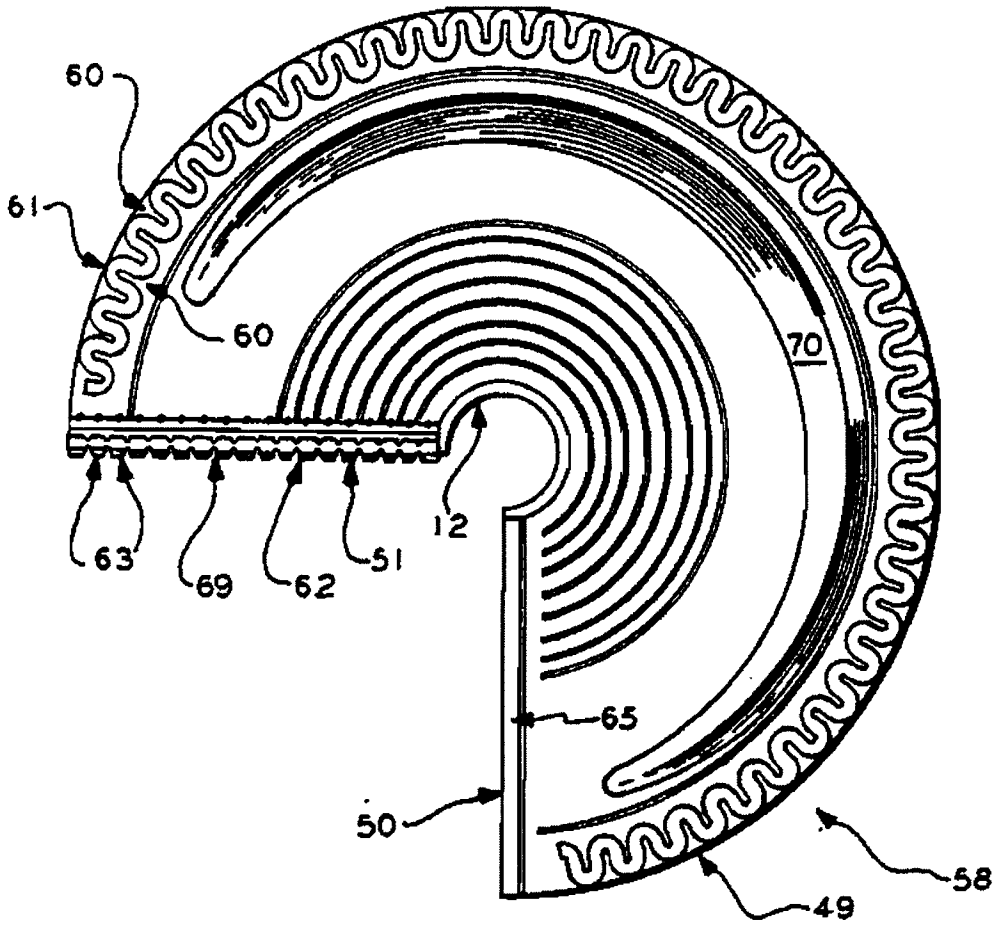


FIG. 5

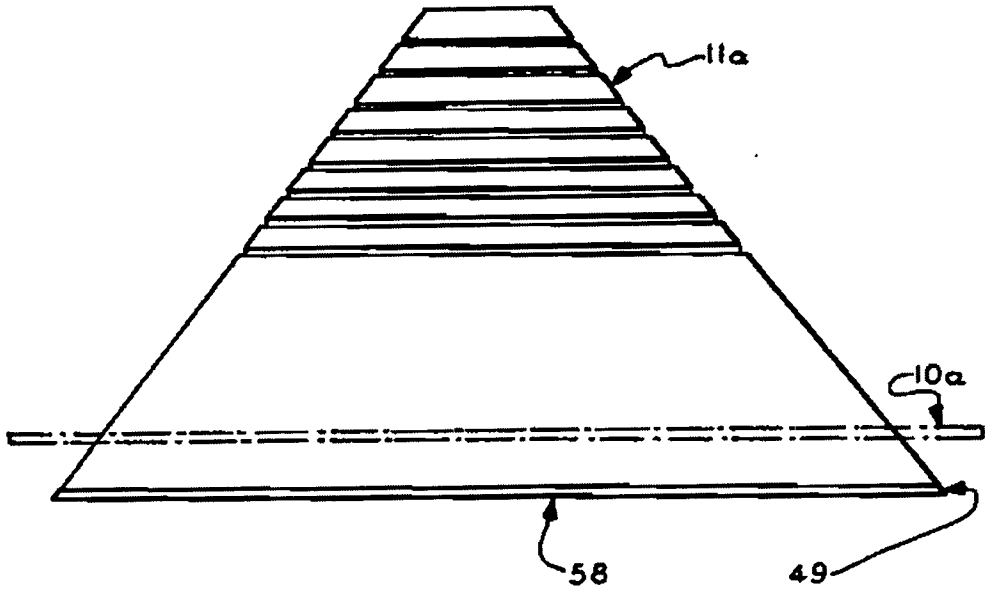
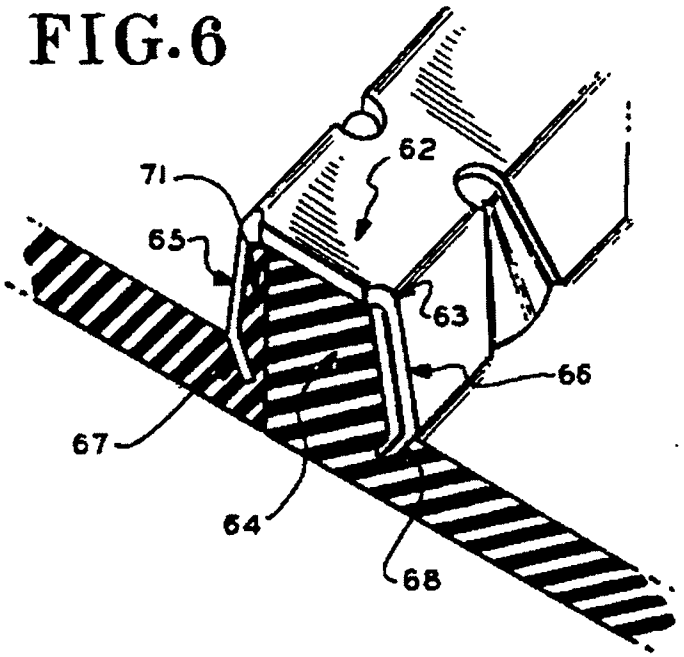


FIG. 6



SEAL DEVICE FOR PIPES PASSING THROUGH ROOF STRUCTURES

This application is a continuation of application Ser. No. 328,223, filed Feb. 27, 1989, now abandoned.

This invention relates to an improved seal device for providing a weather seal between an elongate member and a non-planar surface, such as a roof or wall of a building of like structure.

There are currently in use in Australia seal devices for this purpose comprising an apertured base member including a non-metallic apertured flange element of resilient material bonded in face-to-face relation to a peripheral or part peripheral manually deformable non-resilient metallic flange, and a sleeve member of resilient material integral with the base member and extending upwardly therefrom to receive the elongate member. The base member is in use secured to the non-planar roof or wall and, being of a non-resilient manually deformable nature may, in use, be deformed to conform to the contour of the non-planar surface and will substantially retain such deformed contour. The sleeve member has an end remote from the base member which is adapted to receive said elongate member in sealing engagement therewith when the seal device is in use. The sleeve member, between the said remote end thereof and the base member, is preferably sufficiently flexible to accommodate in use misalignment between the base member and the remote end of the sleeve, that may arise during installation or during the service life of the seal device.

One form of a seal device of the general construction as above referred to is described in more detail in U.S. Pat. No. 4,333,660 issued to Cupit in June 1982. That seal device is very effective when used for pipes or ducts of a size up to about 400 mm diameter or similarly sized rectangular ducts. However, in many applications, as encountered in industrial and commercial building, it is required to seal about large pipes and ducts, as used in ventilation and air conditioning systems, and a modification of the seal device, above referred to, for use on large pipes is disclosed in U.S. Pat. No. 4,664,390 issued May 12, 1987 to David G. Houseman.

Both of the above referred to known constructions require the seal device to be assembled to the elongated member by inserting one end of the member through the sleeve member of the seal device, and then passing the seal device along the elongated member until it comes into the required location relative to the roof or wall structure. This mode of assembly requires the absence of the components on the elongated member or parts thereof protruding beyond the outside surface of the elongate member, which would interfere with the movement of the sleeve of the seal device along the elongate member.

During the initial construction, it is normally possible to arrange the fitment of the seal device to the elongate member before other components, which would interfere with the fitment of the seal device, are attached thereto. However, in situations where it is not possible to insert the end of the elongate member through the sleeve and move the seal device into its required position, seal devices of the above discussed construction cannot be employed. Also it is frequently necessary to provide a replacement seal about an elongate member which is coupled to equipment or has a weather cover or structural stays attached thereto, which preclude the sliding of the sleeve portion of the seal device along the elongate member.

It is therefore the principal object of the present invention to provide an effective weather seal device for use on elongate members that extend through roofs or like surfaces, that is capable of being installed whilst the elongate member is in situ extending through the structure, and irrespective of other components or equipment which may be coupled to or mounted on the elongated member.

With this object in view, there is provided by the present invention a seal device for providing a weather seal between an elongate member and a surface through which the elongate member extends, such as a roof or wall of a building or like structure, the seal device comprising an apertured base member of resilient deformable material to be located in use in superimposed relation to the surface with the elongate member extending through the aperture, a sleeve of resilient deformable material integral with the base member and projecting from one side thereof, the sleeve member encompassing said aperture in the base member so that in use the elongate member also extends through the sleeve member, a rib formed integral with the sleeve and base members projecting outwardly from the external surface thereof, said rib extending generally down the length of the sleeve member and across the base member, whereby in use the sleeve and base member may be slit adjacent to and for the full length of the rib to permit opening of the sleeve member and base member for fitment about the elongate member, and clamp means secured to the sleeve member and base member and extending parallel to and for the length of the rib so the slit may be made between the rib and the clamp means, the clamp means being adapted to embrace the rib and be non resiliently deformed to grip the rib and sealably close the slit to secure the sleeve and base member around the elongate member, the sleeve member, when in use having at the end remote from the base member an aperture dimensioned to receive the elongate member in sealing engagement.

Conveniently, the clamp means comprises a number of clamp elements located in side by side relationship along the length of and adjacent the rib, whereby the closing of the slit and the clamping of the sleeve and base members by the clamp means to sealably close the slit, can be achieved, notwithstanding that the rib may follow a non-linear, curved or tortuous path after fitment of the seal device to the elongate member. The clamp means may comprise a series of clips, preferably secured together in a strip-like manner with the connection between adjacent clips sufficiently flexible or pliable so that each clip may embrace and grip the rib to form a sealed closure even though the rib may follow a non-linear path.

Preferably the rib is provided with a shoulder along the side remote from the clamp means, and the clips may be adapted to interengage with the shoulders when embracing and gripping the rib, thereby increasing the strength of the grip and seal between the clamp means and the rib. The clamp means may be in the form of a plurality of generally U-shaped clips with the clips joined one to the other along the base of the U to provide the required degree of flexibility of the strip to follow the non-linear contour of the rib. The clips having extended fingers along one side of the clamp means, the fingers being attached to the sleeve and/or base

member such as by being embedded in or bonded to or into the sleeve and/or base member.

The seal device constructed in the above manner is suitable for use in the conventional way by inserting the end of the elongated member through the sleeve member and thereafter sliding the seal device along the elongated member to take up the required position. However, the seal device in accordance with the present invention has the additional capability of being fitted to an elongated member, in situ projecting through a roof or like surface, without having to be threaded onto the elongated member from an end thereof. This is achieved by the operator splitting the sleeve and base member along beside the rib, or along a groove provided adjacent to, or in the rib. The operator may then open the seal device and place it about the elongated member so that the latter extends through the sleeve member. Thereafter the operator applies the clamp means to press and hold the two edges formed by the slit together in a sealed relation throughout their length, so that the seal device becomes an integral component again.

When the seal device is split and fitted to an elongate member extending through a roof, as above described, the clamped rib is located so as to be on the down side of the roof with respect to the elongate member, thereby reducing the risk of leakage of water through the reclosed slit. Nevertheless, the clamp means as provided to hold the two edges of the slit together in sealed relation is designed to be completely effective against the leakage of water therethrough.

The seal device as above described is constructed with the sleeve being of tubular form, preferably tapered, and with the base member in the form of an annular flange. In that form the sleeve and base member must be slit adjacent to the rib when the seal device is to be fitted in a situation where the sleeve may not be passed over an end of the elongate member. It is to be understood that the seal device may be initially constructed with the sleeve and base member already slit.

In an alternative construction, the sleeve and base member may be produced in a generally flat form of segmental shape, having the rib extending along one radial edge and the clamp means along the other radial edge. In subsequent use the two radial edges of the flat segmental shape are brought together and clamped to abut along the length of said edges, thereby forming a conical shape. The larger end of the conical shape forms the base member and the smaller end provides an aperture to receive the elongate member in sealing engagement.

This, as produced, flat form of the seal device substantially reduces manufacturing costs as the segmental shape can be produced in a relatively shallow die mould. It also reduces packaging, storage and transportation costs. When produced in this flat form and then rolled into the conical shape, the base member or flange is initially a continuation of the conical form of the sleeve and is then deformed at installation to extend outwardly from the lower end of the sleeve to provide the flange to be secured by suitable fastening devices to the sheet or structure surrounding the elongate member.

A separate annular ring of metal or other suitable non-resilient manually deformable material may be provided to be placed on the base member about the sleeve during installation. The fastening devices such as screws, rivets, or bolts, are fitting through suitable apertures provided in, or made during installation in, the ring, base member and sheet or structure so the base member is clamped between the ring and sheet or structure to establish an effective seal.

Conveniently, the base member which is made of a resilient material, has along at least part of it's length a member or members of non-resilient manually deformable material, such as a soft metal, attached thereto and may be adapted to be manually stretched in at least one direction and when so stretched to be capable of maintaining that portion of resilient material to which it is attached, correspondingly stretched.

Preferably the adaption of the manually deformable member to be stretched in the one direction is such that compressing of the manually deformable member may also be effected. In particular the adaption of the member may be such that it may be stretched along one edge and compressed along the opposite edge. This enables a portion of the member to be manually deformed in the plane thereof into an arcuate or curved form. The member or members are also manually deformable in the direction normal to the plane thereof so that it may be contoured along its length. This contouring of the member may be effected independently or in combination with stretching or compressing of the member.

Conveniently, the non-resilient manually deformable member is provided with a plurality of interruption along at least one edge, that edge extending substantially in said direction of desired stretch, whereby the member is stretched by increasing the width of the interruption at least along part of the length of the member. Preferably, interruptions are provided along each of two opposite edges of the member with alternate interruption extending from opposite edges of the member. The interruptions are preferably in the form of slits or slots that extend from the opposite edges more than half the width of the member, or at least overlap one another in the direction of the width of the member, conventiently in the longitudinal central region of the member.

The non-resilient manually deformable member may be attached to the base member by bonding to one face of the resilient material, either in a superimposed or inlaid relation having one face of the member exposed. Alternatively, the deformable member may be embedded in the resilient material of the base member. When the deformable member is embedded in the base member it is preferably that at least one face thereof be bonded to the resilient material of the base member.

In a construction wherein the seal device is manufactured in the flat form of segmental shape as above referred to, the member of deformable material will reduce in effective diameter as the radial edges of the segmental shape are brought together and clamped to form the conical sleeve and base flange. The member of deformable material is therefore provided with the slots or slits as above described to thus give the member the degree of extensibility and compressability in the circumferential direction to permit the required reshaping of the base flange into a completed annulas, extending generally outwardly from the larger end of the conical sleeve.

The manually deformable member may be a strip of metal, such as aluminum, with slots, or slits extending in from one or both longitudinal edges of the strip. The degree of stretch that the member may achieve without failure is increased with the length and number of the slots, or slits in the member.

One practical arrangement of the invention will now be described with reference to the accompanying drawings, which depict the invention applied to a sealing device of the type generally disclosed in the Australian Patent No. 514247.

In the drawings:

FIG. 1 is a perspective view from above of the seal device in accordance with the present invention.

FIG. 2 is a vertical section through the sealing device shown in FIG. 1 when assembled to an elongated tubular member.

FIG. 3 is a fragmentary view of a portion of the sleeve member of the seal device with the rib and clamp means of the present invention incorporated thereon.

FIG. 4 is a view of an alternative construction of the seal device in the as manufactured form.

FIG. 5 is a diagrammatic view of the seal device shown in FIG. 4 in the as used form.

FIG. 6 is a fragmentary view of portion of the seal device shown in FIG. 4 with the clamp strip in the assembled state.

The seal device as illustrated in FIG. 1 comprises an annular base flange 10 of resilient readily deformable material, such as natural or synthetic rubber, having an integral sleeve 11 of the same material extending from the upper face of the base flange. The sleeve 11 has a tapered portion 18 tapering toward the upper open end 12. The wall of the sleeve 11 is sufficiently flexible to accommodate misalignment of the upper end 12 relative to the other parts of the seal device, as may be necessary in normal use.

The smaller upper end 12 of the sleeve 11 is normally open and of a diameter to require enlargement thereof by stretching to fit a particular sized elongate member. As a result of the stretching the sleeve establishes a sealing contact with the elongate member.

Spaced along the tapered portion 18 are a plurality of external circumferential ridges 14 denoting where the sleeve may be cut off to suit larger elongate members of different diameters. The ridges also provide a reinforcement about the edge of the open end of the sleeve so formed.

As seen in part in FIG. 1, a rib 25 is provided down the external surface of the sleeve member 11 extending from the top edge thereof to the bottom of the sleeve member and then horizontally across the upper surface of the base flange 10 to the outer edge thereof. Although not shown in the drawings, it is preferable for the area at the junction of the sleeve 11 with the flange 10 through which the rib 25 passes, to be provided with a generous fillet rather than the relatively sharp corner normally provided at this junction.

The ring 13 is bonded to the upper face of the base flange 10 and is of a non-resilient manually deformable nature so that it may hold the base flange in a contoured form if desired. The ring 13 is split at 15 to provide for the rib 25 and clamp strip 32.

Adjacent to the ribs 25 is a clamp strip 32 bonded to or embedded in the rubber of the sleeve and base flange, and is adapted to co-operate with the rib 25 to form a sealed closure of a slit in the sleeve and flange as hereinafter described. In FIGS. 1 and 2 a mid-section of the clamp strip 32 is broken away to show the rib 25 therebeneath.

Also, as can be seen in FIG. 3, the rib 25 is provided with a shoulder 24 dividing the rib into a neck part 29 and head part 30. The shoulder 24 is preferably continuous throughout the length of the rib 25, but may be interrupted at selected locations along the length of the rib without departing from the effectiveness of the invention.

In the form as illustrated, the clamp strip 32 is made up of a series of U-shaped clamp elements 33 interconnected in a side by side relation by web elements 34. The clamp elements 33, in their initial state, have the arms 35 and 36 of the U outwardly directed from the base with the free ends 37 of arms 35 inwardly turned. The clamp elements in this configuration are shown in the top two elements in FIG. 3. When the arms 35 and 36 of the U-shaped clamp elements 33 are so spread, the head portion 30 of the rib 25 may be received between the arms 35 and 36 and the end portions 37 of the arms 36 may be seated in the neck part 29 at the base of the rib 25 beneath the shoulder 24.

The U-shaped clamp elements 33 of the clamp strip 32 each have a lateral extension at one side forming a plurality of fingers 42 that are secured to the sleeve 11 and base flange 10 to effect securement of the clamp strip 32 thereto. The fingers may be bonded to the external face of the sleeve and base flange, as shown in FIGS. 1 and 3, or embedded therein with or without bonding. The provision of a series of fingers rather than a continuous strip retains the flexibility of the clamp strip 32 arising from the clamp elements being interconnected by the web elements 34 only. It is also preferred to have a strip of rubber, such as the strip 38 integral with the wall of the sleeve, located within the clamp strip 32 along the side attached by the fingers to the sleeve. When the rib 25 is embraced by the clamp elements, and the elements are closed to grip the rib, the rib 25 will be pressed against that strip of rubber to improve the quality of seal therebetween.

The clamp strip 32 of the clamp element 33 may be conveniently formed from a one piece metal strip with the web elements 34 providing the required flexibility between adjoining clamp elements so that the clamp strip may closely follow the contour of the sleeve member and base flange when they are in the working fitted condition to the elongated member and the roof sheet. In an alternative construction, the clamp element 33 may be made as individual components secured to the sleeve and base flange and/or fitted to a backing strip of suitable flexible material, such as a resilient plastic material, which may be moulded or extruded on to the respective clamp elements to secure them in the form of a strip.

It will be appreciated from the preceding description that the provision of the rib 25 and clamp strip 32 does not interfere with the original construction of the seal device, and accordingly, the seal device may be used in the manner similar to the prior art and as described in the prior Australian Patent No. 514247 previously referred to. In that previous mode of use, the seal device is threaded onto the elongated member from one end thereof, and thus it was necessary for the elongated member to be free of any protrusions or attachments, that would prevent the seal device being moved from the end thereof to the desired location adjacent the roof or the surface through which the elongated member extended.

However, when it is desired to fit the seal device to an elongated member 8 already in position, extending through a roof or like cladding member 9 and being coupled to other components or equipment to prevent the fitment of the seal device via the end of the elongated member, then the operator may split the sleeve

and base flange between the rib 25 and clamp strip 32 for the total length of the rib 25 thereof. In that situation the sleeve member 11 and flange 10 are severed completely along one side so that the seal device may be opened out and placed about the elongated member without the necessity of threading the elongated member through the sleeve member and flange. After the seal device has been so assembled to the elongated member the edges of the slit are brought together and the clamp strip 32 is located to embrace the rib 25 to re-establish continuity of the wall of the sleeve member 11 and of the base flange 10.

The operator may then close the clamp elements by deflecting the arms 35 and 36 inwardly by the use of a pair of pliers or a like hand tool. This will bring the arms 35 and 36 into a generally parallel relation as shown at 39 in FIG. 3, thereby compressing the edges of the slit tightly to form a seal. It will be appreciated that when the arms of the clamp elements are so squeezed together, the end portion 37 of the arms 35 will pinch the neck portion 29 of the rib and be firmly seated beneath the head portion 30. These various interactions between the clamp elements and the rib ensure that the clamp element cannot be accidentally dislodged from the rib 25, and the rib 25 is firmly compressed to form an effective weather tight seal therebetween.

In the above described construction the sleeve 11 and base flange 10 are slit adjacent to the rib 25 when the seal device is to be installed, however, it is to be understood that the seal device may be manufactured with the sleeve and base flange already split, with the clamp strip integral therewith and extending along one edge of the slit and the rib extending along the other edge of the slit.

In a further alternative construction, as illustrated in FIG. 4 of the drawings, the seal device may be manufactured in the form of a generally flat rubber moulding of segmental shape. In the form illustrated the segment is approximately 270° of arc so the two radial edges 50 and 51 have an included angle of about 90°. A rib 64 and clamp strip 62, generally constructed as previously described, are provided along the edges 50 and 51 in a like manner to that previously described.

Along the perimetal area 49 of the flat moulding is a metal strip 58 secured to the rubber moulding. The strip 58 may be bonded to the surface of the moulding, inlaid therein, or embedded therein with or without bonding between the metal and rubber. The strip 58 has slots 60 extending in from each of the longitudinal edges 61 of the strip. The junction of the slots with the edge of the strip are radiused to reduce the risk of the corners piercing the rubber. The metal strip may be stretched in the longitudinal direction by applying tension to the strip to open out, that is widen, the slots 60. This stretching of the strip is a non-resilient stretch and will effect a similar stretching of the rubber of the moulding in the area of the metal strip,. The functioning of the slotted metal strip has been further described earlier in this specification.

When the flat moulded seal device is to be used the two radial edges 50 and 51 are brought into abutting relation about the elongate member, and the clamp strip 62 and rib 65, are operatively interengaged to form a sealed joint between the edges 50 and 51. There is thus formed a generally conical shaped sleeve 11*a* with the perimetal area 49, carrying the strip metal 58, generally co-extensive with the sleeve 11*a* as shown in FIG. 5. The perimetal area 49 may then be increased in length at the lower edge by stretching the metal strip 58 to increase the width of the slots 60 and thereby increase the circumferential length of the lower edge of the perimetal area. The ability to increase the length in a non-resilient manner enables the perimetal area to be formed into an annular flange 10*a* projecting outwardly around the lower large end of the sleeve 11*a* and co-axial therewith, as shown in broken outline in FIG. 5.

In a preferred construction, the clamp strip is as shown in FIG. 6 comprising a plurality of clamp elements 63 of U shape, interconnected by web sections 69. The respective arms 65 and 66 of each clamp element are of the same construction but of opposite hand, with respective inwardly directed end portions 67 and 68. During moulding of the sleeve and base flange of either of the previously described embodiments of the sealing device the inwardly directed end positions 67 of the arms 65 are embedded in the rubber of the sleeve and base flange moulding. As a result of this embedding of the end portion of arms 65 in the moulding the clamp strip is securely attached to the moulding, with the moulding extending through the gaps formed between adjacent clamp element arms 65. Also a continuous strip 71 of rubber is provided within the clamp elements adjacent the arms 65.

The securement of the clamp strip to the sleeve and flange as above described is primarily for retaining them in assembly prior to installation. Upon installation, the closing of the clamp elements about the rib 25 to clamp the two edges of the sleeve and flange together will effect lasting securement of the clamp strip to the moulding forming the sleeve and base flange.

In each of the above described constructions of the seal device, when being installed the base flange 10 is manually deformed to closely follow the contour of the surface of the cladding sheet 9 to which it is being fitted. The base flange is secured to cladding sheet 9 through which the elongated member 8 extends by screws, bolts or rivets that pass through the base flange and cladding sheet. Where the slotted form of the metal strip is incorporated in the base flange, the screws, bolts or rivets are passed through a part of the metal strip or through a washer or the like. The installation of the screws, bolts or rivets achieves a clamping or compression of the resilient material of the base flange between the metal strip and the cladding sheet to provide an effective weather tight seal therebetween. If desired, a sealant paste or the like may be used between the cladding sheet and base flange.

As previously referred to, the sealing device is preferably installed so the side thereof on which the rib and clamp means are provided is located on the lower side or downstream side with respect to the water flow over the roof or cladding sheet. This results in the slit adjacent the rib facing downstream with respect to the water flow and therefore reduces the risk ofleakage due to incorrect installation or damage subsequent to installation.

In the embodiment illustrated in FIGS. 4 and 5, a fold or pleat 70 is formed at the junction of the sleeve 11*a* and base flange 10*a* during moulding of the seal device. The fold 70 is a maximum height at the mid-portion of the length off the fold and progressively decrease toward each end thereof. As seen in FIG. 4 the fold 70 creases a short distance from the respective radial edges 50 and 51. This results in an opening being left on either side of the ridge formed by the clamp elements and the rib assembly of the seal device when installed. Accord-

ingly, as this ridge is on the downstream of the installed seal device, water collecting between the fold 70 and sleeve 11*a* may freely drain therefrom around the respective ends of the fold.

This form of fold may also be incorporated in the seal device as described with reference to FIG. 1. A further advantage of the fold 70 is that it provides an increase in the flexibility between the sleeve and base flange to accommodate relative misalignment and movement therebetween.

I claim:

1. A seal device for providing a weather seal between an elongate member and a cladding sheet through which the elongate member extends, the seal device comprising an apertured base member of resilient deformable material to be located in use in superimposed relation to the sheet with the elongate member extending through the aperture, a sleeve of resilient deformable material integral with the base member and projecting from one side thereof, the sleeve member encompassing said aperture in the base member so that in use the elongate member also extends through the sleeve member, a rib formed integral with the sleeve and base member projecting outwardly from the external surface thereof, said rib extending generally down the length of the sleeve and across the base member to the outer edge thereof, whereby in use the wall of the sleeve and base member is slit adjacent to and for the full length of the rib to permit opening of the sleeve and base member for fitment about the elongated member, and clamp means secured to the sleeve and to the base member extending parallel to and for the length of the rib so the slit can be made between the rib and the clamp means, the clamp means comprises a series of clips interconnected in a strip form, the interconnection between the clips being flexible at least in the longitudinal direction, each clip having a portion to receive and embrace the rib and is non-resiliently deformable to grip the rib to thereby sealably close the slit to secure the sleeve and base member around the elongated member, wherein the sleeve and base member are molded integral in a generally planar form of segmental shape, having two substantially radial edges, wherein each of said clips has a lateral extension at one side forming a finger secured to said sleeve and said base flange to effect securement of said clamp strip thereto, said rib extending along one said radial edge and the clamp means extending along the other said radial edge, said sleeve having an upper edge portion having a plurality of radially-spaced circumferential guide ridges for ease of cutting the edge portion to tightly fit the elongate member.

2. The weather seal as defined in claim 1, wherein a perimetal margin portion extending between said radial edges and has bonded to one face thereof a continuous metal strip adapted to be non-resiliently stretchable in the circumferential direction, whereby said strip will be stretched when the perimetal margin portion is deformed outwardly to form the base member and thereby retain the base member in that disposition.

3. The weather seal as defined in claim 1, wherein the strip of metal has circumferentially spaced slots formed therein extending from at least one edge thereof in a direction across the direction of stretch.

4. The weather seal as defined in claim 3, wherein the slots in the strip of metal extend from opposite edges of the strip.

5. The weather seal as defined in claim 4, wherein the slots in the strip of metal alternately extend from opposite edges of the strip.

6. The weather seal as defined in claim 5, wherein the annular member of non-resilient deformable metal is located about the sleeve and bonded in face to face relation to the base member and is adopted to be manually stretchable in the circumferential direction.

7. The weather seal as defined in claim 6, wherein the annular member has circumferentially spaced slots formed therein extending from an edge thereof in a direction across the direction of stretch.

8. A seal device for providing a weather seal between an elongate member and a cladding of a building sheet through which the elongate member extends, the seal device comprising an apertured base member of manually deformable resilient material to be located in use in superimposed relation to the sheet with the elongate member extending through the aperture, a sleeve of manually deformable resilient material integral with the base member and projecting from one side thereof, the sleeve member encompassing said aperture in the base member so that in use the elongate member also extends through the sleeve member, a rib formed integral with the sleeve and base member projecting outwardly from the external surface thereof, said rib extending generally down the length of the sleeve and across the base member to the outer edge thereof, whereby in use upon splitting the wall of the sleeve and base members adjacent to and for the full length of the rib permits opening of the sleeve and base member for fitment about the elongate member, and clamp means secured integrally to the sleeve and to the base member and extending parallel to and for the length of the rib so that upon splitting the slit is made between the rib and the clamp means, the clamp means comprises a series of clips interconnected in a strip form, the interconnection between the clips being flexible at least in the longitudinal direction, each clip having a portion to receive and embrace the rib and is non-resiliently deformable to grip the rib and thereby by the deformation alone sealably close the slit to secure the sleeve and base member around the elongate member, wherein each of said clips has a lateral extension at one side forming a finger secured to said sleeve and said base flange to effect securement of said clamp strip thereto, said rib having a neck portion for conforming the rib to the clamp means.

9. The weather seal as defined in claim 8, wherein each clip is of generally U shape cross-section and the clips are interconnected in spaced relation at the base of form a channel like strip, one arm of each U shape clip on the same side of each clip being secured to the sleeve or base member at a location so the slit can be made between the rib and arms of the clips secured to the sleeve and base member.

10. The weather seal as defined in claim 9, wherein each said one arm has an end portion thereof turned inwardly toward the other arm of that clip, said turned-in portion on each clip being embedded in the sleeve or base member.

11. The weather seal as defined in claim 10, wherein the sleeve and base member are moulded integral in a generally planar form of segmental shape, having two substantially radial edges, said rib extending along one said radial edge and the clamp means extending along the other said radial edge.

12. The weather seal as defined in claim 11, wherein the perimetal margin portion of said segmental shape

extending between said radial edges forms and said base, has bonded to one face thereof a continuous metal strip adapted to be non-resiliently manually stretchable in the circumferential direction, whereby said strip will be stretched when the perimetal margin portion is deformed outwardly to form the base member and thereby retain the base member in that disposition.

13. The weather seal as defined in claim 12, wherein the strip of metal has circumferentially spaced slits formed therein extending from at least one edge thereof in a direction across the direction of stretch.

14. The weather seal as defined in claim 13, wherein the slits in the strip of metal extend from opposite edges of the strip.

15. The weather seal as defined in claim 14, wherein the slits in the strip of metal alternately extend from opposite edges of the strip.

16. The weather seal as defined in claim 8, wherein the sleeve and base member are formed with said slit therein located between and extending the length of said rib and clamp means.

17. The weather seal as defined in claim 8, wherein an annular member of non-resilient deformable metal is located about the sleeve and bonded in face to face relation to the base member whereby the base member will take-up and retain any contoured shape imparted to the annular member.

18. The weather seal as defined in any one of claims 8 to 10, wherein an annular member of non-resilient deformable metal is located about the sleeve and bonded in face to face relation to the base member and is adopted to be manually stretchable in the circumferential direction.

19. The weather seal as defined in claim 18, wherein the annular member has circumferentially spaced slot or slits formed therein extending from an edge thereof in a direction across the direction of stretch.

20. The weather seal as defined in claim 19, wherein the slots or slits in the annular member extend from opposite edges of the annular ember.

21. The weather seal as defined in claim 20 wherein the slits in the annular member alternately extend from opposite edges of the annular member.

* * * * *

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United States Patent [19]

Bravo et al.

[11] Patent Number: 5,826,919

[45] Date of Patent: Oct. 27, 1998

[54] **FLEXIBLE PENETRATION FITTING**

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[73] Assignee: **S. Bravo Systems, Inc.**, Buena Park, Calif.

[21] Appl. No.: **889,900**

[22] Filed: **Jul. 8, 1997**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 714,471, Sep. 16, 1996, abandoned.

[51] **Int. Cl.**[6] **F16L 3/04**

[52] **U.S. Cl.** **285/139.2**; 285/139.3; 285/148.25; 285/192; 285/236

[58] **Field of Search** 285/48, 49, 50, 285/137.1, 139.2, 139.3, 142.1, 148.25, 205, 226, 229, 236, 348, 368, 192

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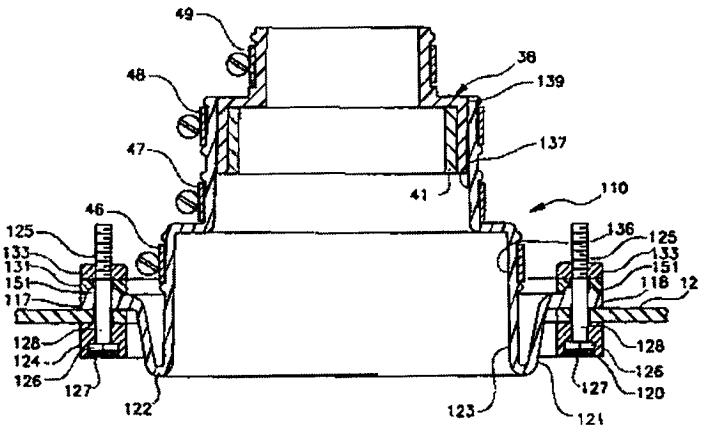
Primary Examiner—Dave W. Arola

Attorney, Agent, or Firm—Christie, Parker & Hale, LLP

[57] **ABSTRACT**

A flexible penetration fitting is provided for sealing the hole through which a pipeline penetrates a wall of an underground containment box. The penetration fitting includes a flexible boot with a sealing flange for providing a first seal against the inside wall of the box. The sealing flange is held against the wall by a backing ring placed against the outside wall of the box. The backing ring includes a plurality of studs extending through the wall and into the box. A compression ring with a plurality of holes is placed over the sealing flange with the studs of the backing ring extending though the holes. A plurality of nuts are threaded to the studs to hold the sealing flange firmly against the inside wall of the box. The flexible boot also includes a sleeve for providing a second seal against the outside surface of the pipeline. The sleeve is stepped with different sized openings so as to be able to receive different sizes of pipelines. A hose clamp placed around the sleeve at the appropriate sized opening seals the sleeve against the pipeline.

5 Claims, 10 Drawing Sheets



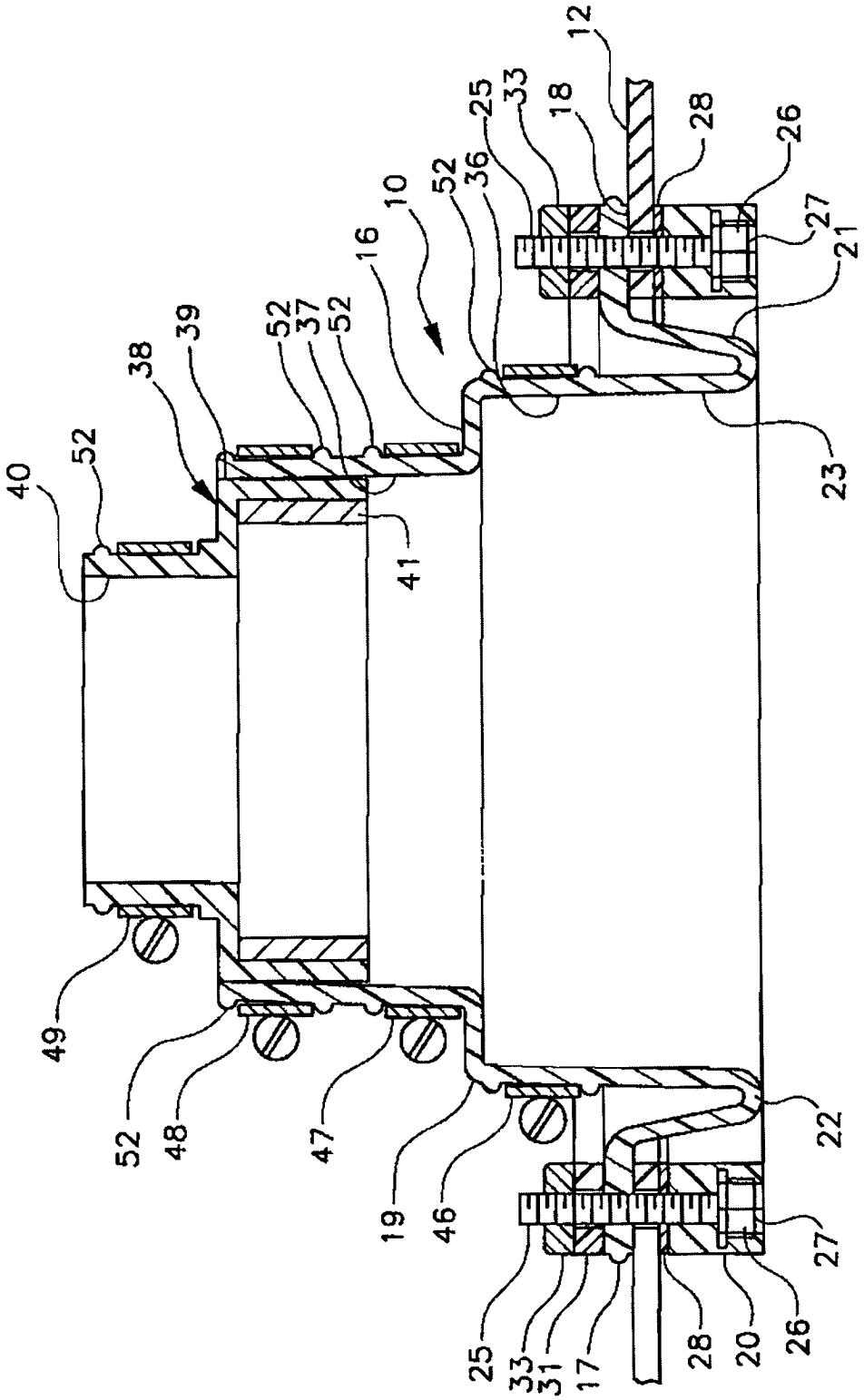

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FIG. 2

FIG. 3

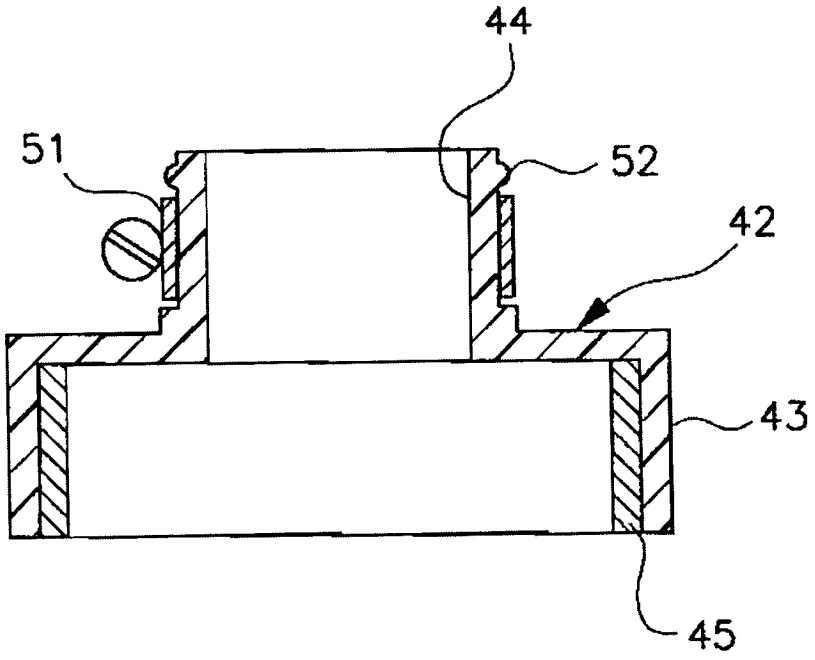

FIG.4a

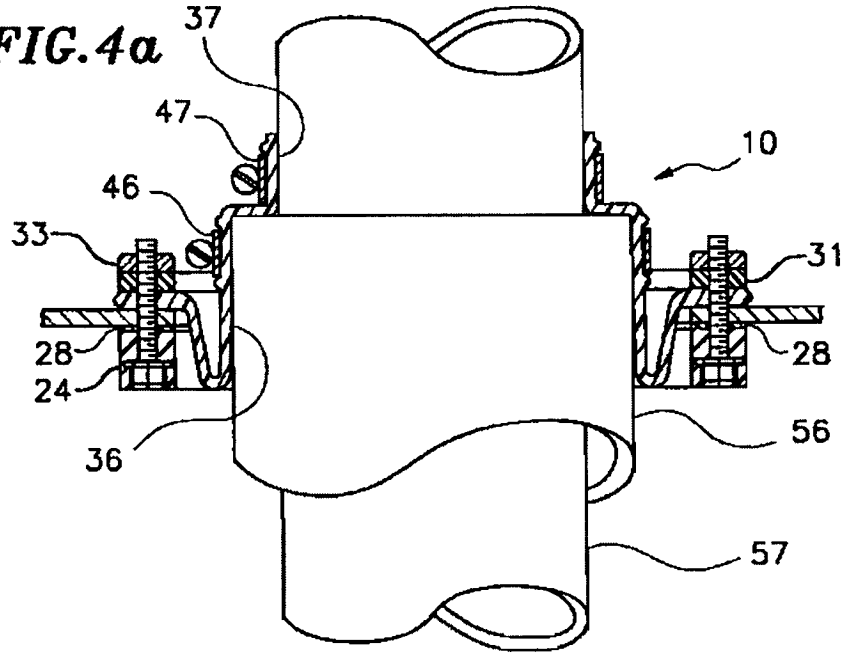
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FIG.4b

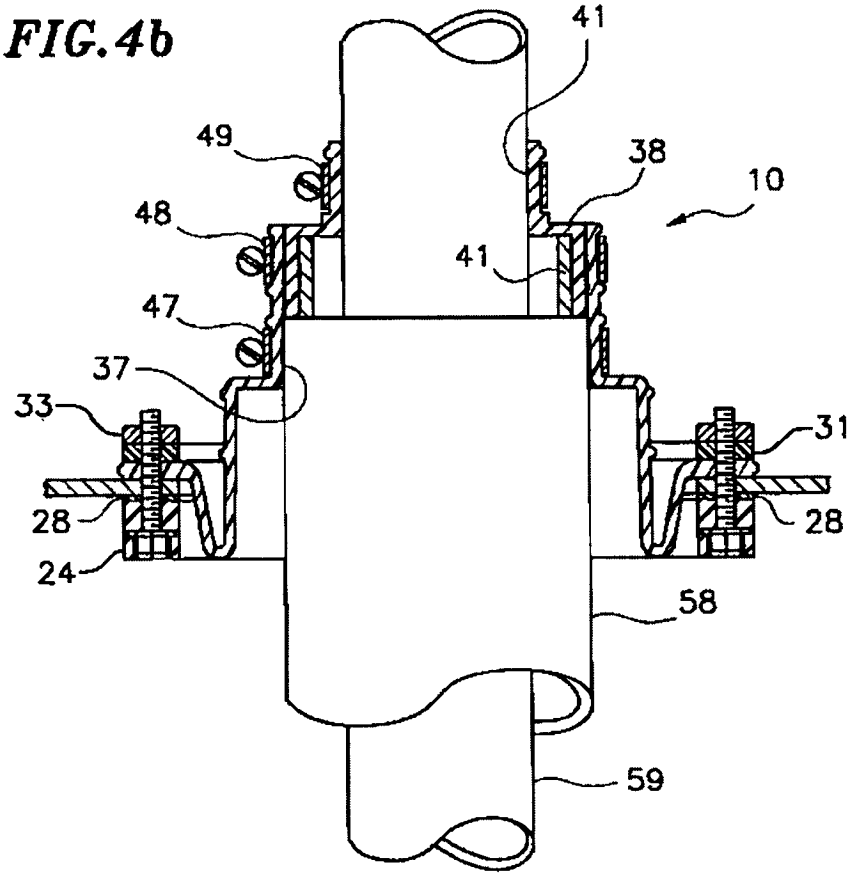
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FIG. 4c

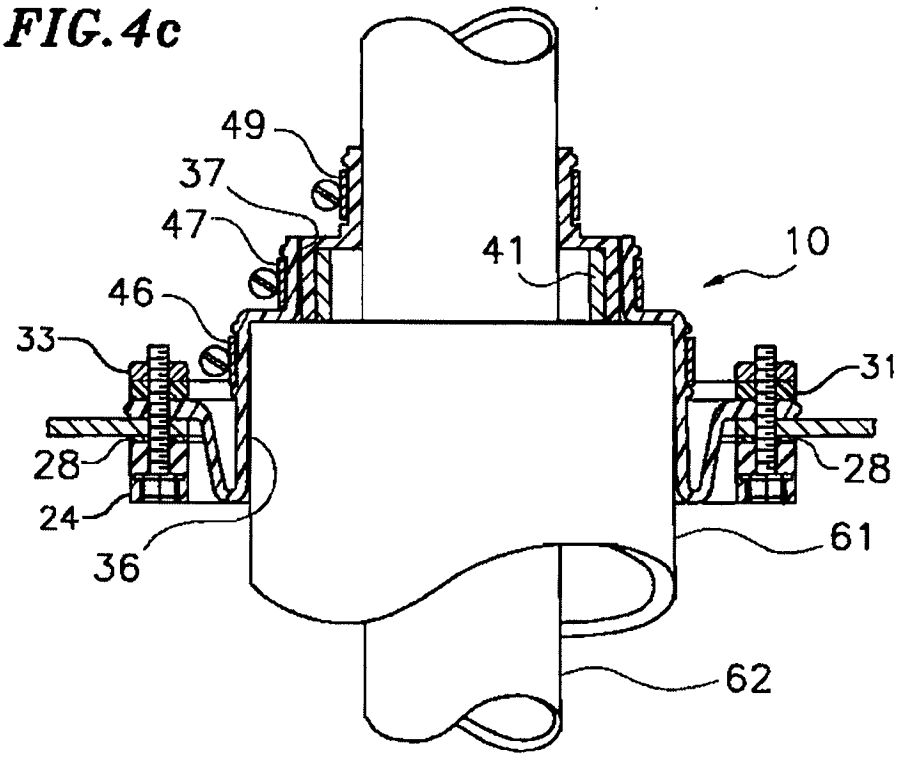

FIG. 4d

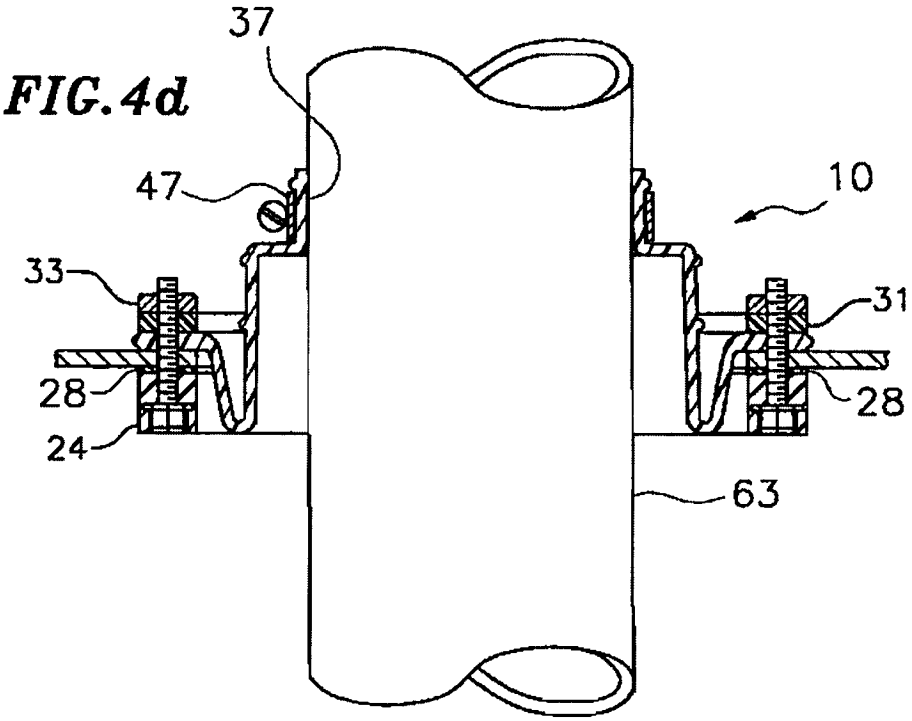

FIG.5

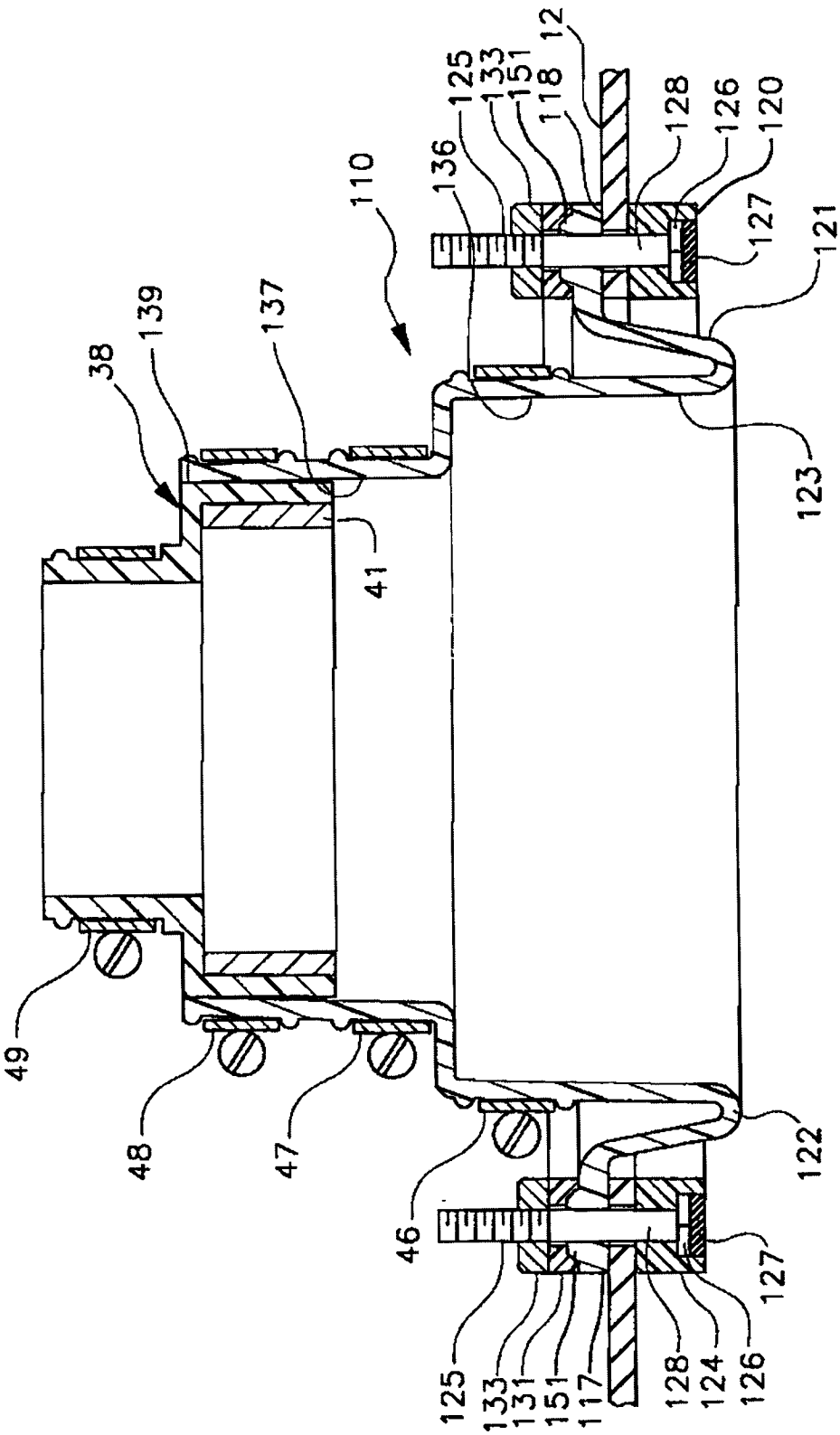
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FIG.6

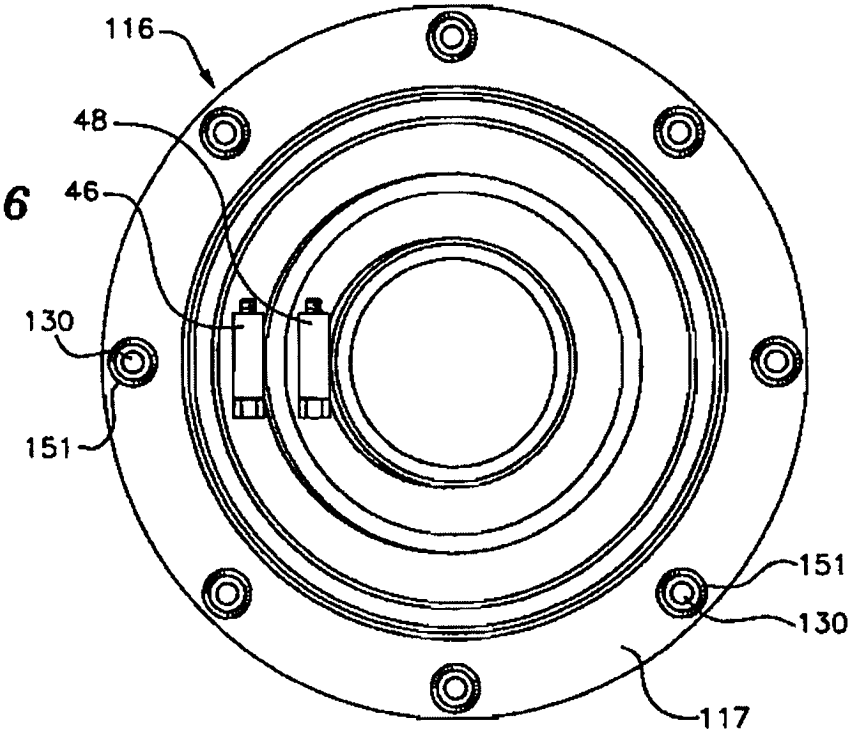


FIG.7

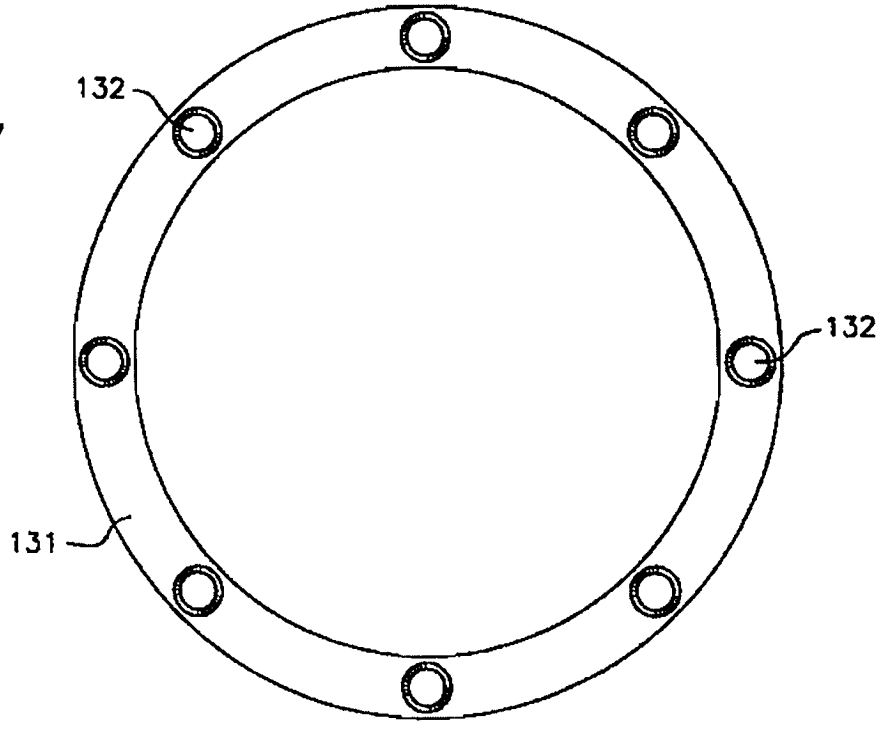


FIG.8

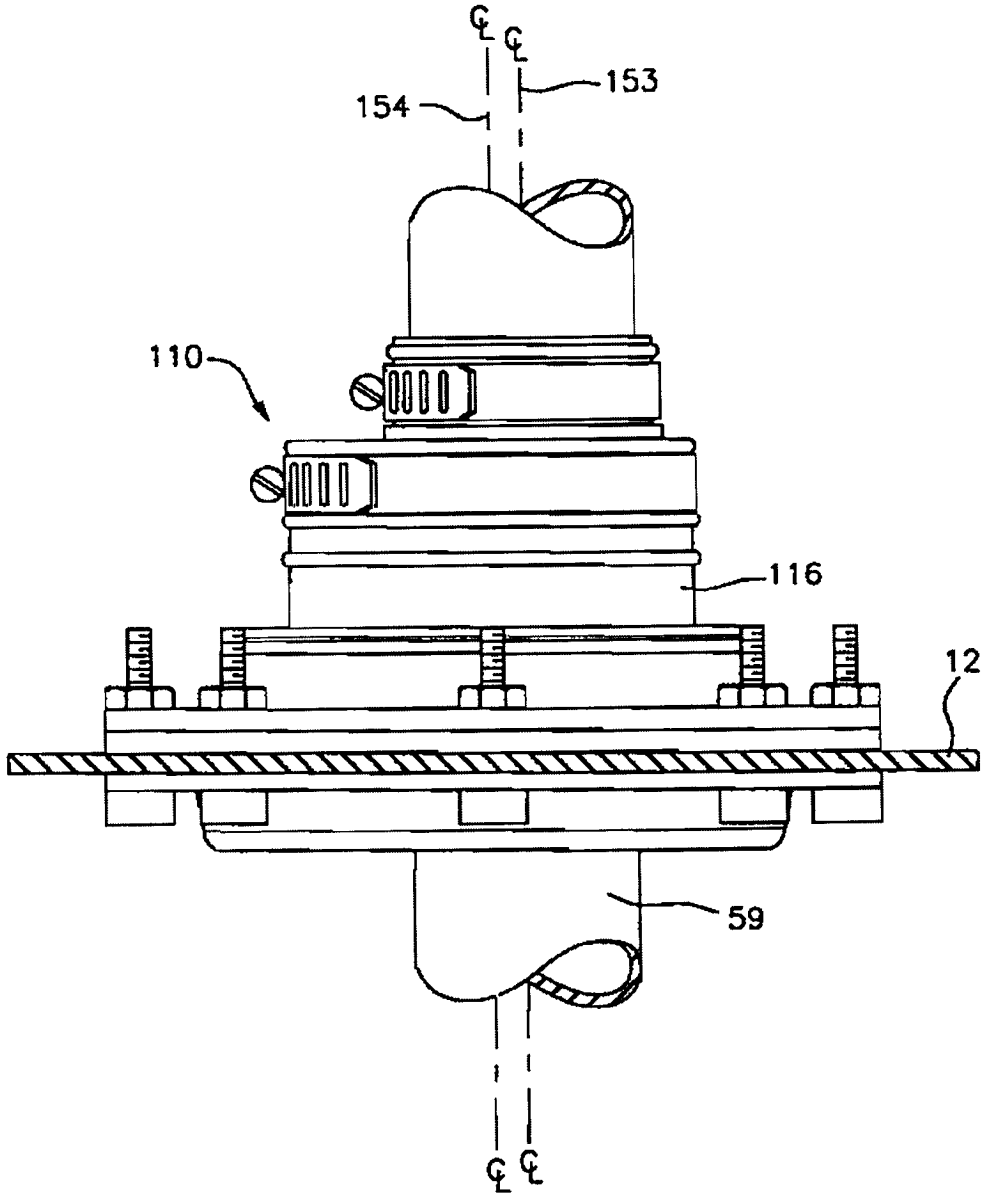


FIG.9

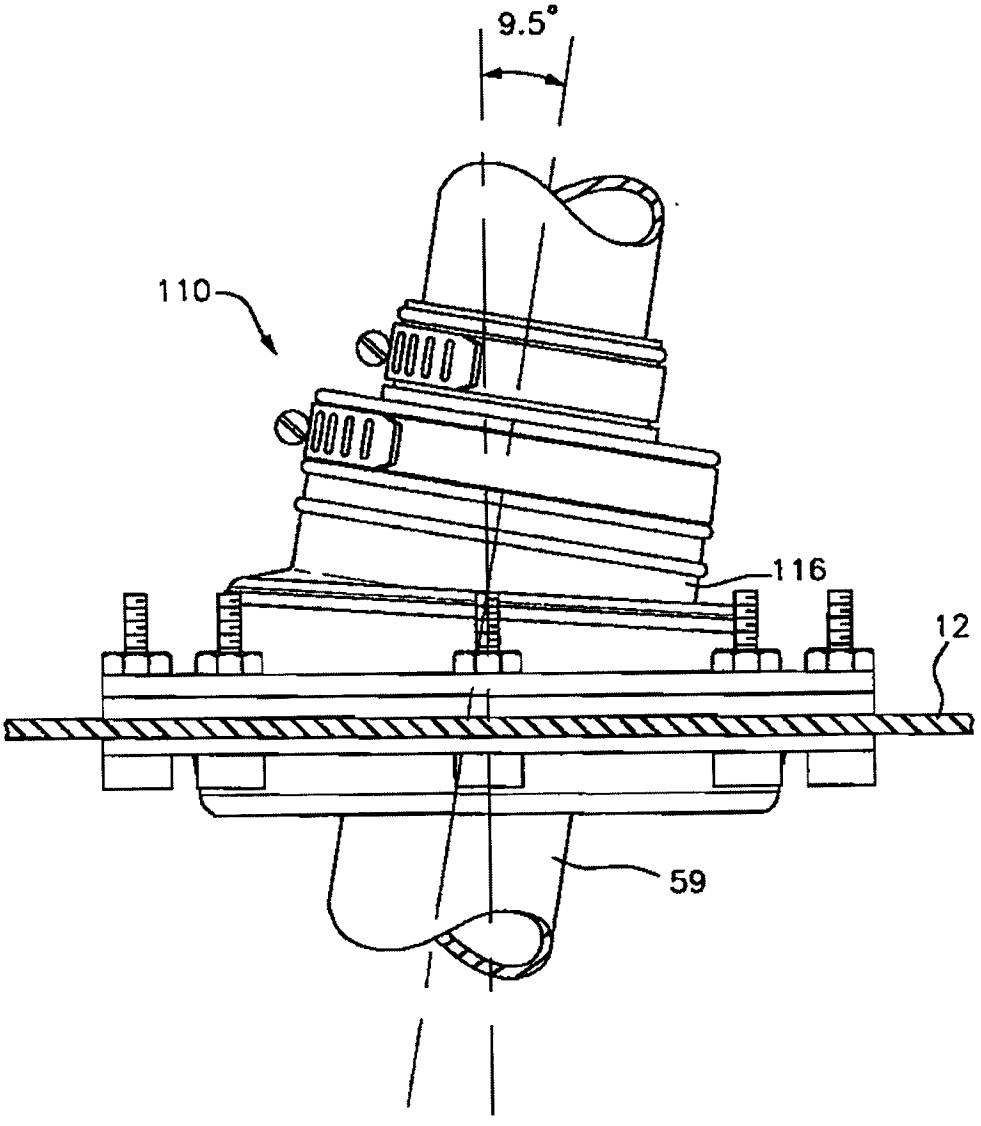
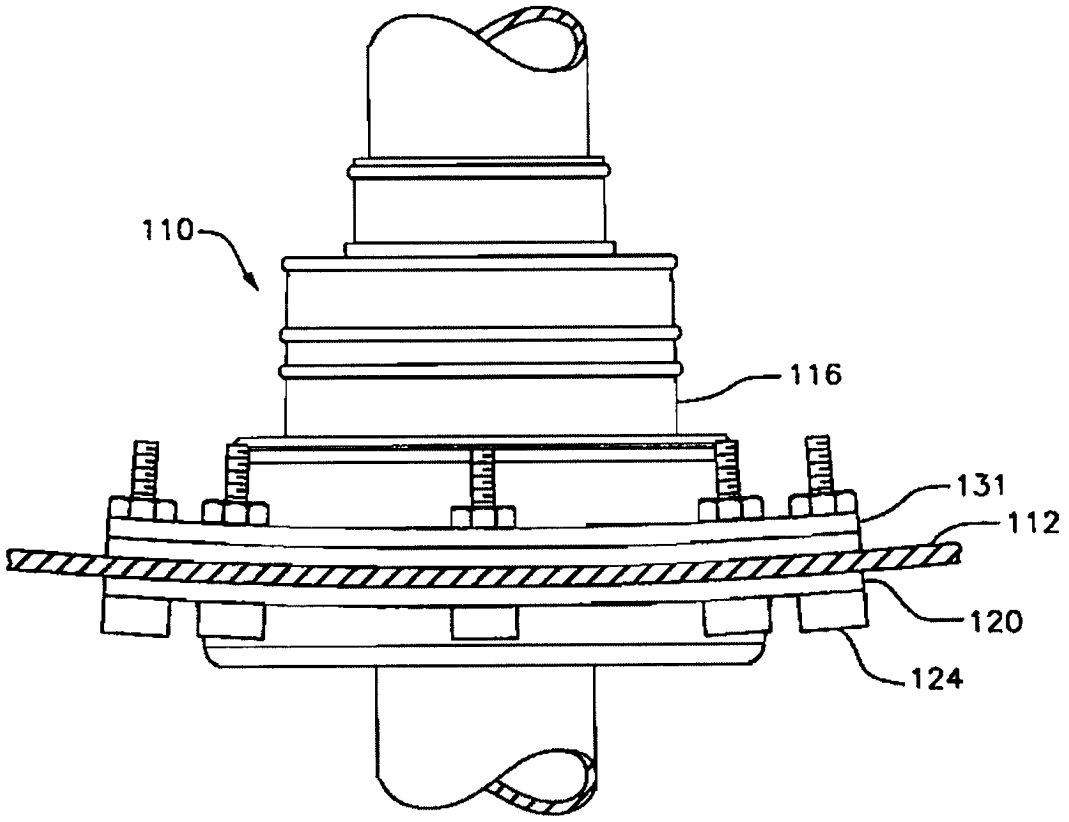


FIG. 10



FLEXIBLE PENETRATION FITTING

CROSS REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of patent application Ser. No. 08/714,471, filed Sep. 16, 1996, abandoned.

FIELD OF THE INVENTION

The present invention relates to a flexible penetration fitting for use with a secondary containment box. More particularly, it relates to a universal penetration fitting that can be used with a broad range of sizes of flexible or rigid pipeline including various configurations of coaxial pipelines. The penetration fitting is also simple to replace in the event it becomes damaged after installation.

BACKGROUND OF THE INVENTION

For several years there has been a growing awareness of air and water pollution problems caused by leaking liquids such as gasoline that flow through buried pipelines such as those present at gasoline service stations. As a result, secondary containment systems have been developed for these systems. A secondary containment system typically includes a primary pipeline in which a product such as gasoline flows from an underground storage tank to a product dispenser. The system also includes a secondary pipeline that surrounds the primary pipeline. The purpose of the secondary pipeline is to contain any fluid that may leak from a damaged primary pipeline, and prevent the fluid from contaminating the surrounding ground. The secondary pipeline is generally monitored for fluid collection so that any leak in the primary pipeline can be repaired promptly.

Fittings known as bulkhead fittings or penetration fittings are generally used in combination with secondary containment systems to permit a buried pipeline to penetrate the wall or bulkhead of a containment box. Containment boxes are liquid-tight boxes associated with connections in the primary pipeline. For example, containment boxes are often provided under product dispensers, at product pumps, or at other junctions in the primary pipeline to contain any product that may leak or spill from the primary pipeline associated with such equipment. A penetration fitting prevents any such liquid that is collected in a containment box from contaminating the ground by sealing the hole in the wall through which the pipeline penetrates the wall of the containment box.

Many different types of penetration fittings have been developed. A popular type of penetration fitting is a boot made from a resilient elastomeric material which imparts flexibility to the joint between the pipeline and the containment box. One such a boot is disclosed at FIG. 22 of U.S. Pat. No. 5,297,896 to Webb. According to the Webb patent the containment box includes a pipe entry hole through which the pipeline extends. Surrounding the entry hole are a plurality of stud holes which assist in fastening the boot to the wall of the containment box. The boot is installed from the outside of the containment box and includes a flexible sleeve section extending from a sealing flange. While the sealing flange is located outside the box, the sleeve extends through the pipe entry hole and into the box. The sealing flange includes integral studs that extend through the stud holes of the containment box. The studs also extend through a plurality of holes in a compression ring located in the box. Nuts are threaded over the studs to press on the compression ring which in turn pulls the sealing flange against the outer surface of the wall of the containment box to effect the seal. The pipeline extends into the box through the flexible sleeve portion of the boot and is sealed to the sleeve portion with a hose clamp.

A similar penetration fitting is sold by Environ Products, Inc. of Lionville, Pa. This penetration fitting additionally includes a return bend in the flexible tube portion such that the sleeve is made of a flexible tube that first extends away from the containment box and then turns inward on itself to extend through the hole in the wall of the containment box. Such a return bend provides further flexibility to the boot.

Fittings with boot portions that are stepped to accommodate two different sizes of pipes are also known. Such penetration fittings allow a single fitting to seal against two different sizes of pipeline where the two pipelines are provided in a coaxial arrangement. Such penetration fittings can also include inserts that can be clamped in place within the flexible tube to allow a single penetration fitting to accommodate different sizes of pipelines. Examples of such penetration fittings and inserts are those sold by Total Containment, Inc. of Exton, Pa.

Because prior art penetration fittings include a boot made from a resilient material, the boot can periodically crack or tear. If the integrity of a penetration fitting is compromised due to a crack or tear in the boot, it must be replaced. However, one important problem with prior art penetration fittings is that they generally cannot be easily removed and reinstalled. Because such a penetration fitting is installed on the containment box from the outside, excavation is required to put a new penetration fitting in place. Such excavation can lead to extensive maintenance costs as well as prolonged downtime of a service station.

SUMMARY OF THE INVENTION

The penetration fitting of the present invention is used for forming a seal between a pipeline and a wall of a containment box. An optional gasket is placed on the outside surface of the wall of the box. A backing ring is also provided outside of the box with a plurality of studs extending from it. The studs are oriented to extend through a plurality of holes in the gasket and into the box. A flexible boot is provided with a sealing flange for placement against the inside surface of the wall. The sealing flange includes a plurality of holes through which the studs extend.

A compression ring is provided over the sealing flange inside the box. The compression ring also has a plurality of holes through which the studs extend. The boot is sealed to the inside wall of the box at the sealing flange by threading nuts to the studs which press the compression ring against the sealing flange and press the sealing flange against the wall. The optional gasket between the backing ring and wall of the box provides further sealing in the event there is leakage through the holes in the sealing flange.

Extending from the sealing flange is a sleeve for receiving the pipeline. In the preferred embodiment the sleeve includes a return bend which provides added flexibility to the boot. The preferred embodiment also includes a stepped sleeve configuration in which the circumference of the sleeve decreases in increments along its length. This configuration permits the boot to accommodate a number of different sizes of pipelines including coaxial pipelines having inner and outer pipelines. A particular pipeline is sealed to the sleeve by a hose clamp at the appropriate location along the length of the sleeve where the pipeline best fits. Any portion of the sleeve smaller than the pipeline can be removed easily with a utility knife.

An important benefit of the penetration fitting of the present invention is that once the backing ring is in place, the boot can be installed entirely from inside the containment box. This permits a damaged boot to be replaced without the need for excavating around the containment box.

BRIEF DESCRIPTION OF THE DRAWINGS

Other features, aspects, and advantages of the present invention will be more fully understood when considered with respect to the following detailed description, appended claims, and accompanying drawings where:

FIG. 1 is an exploded perspective view of a flexible penetration fitting of the present invention;

FIG. 2 is a sectional elevation view of the penetration fitting of FIG. 1;

FIG. 3 is a sectional elevation view of an alternative insert for use with the penetration fitting of FIG. 1;

FIGS. 4*a*–4*d* are sectional elevation views of the penetration fitting of FIG. 1 when used in various pipeline configurations;

FIG. 5 is a sectional elevation view of another embodiment of the invention;

FIG. 6 is a top plan view of the flexible boot of FIG. 5;

FIG. 7 is a bottom plan view of the compression ring of FIG. 5;

FIGS. 8 and 9 are elevation views of the penetration fitting of FIG. 5 illustrating the flexibility of the boot when installed; and

FIG. 10 is an elevation view partly in section illustrating the penetration fitting of FIG. 5 installed on a curved wall.

DETAILED DESCRIPTION

According to the present invention, a flexible penetration fitting 10 as illustrated in FIGS. 1 and 2 is provided to seal a wall 12 of an underground containment box at the point where a pipeline (not shown) penetrates the wall. The containment box includes a first pipe entry hole 13 through which the pipe extends and a plurality of mounting holes 14 arranged around the entry hole for mounting the penetration fitting to the containment box.

The penetration fitting includes a flexible boot 16 made of a resilient oil resistant elastomeric material. The boot includes a ring-shaped sealing flange 17 for providing a seal against the inside surface 18 of the containment box wall. The boot also includes an integral flexible tube portion 19 that extends from the sealing flange. In the preferred embodiment, a first outwardly extending portion 21 of the tube extends in an outward direction away from the containment box. The tube then forms a return bend section 22 where it turns back on itself in an inward direction and back into the containment box to form a sleeve section 23. The sleeve section provides a sealing surface for sealing against the pipeline as will be discussed in further detail below.

The penetration fitting also includes a backing ring 24 provided outside the containment box. The backing ring includes a ring portion 20 with a plurality of studs 25 extending in a direction perpendicular to the plane of the ring portion. Preferably, eight studs are provided spaced equidistantly around the circumference of the backing ring. In the preferred embodiment the ring portion of the backing ring is made of a durable polymeric material with eight bolts 26 fastened to the backing ring by embedding their heads 27 within the backing ring. The threaded shafts of the bolts act as the studs for the backing ring. The backing ring is placed around the pipe entry hole outside the containment box with an optional gasket 28 between it and the wall. The studs of the backing ring extend through a plurality of holes 29 in the surface of the gasket, through the plurality of mounting holes in the wall of the box and into the box. The studs further extend through a plurality of holes 30 in the sealing flange of the boot.

A compression ring 31, also with a plurality of holes 32 for cooperating with the plurality of studs is provided inside the containment box. The compression ring is preferably made of a fairly rigid material compared to that used for the flexible boot. While the compression ring may be made of metal, it is preferably made of a fairly rigid polymeric material such as that used for the ring portion of the backing ring. Eight nuts 33 are threaded to the studs and press the compression ring against the sealing flange to press the sealing flange against the inside wall of the containment box sealing the boot to the containment box.

The flexible sleeve of the boot is designed to receive a variety of different pipe sizes. This is achieved by a stepped configuration in the circumference of the sleeve. A first circumference 36 is provided on the sleeve at a point near the sealing flange. The first circumference is capable of receiving a first pipe with a relatively large diameter. As the sleeve extends away from the sealing flange, the first circumference necks down to a second circumference 37 for receiving a second pipe with an intermediate diameter.

In the preferred embodiment, the penetration fitting also includes a first insert 38 having an outside diameter 39 for cooperating with the second circumference of the sleeve. The outside diameter necks down to a narrower section with an inside opening 40 for receiving a third pipe with a relatively small diameter. A structural ring 41 made of a fairly rigid material is provided inside the first insert at the first diameter to prevent either the insert or the sleeve from collapsing when the insert is attached to the sleeve. A second insert 42 as illustrated in FIG. 3 is also provided similar to the first insert. The second insert has an outside diameter 43 for cooperating with the second circumference of the sleeve and an opening 44 for receiving a fourth pipe with a relatively small diameter different from the diameter of the opening of the first insert. Like the first insert, the second insert includes a structural ring 45 for preventing the insert or the sleeve from collapsing when attached to the sleeve. Preferably, the first and second inserts are made of a resilient elastomeric material similar to that used for the boot. The structural rings are made of a more rigid material, preferably a polymeric material similar to that used for the backing ring.

According to the preferred embodiment, the first circumference is sized to receive a 4 inch pipeline and the second circumference is sized to receive a 3 inch pipeline. The opening of the first insert is sized to receive a 2 inch pipeline while the opening of the second insert is sized to receive a 1½ inch pipeline. A single penetration fitting having a sleeve of this design can receive four different sizes of pipeline.

A plurality of circumferential clamps such as radiator clamps or hose clamps are provided to effect the various seals to the sleeve. Such clamps are well known in the art and generally include a circular band in which the circumference can be adjusted by turning a screw or bolt located on the band. Referring back to FIG. 2, a first hose clamp 46 is provided at the first circumference to seal the sleeve against a large diameter pipe. The hose clamp can be tightened with a tool such as a wrench or screwdriver to seal the sleeve against the pipeline. A second hose clamp 47 and a third hose

clamp 48 are provided next to one another at the second circumference to seal the sleeve against either an intermediate diameter pipeline or one of the inserts. A fourth hose clamp 49 and a fifth hose clamp 51 (FIG. 3) are provided to clamp the opening of the first and second inserts around small diameter pipelines.

A plurality of circumferential beads 52 running around the sleeve above each hose clamp help to keep the hose clamps in place at their respective points along the sleeve. The beads are also useful in that they can be used as guides for trimming from the boot any portion of the sleeve that will not be used. For example, if the boot is used to seal a large diameter pipeline, the portion of the sleeve above the bead at the first hose clamp can be trimmed such as with a utility knife.

The stepped sleeve design and inserts make the penetration fitting capable of accommodating a number of different piping configurations. Just a few of the many different piping configurations are illustrated in FIGS. *4a–4d*. In FIG. *4a*, the penetration fitting 10 is shown installed on a system with a coaxial pipeline in which an outer pipeline 56 is provided with a 4 inch diameter and an inner pipeline 57 is provided with a 3 inch diameter. The outer pipeline is sealed to the sleeve at the first circumference 36 by the first hose clamp 46. The inner pipeline is sealed to the sleeve by the second hose clamp 47 at the second circumference 37. The portion of the sleeve above the second hose clamp has been cut away in this installation.

According to FIG. *4b*, the penetration fitting 10 is shown installed on a second coaxial pipeline configuration in which an outer pipeline 58 is provided with a 3 inch diameter and an inner pipeline 59 is provided with a 2 inch diameter. The outer pipeline is sealed at the second circumference 37 with the second hose clamp 47. The first insert 38 is sealed to the second circumference with the third hose clamp 48 and the inner pipeline is sealed to the opening 40 of the first insert by the fourth hose clamp 49.

Referring to FIG. 4c, the penetration fitting is configured as installed on yet another coaxial pipeline configuration. An outer pipeline 61 is provided with a 4 inch diameter and is sealed at the first circumference 36 by the first hose clamp 46. The first insert 38 is sealed to the second circumference 37 by the second hose clamp 47. The portion of the sleeve above the second hose clamp has been cut away for this installation. An inner pipeline 62 with a 2 inch diameter is sealed at the opening 40 of the first insert by the fourth hose clamp 49.

Referring to FIG. *4d*, yet another piping configuration is illustrated. Here a pipeline 63 with a 3 inch diameter is sealed to the sleeve at the second circumference 37 with the second hose clamp 47. For this installation the portion of the sleeve above the second hose clamp has been cut away.

Still other configurations are possible with the penetration fitting of the present invention. A single penetration fitting can be used to accommodate pipelines having diameters of 4 inches, 3 inches, 2 inches and 1½ inches. The same penetration fitting can also accommodate coaxial pipelines in which the inner and outer pipeline diameters are (expressed as outer diameter in inches × inner diameter in inches): 4×3; 4×2; 4×1½; 3×2; and 3×1½. The penetration fitting can also be used with either rigid or flexible pipelines.

Another embodiment of the present invention is illustrated in FIGS. 5, 6 and 7. This is presently the most preferred embodiment. According to this embodiment as illustrated in FIG. 5, a penetration fitting 110 is attached to the wall 12 of the containment box. The penetration fitting includes a flexible boot 116 (also see FIG. 6) with a sealing flange 117 that seals the flexible boot against the inside surface of the wall of the containment box. The general shape of the flexible boot is identical to the previous embodiment in that it includes a return bend 122 and a sleeve section 123 with a first circumference 136, a second circumference 137 and an insert 38. First, second third and fourth hose clamps 46, 47, 48, 49 are also provided.

Also like the prior embodiment, the heads of a plurality of bolts 126 are embedded within a ring portion 120 of a backing ring 124. Preferably, the bolts are embedded in hexagonal holes in the ring portion and sealed with an epoxy or a sealer such as silicone 127. One important difference in this embodiment over the prior embodiment is that rather than including bolts with shafts threaded their entire lengths, the shafts include a smooth shoulder 128 adjacent the head which extends into an outer threaded stud 125 opposite the head.

Another difference is the inclusion of a number of lips 151, each with a chamfered edge which circumferentially surrounds each of the sealing flange holes 130 on the surface 152 of the sealing flange (FIGS. 5 and 6). The lips mate with a plurality of counter bored holes 132 on a compression ring 131, each of the counter bored holes including each having a similarly chamfered edge. In the most preferred embodiment, the sealing flange holes are slightly smaller than the diameter of the shoulders of the bolts. For ¼ inch diameter bolts, the holes in the sealing flange are preferably 0.010 inch smaller in diameter. It is also preferred that when the penetration fitting is installed, the shoulder portion of each of the bolts should extend up to at least the tops of the lips on the sealing flange holes. It should be noted that even with such tolerances, a single size penetration fitting can fit a number of different containment boxes having different wall thicknesses as the width of the backing ring prevents the nuts 133 from bottoming-out on the threaded portions of the bolts during installation.

According to this embodiment, a particularly reliable seal among the components is achieved when the plurality of nuts are tightened down on the studs. The tightening of the nuts not only presses the sealing flange against the inside surface of the wall of the containment box by sandwiching the sealing flange and the wall between the backing ring and the compression ring, it also helps to seal against leakage which may occur at the bolts. This is accomplished by the cooperation between the lips on the sealing flange and the counter bored holes of the compression ring whereby the counter bored holes press the lips of the sealing flange against the shoulder portions of the bolts. Without such a design, in order to prevent leakage at the bolts, a second gasket such as that illustrated in the embodiment of FIG. 2 is required. In the prior art, leakage at the bolts generally prevented the mounting of a flexible boot to the inside wall of the containment box.

Another advantage to the use of the penetration fitting of the present invention is that the flexible boot permits great flexibility in the joint between the wall of the containment box and the pipeline penetrating the box. For example, as shown in FIG. 8, a penetration fitting 110 with a flexible boot 116 is illustrated in an installation where the center axis 153 of the pipeline 59 does not coincide with the center axis 154 of the entry hole through the wall 12 of the box. Here, a penetration fitting with a sealing flange approximately seven inches in diameter designed for up to a four inch pipeline with an entry hole of about 6 inches, is fitted with a two inch pipeline. By using the design of the present invention, an offset between the center axes of the pipeline and the entry

hole is permitted without compromising the integrity of the seal. For an installation with the penetration fitting described above fitted for a three inch pipeline, an offset of ¾ inch is permitted.

Furthermore, the flexible boot permits the pipeline to enter the box at a broad range of angles. This is in large part due to the low profile of the boot. In FIG. 9, a penetration fitting 110 with a flexible boot 116 and a two inch pipeline 59 attached to the flexible boot is shown flexed to an angle of about 9½ degrees from a line perpendicular to the wall of the box. For a four inch pipeline, an angle of up to about 45 degrees from perpendicular is permitted without compromising the integrity of the seal.

Another important feature of the present invention is that if the boot of a penetration fitting were to crack or tear, a new boot can be installed without excavating the ground around the containment box. First the primary pipeline is disconnected from the equipment inside the containment box. Then the nuts and the compression ring are removed from the penetration fitting. The damaged boot is removed and a new boot is placed over the pipeline such that the holes in the sealing flange fit over the studs of the existing backing ring. The compression ring and nuts are then reinstalled to seal the new boot against the wall of the containment box. There is generally no need to replace the gasket. A hose clamp is placed around the sleeve and tightened to seal the boot to the pipeline. The primary pipeline can then be reconnected to the equipment in the box with minimal downtime. Such a simple method for replacing a boot is impossible with prior art penetration fittings which are installed from the outside of the box.

Yet another advantage of the use of an embodiment such as that illustrated in FIG. 4*b* is that the use of the insert simplifies assembly of the piping system. The flexible boot of the penetration fitting can first be fastened to the box as set forth above. The insert 38 can then be placed at an appropriate point on the inner pipeline 59 and any fitting (not shown) that is to be placed on the inner pipeline can be attached before the pipeline is set in place. The pipeline can then be inserted into the boot, the second hose clamp 47 can be tightened against the outer pipeline 58, the insert can be slid along the inner pipeline until it rests within the sleeve of the boot, the third hose clamp 48 can be tightened to the insert and the fourth hose clamp 49 can be tightened to fasten the inner pipeline to the boot. For coaxial pipelines that require special equipment to attach a fitting to the inner pipeline, it can greatly simplify assembly if the fitting is attached to the end of the pipeline before the pipeline is placed in the box.

The use of the insert also simplifies the later replacement of the boot if the boot is ever damaged. In order to replace a damaged boot, first the inner pipeline is disconnected from any equipment in the box. Then the nuts and compression ring are removed along with the second and third hose clamps 47 and 48. The inner and outer pipelines can be left in place with the insert attached and the boot can be pulled over the pipeline including any fitting that may be attached to the inner pipeline. A new boot can then be pulled over the pipeline and sealed as set forth above. Without an insert, it can be difficult to pull a new boot over the pipeline, especially if the inner pipeline includes a permanently mounted fitting.

Still another advantage of the penetration fitting of the present invention is that the flexible boot permits the fitting to be installed on a slightly curved wall without the use of any special adaptors. According to FIG. 10, a penetration fitting 110 with a flexible boot 116 is shown attached to a containment box with a curved wall 112. Not only can the flexible boot be easily flexed to conform to the curvature of the wall, but since the ring portion 120 of the backing ring 124 and the compression ring 131 are also made of a somewhat resilient material, they too can conform to the curvature of the wall. The preferred material for these components is an acetyl copolymer sold under the name Celcon™. This is also the preferred material for the ring portion of the backing ring, the compression ring and the structural rings of the inserts. A penetration fitting with a seven inch flange and designed for up to a four inch pipeline can be mounted on a cylindrical wall having a radius of curvature greater than about 10 inches without the need for special fittings as are generally required for prior art penetration fittings. For walls having a smaller radius of curvature, a dished backing ring with a similarly dished compression ring can be provided for use with the same flexible boot described above.

What is claimed is:

1. A penetration fitting for forming a seal between a pipeline and a wall having an inside surface and an outside surface, the penetration fitting comprising:

a backing ring comprising a ring portion and a plurality of studs extending from the ring portion, the backing ring for placement against the outside surface of the wall and the studs for extending through the wall, the studs including a first smooth shoulder portion proximate the ring portion and a second threaded portion distal the ring portion;

a flexible boot comprising:

a sleeve for receiving the pipeline; and

a sealing flange including a first face for placement against the inside surface of the wall, a second face opposite the first face, a plurality of apertures extending between the first and second faces for receiving the plurality of studs, and a plurality of lips extending circumferentially around each aperture;

a clamp for sealing the sleeve of the flexible boot to the pipeline;

a compression ring defining a plurality of holes for receiving the plurality of studs, each hole including a counter bore for mating with the lips of the sealing flange; and

a plurality of nuts for cooperating with the studs to press the sealing flange between the compression ring and the inside surface of the wall.

2. The penetration fitting of claim 1 wherein the flexible boot further comprises a return bend.

3. The penetration fitting of claim 1 wherein the flexible boot further comprises a plurality of stepped openings for receiving a plurality of different sizes of pipes.

4. The penetration fitting of claim 3 further comprising an insert for cooperating with an opening to receive yet another different size of pipe.

5. The penetration fitting of claim 1 wherein the backing ring and the compression ring are made of a deformable material that permits the fitting to be installed on a curved wall.

* * * * *

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United States Patent [19]

Bravo et al.

[11] Patent Number: 5,988,698

[45] Date of Patent: *Nov. 23, 1999

[54] FLEXIBLE PENETRATION FITTING

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[73] Assignees: Sergio M. Bravo; S. Bravo Systems, Inc., both of Buena Park, Calif.

[*] Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).
This patent is subject to a terminal disclaimer.

[21] Appl. No.: 09/081,165

[22] Filed: May 18, 1998

Related U.S. Application Data

[63] Continuation of application No. 08/889,900, Jul. 8, 1997, Pat. No. 5,826,919.

[51] Int. Cl.[6] F16L 3/04

[52] U.S. Cl. 285/139.2; 285/139.3; 285/148.25; 285/192; 285/236

[58] Field of Search 285/48, 49, 50, 285/205, 206, 229, 226, 236, 308, 368, 192, 139.2, 137.1, 139.3, 142.1, 148.25

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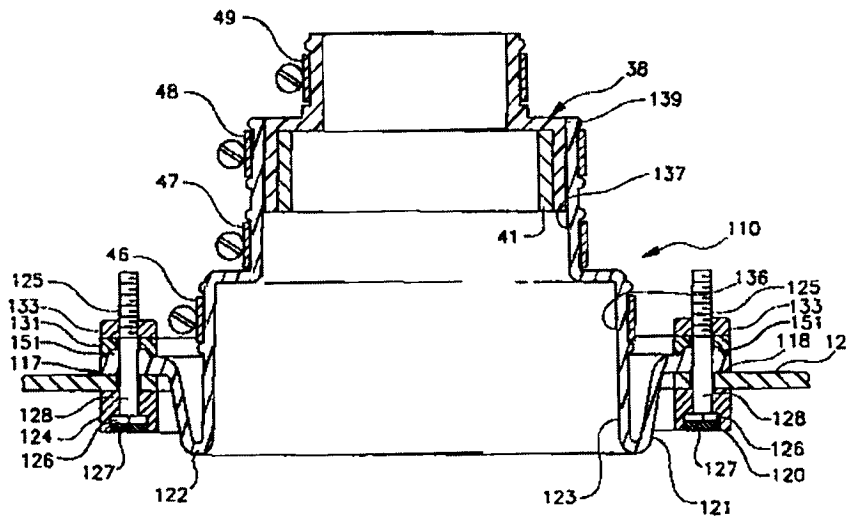
Primary Examiner—Dave W. Arola
Attorney, Agent, or Firm—Christie, Parker & Hale, LLP

[57] ABSTRACT

A flexible penetration fitting is provided for sealing the hole through which a pipeline penetrates a wall of an underground containment box. The penetration fitting includes a flexible boot with a sealing flange for providing a first seal against the inside wall of the box. The sealing flange is held against the wall by a backing ring placed against the outside wall of the box. The backing ring includes a plurality of studs extending through the wall and into the box. A compression ring with a plurality of holes is placed over the sealing flange with the studs of the backing ring extending though the holes. A plurality of nuts are threaded to the studs to hold the sealing flange firmly against the inside wall of the box. The flexible boot also includes a sleeve for providing a second seal against the outside surface of the pipeline. The sleeve is stepped with different sized openings so as to be able to receive different sizes of pipelines. A hose clamp placed around the sleeve at the appropriate sized opening seals the sleeve against the pipeline.

5 Claims, 10 Drawing Sheets



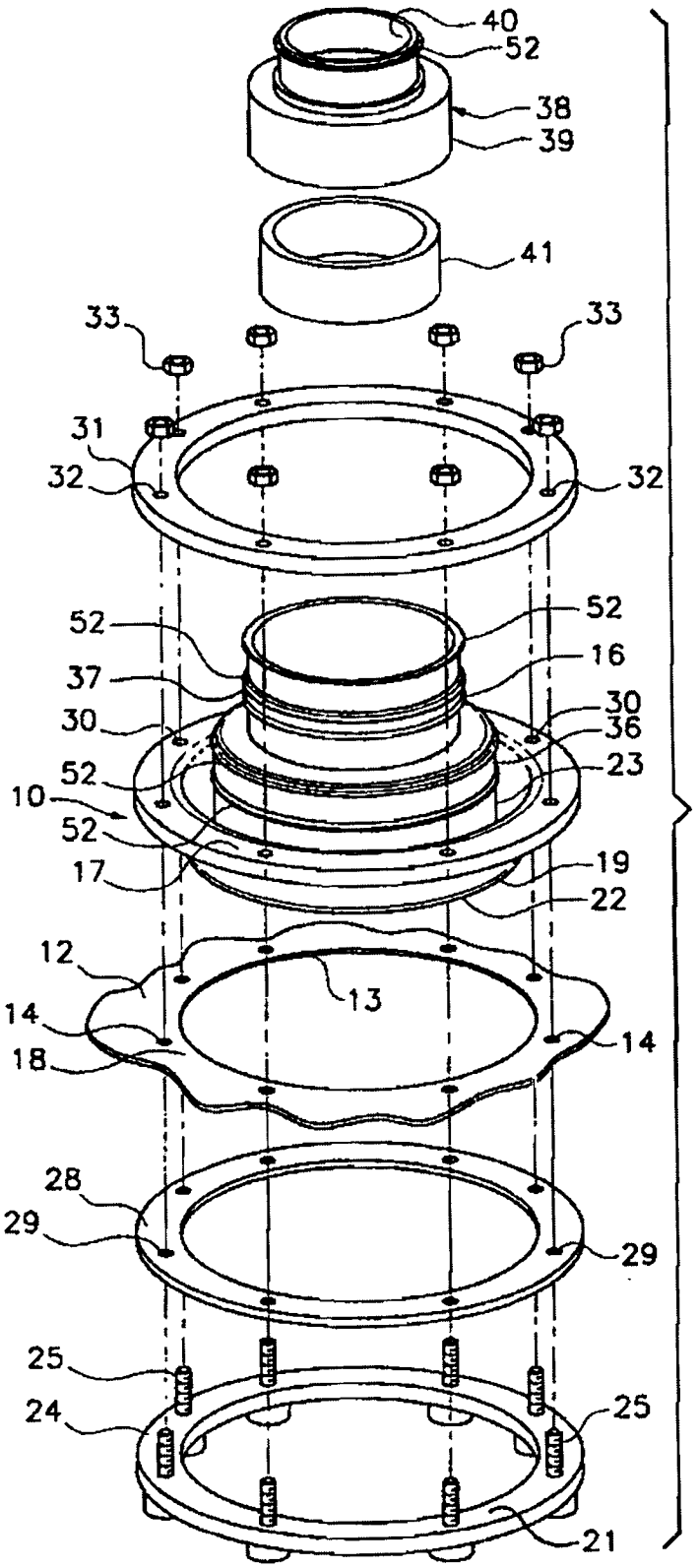

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FIG. 1

FIG.2

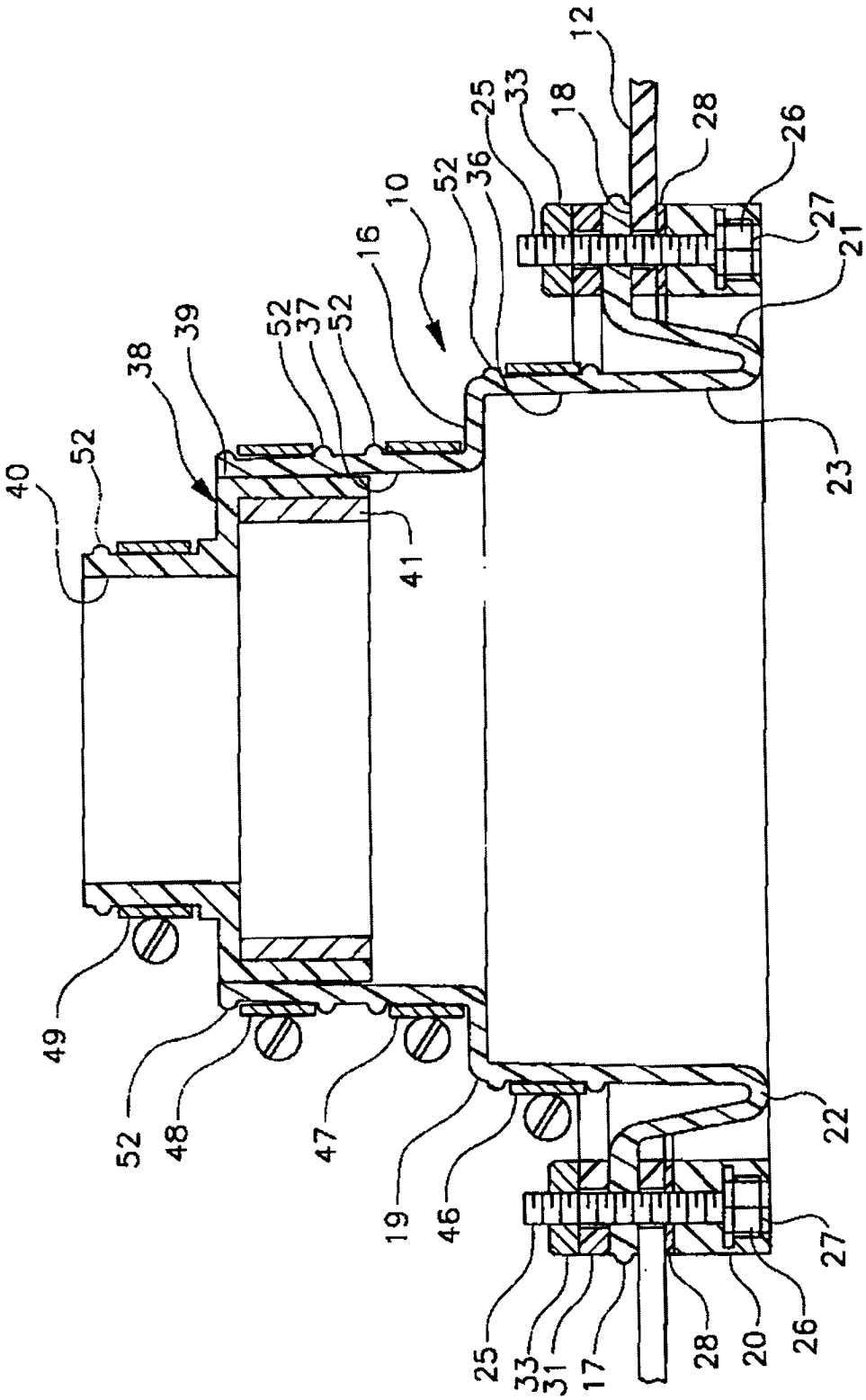
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FIG. 3

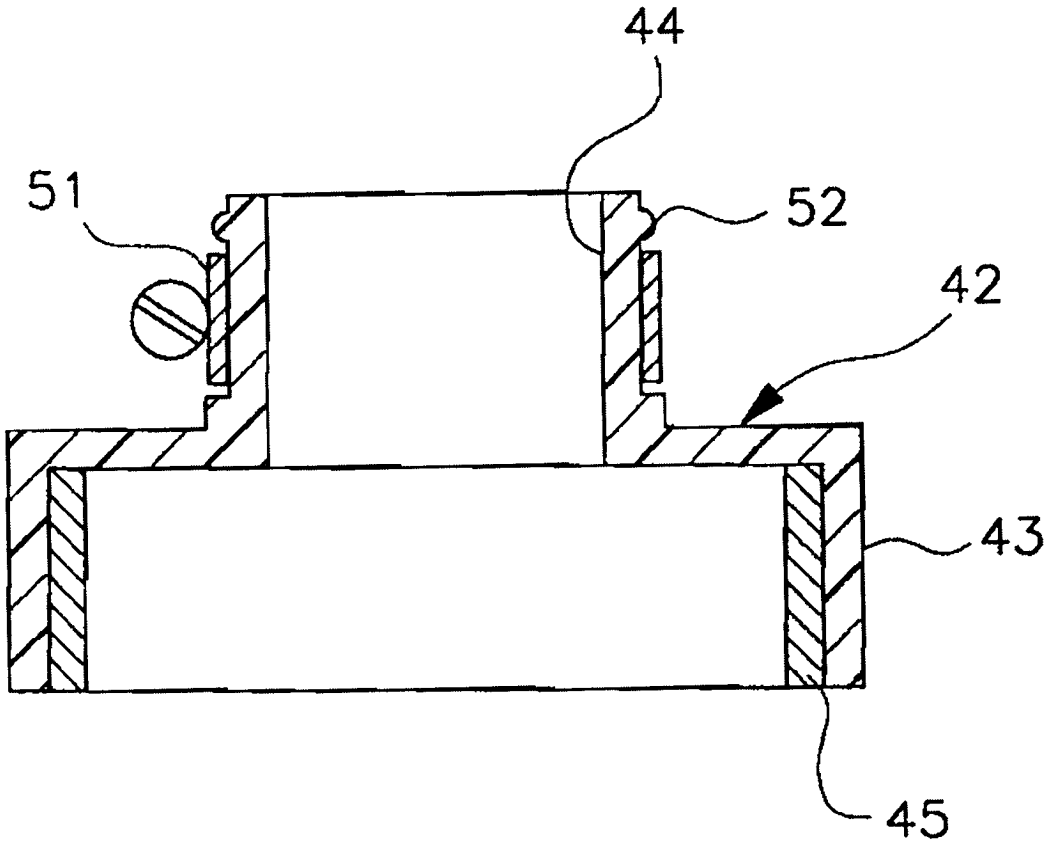

FIG.4a

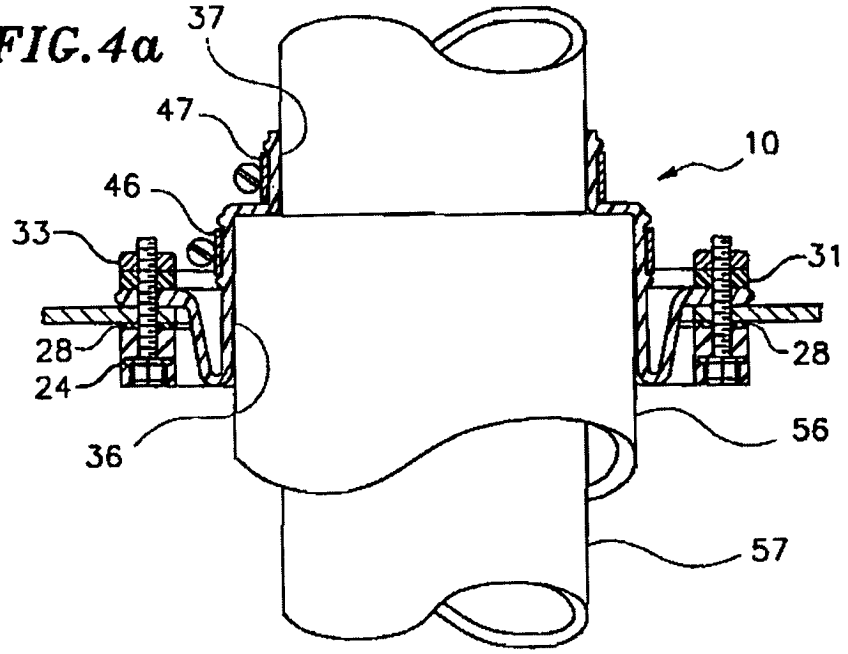
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FIG.4b

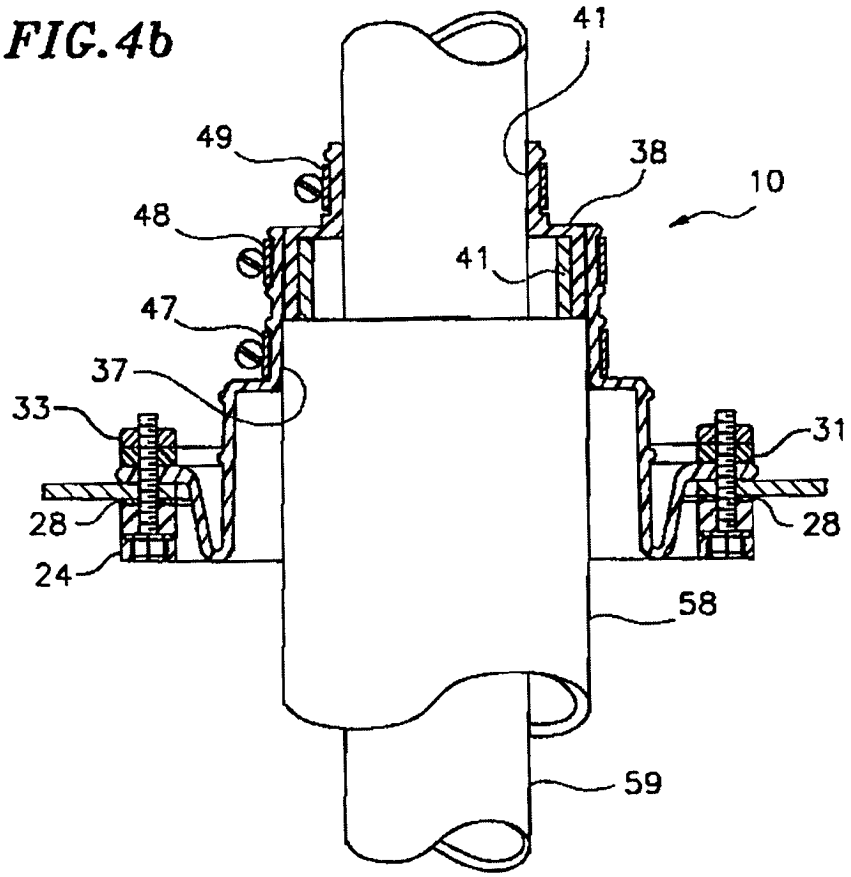
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FIG. 4c

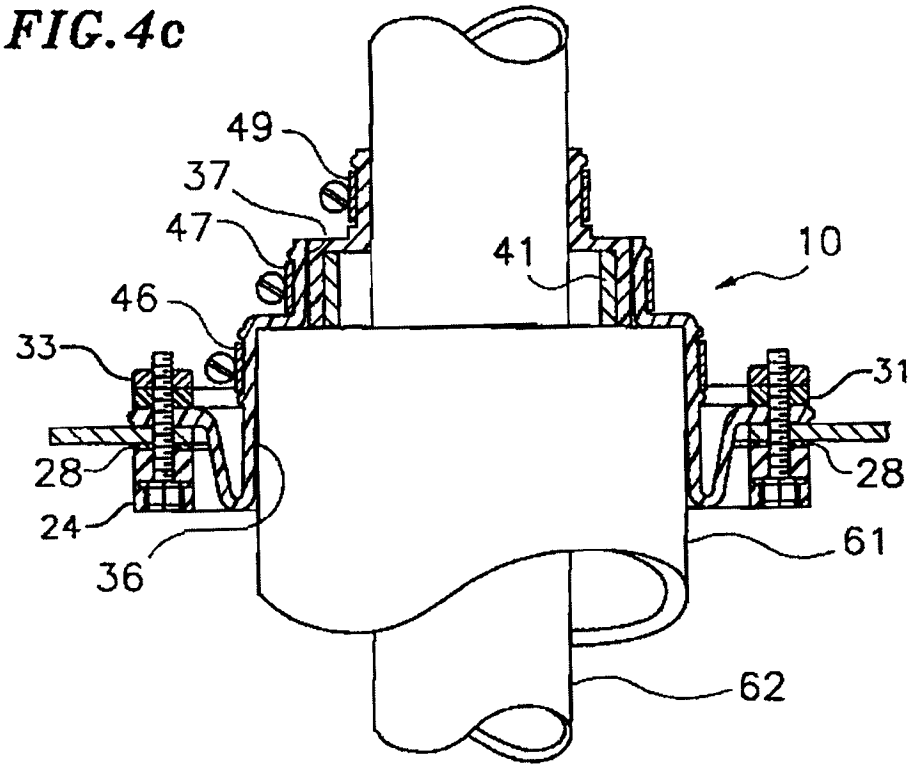

FIG. 4d

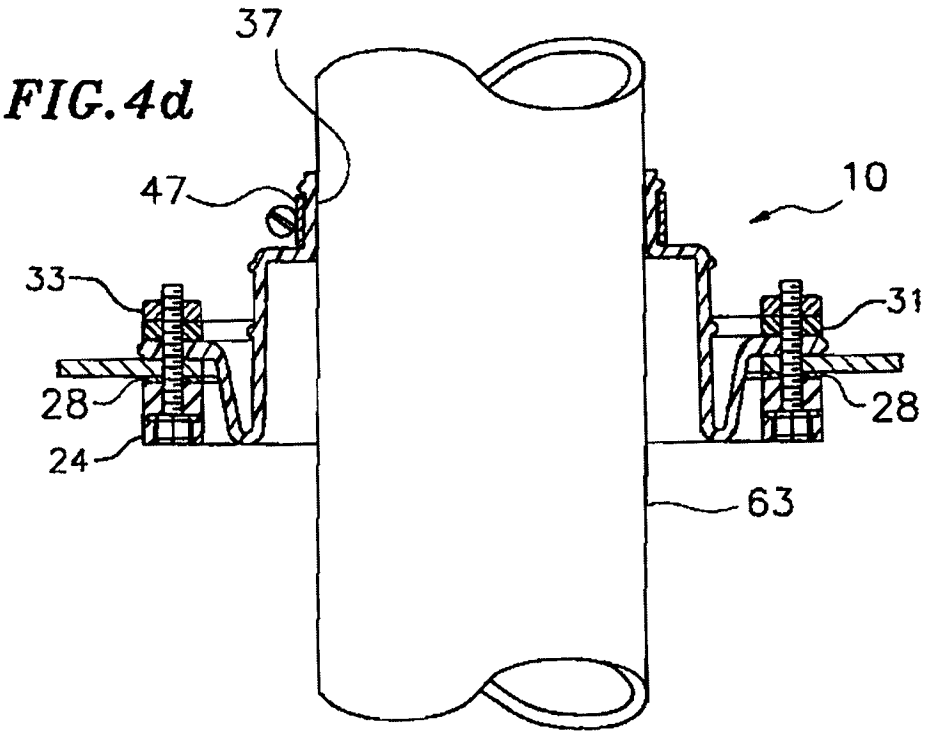

FIG. 5

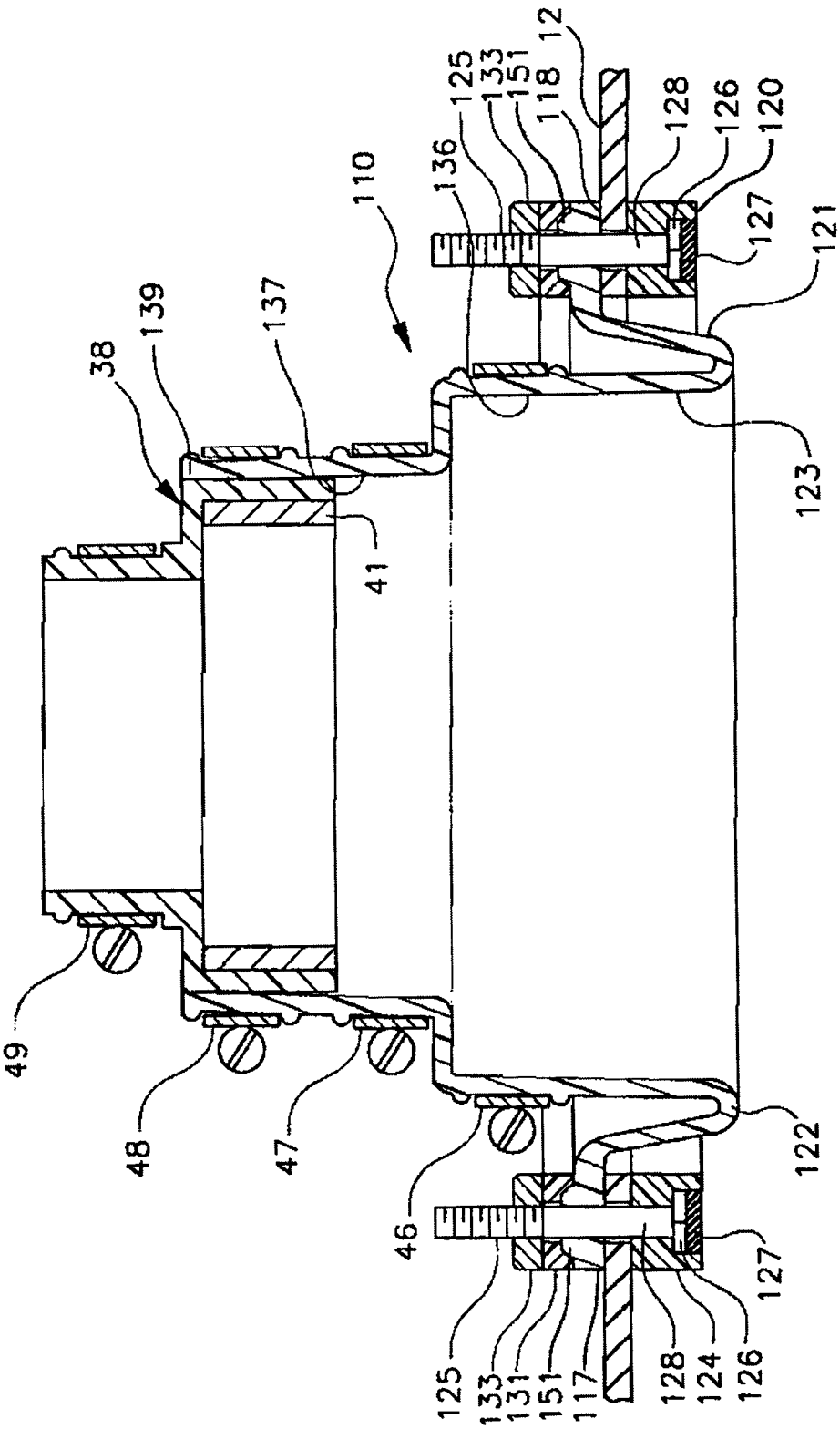
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FIG. 6

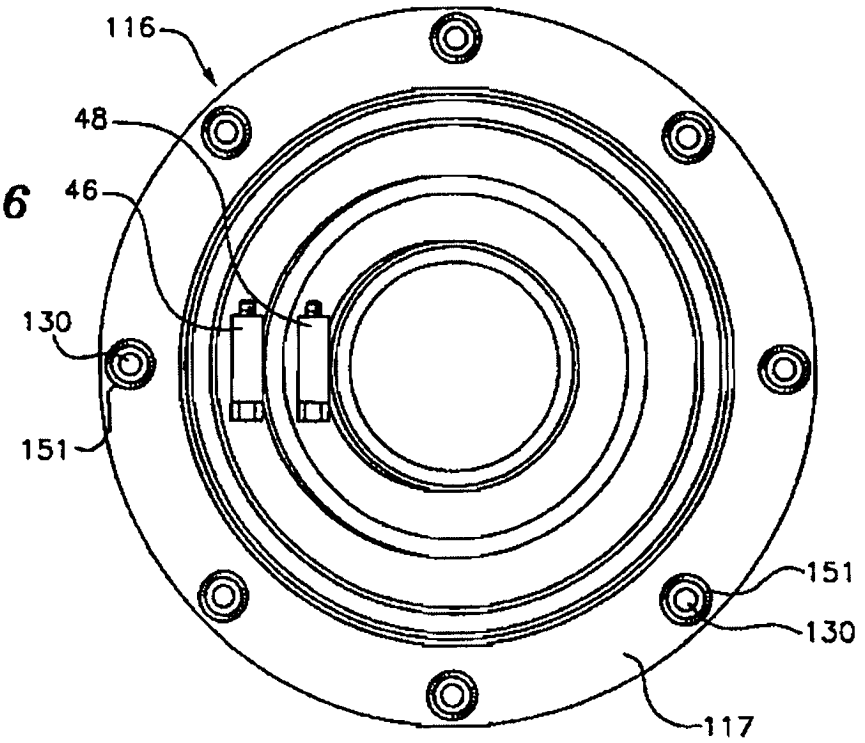


FIG. 7

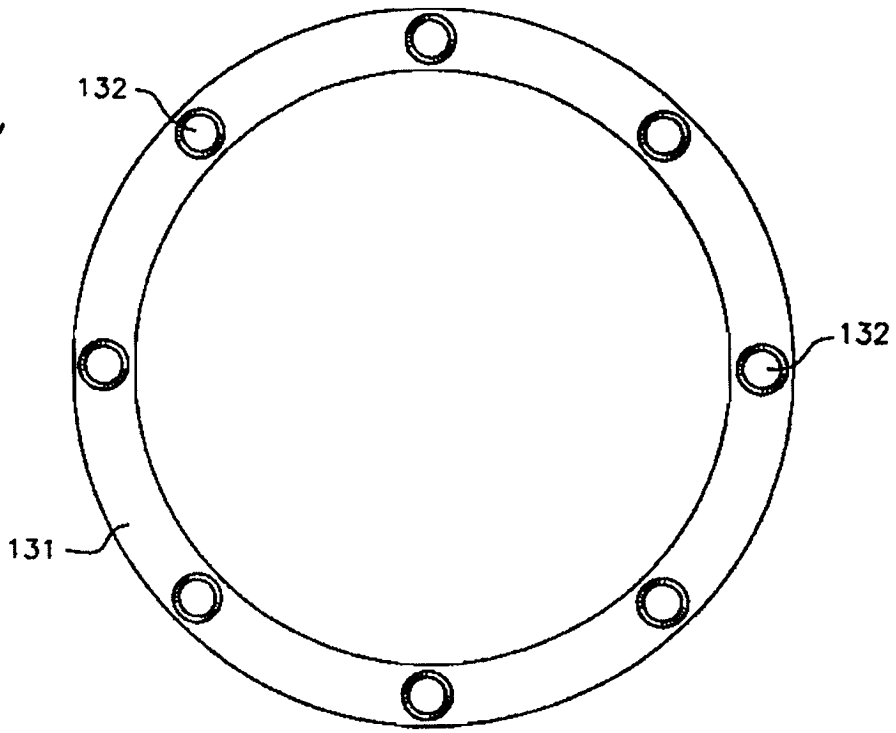


FIG.8

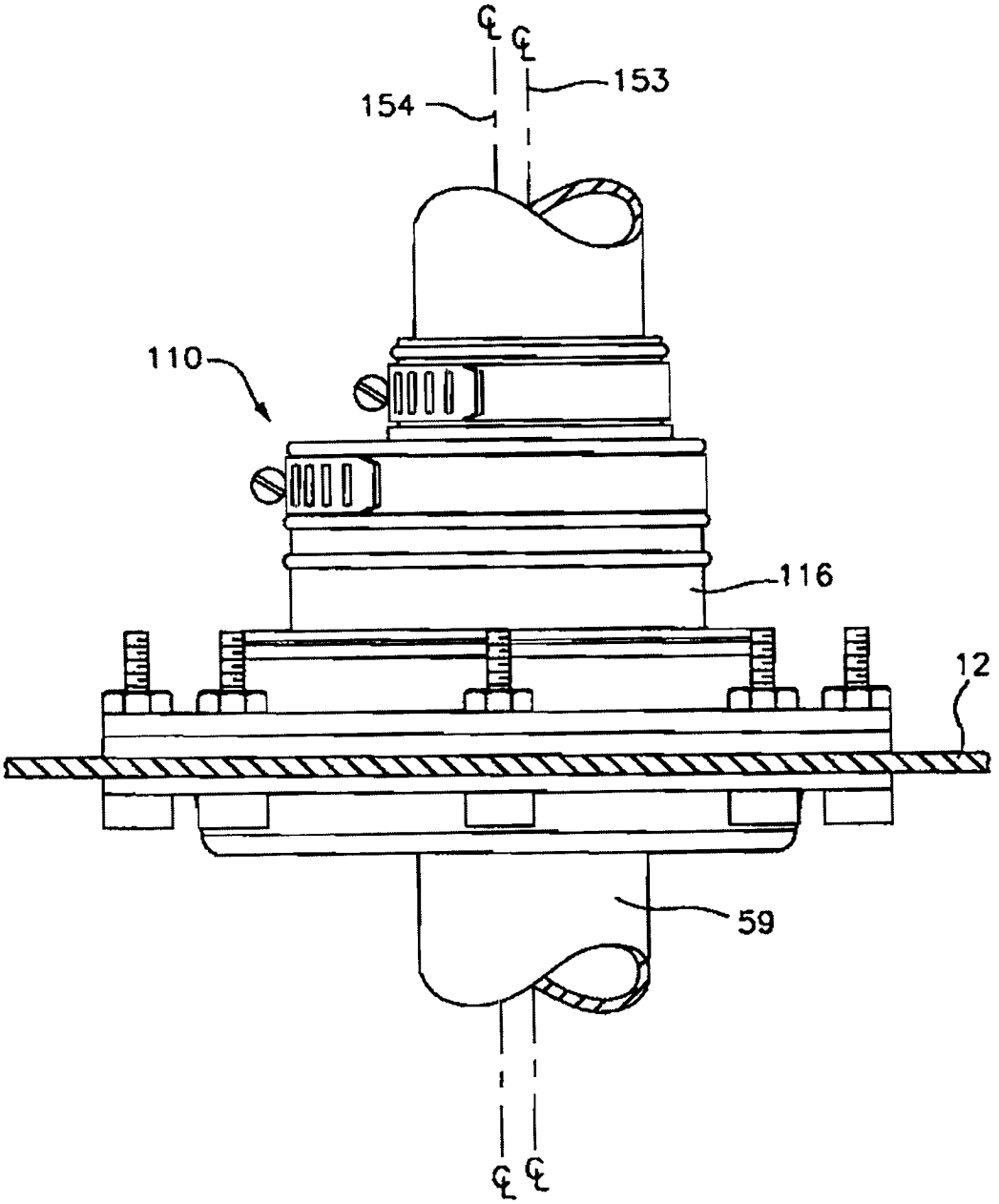


FIG. 9

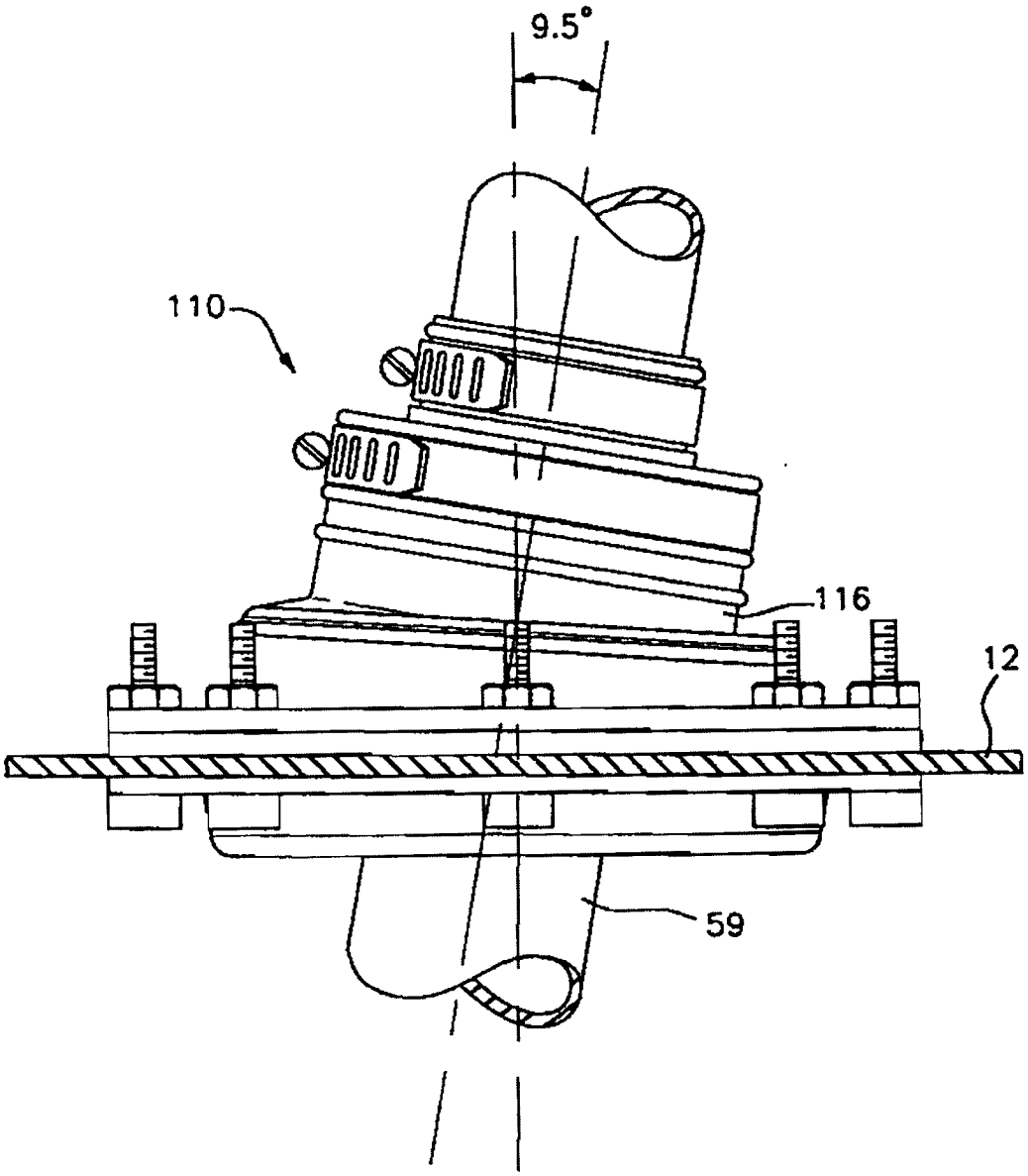
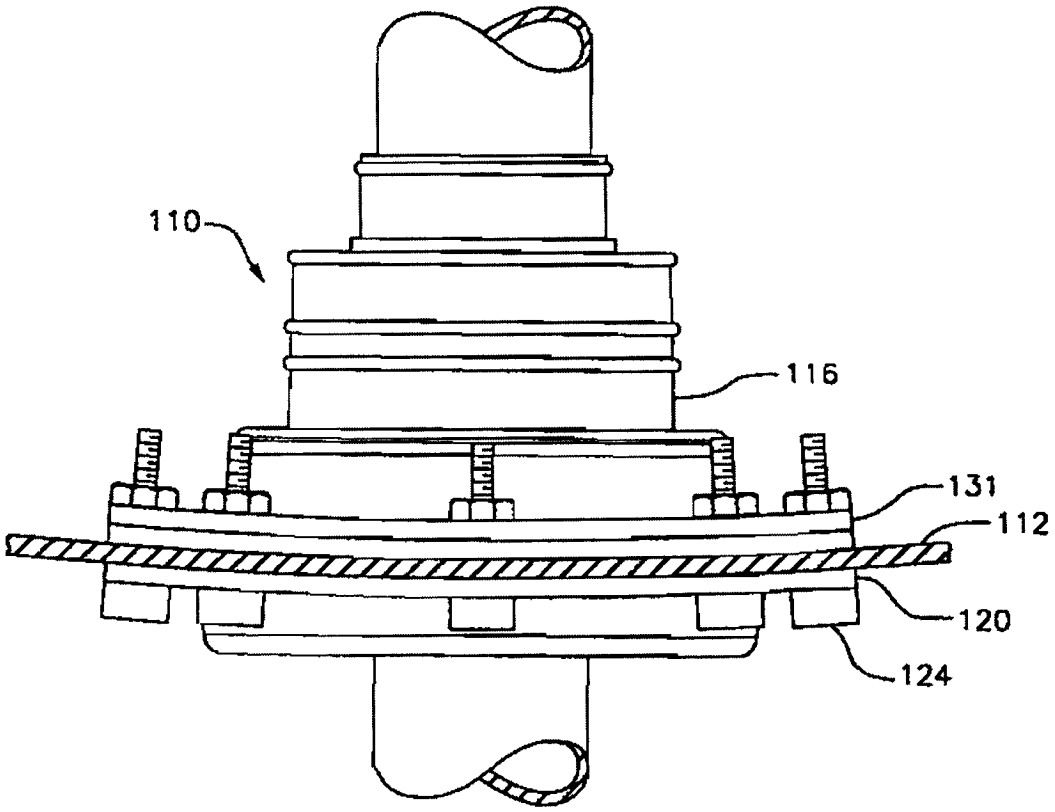


FIG. 10



FLEXIBLE PENETRATION FITTING

CROSS REFERENCE TO RELATED APPLICATIONS

The present invention is a continuation of application Ser. No. 08/889,900, now U.S. Pat. No. 5,826,919, filed Jul. 8, 1997.

FIELD OF THE INVENTION

The present invention relates to a flexible penetration fitting for use with a secondary containment box. More particularly, it relates to a universal penetration fitting that can be used with a broad range of sizes of flexible or rigid pipeline including various configurations of coaxial pipelines. The penetration fitting is also simple to replace in the event it becomes damaged after installation.

BACKGROUND OF THE INVENTION

For several years there has been a growing awareness of air and water pollution problems caused by leaking liquids such as gasoline that flow through buried pipelines such as those present at gasoline service stations. As a result, secondary containment systems have been developed for these systems. A secondary containment system typically includes a primary pipeline in which a product such as gasoline flows from an underground storage tank to a product dispenser. The system also includes a secondary pipeline that surrounds the primary pipeline. The purpose of the secondary pipeline is to contain any fluid that may leak from a damaged primary pipeline, and prevent the fluid from contaminating the surrounding ground. The secondary pipeline is generally monitored for fluid collection so that any leak in the primary pipeline can be repaired promptly.

Fittings known as bulkhead fittings or penetration fittings are generally used in combination with secondary containment systems to permit a buried pipeline to penetrate the wall or bulkhead of a containment box. Containment boxes are liquid-tight boxes associated with connections in the primary pipeline. For example, containment boxes are often provided under product dispensers, at product pumps, or at other junctions in the primary pipeline to contain any product that may leak or spill from the primary pipeline associated with such equipment. A penetration fitting prevents any such liquid that is collected in a containment box from contaminating the ground by sealing the hole in the wall through which the pipeline penetrates the wall of the containment box.

Many different types of penetration fittings have been developed. A popular type of penetration fitting is a boot made from a resilient elastomeric material which imparts flexibility to the joint between the pipeline and the containment box. One such a boot is disclosed at FIG. 22 of U.S. Pat. No. 5,297,896 to Webb. According to the Webb patent the containment box includes a pipe entry hole through which the pipeline extends. Surrounding the entry hole are a plurality of stud holes which assist in fastening the boot to the wall of the containment box. The boot is installed from the outside of the containment box and includes a flexible sleeve section extending from a sealing flange. While the sealing flange is located outside the box, the sleeve extends through the pipe entry hole and into the box. The sealing flange includes integral studs that extend through the stud holes of the containment box. The studs also extend through a plurality of holes in a compression ring located in the box. Nuts are threaded over the studs to press on the compression ring which in turn pulls the sealing flange against the outer surface of the wall of the containment box to effect the seal. The pipeline extends into the box through the flexible sleeve portion of the boot and is sealed to the sleeve portion with a hose clamp.

A similar penetration fitting is sold by Environ Products, Inc. of Lionville, Pa. This penetration fitting additionally includes a return bend in the flexible tube portion such that the sleeve is made of a flexible tube that first extends away from the containment box and then turns inward on itself to extend through the hole in the wall of the containment box. Such a return bend provides further flexibility to the boot.

Fittings with boot portions that are stepped to accommodate two different sizes of pipes are also known. Such penetration fittings allow a single fitting to seal against two different sizes of pipeline where the two pipelines are provided in a coaxial arrangement. Such penetration fittings can also include inserts that can be clamped in place within the flexible tube to allow a single penetration fitting to accommodate different sizes of pipelines. Examples of such penetration fittings and inserts are those sold by Total Containment, Inc. of Exton, Pa.

Because prior art penetration fittings include a boot made from a resilient material, the boot can periodically crack or tear. If the integrity of a penetration fitting is compromised due to a crack or tear in the boot, it must be replaced. However, one important problem with prior art penetration fittings is that they generally cannot be easily removed and reinstalled. Because such a penetration fitting is installed on the containment box from the outside, excavation is required to put a new penetration fitting in place. Such excavation can lead to extensive maintenance costs as well as prolonged downtime of a service station.

SUMMARY OF THE INVENTION

The penetration fitting of the present invention is used for forming a seal between a pipeline and a wall of a containment box. An optional gasket is placed on the outside surface of the wall of the box. A backing ring is also provided outside of the box with a plurality of studs extending from it. The studs are oriented to extend through a plurality of holes in the gasket and into the box. A flexible boot is provided with a sealing flange for placement against the inside surface of the wall. The sealing flange includes a plurality of holes through which the studs extend.

A compression ring is provided over the sealing flange inside the box. The compression ring also has a plurality of holes through which the studs extend. The boot is sealed to the inside wall of the box at the sealing flange by threading nuts to the studs which press the compression ring against the sealing flange and press the sealing flange against the wall. The optional gasket between the backing ring and wall of the box provides further sealing in the event there is leakage through the holes in the sealing flange.

Extending from the sealing flange is a sleeve for receiving the pipeline. In the preferred embodiment the sleeve includes a return bend which provides added flexibility to the boot. The preferred embodiment also includes a stepped sleeve configuration in which the circumference of the sleeve decreases in increments along its length. This configuration permits the boot to accommodate a number of different sizes of pipelines including coaxial pipelines having inner and outer pipelines. A particular pipeline is sealed to the sleeve by a hose clamp at the appropriate location along the length of the sleeve where the pipeline best fits. Any portion of the sleeve smaller than the pipeline can be removed easily with a utility knife.

An important benefit of the penetration fitting of the present invention is that once the backing ring is in place, the boot can be installed entirely from inside the containment box. This permits a damaged boot to be replaced without the need for excavating around the containment box.

BRIEF DESCRIPTION OF THE DRAWINGS

Other features, aspects, and advantages of the present invention will be more fully understood when considered with respect to the following detailed description, appended claims, and accompanying drawings where:

FIG. 1 is an exploded perspective view of a flexible penetration fitting of the present invention;

FIG. 2 is a sectional elevation view of the penetration fitting of FIG. 1;

FIG. 3 is a sectional elevation view of an alternative insert for use with the penetration fitting of FIG. 1;

FIGS. 4*a*–4*d* are sectional elevation views of the penetration fitting of FIG. 1 when used in various pipeline configurations;

FIG. 5 is a sectional elevation view of another embodiment of the invention;

FIG. 6 is a top plan view of the flexible boot of FIG. 5;

FIG. 7 is a bottom plan view of the compression ring of FIG. 5;

FIGS. 8 and 9 are elevation views of the penetration fitting of FIG. 5 illustrating the flexibility of the boot when installed; and

FIG. 10 is an elevation view partly in section illustrating the penetration fitting of FIG. 5 installed on a curved wall.

DETAILED DESCRIPTION

According to the present invention, a flexible penetration fitting **10** as illustrated in FIGS. **1** and **2** is provided to seal a wall **12** of an underground containment box at the point where a pipeline (not shown) penetrates the wall. The containment box includes a first pipe entry hole **13** through which the pipe extends and a plurality of mounting holes **14** arranged around the entry hole for mounting the penetration fitting to the containment box.

The penetration fitting includes a flexible boot **16** made of a resilient oil resistant elastomeric material. The boot includes a ring-shaped sealing flange **17** for providing a seal against the inside surface **18** of the containment box wall. The boot also includes an integral flexible tube portion **19** that extends from the sealing flange. In the preferred embodiment, a first outwardly extending portion **21** of the tube extends in an outward direction away from the containment box. The tube then forms a return bend section **22** where it turns back on itself in an inward direction and back into the containment box to form a sleeve section **23**. The sleeve section provides a sealing surface for sealing against the pipeline as will be discussed in further detail below.

The penetration fitting also includes a backing ring **24** provided outside the containment box. The backing ring includes a ring portion **20** with a plurality of studs **25** extending in a direction perpendicular to the plane of the ring portion. Preferably, eight studs are provided spaced equidistantly around the circumference of the backing ring. In the preferred embodiment the ring portion of the backing ring is made of a durable polymeric material with eight bolts **26** fastened to the backing ring by embedding their heads **27** within the backing ring. The threaded shafts of the bolts act as the studs for the backing ring. The backing ring is placed around the pipe entry hole outside the containment box with an optional gasket **28** between it and the wall. The studs of the backing ring extend through a plurality of holes **29** in the surface of the gasket, through the plurality of mounting holes in the wall of the box and into the box. The studs further extend through a plurality of holes **30** in the sealing flange of the boot.

A compression ring **31**, also with a plurality of holes **32** for cooperating with the plurality of studs is provided inside the containment box. The compression ring is preferably made of a fairly rigid material compared to that used for the flexible boot. While the compression ring may be made of metal, it is preferably made of a fairly rigid polymeric material such as that used for the ring portion of the backing ring. Eight nuts **33** are threaded to the studs and press the compression ring against the sealing flange to press the sealing flange against the inside wall of the containment box sealing the boot to the containment box.

The flexible sleeve of the boot is designed to receive a variety of different pipe sizes. This is achieved by a stepped configuration in the circumference of the sleeve. A first circumference **36** is provided on the sleeve at a point near the sealing flange. The first circumference is capable of receiving a first pipe with a relatively large diameter. As the sleeve extends away from the sealing flange, the first circumference necks down to a second circumference **37** for receiving a second pipe with an intermediate diameter.

In the preferred embodiment, the penetration fitting also includes a first insert **38** having an outside diameter **39** for cooperating with the second circumference of the sleeve. The outside diameter necks down to a narrower section with an inside opening **40** for receiving a third pipe with a relatively small diameter. A structural ring **41** made of a fairly rigid material is provided inside the first insert at the first diameter to prevent either the insert or the sleeve from collapsing when the insert is attached to the sleeve. A second insert **42** as illustrated in FIG. **3** is also provided similar to the first insert. The second insert has an outside diameter **43** for cooperating with the second circumference of the sleeve and an opening **44** for receiving a fourth pipe with a relatively small diameter different from the diameter of the opening of the first insert. Like the first insert, the second insert includes a structural ring **45** for preventing the insert or the sleeve from collapsing when attached to the sleeve. Preferably, the first and second inserts are made of a resilient elastomeric material similar to that used for the boot. The structural rings are made of a more rigid material, preferably a polymeric material similar to that used for the backing ring.

According to the preferred embodiment, the first circumference is sized to receive a 4 inch pipeline and the second circumference is sized to receive a 3 inch pipeline. The opening of the first insert is sized to receive a 2 inch pipeline while the opening of the second insert is sized to receive a 1½ inch pipeline. A single penetration fitting having a sleeve of this design can receive four different sizes of pipeline.

A plurality of circumferential clamps such as radiator clamps or hose clamps are provided to effect the various seals to the sleeve. Such clamps are well known in the art and generally include a circular band in which the circumference can be adjusted by turning a screw or bolt located on the band. Referring back to FIG. **2**, a first hose clamp **46** is provided at the first circumference to seal the sleeve against a large diameter pipe. The hose clamp can be tightened with a tool such as a wrench or screwdriver to seal the sleeve against the pipeline. A second hose clamp **47** and a third hose

clamp 48 are provided next to one another at the second circumference to seal the sleeve against either an intermediate diameter pipeline or one of the inserts. A fourth hose clamp 49 and a fifth hose clamp 51 (FIG. 3) are provided to clamp the opening of the first and second inserts around small diameter pipelines.

A plurality of circumferential beads 52 running around the sleeve above each hose clamp help to keep the hose clamps in place at their respective points along the sleeve. The beads are also useful in that they can be used as guides for trimming from the boot any portion of the sleeve that will not be used. For example, if the boot is used to seal a large diameter pipeline, the portion of the sleeve above the bead at the first hose clamp can be trimmed such as with a utility knife.

The stepped sleeve design and inserts make the penetration fitting capable of accommodating a number of different piping configurations. Just a few of the many different piping configurations are illustrated in FIGS. 4*a*–4*d*. In FIG. 4*a*, the penetration fitting 10 is shown installed on a system with a coaxial pipeline in which an outer pipeline 56 is provided with a 4 inch diameter and an inner pipeline 57 is provided with a 3 inch diameter. The outer pipeline is sealed to the sleeve at the first circumference 36 by the first hose clamp 46. The inner pipeline is sealed to the sleeve by the second hose clamp 47 at the second circumference 37. The portion of the sleeve above the second hose clamp has been cut away in this installation.

According to FIG. 4*b*, the penetration fitting 10 is shown installed on a second coaxial pipeline configuration in which an outer pipeline 58 is provided with a 3 inch diameter and an inner pipeline 59 is provided with a 2 inch diameter. The outer pipeline is sealed at the second circumference 37 with the second hose clamp 47. The first insert 38 is sealed to the second circumference with the third hose clamp 48 and the inner pipeline is sealed to the opening 40 of the first insert by the fourth hose clamp 49.

Referring to FIG. 4*c*, the penetration fitting is configured as installed on yet another coaxial pipeline configuration. An outer pipeline 61 is provided with a 4 inch diameter and is sealed at the first circumference 36 by the first hose clamp 46. The first insert 38 is sealed to the second circumference 37 by the second hose clamp 47. The portion of the sleeve above the second hose clamp has been cut away for this installation. An inner pipeline 62 with a 2 inch diameter is sealed at the opening 40 of the first insert by the fourth hose clamp 49.

Referring to FIG. 4*d*, yet another piping configuration is illustrated. Here a pipeline 63 with a 3 inch diameter is sealed to the sleeve at the second circumference 37 with the second hose clamp 47. For this installation the portion of the sleeve above the second hose clamp has been cut away.

Still other configurations are possible with the penetration fitting of the present invention. A single penetration fitting can be used to accommodate pipelines having diameters of 4 inches, 3 inches, 2 inches and 1½ inches. The same penetration fitting can also accommodate coaxial pipelines in which the inner and outer pipeline diameters are (expressed as outer diameter in inches x inner diameter in inches): 4x3; 4x2; 4x1½; 3x2; and 3x1¼. The penetration fitting can also be used with either rigid or flexible pipelines.

Another embodiment of the present invention is illustrated in FIGS. 5, 6 and 7. This is presently the most preferred embodiment. According to this embodiment as illustrated in FIG. 5, a penetration fitting 110 is attached to the wall 12 of the containment box. The penetration fitting includes a flexible boot 116 (also see FIG. 6) with a sealing flange 117 that seals the flexible boot against the inside surface of the wall of the containment box. The general shape of the flexible boot is identical to the previous embodiment in that it includes a return bend 122 and a sleeve section 123 with a first circumference 136, a second circumference 137 and an insert 38. First, second third and fourth hose clamps 46, 47, 48, 49 are also provided.

Also like the prior embodiment, the heads of a plurality of bolts 126 are embedded within a ring portion 120 of a backing ring 124. Preferably, the bolts are embedded in hexagonal holes in the ring portion and sealed with an epoxy or a sealer such as silicone 127. One important difference in this embodiment over the prior embodiment is that rather than including bolts with shafts threaded their entire lengths, the shafts include a smooth shoulder 128 adjacent the head which extends into an outer threaded stud 125 opposite the head.

Another difference is the inclusion of a number of lips 151, each with a chamfered edge which circumferentially surrounds each of the sealing flange holes 130 on the surface 152 of the sealing flange (FIGS. 5 and 6). The lips mate with a plurality of counter bored holes 132 on a compression ring 131, each of the counter bored holes including each having a similarly chamfered edge. In the most preferred embodiment, the sealing flange holes are slightly smaller than the diameter of the shoulders of the bolts. For ¼ inch diameter bolts, the holes in the sealing flange are preferably 0.010 inch smaller in diameter. It is also preferred that when the penetration fitting is installed, the shoulder portion of each of the bolts should extend up to at least the tops of the lips on the sealing flange holes. It should be noted that even with such tolerances, a single size penetration fitting can fit a number of different containment boxes having different wall thicknesses as the width of the backing ring prevents the nuts 133 from bottoming-out on the threaded portions of the bolts during installation.

According to this embodiment, a particularly reliable seal among the components is achieved when the plurality of nuts are tightened down on the studs. The tightening of the nuts not only presses the sealing flange against the inside surface of the wall of the containment box by sandwiching the sealing flange and the wall between the backing ring and the compression ring, it also helps to seal against leakage which may occur at the bolts. This is accomplished by the cooperation between the lips on the sealing flange and the counter bored holes of the compression ring whereby the counter bored holes press the lips of the sealing flange against the shoulder portions of the bolts. Without such a design, in order to prevent leakage at the bolts, a second gasket such as that illustrated in the embodiment of FIG. 2 is required. In the prior art, leakage at the bolts generally prevented the mounting of a flexible boot to the inside wall of the containment box.

Another advantage to the use of the penetration fitting of the present invention is that the flexible boot permits great flexibility in the joint between the wall of the containment box and the pipeline penetrating the box. For example, as shown in FIG. 8, a penetration fitting 110 with a flexible boot 116 is illustrated in an installation where the center axis 153 of the pipeline 59 does not coincide with the center axis 154 of the entry hole through the wall 12 of the box. Here, a penetration fitting with a sealing flange approximately seven inches in diameter designed for up to a four inch pipeline with an entry hole of about 6 inches, is fitted with a two inch pipeline. By using the design of the present invention, an offset between the center axes of the pipeline and the entry

hole is permitted without compromising the integrity of the seal. For an installation with the penetration fitting described above fitted for a three inch pipeline, an offset of ¾ inch is permitted.

Furthermore, the flexible boot permits the pipeline to enter the box at a broad range of angles. This is in large part due to the low profile of the boot. In FIG. **9**, a penetration fitting **110** with a flexible boot **116** and a two inch pipeline **59** attached to the flexible boot is shown flexed to an angle of about 9½ degrees from a line perpendicular to the wall of the box. For a four inch pipeline, an angle of up to about 45 degrees from perpendicular is permitted without compromising the integrity of the seal.

Another important feature of the present invention is that if the boot of a penetration fitting were to crack or tear, a new boot can be installed without excavating the ground around the containment box. First the primary pipeline is disconnected from the equipment inside the containment box. Then the nuts and the compression ring are removed from the penetration fitting. The damaged boot is removed and a new boot is placed over the pipeline such that the holes in the sealing flange fit over the studs of the existing backing ring. The compression ring and nuts are then reinstalled to seal the new boot against the wall of the containment box. There is generally no need to replace the gasket. A hose clamp is placed around the sleeve and tightened to seal the boot to the pipeline. The primary pipeline can then be reconnected to the equipment in the box with minimal downtime. Such a simple method for replacing a boot is impossible with prior art penetration fittings which are installed from the outside of the box.

Yet another advantage of the use of an embodiment such as that illustrated in FIG. **4***b* is that the use of the insert simplifies assembly of the piping system. The flexible boot of the penetration fitting can first be fastened to the box as set forth above. The insert **38** can then be placed at an appropriate point on the inner pipeline **59** and any fitting (not shown) that is to be placed on the inner pipeline can be attached before the pipeline is set in place. The pipeline can then be inserted into the boot, the second hose clamp **47** can be tightened against the outer pipeline **58**, the insert can be slid along the inner pipeline until it rests within the sleeve of the boot, the third hose clamp **48** can be tightened to the insert and the fourth hose clamp **49** can be tightened to fasten the inner pipeline to the boot. For coaxial pipelines that require special equipment to attach a fitting to the inner pipeline, it can greatly simplify assembly if the fitting is attached to the end of the pipeline before the pipeline is placed in the box.

The use of the insert also simplifies the later replacement of the boot if the boot is ever damaged. In order to replace a damaged boot, first the inner pipeline is disconnected from any equipment in the box. Then the nuts and compression ring are removed along with the second and third hose clamps **47** and **48**. The inner and outer pipelines can be left in place with the insert attached and the boot can be pulled over the pipeline including any fitting that may be attached to the inner pipeline. A new boot can then be pulled over the pipeline and sealed as set forth above. Without an insert, it can be difficult to pull a new boot over the pipeline, especially if the inner pipeline includes a permanently mounted fitting.

Still another advantage of the penetration fitting of the present invention is that the flexible boot permits the fitting to be installed on a slightly curved wall without the use of any special adaptors. According to FIG. **10**, a penetration fitting **110** with a flexible boot **116** is shown attached to a containment box with a curved wall **112**. Not only can the flexible boot be easily flexed to conform to the curvature of the wall, but since the ring portion **120** of the backing ring **124** and the compression ring **131** are also made of a somewhat resilient material, they too can conform to the curvature of the wall. The preferred material for these components is an acetyl copolymer sold under the name Celcon™. This is also the preferred material for the ring portion of the backing ring, the compression ring and the structural rings of the inserts. A penetration fitting with a seven inch flange and designed for up to a four inch pipeline can be mounted on a cylindrical wall having a radius of curvature greater than about 10 inches without the need for special fittings as are generally required for prior art penetration fittings. For walls having a smaller radius of curvature, a dished backing ring with a similarly dished compression ring can be provided for use with the same flexible boot described above.

What is claimed is:

1. A penetration fitting for forming a seal between a pipeline and a wall having first and second surfaces, the penetration fitting comprising:

a backing ring comprising a ring portion and a plurality of studs extending from the ring portion, the backing ring for placement against the first surface of the wall and the studs for extending through the wall, each stud including a first smooth shoulder portion proximate the ring portion and a second threaded portion distal the ring portion;

a flexible boot comprising a sleeve for receiving the pipeline, a sealing flange including a face for placement against the second surface of the wall, a plurality of apertures, each aperture for receiving at least a portion of the smooth shoulder portion of one of the plurality of studs and a plurality of lips, each lip extending circumferentially around aperture;

a clamp for sealing the sleeve of the flexible boot to the pipeline;

a compression ring defining a plurality of holes for receiving the plurality of studs each hole including a counter bore for mating with a respective lip of the sealing flange; and

a plurality of nuts for cooperating with the studs to press the sealing flange between the compression ring and the second surface of the wall.

2. The penetration fitting of claim **1** wherein the flexible boot further comprises a return bend.

3. The penetration fitting of claim **1** wherein the flexible boot further comprises a plurality of stepped openings for receiving a plurality of different sizes of pipes.

4. The penetration fitting of claim **3** further comprising an insert for cooperating with an opening to receive yet another different size of pipe.

5. The penetration fitting of claim **1** wherein the backing ring and the compression ring are made of a deformable material that permits the fitting to be installed on a curved wall.

* * * * *

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(12) **United States Patent**
Daoud

(10) **Patent No.: US 6,353,184 B1**
(45) **Date of Patent: Mar. 5, 2002**

(54) **LOW PROFILE ADAPTER FOR VARIABLE SIZE HEAT SHRINK TUBING JOINT**

(75) Inventor: **Bassel Hage Daoud**, Parsippany, NJ (US)

(73) Assignee: **Avaya Technology Corp.**, Basking Ridge, NJ (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/372,335**

(22) Filed: **Aug. 11, 1999**

(51) **Int. Cl.**[7] **H02G 3/04**

(52) **U.S. Cl.** ..... **174/65 R**; 177/65 G; 177/151; 16/2.1

(58) **Field of Search** ..... 174/65 G, 151, 174/152 G, 153 G, 135, 65 R; 16/2.1, 2.2, 2.3; 285/139.2, 139.3, 148.25, 192; 248/56

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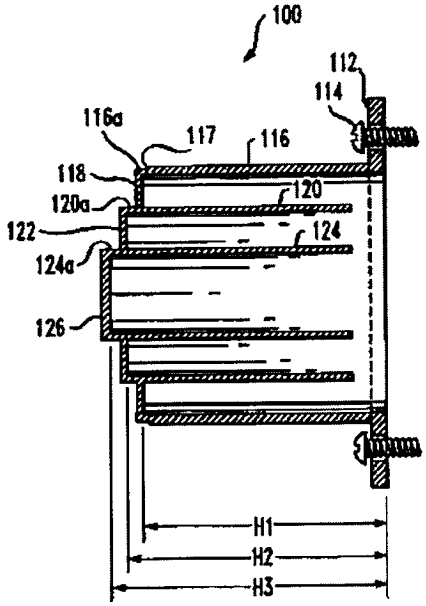
(57) **ABSTRACT**

A building entrance protector assembly includes a building entrance protector housing having an opening. The housing includes a plurality of concentric cylindrical side walls around the opening. Each side wall at least partly overlies another one of the side walls. At least one annular surface is provided at an end of the side walls distal from the flange. The distance between the flange and each distal (annular or disk shaped) surface increases monotonically from an outermost annular surface to an innermost annular or circular surface. Each annular surface is located at a respectively different distance from the flange. Each side wall is connected to an adjacent side wall by one of the annular surfaces. One or more of the inner side walls may be cut away to accommodate a variety of cable sizes. A cable passes through an innermost one of the side walls. A heat shrink tubing secures the cable to the adapter. The heat shrink tubing is adhered to the cable and the outermost side wall. The innermost side wall has approximately the same diameter as the cable. Optionally, the housing has an adapter mounted on it. The adapter includes the side walls and the annular surface. The adapter includes a mounting flange for mounting the adapter to the housing. Alternatively, the side walls, annular surfaces and distal circular surface may be formed integrally as a part of the end cap of the housing.

6 Claims, 7 Drawing Sheets



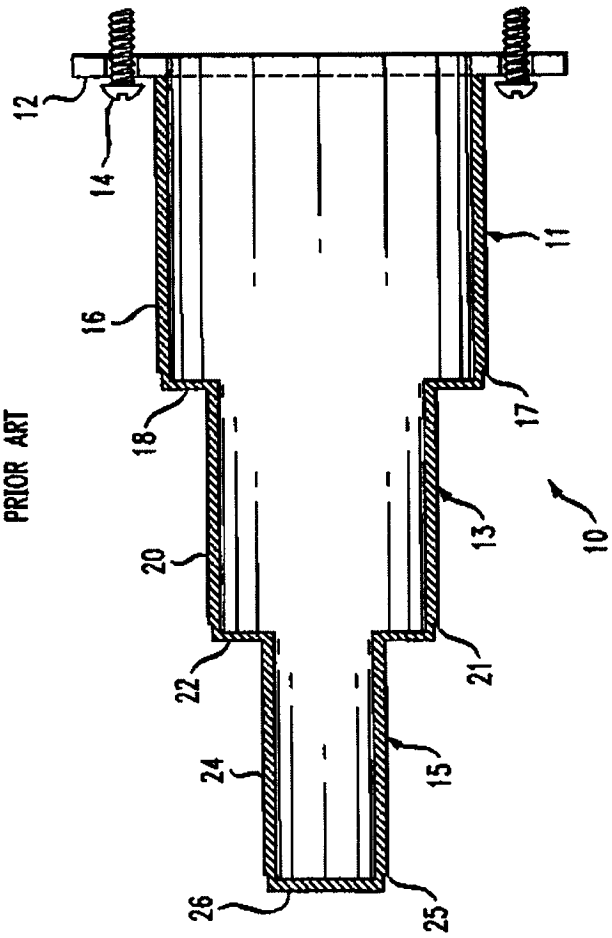


FIG. 2
PRIOR ART

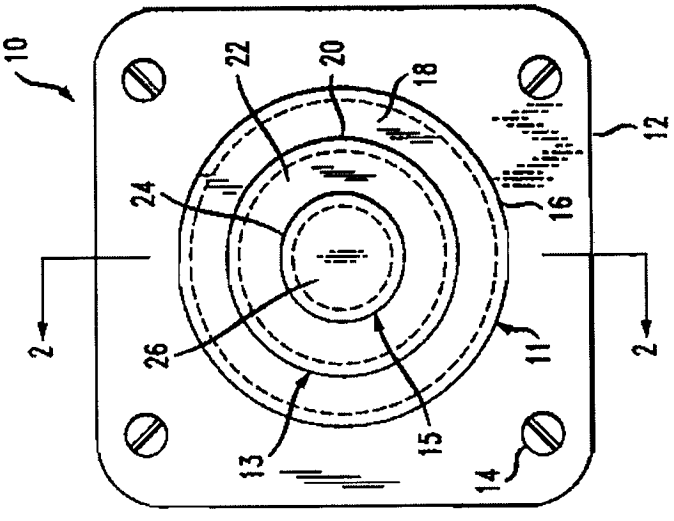


FIG. 1
PRIOR ART

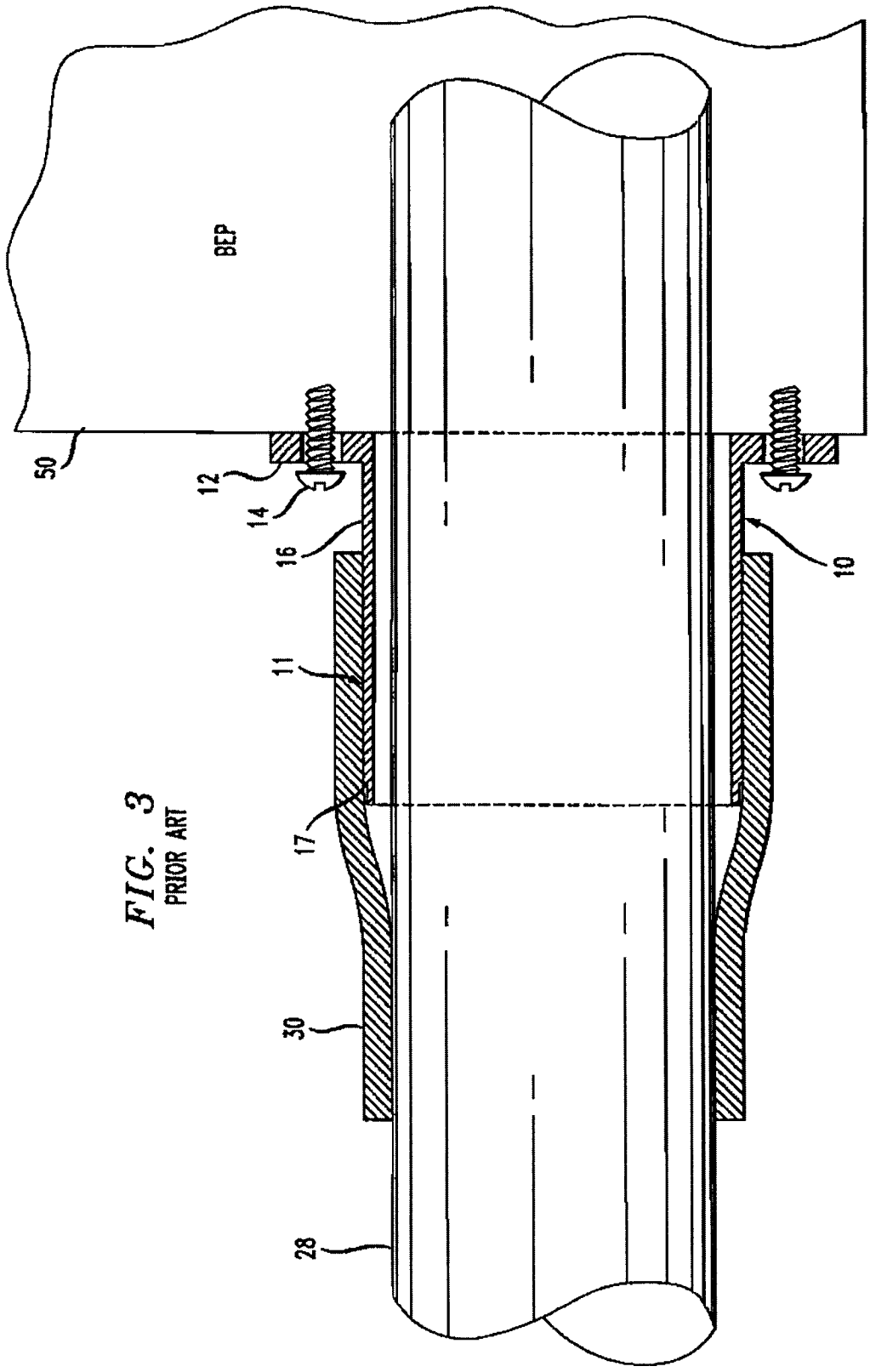


FIG. 3
PRIOR ART

FIG. 5

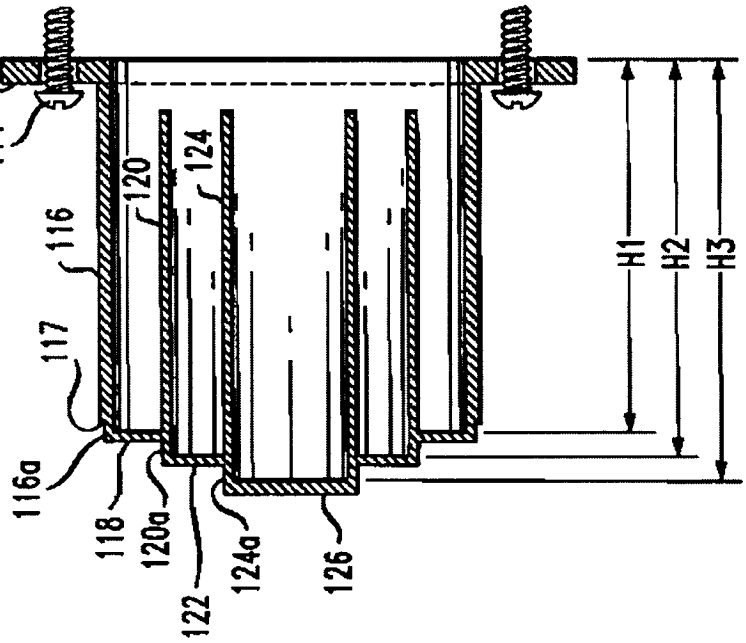
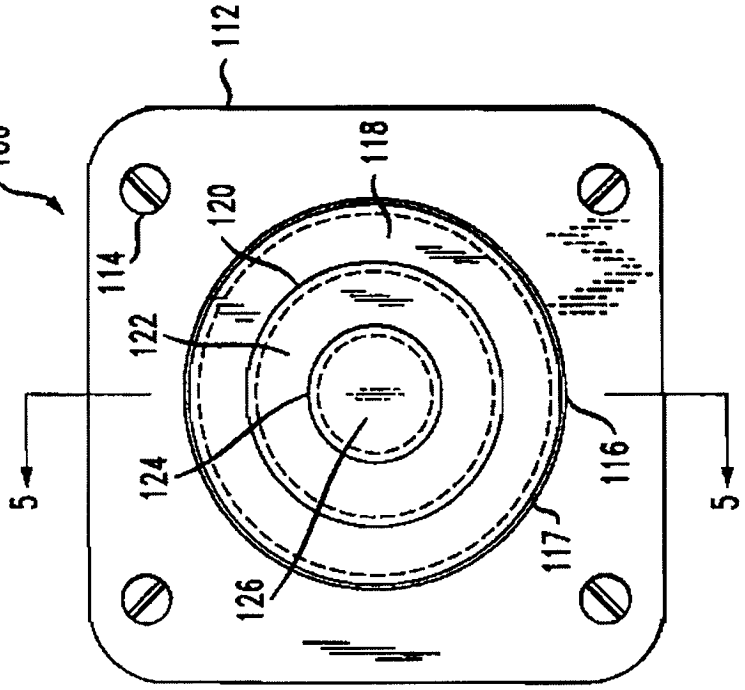

100
112
114
116
117
116a
118
120
120a
122
124
124a
126
H1
H2
H3

FIG. 4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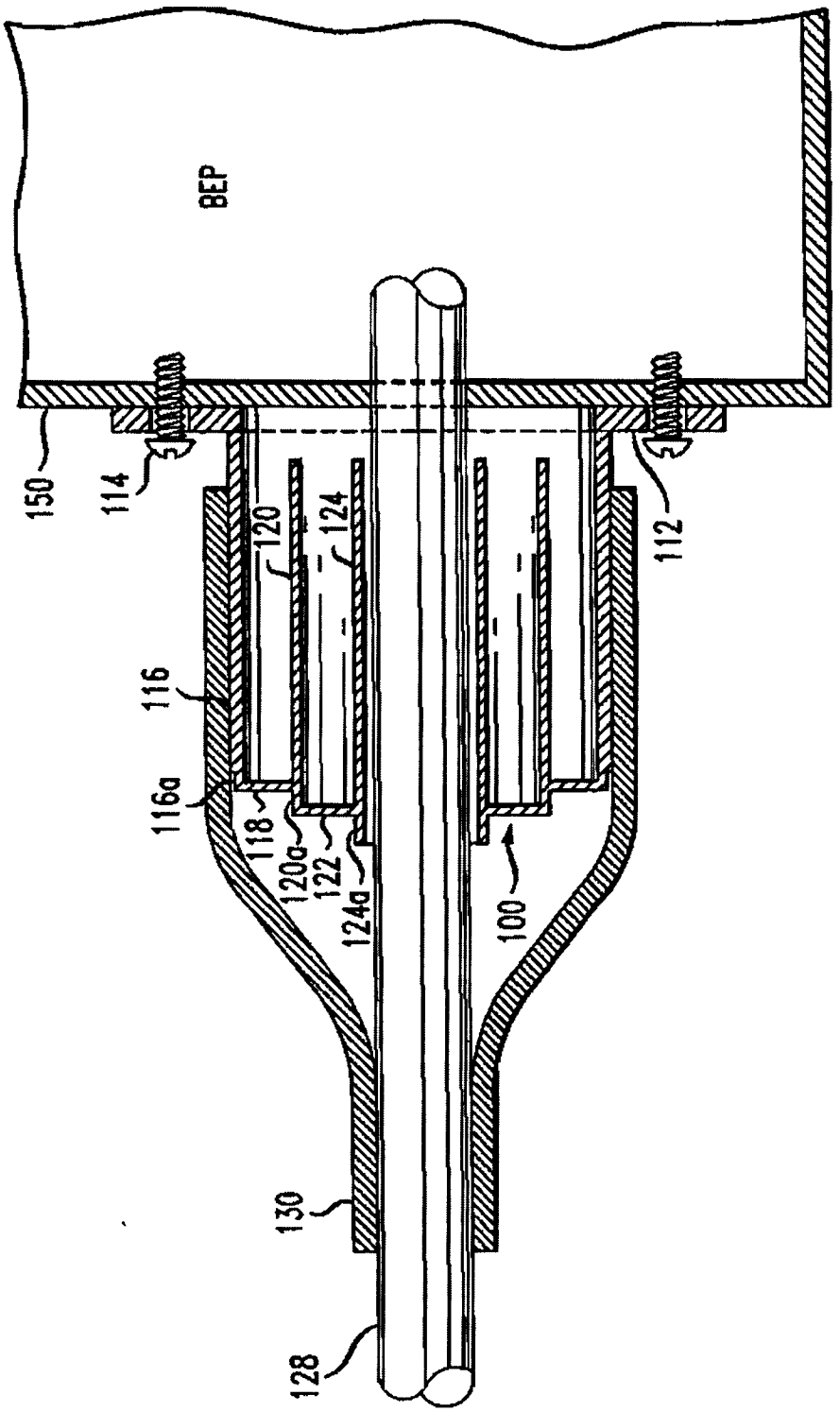


FIG. 6

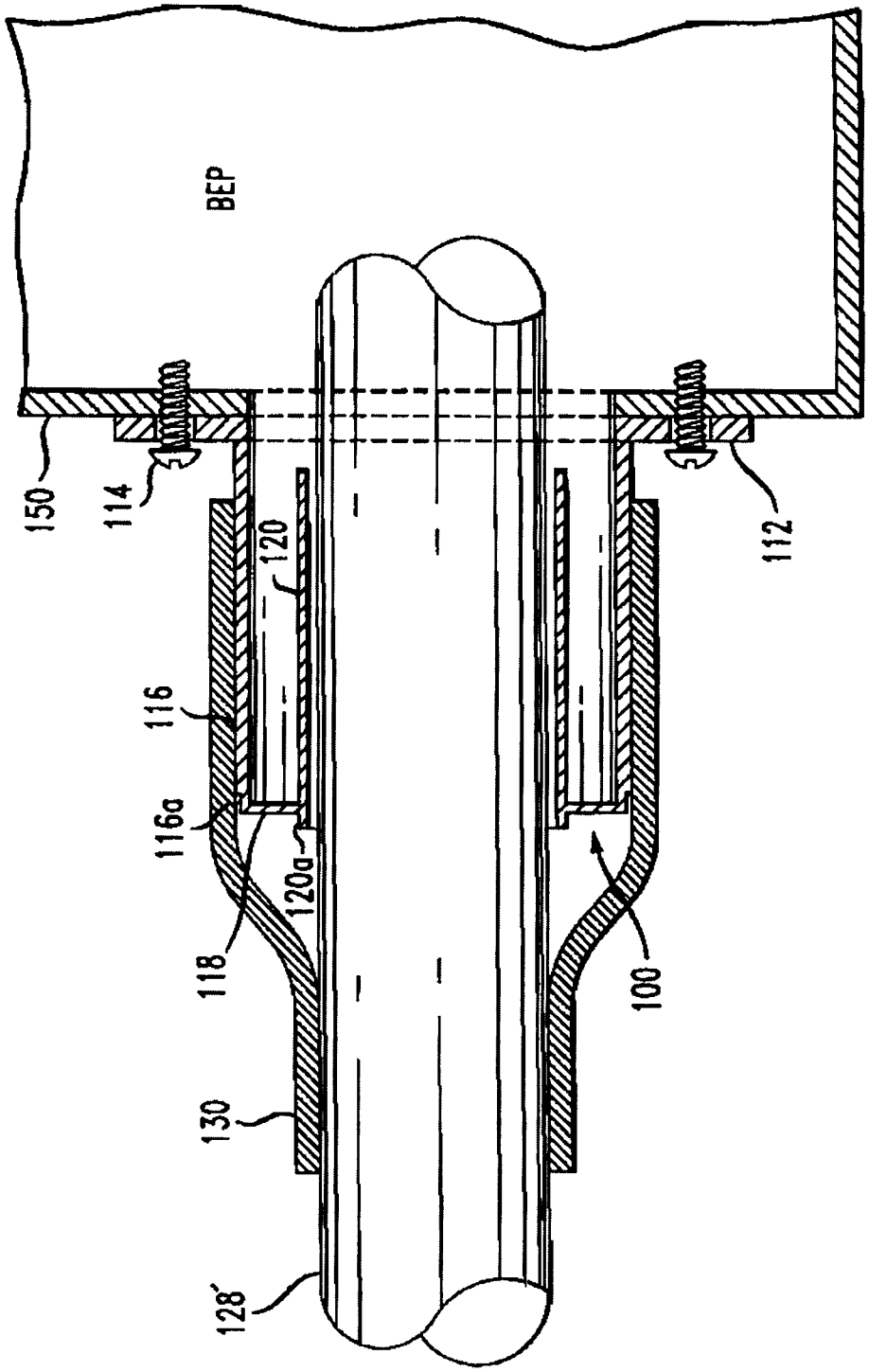


FIG. 7

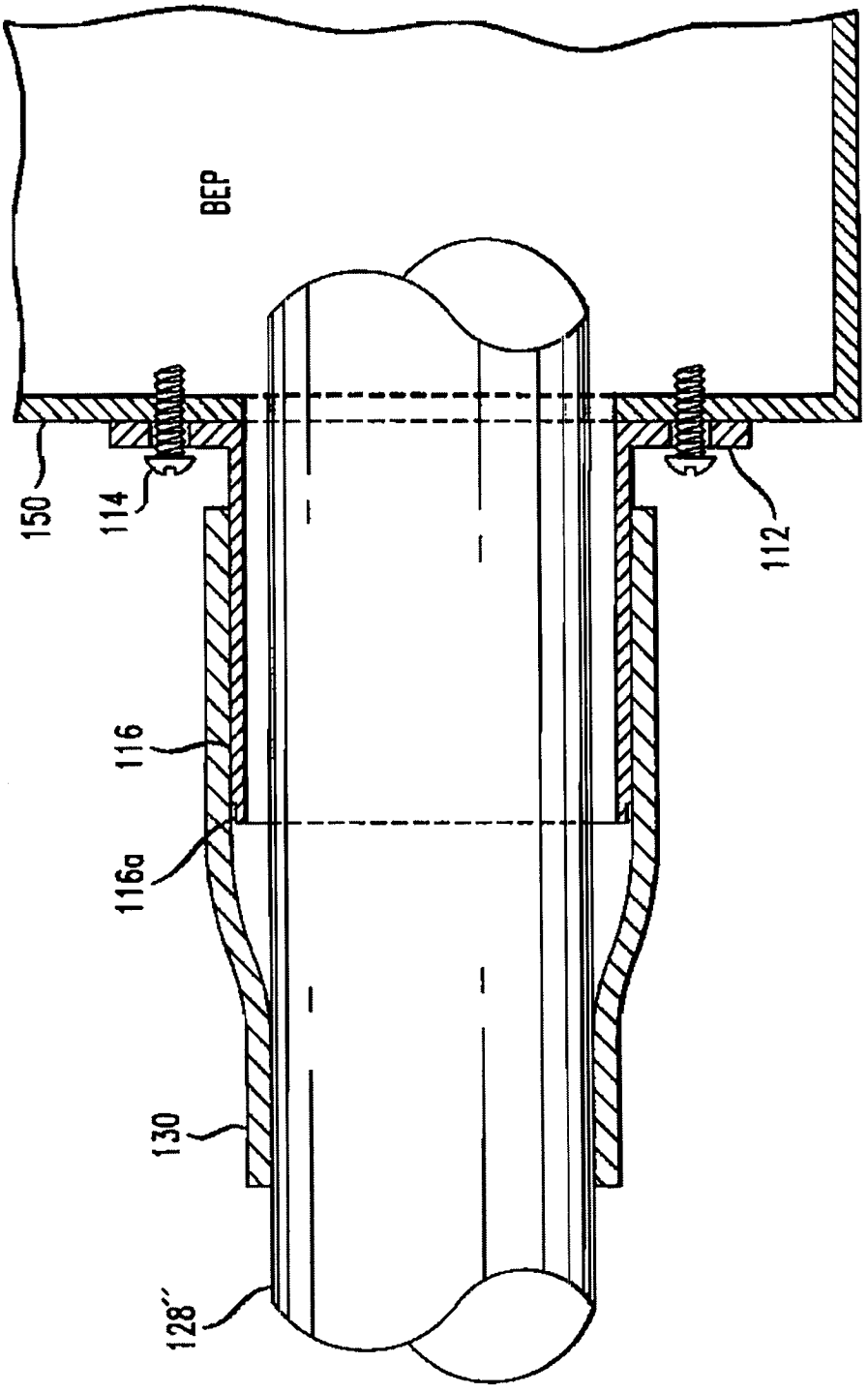
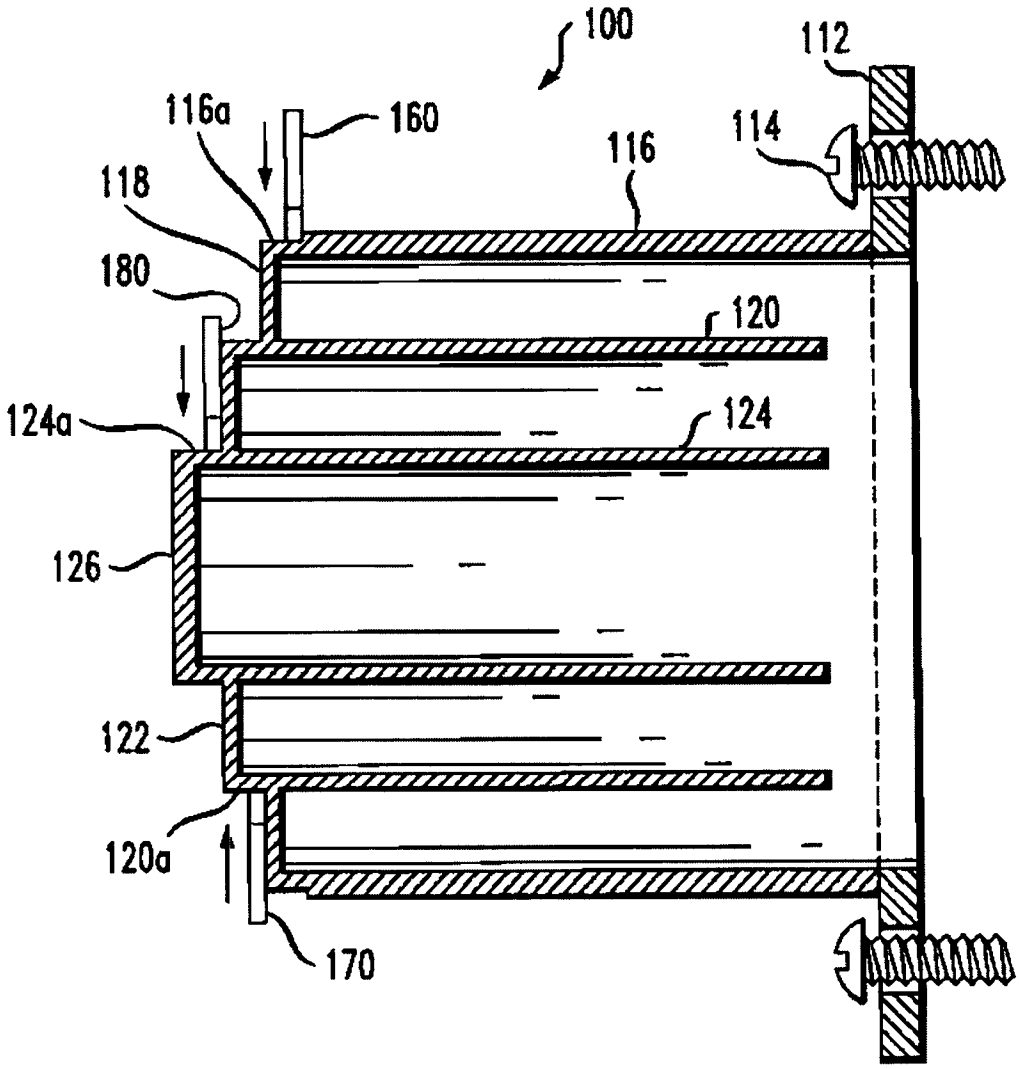


FIG. 8

FIG. 9



LOW PROFILE ADAPTER FOR VARIABLE SIZE HEAT SHRINK TUBING JOINT

FIELD OF THE INVENTION

The present invention relates to telecommunications equipment generally, and more specifically to adapters for connecting a cable to an enclosure, such as a building entrance protector.

DESCRIPTION OF THE RELATED ART

A building entrance protector (BEP) enclosure houses the physical interface between the nodes of a local telecommunications network and a telecommunications cable. For example, a BEP enclosure may house the interface hardware between the telephones of an office building and an exterior telephone cable having a number of twisted copper pairs that carry the voice signals for those telephones. A BEP enclosure is typically mounted in the basement or first floor of the office building. A BEP enclosure may also be used to house the interface hardware for systems based on fiber optical communications. Similarly, BEP enclosures may be used with telecommunications systems carrying signals other than just telephone voice signals.

A BEP enclosure provides two main functions: (1) it houses the hardware that provides connections between a cable and the individual nodes (e.g., telephones) of a local network; and (2) it houses the hardware that provides electrical isolation between the cable and the local network. Electrical isolation is intended to prevent any high voltages and/or high currents that may exist from time to time in the cable from reaching the local network. For example, a BEP enclosure will house isolation components designed to protect telephone users from lightning striking a telephone cable. Such electrical isolation is typically provided by 5-pin plug-in protectors that quickly connect signals to ground upon detection of sufficiently high voltages or currents. Building entrance protectors are described in U.S. Pat. Nos. 5,803,292 and 5,907,127, which are expressly incorporated by reference herein.

The end cap of a BEP may include one or more cable ports, which extend outwardly from the end cap. The cable port allows the cable to enter into the enclosure. If the housing is to be pressurized, then heat shrink tubing is commonly used. The heat shrink tubing secures the cable to the BEP housing, aligns the cable, and provides a seal to protect the fiber enclosure from the outdoor environments.

If the cable port size is too large relative to the cable size, the cable does not remain aligned straight within the port. A wobbly cable could result in damage to the exposed fibers within the enclosure. To alleviate this problem, different sized ports may be required to maintain a firm hold on the fiber cable, typically, small, medium and large. To fit an equal number of small, medium and large ports within the limited space of the enclosure end cap, the number of any port size would be reduced to one third of the total number of cable ports.

FIGS. 1 and 2 show a multi-size adapter **10** according to the prior art. Adapter **10** can accommodate a small, medium or large cable. Adapter **10** has three cable ports **11**, **13** and **15**, with respective cylindrical side walls, **16**, **20** and **24**. Cable ports **11**, **13** and **15** are sized to accommodate large, medium (not shown) and small (not shown) cables respectively. For each cable size, a different portion of adapter **10** is cut away to leave an appropriately sized cable port **11**, **13** or **15** for the cable being accommodated.

For example, FIG. 3 shows an adapter that has been cut between the ledge 17 and the flat surface 18 to accommodate

a large cable **28**. The portion of the adapter **10** to the left of ledge **17** in FIG. **2** (including side walls **20** and **24**, and flat surfaces **22** and **26**) is cut away and discarded. The remaining portion of adapter **10** includes a mounting flange **12** and a cable port **11** having side wall **16** with a size that is matched to the cable **28** and the heat shrink tubing **30**. The adapter **10** is mounted to the end cap of a BEP **50** using fasteners **14**. The heat shrink tubing **30** is placed over the cable port **11**. The cable **28** is fit through the heat shrink tubing **30** and the cable port **11** of adapter **10**. The tubing **30** is heated, typically using a heat gun, and the tubing shrinks to form a sealed joint around the cable port **11** and the cable **28**.

As best seen in FIG. **2**, the adapter **10** has a length that is three times the length of an adaptor (not shown) that is designed to accommodate only a single cable size. This may be a disadvantage if, for example, it is desired to install more than one BEP **50** in a small space, or if it is desired to install a BEP near the floor. In either case, the length of the adapter **10** may exceed the available space. A more compact adapter is desired.

SUMMARY OF THE INVENTION

The present invention is an adapter for securing a cable to a housing. The adapter has a flange that is attachable to the housing. The adapter has a plurality of concentric cylindrical side walls, at least one of which is connected to the flange. Each side wall at least partially overlies an adjacent one of the plurality of side walls. The adapter has a plurality of annular surfaces. Each side wall is connected to an adjacent side wall by one of the plurality of annular surfaces.

BRIEF DESCRIPTION OF THE DRAWINGS

The drawings of this application are not drawn to scale. In particular, several dimensions are exaggerated to improve the readability of the drawings.

FIG. **1** is a plan view of a conventional cable adapter capable of accommodating multiple cable sizes.

FIG. **2** is a cross sectional view of the conventional adapter of FIG. **1**, taken along section line **2**—**2** of FIG. **1**.

FIG. **3** is a cross sectional view of a conventional BEP assembly including the adapter of FIG. **2**, after removing the small and medium diameter cable ports and securing a cable to the adapter.

FIG. **4** is a plan view of an exemplary adapter according to the present invention.

FIG. **5** is a cross sectional view of the adapter of FIG. **4**, taken along section line **5**—**5** of FIG. **4**.

FIG. **6** is a cross sectional view of a BEP assembly including the adapter of FIG. **4**, after removing the small disk shaped surface from the distal end to accommodate a small cable.

FIG. **7** is a cross sectional view of a BEP assembly including the adapter of FIG. **4**, after removing the small and medium flat surfaces and small cylindrical side wall to accommodate a medium cable.

FIG. **8** is a cross sectional view of a BEP assembly including the adapter of FIG. **4**, after removing the small, medium and large flat surfaces and small and medium cylindrical side walls to accommodate a large cable.

FIG. **9** shows three blade positions that are used to cut the adapter to any of the configurations of FIGS. **6**–**8**.

DETAILED DESCRIPTION

FIGS. **4** and **5** show an exemplary adapter **100** according *to the invention. The adapter 100 is used to secure a cable*

128 to a housing 150. The adapter 100 is advantageous for securing any of a variety of cable sizes to the housing 150 with heat shrink tubing 130. Unlike the adapters of the prior art, adapter 100 has overlapping cylindrical side walls 116, 120 and 124, providing a lower profile. The lower profile allows the adapter to fit into smaller spaces without any loss of function. For the exemplary configuration shown in FIGS. 4 and 5, the height H3 of the adapter is approximately one third (⅓) of the height of the conventional adapter 10 shown in FIGS. 1 and 2. Nevertheless, adapter 100 provides a small gap size between the inside diameter of the adapter and a variety of differently sized cables, allowing formation of a heat shrink joint that can withstand over 50 ft.-lb. (67.8 m-N) of torque.

The adapter 100 has a flange 112 that is attachable to the housing 150. The adapter 100 has a plurality of concentric cylindrical side walls 116, 120, and 124, at least one of which is connected to the flange 112. Each side wall 116, 120, 124 at least partially overlies an adjacent one of the plurality of side walls. In the exemplary embodiment, side wall 120 overlaps (overlies and extends beyond) side wall 116, and side wall 124 overlaps side wall 120.

The adapter has a plurality of annular surfaces 118 and 122. Each annular surface 118 and 122 is positioned at an end of a respective side wall 116 and 120 that is distal from the flange 112. Each side wall 116, 120 and 124 is connected to an adjacent side wall by one of the plurality of annular surfaces 118 and 122. For example, side wall 116 is connected to side wall 120 by annular surface 118. Side wall 120 is connected to side wall 124 by annular surface 122.

Advantageously, each of the inner cylindrical side wall 120, 124 is only attached at its distal end, so that the adapter 100 can be cut to accommodate the appropriate cable size after the adapter is installed on the housing 150.

In addition to the annular surfaces 118 and 122, the innermost cylinder 124 has a flat circular surface 126 at the distal end of the side wall. Surface 126 is located further from the flange 112 than the annular surfaces 118 and 122. If the adapter 100 is installed on the BEP housing 150 before a cable is installed in the adapter, the combination of the cylindrical side walls 116, 120, 124, the annular surfaces 118, 122 and the circular surface 126 form a sealed adapter, so that the BEP 150 can be pressurized. If the adapter is only to be mounted to the housing when a cable is to be sealed to the adapter, then the adapter need not have the surface 126, and an adapter formed without surface 126 would perform the same function.

Each annular surface 118, 122 and disk 126 is located at a respectively different distance H1, H2, H3 from the flange 112. In the exemplary embodiment, the distance from the flange 112 increases monotonically from an outermost annular surface 118 (distance=H1) to an innermost annular surface 122 (distance=H2) and to the inner disk 126 (distance=H3).

Preferably, the side walls 116, 120 and 124 in each pair of successive side walls differ from each other in height by at least a thickness of a blade 160, 170, 180 (FIG. 9) used to cut unused ones of the plurality of side walls from the adapter 100. That is, the differences (H3-H2) and (H2-H1) are each sufficient so that one or more of the cylinders can be severed by cutting a portion of the distal end of adapter 100. Preferably, the distance in height is small relative to the height of the cylindrical walls, so that the overall height H3 of the adapter 100 is small.

In the exemplary embodiment, at least one side wall 116 has a ledge 117 thereon, proximate to the end of the side wall 116 distal from the flange 112. The annular surfaces 118, 122 and ledge 117 are discussed below with reference to the method for using the adapter 100 to secure a cable 128.

The adapter 100 may be made of any rigid material that is easy to cut. Exemplary materials include polymers, such as polycarbonate and polyvinyl chloride. These materials are easily cut in the field with a saw 160, 170 or 180 (FIG. 9). Although metal may also be used, metal is more difficult to cut with manual tools.

FIGS. 6, 7 and 8 show three different configurations into which adapter 100 may be cut to accommodate three respective cable sizes. In each case, a portion of a selected one of the side walls 116, 120 or 124 is cut, so as to remove any side wall that is smaller in diameter than the selected side wall. Then, the cable is secured to the side wall 116 having the largest diameter. Once the adapter 100 is properly cut, the innermost remaining side wall has approximately the same diameter as the cable. A small clearance is allowed between the inner diameter of the adapter and the sheathing of the cable, so that the inner wall of the adapter guides the cable without forming an interference fit.

FIG. 6 shows the configuration of the adapter 100 for securing a small cable 128 to the BEP housing 150. The distal end 124*a* of innermost cylindrical side wall 124 is cut (using a knife or saw), severing the circular flat surface 126. In this configuration, the adapter 100 now has an inner diameter sized to accommodate the small sized cable 128. Because the adapter wall 124 has a minimal clearance around the cable 128, the cable alignment is maintained, and the cable cannot wobble or work itself loose. The heat shrink tubing 130 has a wide range of shrinkage capability, and can shrink at one end to grip a small diameter cable 128 at the same time that the other end of the tubing 130 grips a relatively large adapter surface 116.

As noted above, the drawings are not to scale. In particular, the configuration of FIG. 6, has the greatest difference between the outer diameter of side wall 116 and the diameter of the cable 128. This gap about 0.1 inch (2.5 mm)

FIG. 7 shows the configuration of the adapter 100 for securing a medium cable 128' to the BEP housing 150. The distal end 120*a* of the middle cylindrical side wall 120 is cut (using a knife or saw), severing the wall 120. In this configuration, the adapter 100 now has an inner diameter sized to accommodate the medium sized cable 128'. Again, the adapter wall 120 has a minimal clearance around the cable 128', so the cable alignment is maintained, and the cable cannot wobble or work itself loose.

FIG. 8 shows the configuration of the adapter 100 for securing a large cable 128" to the BEP housing 150. The distal end 116*a* of the outermost cylindrical side wall 116 is cut (using a knife or saw), severing the wall 116. In this configuration, the adapter 100 now has an inner diameter sized to accommodate the large sized cable 128". As in the case of the small and medium cables 128 and 128', the adapter wall 116 has a minimal clearance around the cable 128", so the cable alignment is maintained, and the cable cannot wobble or work itself loose.

FIG. 9 shows three different blade positions, indicated by blades 160, 170 and 180. The adapter 100 can be cut to accommodate a cable by aligning a blade on one of the annular surfaces that is adjacent to the selected side wall and is connected to the selected side wall at an inner circumference of that annular surface, and cutting the selected side wall with the aligned blade. For example, to accommodate a small cable, the blade 180 is aligned on annular surface

122 (which is adjacent to the side wall 124 to be cut), and the end 124a of side wall 124 is cut. Similarly, to accommodate a medium cable, the blade 170 is aligned on annular surface 118, and the end 120a of side wall 120 is cut.

In the case of a large diameter cable, the adapter 100 is prepared by aligning the blade 160 on a ledge 117 of the selected side wall 116, and cutting the selected side wall with the aligned blade.

Either before or after the adapter 100 is cut to accommodate the selected cable size, the adapter is fastened to the housing 150 by driving fasteners 114 through the flange 112 connected to the outermost cylindrical wall side 116. After the adapter is cut and the adapter is fastened to the housing 150, the cable 128, 128' or 128" is inserted through the selected cylindrical wall 124, 120 or 116, respectively. A heat-shrink tubing 130 is fit over the outermost cylindrical wall 116 and over a portion of the cable 128, 128' or 128" protruding through the selected cylindrical wall. The heat-shrink tubing 130 is then heated to form a seal over the outermost cylindrical wall 116 and the portion of the cable 128, 128' or 128". The heat shrink tubing 130 is adhered to the cable 128, 128' or 128" and the outermost side wall 116.

Although the exemplary adapter includes three cable ports, it is contemplated that adapters according to the present invention may be formed to accommodate any number of cable sizes, by adding additional cylindrical side walls, and connecting distal annular flat surfaces.

Although the exemplary housing 150 is a building entrance protector housing, the invention may be practiced to secure a cable to other types of housings, to form a high pressure seal. Although the exemplary cables 128, 128' and 128" have optical fibers therein, the invention may be used to secure other types of cables to a housing. Although the invention is advantageous for housings subjected to high pressure, it may also be used for securing a cable to a housing that is not pressurized.

Although the exemplary embodiment includes an adapter that is separate and distinct from the BEP housing 150, the adapter may be formed integrally as a portion of the end cap of the BEP housing, in which case the end cap and adapter form a single component.

Although the invention has been described in terms of exemplary embodiments, it is not limited thereto. Rather, the appended claim should be construed broadly, to include other variants and embodiments of the invention which may be made by those skilled in the art without departing from the scope and range of equivalents of the invention.

What is claimed is:

1. A method for securing a cable to a housing, comprising the steps of:

(a) providing a housing having an opening with a plurality of concentric cylindrical side walls adjacent the opening, each side wall at least partially overlying an adjacent one of the plurality of side walls, the housing having at least one annular surface, each side wall connected to an adjacent side wall by a respective annular surface, at least one of said side walls having a ledge thereon;

(b) aligning a blade on a ledge of a selected side wall;

(c) cutting a portion of the selected side wall with the aligned blade, so as to remove any side wall that is smaller in diameter than the selected side wall; and

(d) securing the cable to the side wall having the largest diameter.

2. The method of claim 1, wherein step (d) includes:

inserting the cable through the selected cylindrical wall;

fitting a heat-shrink tubing over the outermost one of the cylindrical walls and over a portion of the cable protruding through the selected cylindrical wall; and

heating the heat-shrink tubing to form a seal over the outermost cylindrical wall and the portion of the cable.

3. The method of claim 1, wherein step (a) includes fastening an adapter to the housing, the adapter including the plurality of side walls and a mounting flange connected to an outermost one of the side walls.

4. The method of claim 3, wherein said ledge is at an end of said at least one side wall distal from said flange.

5. The method of claim 1, wherein said concentric cylindrical side walls are rigid.

6. The method of claim 1, wherein said concentric cylindrical side walls are fixed.

* * * * *

US006362427B1

(12) **United States Patent**
Daoud

(10) **Patent No.: US 6,362,427 B1**
(45) **Date of Patent: Mar. 26, 2002**

(54) **LOW PROFILE ADAPTER FOR VARIABLE SIZE TUBING**

(75) Inventor: **Bassel Hage Daoud**, Parsippany, NJ (US)

(73) Assignee: **Avaya Technology Corp.**, Basking Ridge, NJ (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/372,337**

(22) Filed: **Aug. 11, 1999**

(51) **Int. Cl.**[7] **H02G 3/18**
(52) **U.S. Cl.** ..... **174/65 R**; 174/65 G; 174/152 G
(58) **Field of Search** ..... 174/56, 57, 50, 174/65 G, 65 R, 135, 151, 152 G, 153 G; 220/402, 3.8, 3.92, 3.94; 285/4, 423, 424

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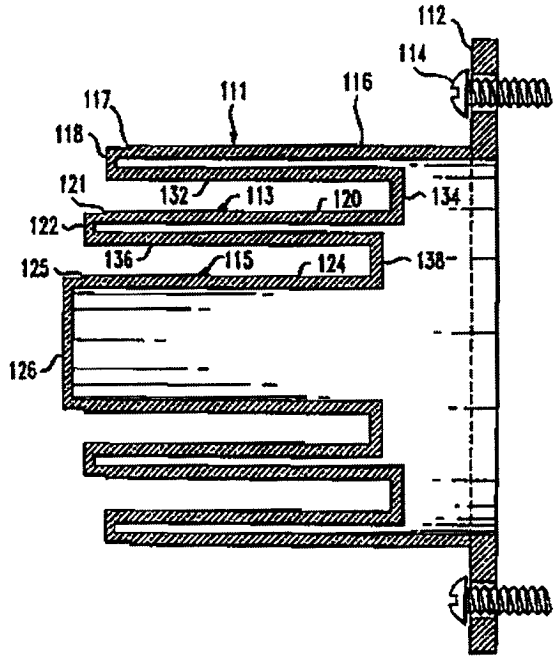
* cited by examiner

Primary Examiner—Dean A. Reichard
Assistant Examiner—Angel R. Estrada
(74) *Attorney, Agent, or Firm*—Duane, Morris & Heckscher LLP

(57) **ABSTRACT**

An adapter for securing a cable to a housing has a flange that is attachable to the housing and a plurality of concentric cable ports connected to the flange. Each cable port has a side wall. The side wall of each cable port overlaps a side wall of an adjacent one of the plurality of cable ports. Each cable port has a respective diameter and a respective height with respect to the flange, and the heights of the cable ports increase monotonically from the cable port having the largest diameter to the cable port having the smallest diameter. Each cable port other than the cable port having the smallest diameter has a flat surface at a distal end opposite the flange. Each pair of successive cable ports differ from each other in height by a constant amount that is at least a thickness of a blade used to cut unused ones of the plurality of cable ports from the adapter. Each cable port may have a ledge proximate to the distal end. The ledge of an inner one of an adjacent pair of cable ports within the plurality of cable ports is located at the same height as the flat surface at the distal end of the outer one of the pair of cable ports. The adapter may be formed from a single piece of material, adjacent cable ports connected to each other.

26 Claims, 7 Drawing Sheets



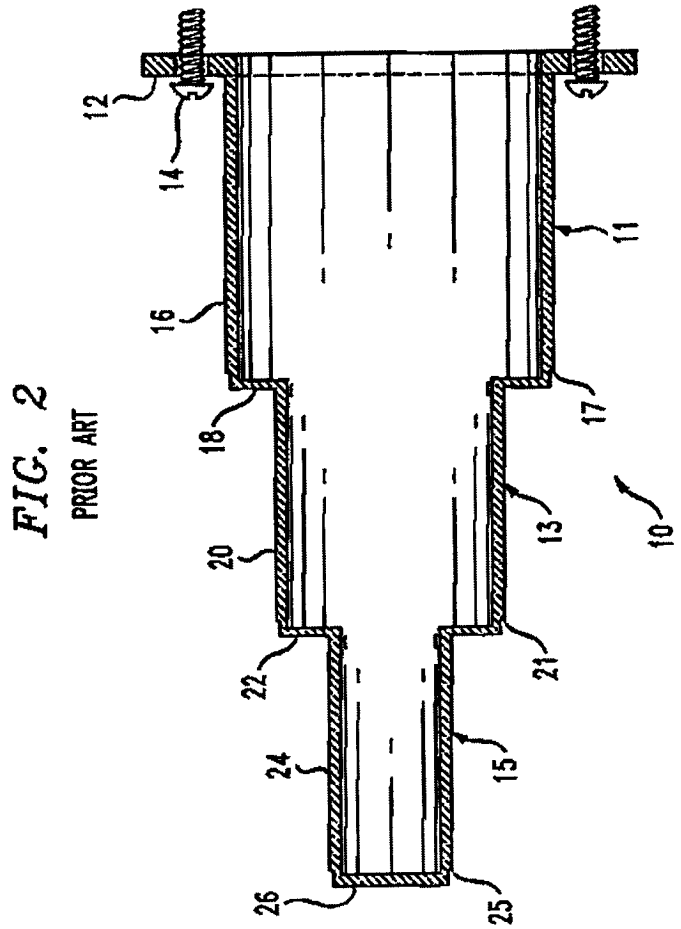


FIG. 2
PRIOR ART

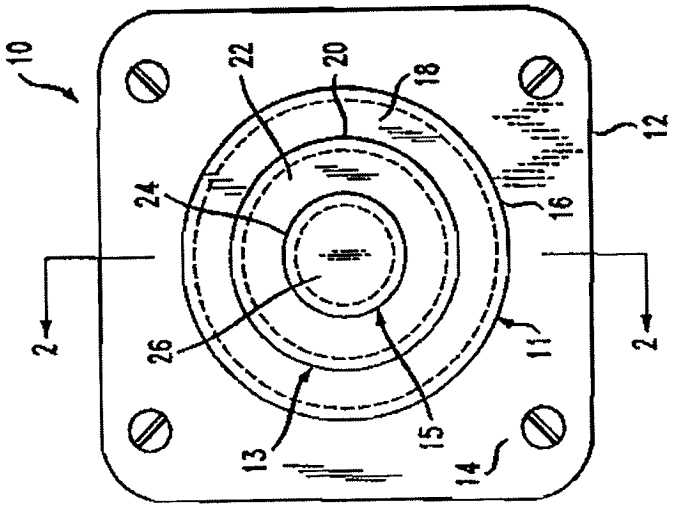


FIG. 1
PRIOR ART

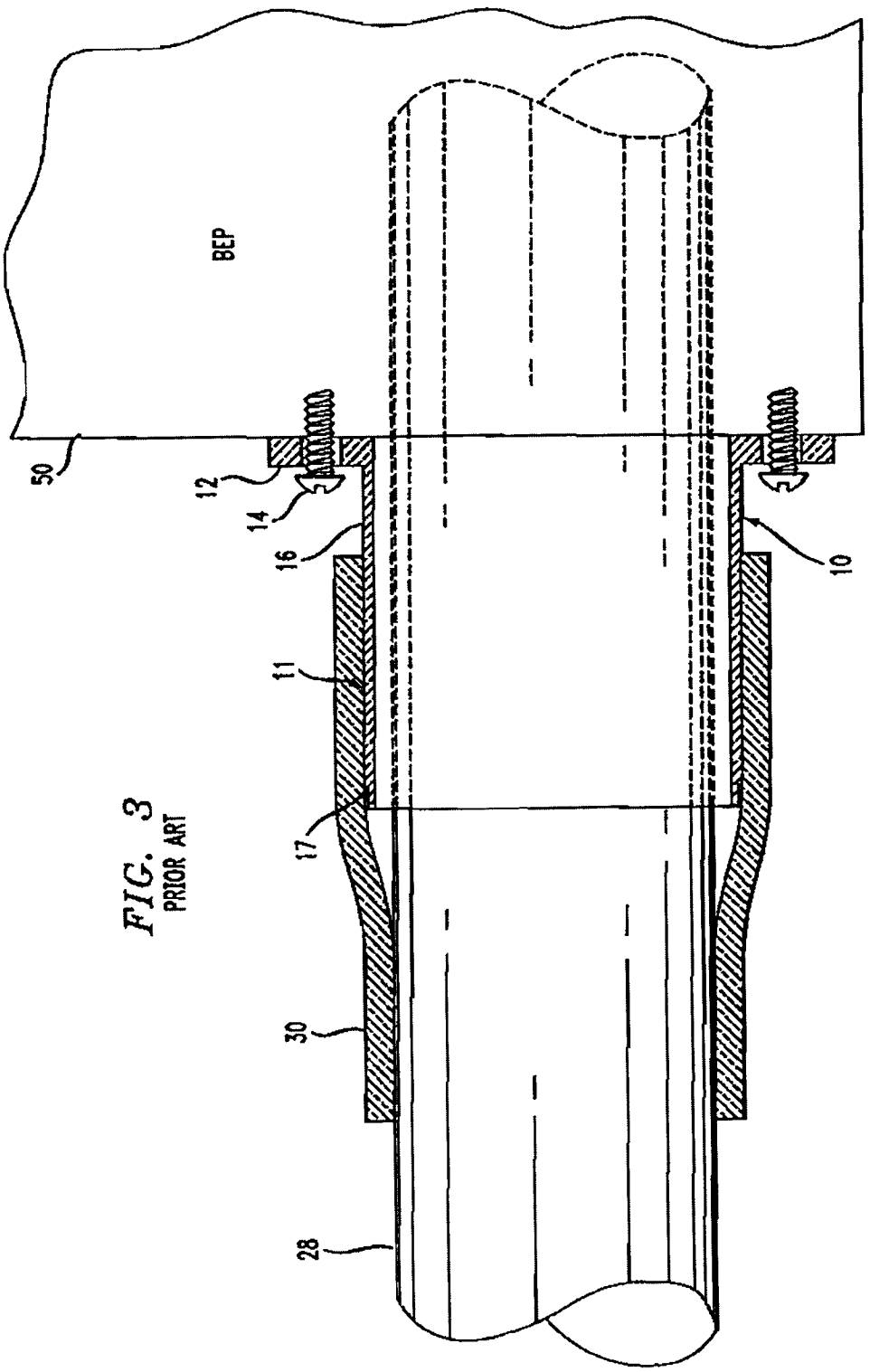


FIG. 3
PRIOR ART

FIG. 5

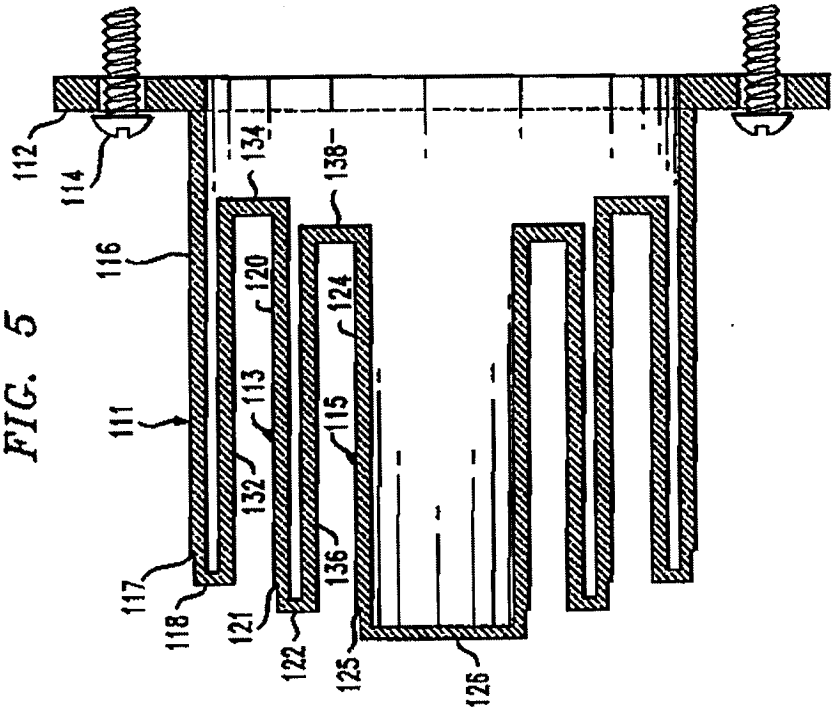

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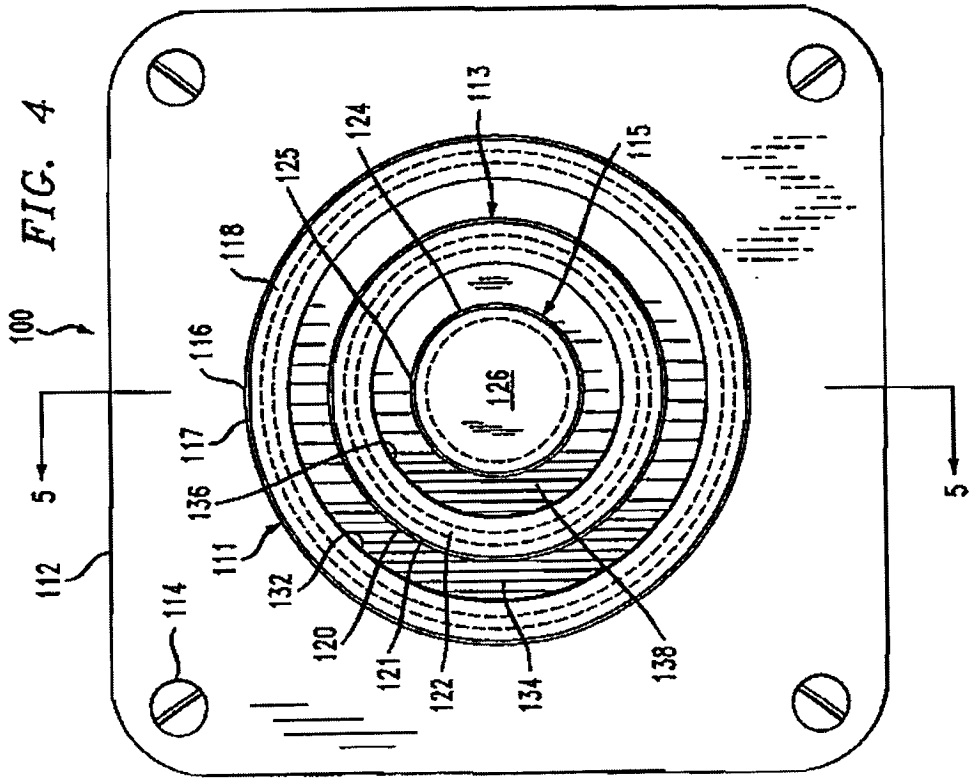
FIG. 4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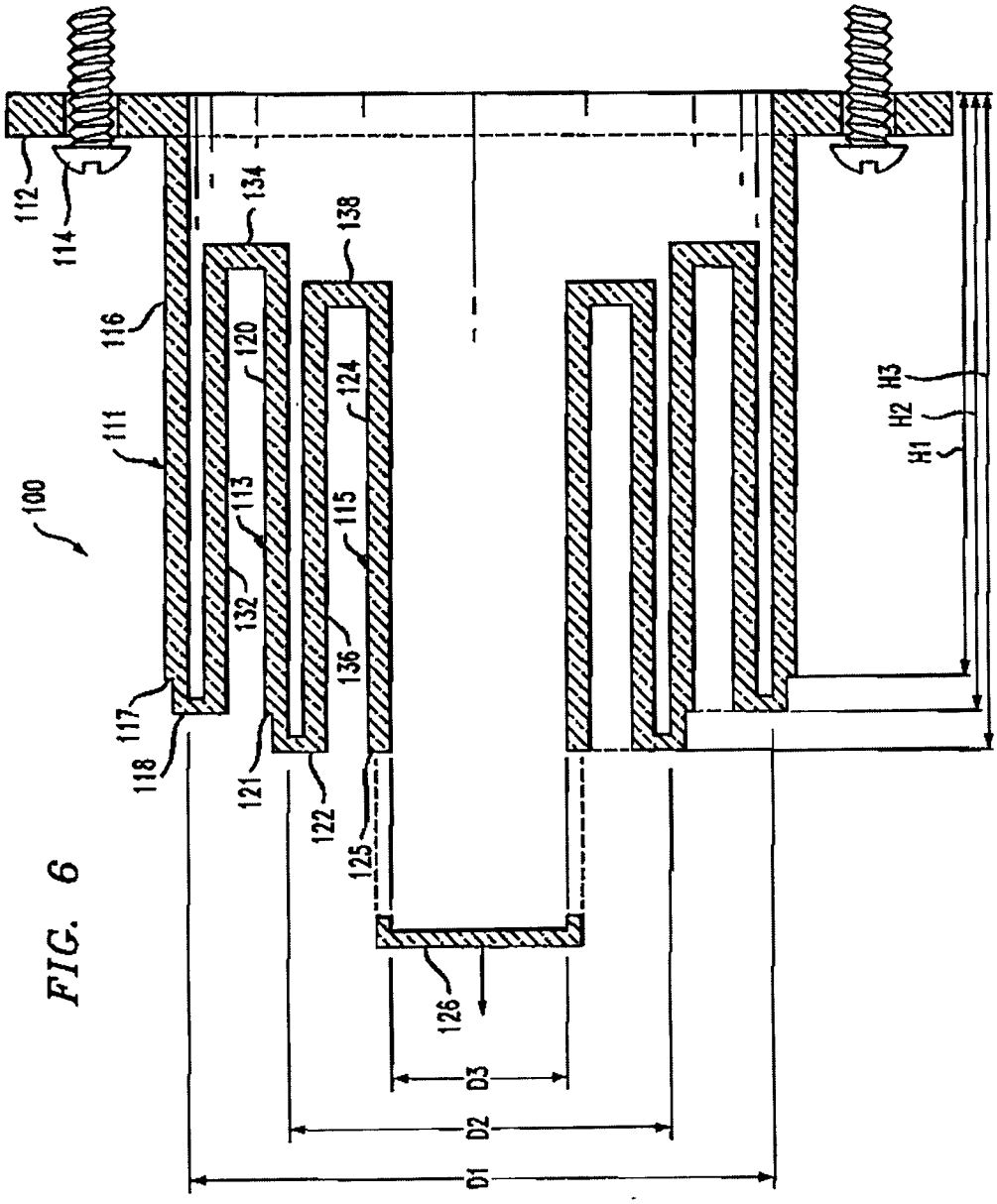
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FIG. 6

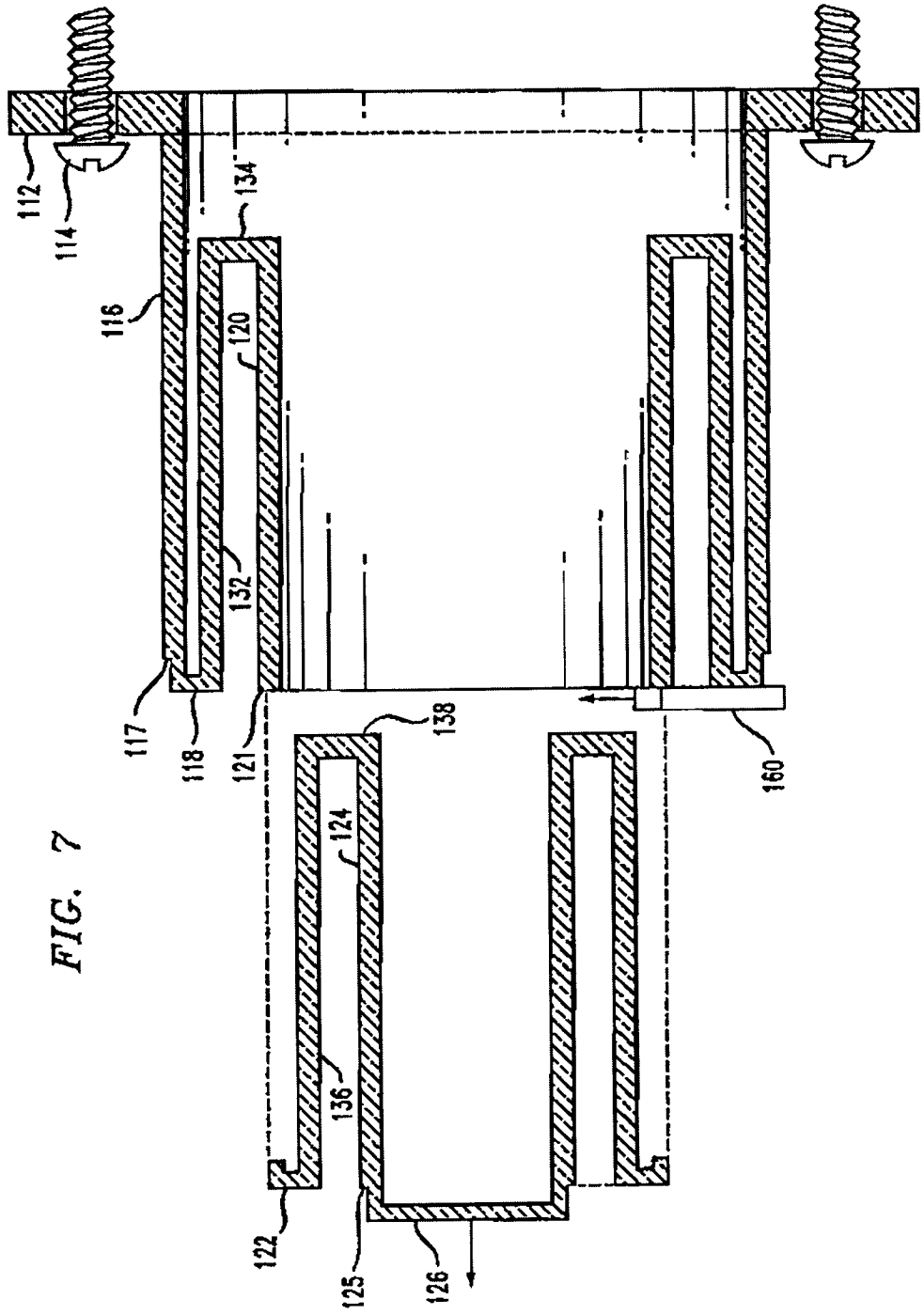

FIG. 7

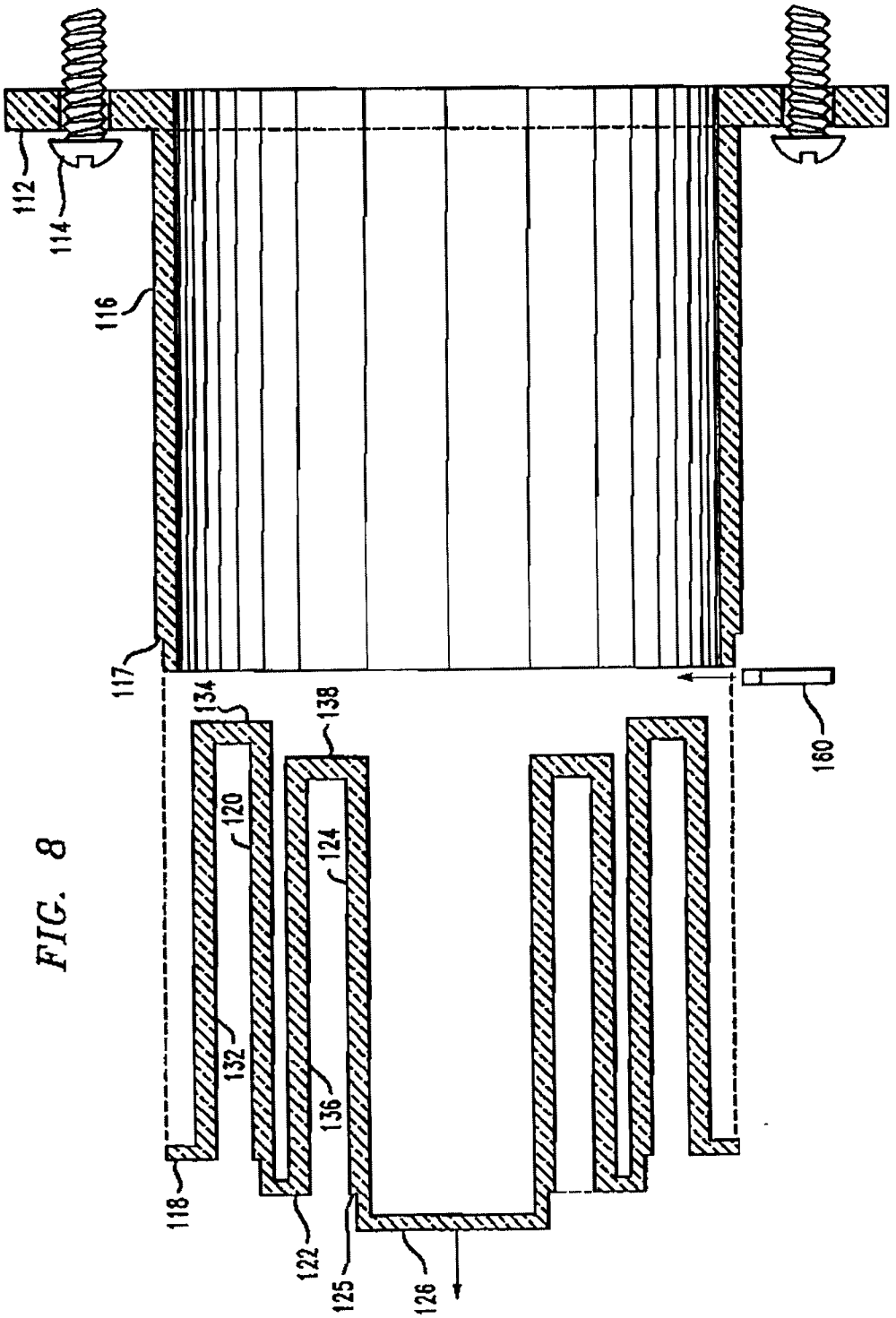

FIG. 8

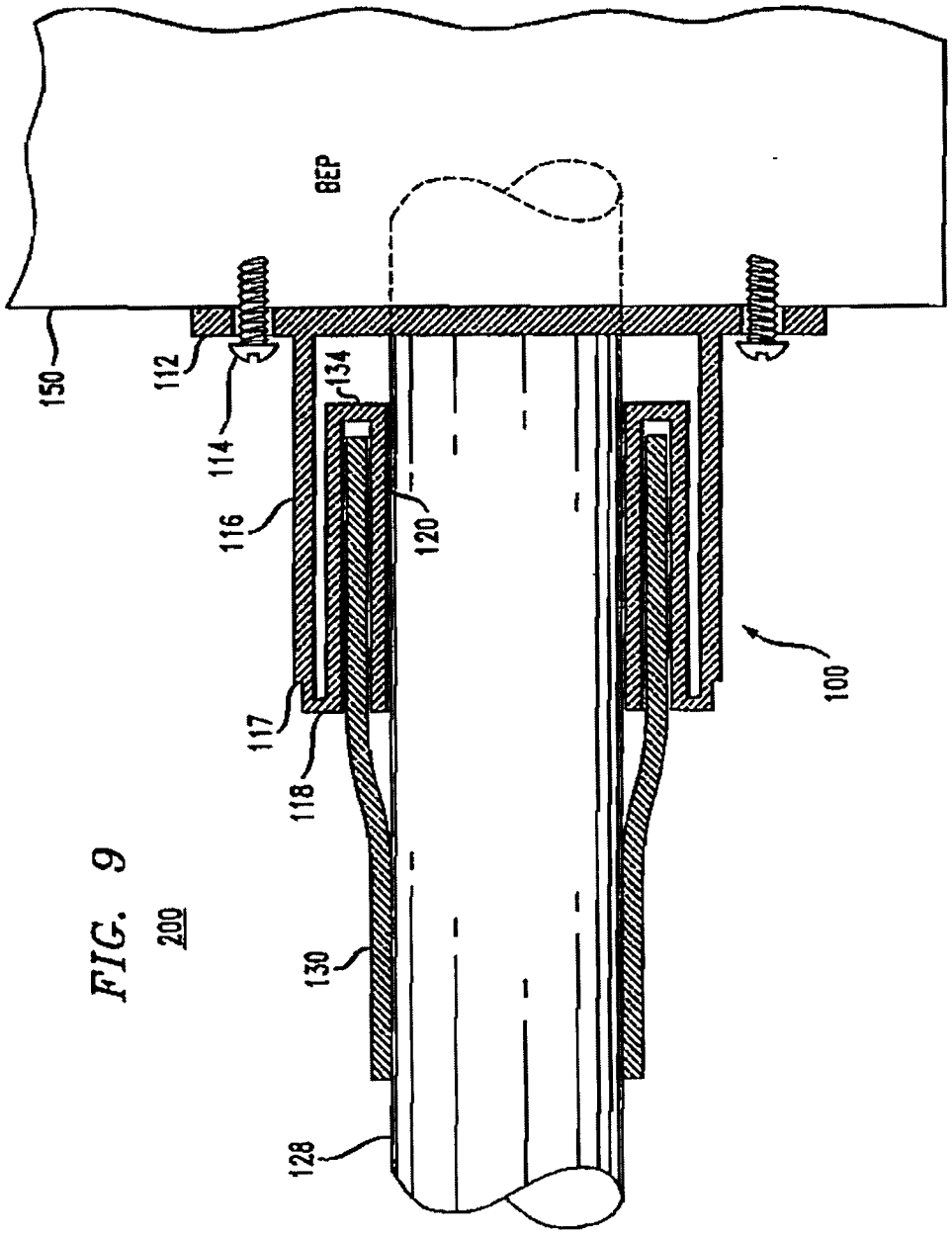

FIG. 9

200

LOW PROFILE ADAPTER FOR VARIABLE SIZE TUBING

FIELD OF THE INVENTION

The present invention relates to telecommunications equipment generally, and more specifically to adapters for connecting a cable to an enclosure, such as a building entrance protector.

DESCRIPTION OF THE RELATED ART

A building entrance protector (BEP) enclosure houses the physical interface between the nodes of a local telecommunications network and a telecommunications cable. For example, a BEP enclosure may house the interface hardware between the telephones of an office building and an exterior telephone cable having a number of twisted copper pairs that carry the voice signals for those telephones. A BEP enclosure is typically mounted in the basement or first floor of the office building. A BEP enclosure may also be used to house the interface hardware for systems based on fiber optical communications. Similarly, BEP enclosures may be used with telecommunications systems carrying signals other than just telephone voice signals.

A BEP enclosure provides two main functions: (1) it houses the hardware that provides connections between a cable and the individual nodes (e.g., telephones) of a local network; and (2) it houses the hardware that provides electrical isolation between the cable and the local network. Electrical isolation is intended to prevent any high voltages and/or high currents that may exist from time to time in the cable from reaching the local network. For example, a BEP enclosure will house isolation components designed to protect telephone users from lightning striking a telephone cable. Such electrical isolation is typically provided by 5-pin plug-in protectors that quickly connect signals to ground upon detection of sufficiently high voltages or currents. Building entrance protectors are described in U.S. Pat. Nos. 5,803,292 and 5,907,127, which are expressly incorporated by reference herein.

The end cap of a BEP may include one or more cable ports, which extend outwardly from the end cap. The cable port allows the cable to enter into the enclosure. A cold shrink tubing is normally used to seal around both the cable and the cable port. Cold shrink tubing is described in U.S. Pat No. 3,515,798, U.S. Pat. No. 4,871,599, and U.S. Pat. No. 5,670,223, all of which are expressly incorporated herein by reference. The cold shrink tubing secures the cable to the BEP housing, aligns the cable, and provides a seal to protect the fiber enclosure from the outdoor environments.

Different size cables require different size ports. To perform its functions properly, a piece of cold shrink tubing must have a diameter that is suitable for the cable. A given size of cold shrink tubing does not have the range of shrinkage ability that is provided by heat shrink tubing. Thus, a given piece of cold shrink tubing cannot handle all cable sizes. A series of cold shrink tubing sizes are needed to seal around a wide range of cable sizes. For example, the Minnesota Mining and Manufacturing Co. of St. Paul, Minn. sells a series of products, numbers 4626L (or S) through 4631L (or S).

If the cable port size is too large relative to the cable size, the cable does not remain aligned straight within the port. A wobbly cable could result in damage to the exposed fibers within the enclosure. To alleviate this problem, different sized ports may also be required to maintain a firm hold on the fiber cable, typically, small, medium and large. To fit an equal number of small, medium and large ports within the limited space of the enclosure end cap, the number of any port size would be reduced to one third of the total number of cable ports.

FIGS. **1** and **2** show a multi-size adapter **10** according to the prior art. Adapter **10** can accommodate a small, medium or large cable. Adapter **10** has three cable ports **11**, **13** and **15**, with respective cylindrical side walls, **16**, **20** and **24**. Cable ports **11**, **13** and **15** are sized to accommodate large, medium (not shown) and small (not shown) cables respectively. For each cable size, a different portion of adapter **10** is cut away to leave an appropriately sized cable port **11**, **13** or **15** for the cable being accommodated.

For example, FIG. **3** shows an adapter that has been cut between the ledge **17** and the flat surface **18** of FIG. **2** to accommodate a large cable **28**. The portion of the adapter **10** to the left of ledge **17** in FIG. **2** (including side walls **20** and **24**, and flat surfaces **22** and **26**) is cut away and discarded. The remaining portion of adapter **10** includes a mounting flange **12** and a cable port **11** having side wall **16** with a size that is matched to the cable **28** and the cold shrink tubing **30**. The adapter **10** is mounted to the end cap of a BEP **50** using fasteners **14**. The cold shrink tubing **30** with its core (not shown) still intact is placed over the cable port **11**. The cable **28** is fit through the cold shrink tubing **30** and the cable port **11** of adapter **10**. The core of the cold shrink tubing **30** is removed, and the tubing collapses to form a sealed joint around the cable port **11** and the cable **28**.

As best seen in FIG. **2**, the adapter **10** has a length that is three times the length of an adaptor (not shown) that is designed to accommodate only a single cable size. This may be a disadvantage if, for example, it is desired to install more than one BEP **50** in a small space, or if it is desired to install a BEP near the floor. In either case, the length of the adapter **10** may exceed the available space. A more compact adapter is desired.

SUMMARY OF THE INVENTION

The present invention is an adapter for securing a cable to a housing. The adapter has a flange that is attachable to the housing. A plurality of concentric cable ports are connected to the flange. Each cable port has a side wall. The side wall of each cable port overlaps a side wall of an adjacent one of the plurality of cable ports.

Another aspect of the invention is a method for securing a cable to a housing. An adapter is attached to the housing, the adapter having a plurality of concentric cable ports, each cable port having a side wall, the side wall of each cable port overlapping a side wall of an adjacent one of the plurality of cable ports. A portion of a selected one of the cable ports is cut, so as to remove any cable port that is smaller in diameter than the selected cable port. The cable is secured to the selected cable port.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a plan view of a conventional cable adapter capable of accommodating multiple cable sizes.

FIG. **2** is a cross sectional view of the conventional adapter of FIG. **1**, taken along section line 2—2 of FIG. **1**.

FIG. **3** is a cross sectional view of a conventional BEP assembly including the adapter of FIG. **2**, after removing the small and medium diameter cable ports and securing a cable to the adapter.

FIG. **4** is a of an exemplary adapter according to the present invention.

FIG. 5 is a cross sectional view of the adapter of FIG. 4, taken along section line 5—5 of FIG. 4.

FIG. 6 shows the adapter of FIG. 5, with the smallest diameter flat center portion removed to accommodate a small diameter cable.

FIG. 7 shows the adapter of FIG. 5, with small diameter cable port removed to accommodate a medium sized cable.

FIG. 8 shows the adapter of FIG. 5, with the small and medium diameter cable ports removed to accommodate a large sized cable.

FIG. 9 shows a BEP assembly including the adapter cut as shown in FIG .7, after securing a medium sized cable to the medium size cable port.

DETAILED DESCRIPTION

FIGS. 4 and 5 show an exemplary adapter **100** according to the present invention. Adapter **100** may be used for securing a cable **128** to a housing **150** (FIG. 9), which may be a BEP cabinet.

Adapter **100** has a mounting flange **112** that is attachable to the housing **150**. The flange may be of a conventional design, including mounting holes to accommodate fasteners **114**. The fasteners may be of any conventional type, but screws are preferred, because of their pull-out strength, and ease of installation.

A plurality of concentric cable ports **111**, **113** and **115** are (directly or indirectly) connected to the flange **112**. Cable ports **111**, **113** and **115** have respective side walls **116**, **120** and **124**. The side wall **116**, **120** or **124** of each cable port **111**, **113** and **115** overlaps the side wall of an adjacent one of the plurality of cable ports. For example, side wall **120** overlaps both side walls **116** and **124**, and side wall **124** overlaps both side walls **116** and **120**. As used herein, the term "overlap" means that one of the side walls **116**, **120** or **124** coincides (at least in part) with another one of the side walls, and may optionally extend beyond that other one of the side walls.

As best seen in FIG. 6, each cable port **111**, **113**, **115** has a respective diameter and a respective height with respect to the flange. Port **111** has a diameter D1 and a height H1. Port **113** has a diameter D2 and a height H2. Port **115** has a diameter D3 and height H3. The heights H1, H2 and H3 of the cable ports **111**, **113** and **115** increase monotonically from the cable port **111** having the largest diameter D1 to the cable port **115** having the smallest diameter D3. Thus, exemplary cable port **113** extends beyond cable port **111**, and cable port **115** extends beyond cable port **113**.

Each pair of successive cable ports **111**, **113** and **115** differ from each other in height by at least the thickness of a blade (shown in FIGS. 7 and 8) used to cut unused ones of the plurality of cable ports from the adapter. The cable ports within each pair of successive cable ports may optionally differ in height from one another by a constant amount. That is, the difference (H1–H2) may be substantially equal to (H2–H3).

Each cable port **111** and **113** (other than the cable port **115** having the smallest diameter) has a distal flat surface **118** and **122** at a distal end opposite the flange **112**. The smallest cable port **115** may have a flat surface **126** that is removed (as shown in FIG. 6) to accommodate a small cable. If the BEP is to be installed with the adapter **100** and maintained in a sealed state before any cables are secured to the BEP, then the flat surface **126** should be present, until the cable is installed. Alternatively, if the cable is to be secured to the BEP at the same time the BEP is installed, then an adapter formed without the flat surface **126** may be used.

Each of the exemplary cable ports **111**, **113** and **115** has a respective ledge **117**, **121** and **125** proximate to the distal end. In the exemplary embodiment, the ledge of an inner one of an adjacent pair of cable ports within the plurality of cable ports is located at the same height as the flat surface at the distal end of the outer one of the pair of cable ports. For example, the ledge **125** of cable port **115** has the same height as the flat surface **122** of cable port **113**. Similarly, ledge **121** of cable port **113** has the same height as the flat surface **118** of cable port **111**.

Preferably, the adapter **100** is formed from a single piece of material. In the exemplary embodiment, the overlapping side walls of each successive pair of cable ports are connected by a connecting portion, including a first flat surface proximal to the flange **112**, a cylindrical wall concentric with the plurality of cable ports, and a second flat surface at a distal end opposite the flange. For example, cable port **113** is connected to cable port **111** by a first flat surface **134** proximal to the flange **112**, a cylindrical wall **132**, and a second flat surface **118** at the distal end opposite the flange. Similarly, cable port **115** is connected to cable port **113** by a first flat surface **138** proximal to the flange **112**, a cylindrical wall **136**, and a second flat surface **122** at the distal end opposite the flange.

The construction described in the preceding paragraph allows the adapter **100** to be formed from a single piece of material, with overlapping cylindrical side walls **116**, **120** and **124** of cable ports **111**, **113** and **115** conveniently connected to one another. Thus, only a single cut is required to prepare the adapter **100** to accept any size of cable (e.g., small, medium or large). At the same time, a low profile can be achieved.

It is possible for the adapter **100** to have a height that is approximately equal to the height H1 of the cable port **111** having the largest diameter. The difference between the heights of successive cable ports (H2—H1, or H3–H2) can be set as small as desired. Preferably, the difference H2–H1 is greater than the thickness of a blade used to cut the unused cable ports from the adapter. Smaller height differences (or no height difference) may be used if the unused portion of the adapter is severed on the distal flat surface **118**, **122**, or **126**, but it would be more difficult to make such a cut using a manual tool, such as a saw, in the field.

A method according to the invention for securing a cable to a housing, includes attaching an adapter **100** to the housing **150**, where the adapter has a plurality of concentric cable ports **111**, **113** and **115**, each cable port has a side wall **116**, **120** and **124**, and the side wall of each cable port overlaps a side wall of an adjacent one of the plurality of cable ports. A portion of a selected one of the cable ports is cut, so as to remove any cable port that is smaller in diameter than the selected cable port, and the cable is secured to the selected cable port. FIGS. 6, 7 and 8 show the three different configurations into which adapter **100** may be cut.

FIG. 6 shows the configuration for securing a small cable (not shown) to the BEP **150** (FIG. 9). Only the flat surface **126** of the small cable port **115** is removed. This is easily accomplished by a circumferential cut between ledge **125** and flat surface **126**.

FIG. 7 shows the configuration for securing a medium cable **128** (FIG. 9) to the BEP **150** (FIG. 9). The small cable port **115** is removed. This is easily accomplished by a circumferential cut between ledge **121** and flat surface **122**. The unused portion of the adapter (including flat surface **126**, side wall **124**, proximal flat surface **138**, connecting cylindrical wall **136** and distal flat surface **122**) is removed in a single piece.

FIG. 8 shows the configuration for securing a large cable (not shown) to the BEP 150 (FIG. 9). The small cable port 115 and medium cable port 113 are removed. This is easily accomplished by a circumferential cut between ledge 117 and flat surface 118. The unused portion of the adapter (including flat surface 126, side wall 124, proximal flat surface 138, connecting cylindrical wall 136, distal flat surface 122, side wall 120, proximal flat surface 134, connecting cylindrical wall 132 and distal flat surface 118) is removed in a single piece.

In an exemplary method, the cutting step includes aligning a blade (such as saw blade 160 shown in FIG. 7) on the flat surface 118 of a cable port 111 adjacent to the selected cable port 113 to be cut, and cutting the selected cable port with the aligned blade. The cutting step may further include aligning the blade 160 on a ledge 121 of the selected cable port 113 and the flat surface 118 of the adjacent cable port 111 simultaneously. As shown in FIG. 7, an advantage of aligning the ledge 121 of a cable port 113 with the distal flat surface 118 of the next larger cable port is the ability to simultaneously rest a cutting blade on both the flat surface 118 and the ledge 121 simultaneously to position, align and steady the blade 160 during cutting.

One of ordinary skill can easily recognize how a similar cutting step may be used for the configuration shown in FIG. 6. A blade 160 can simultaneously be aligned on ledge 125 of cable port 115 and distal flat surface 122 of adjacent cable port 113. In the case of the largest cable port 111 (FIG. 8), the blade 160 may be aligned on the ledge 117, but there is no distal flat surface parallel to ledge 117. If desired, the blade may be aligned on the ledge 117 for cutting.

FIG. 9 shows building entrance protector assembly 200, including a building entrance protector housing 150 having an opening therethrough. An adapter 100 is used for securing a cable 128 to the housing 150. The adapter 100 may be of the type described above. Cold-shrink tubing 130 may be used to form a seal between cable 128 and side wall 120.

Although it is advantageous to cut the plastic at the height of one of the ledges 117, 121 or 125, the adaptor may be cut at a position between the ledge 117, 121 or 125 and the respective distal flat surface 118, 122 or 126 (as shown in FIG. 8). Further, the cut may be made through the distal flat surface 118, 122, or 126, but such a cut is likely to be more difficult to perform, particularly using manual tools in the field.

Once the adapter 100 is cut to the desired configuration corresponding to the diameter of the cable to be used, the cable is inserting through the selected cable port. A cold-shrink tubing is fit over the selected cable port and a portion of the cable protruding therethrough. The core of the cold shrink tubing is removed, so that the tubing collapses to form a seal over the selected cable port and the portion of the cable.

An adapter according to the invention is preferably formed from a single piece of a polymer material, such as polycarbonate or polyvinyl chloride. The material should be rigid, yet easy to cut with a saw or other cutting tool. Although a metal adapter would have the desired rigidity, metal is more difficult to cut with a saw in the field.

Although the exemplary adapter includes three cable ports, it is contemplated that adapters according to the present invention may be formed to include any number of cable ports, by adding additional cylindrical side walls, and connecting proximal and distal flat surfaces.

Although the exemplary proximal flat (connecting) surfaces 134 and 138 (FIG. 8) are not parallel to each other, it is contemplated that an adapter according to the invention may be made in which the proximal connecting surfaces are parallel to each other (not shown).

Although the invention has been described in terms of exemplary embodiments, it is not limited thereto. Rather, the appended claim should be construed broadly, to include other variants and embodiments of the invention which may be made by those skilled in the art without departing from the scope and range of equivalents of the invention.

What is claimed is:

1. An adapter for securing a cable to a housing, comprising:

a flange that is attachable to the housing; and

a plurality of concentric cable ports connected to the flange, each cable port having a side wall, the side wall of each cable port overlapping a side wall of an adjacent one of the plurality of cable ports, wherein:

each cable port has a respective diameter and a respective height with respect to the flange,

the heights of the cable ports increase as the diameters of the cable ports decrease,

each cable port other than the cable port having the smallest diameter has a flat surface at a distal end opposite the flange,

one of the cable ports other than the cable port having the largest diameter has a ledge proximate to the distal end, said one of the cable ports being an inner one of an adjacent pair of cable ports within the plurality of cable ports; and

the ledge of said inner one is located at the same height as the flat surface at the distal end of an outer one of the pair of cable ports.

2. The adapter of claim 1, wherein:

each cable port has a ledge proximate to the distal end; and

the ledge of an inner one of any adjacent pair of cable ports within the plurality of cable ports is located at the same height as the flat surface at the distal end of an outer one of the pair of cable ports.

3. The adapter of claim 1, wherein the side wall of each cable port is rigid.

4. The adapter of claim 1, wherein the side wall of each cable port is fixed.

5. The adapter of claim 1, wherein the plurality of cable ports includes at least one pair of successive cable ports, and the cable ports within each pair of successive cable ports differ from each other in height.

6. The adapter of claim 5, wherein each pair of successive cable ports differ from each other in height by a constant amount.

7. The adapter of claim 1, wherein at least one of the cable ports is connected to an adjacent one of the cable ports by a first flat surface proximal to the flange, a cylindrical wall concentric with the plurality of cable ports, and a second flat surface at a distal end opposite the flange.

8. An adapter for securing a cable to a housing, comprising:

a flange that is attachable to the housing; and

a plurality of concentric cable ports connected to the flange, each cable port having a side wall, the side wall of each cable port overlapping a side wall of an adjacent one of the plurality of cable ports,

wherein at least one of the cable ports is connected to an adjacent one of the cable ports by a first flat surface

proximal to the flange, a cylindrical wall concentric with the plurality of cable ports, and a second flat surface at a distal end opposite the flange.

9. The adapter of claim 8, wherein:

each cable port has a respective diameter and a respective height with respect to the flange, and

the heights of the cable ports increase as the diameters of the cable ports decrease.

10. The adapter of claim 8, wherein more than one of said plurality of cable ports are connected to a respective adjacent one of the cable ports by a respective first flat surface proximal to the flange, a respective cylindrical wall concentric with the plurality of cable ports, and a respective second flat surface at a distal end opposite the flange.

11. The adapter of claim 8, wherein the adapter is formed from a single piece of material.

12. A building entrance protector assembly, comprising:

a building entrance protector housing having an opening therethrough; and

an adapter for securing a cable to the housing, the adapter comprising:

a flange that is attachable to the housing; and

a plurality of concentric cable ports connected to the flange, each cable port having a side wall, the side wall of each cable port overlapping a side wall of an adjacent one of the plurality of cable ports, wherein:

each cable port has a respective diameter and a respective height with respect to the flange,

the heights of the cable ports increase as the diameters of the cable ports decrease,

each cable port other than the cable port having the smallest diameter has a flat surface at a distal end opposite the flange,

one of the cable ports other than the cable port having the largest diameter has a ledge proximate to the distal end, said one of the cable ports being an inner one of an adjacent pair of cable ports within the plurality of cable ports; and

the ledge of said inner one is located at the same height as the flat surface at the distal end of an outer one of the pair of cable ports.

13. The building entrance protector of claim 12, wherein:

each cable port has a ledge proximate to the distal end; and

the ledge of an inner one of any adjacent pair of cable ports within the plurality of cable ports is located at the same height as the flat surface at the distal end of an outer one of the pair of cable ports.

14. The assembly of claim 12, wherein the side wall of each cable port is rigid.

15. The assembly of claim 12, wherein the side wall of each cable port is fixed.

16. The assembly of claim 12, wherein at least one of the cable ports is connected to an adjacent one of the cable ports by a first flat surface proximal to the flange, a cylindrical wall concentric with the plurality of cable ports, and a second flat surface at a distal end opposite the flange.

17. The assembly of claim 12, wherein the plurality of cable ports includes at least one pair of successive cable ports, and the cable ports within each pair of successive cable ports differ from each other in height.

18. The assembly of claim 12, wherein each pair of successive cable ports differ from each other in height by a constant amount.

19. A building entrance protector assembly, comprising:

a building entrance protector housing having an opening therethrough; and

an adapter for securing a cable to the housing, the adapter comprising:

a flange that is attachable to the housing; and

a plurality of concentric cable ports connected to the flange, each cable port having a side wall, the side wall of each cable port overlapping a side wall of an adjacent one of the plurality of cable ports,

wherein at least one of the cable ports is connected to an adjacent one of the cable ports by a first flat surface proximal to the flange, a cylindrical wall concentric with the plurality of cable ports, and a second flat surface at a distal end opposite the flange.

20. The building entrance protector assembly of claim 19, wherein more than one of said plurality of cable ports are connected to a respective adjacent one of the cable ports by a respective first flat surface proximal to the flange, a respective cylindrical wall concentric with the plurality of cable ports, and a respective second flat surface at a distal end opposite the flange.

21. The assembly of claim 19, wherein the adapter is formed from a single piece of material.

22. The assembly of claim 19, wherein:

each cable port has a respective diameter and a respective height with respect to the flange, and

the heights of the cable ports increase as the diameters of the cable ports decrease.

23. A method for securing a cable to a housing, comprising the steps of:

(a) attaching an adapter to the housing, the adapter having a plurality of concentric cable ports, each cable port having a side wall, the side wall of each cable port overlapping a side wall of an adjacent one of the plurality of cable ports, wherein:

each cable ports other than the cable port having the smallest diameter has a flat surface at a distal end opposite the flange, and

each cable port has a ledge proximate to the distal end;

(b) aligning the blade on the ledge of the selected cable port and the flat surface of the adjacent cable port simultaneously;

(c) cutting a portion of the selected one of the cable ports with the aligned blade, so as to remove any cable port that is smaller in diameter than the selected cable port; and

(d) securing the cable to the selected cable port.

24. The method of claim 23, wherein step (d) includes:

inserting the cable through the selected cable port;

fitting a cold-shrink tubing over the selected cable port and a portion of the cable protruding therethrough; and

removing a core of the cold shrink tubing, so that the tubing collapses to form a seal over the selected cable port and the portion of the cable.

25. The method of claim 23, wherein the side wall of each cable port is rigid.

26. The method of claim 23, wherein the side wall of each cable port is fixed.

* * * * *

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(12) **United States Patent**
Evensen

(10) **Patent No.: US 6,591,561 B1**
(45) **Date of Patent: Jul. 15, 2003**

(54) **WATERPROOF ROOF DECK POST CONSTRUCTION**

(76) Inventor: **Lawrence P. Evensen**, 29254 Greenwater Rd., Malibu, CA (US) 90265

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/240,807**

(22) Filed: **Feb. 1, 1999**

(51) **Int. Cl.**[7] **E04H 12/28**
(52) **U.S. Cl.** **52/199**; 52/219; 52/58; 52/60; 285/42
(58) **Field of Search** 52/199, 58, 59, 52/60, 219; 285/83, 82, 42

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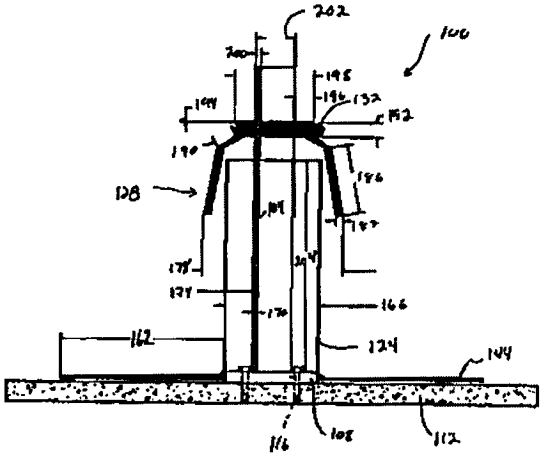
Primary Examiner—Carl D. Friedman
Assistant Examiner—Jennifer I. Thissell
(74) *Attorney, Agent, or Firm*—Oppenheimer Wolff & Donnelly LLP

(57) **ABSTRACT**

A deck post (or brace) having a non-circular cross-section is secured in place by bolting its mounting bracket to the roof deck. A lead pipe jack is slid over the post, and its lower flange is nailed to the deck. A waterproofing assembly having a collar and a skirt is provided; the collar has an opening with generally the same non-circular cross-section as that of the post. The collar opening is positioned on the deck post, and the unit is slid down the post until the collar is at the top of the lead pipe jack and the skirt extends down over it. A stainless steel hose clamp is then positioned and tightened around the collar to provide a watertight seal on the deck post. When the post is already installed on a roof deck and the jack and the waterproofing assembly cannot be slid into place on the post, a modified waterproofing assembly and jack are used to provide the waterproofing. The modified jack is a prior art split lead flashing jack with an open seam on one side. The jack is opened up, wrapped around the post and soldered closed. The modified waterproofing assembly has a split joint through the skirt and collar. To position this assembly on the post at the top of the split lead flashing jack, the joint is opened up, the assembly wrapped around the post and the slip joint closed with a watertight flap. A snap-fit closure can be provided. A further alternative waterproofing assembly forms the collar as a plug separate from the skirt; the skirt is opened and the plug inserted therein. This arrangement allows a plug having the desired opening configuration to be selected from an inventory of different plugs and used with a single skirt design.

21 Claims, 15 Drawing Sheets



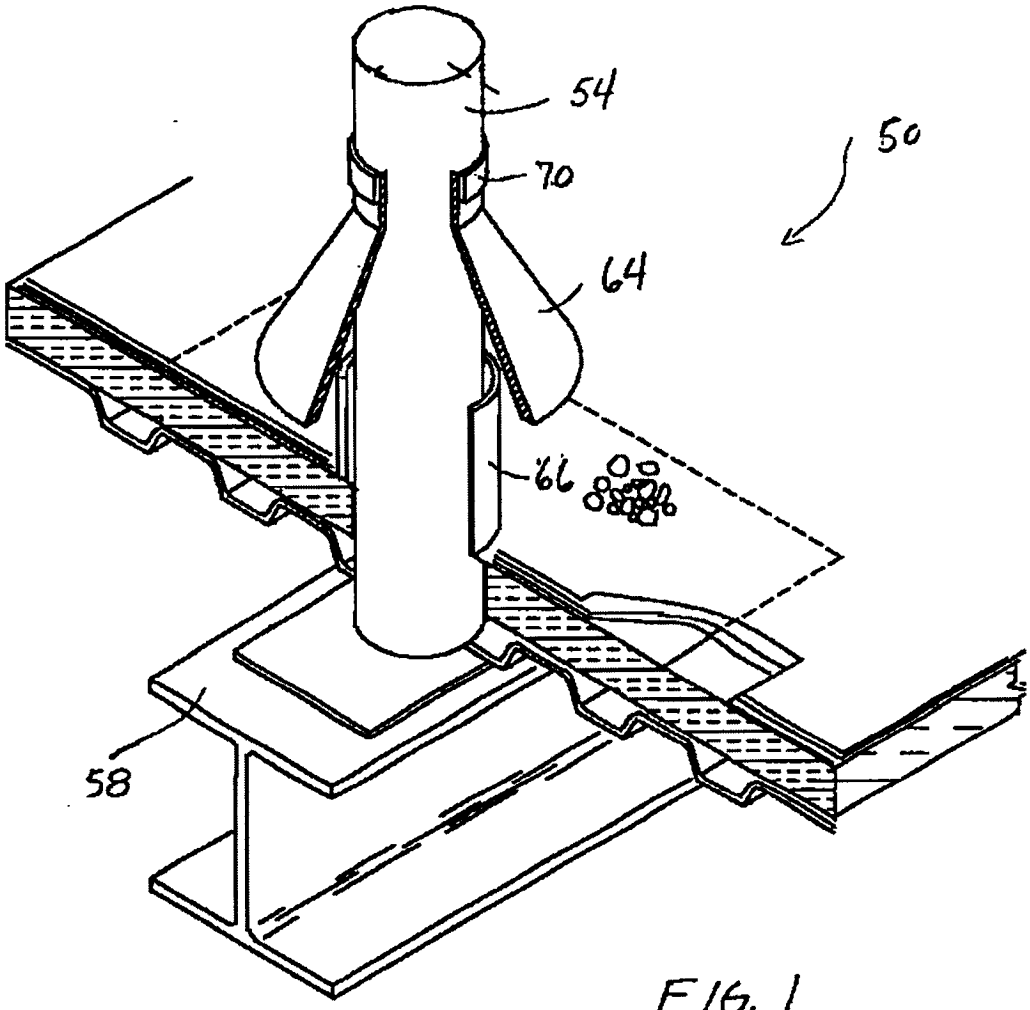


FIG. 1
(PRIOR ART)

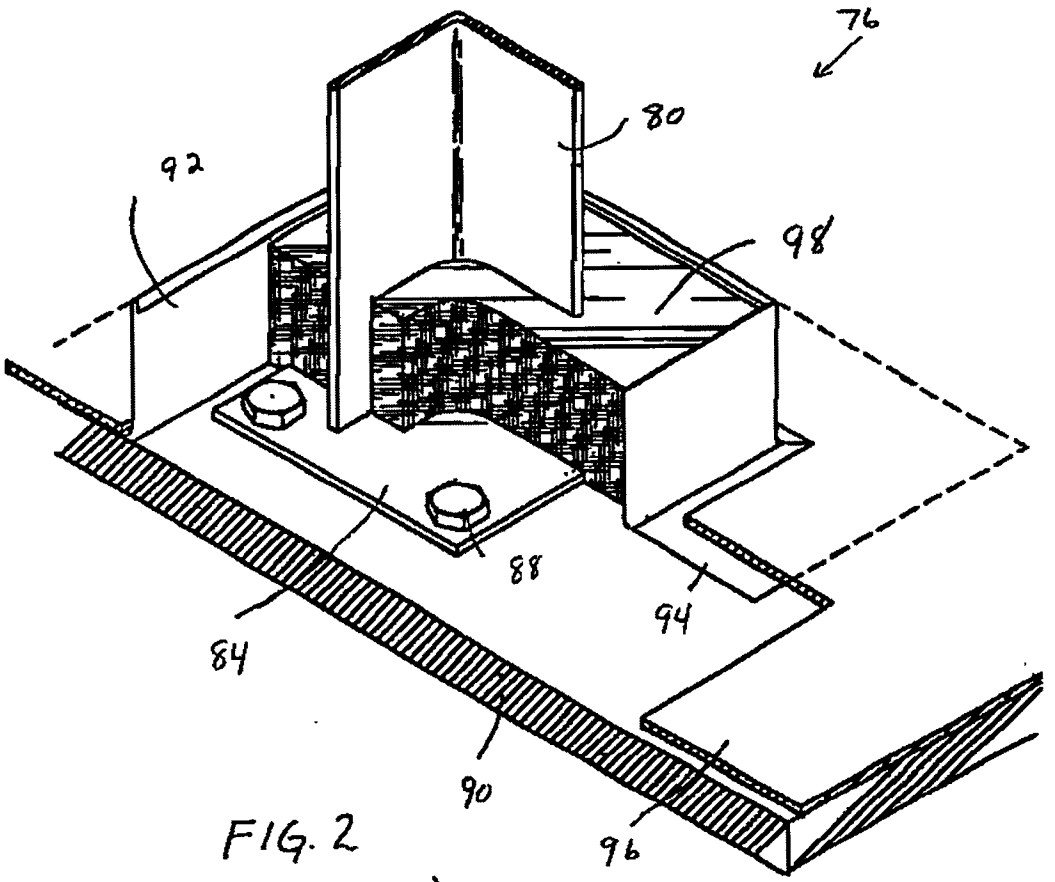


FIG. 2
(PRIOR ART)

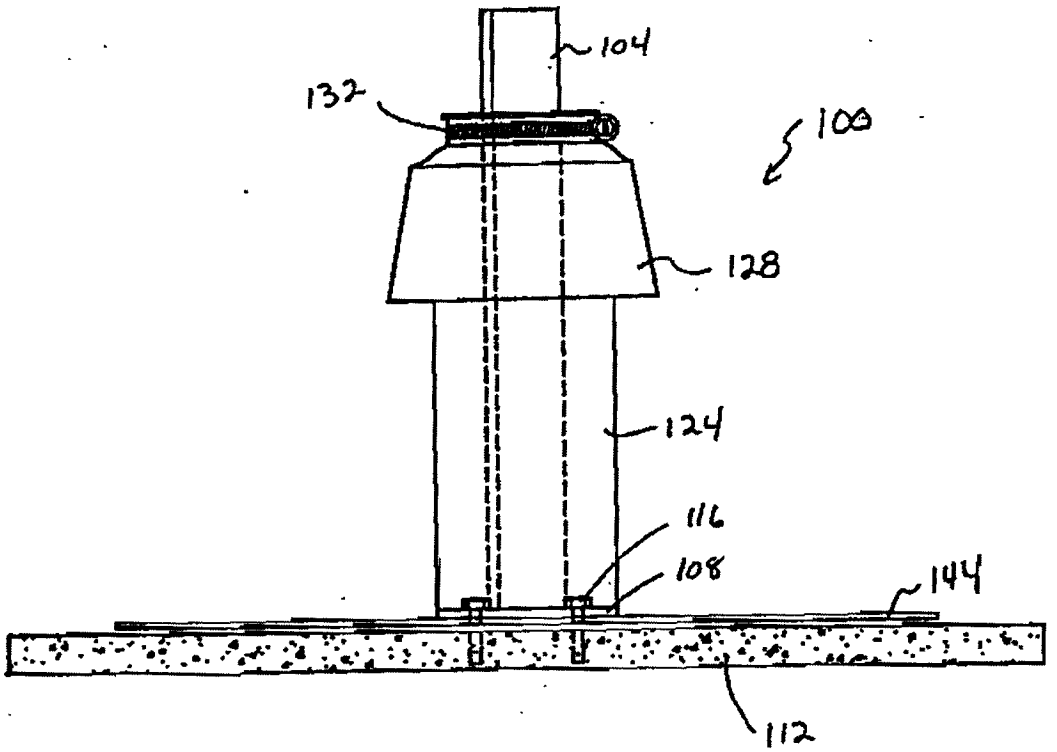


FIG. 3

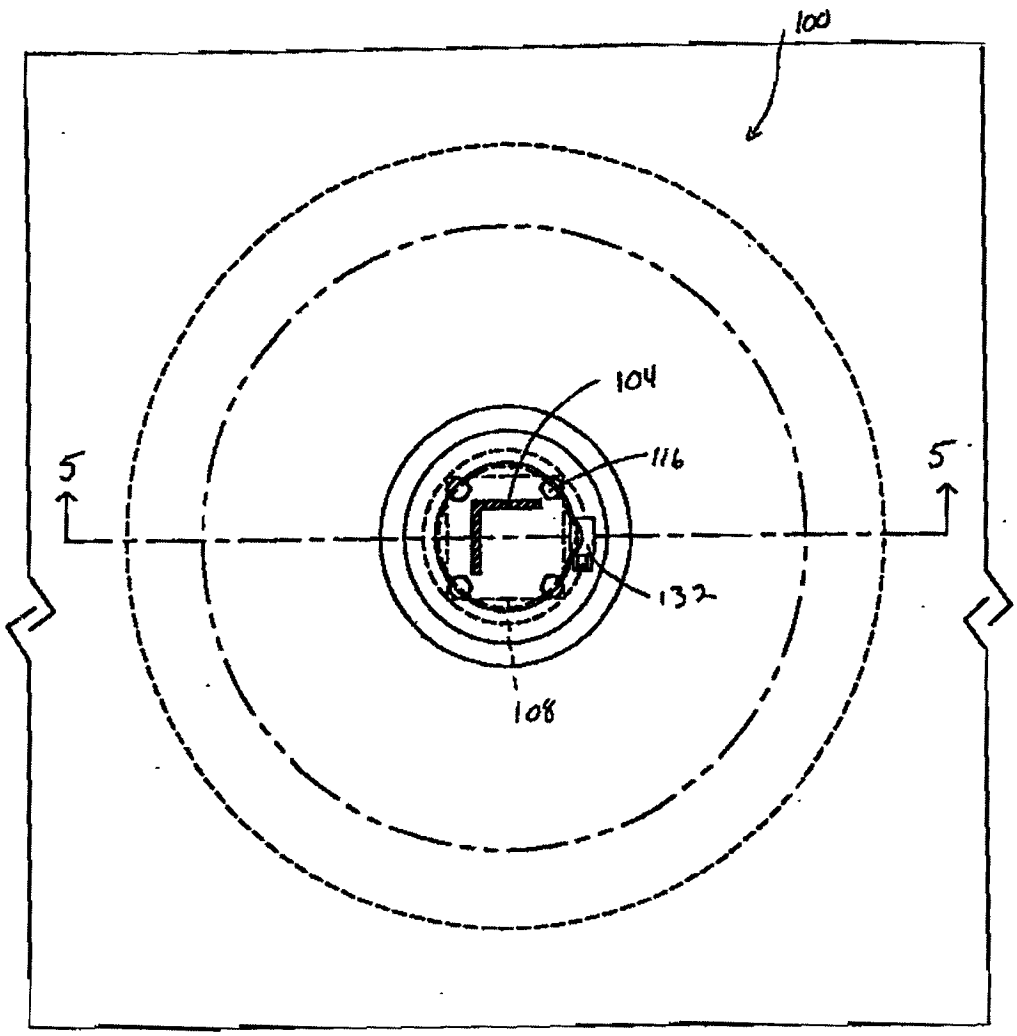
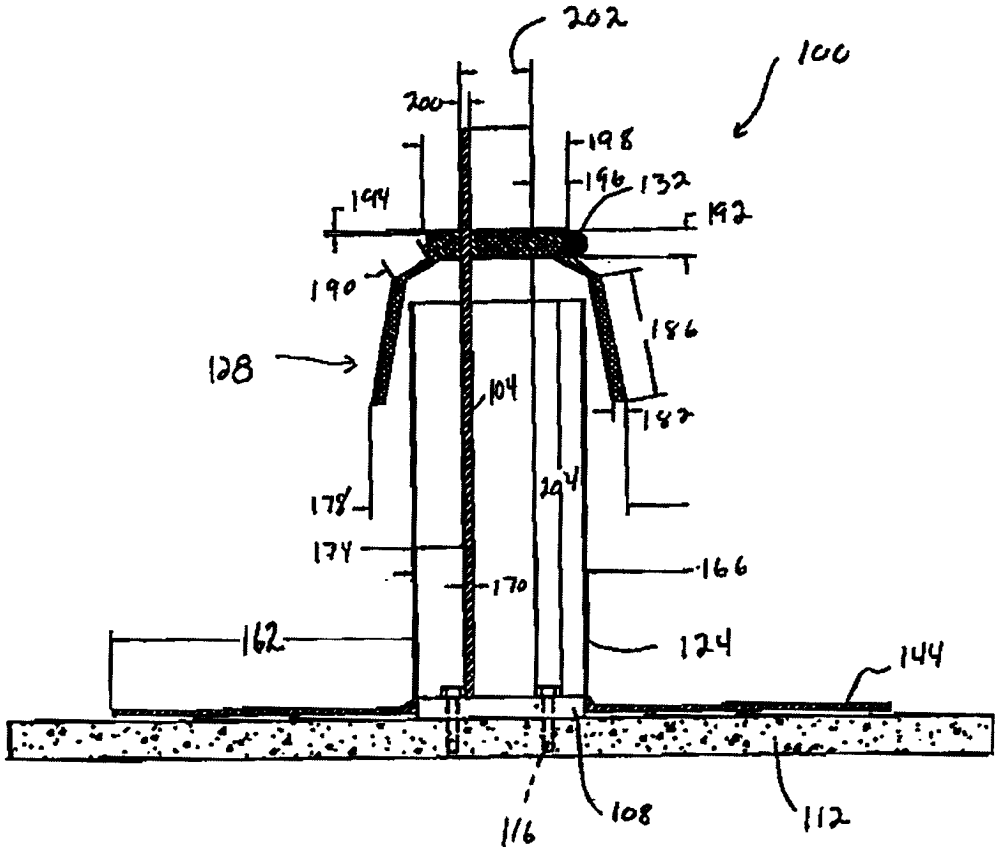


FIG 4


202
100
200
198
196
132
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174
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124
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116
108
112

FIG. 5

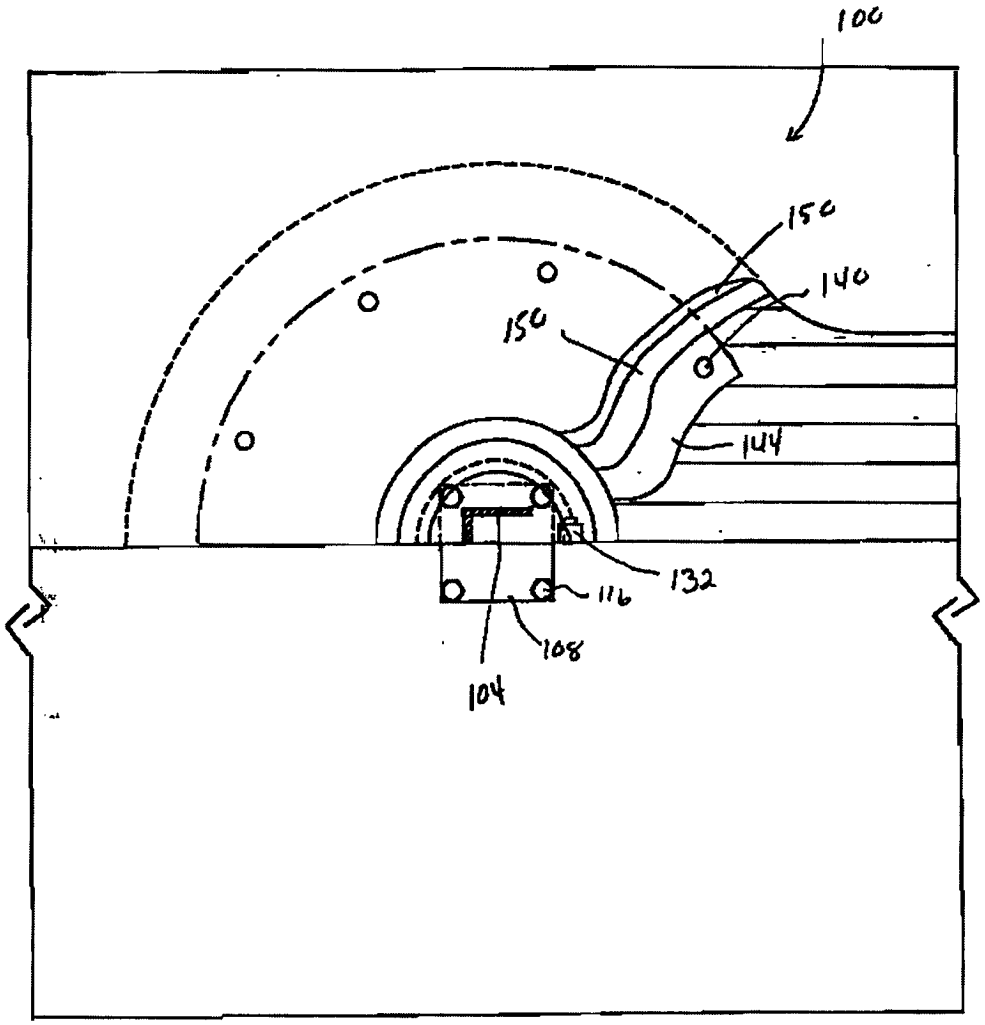

FIG. 6

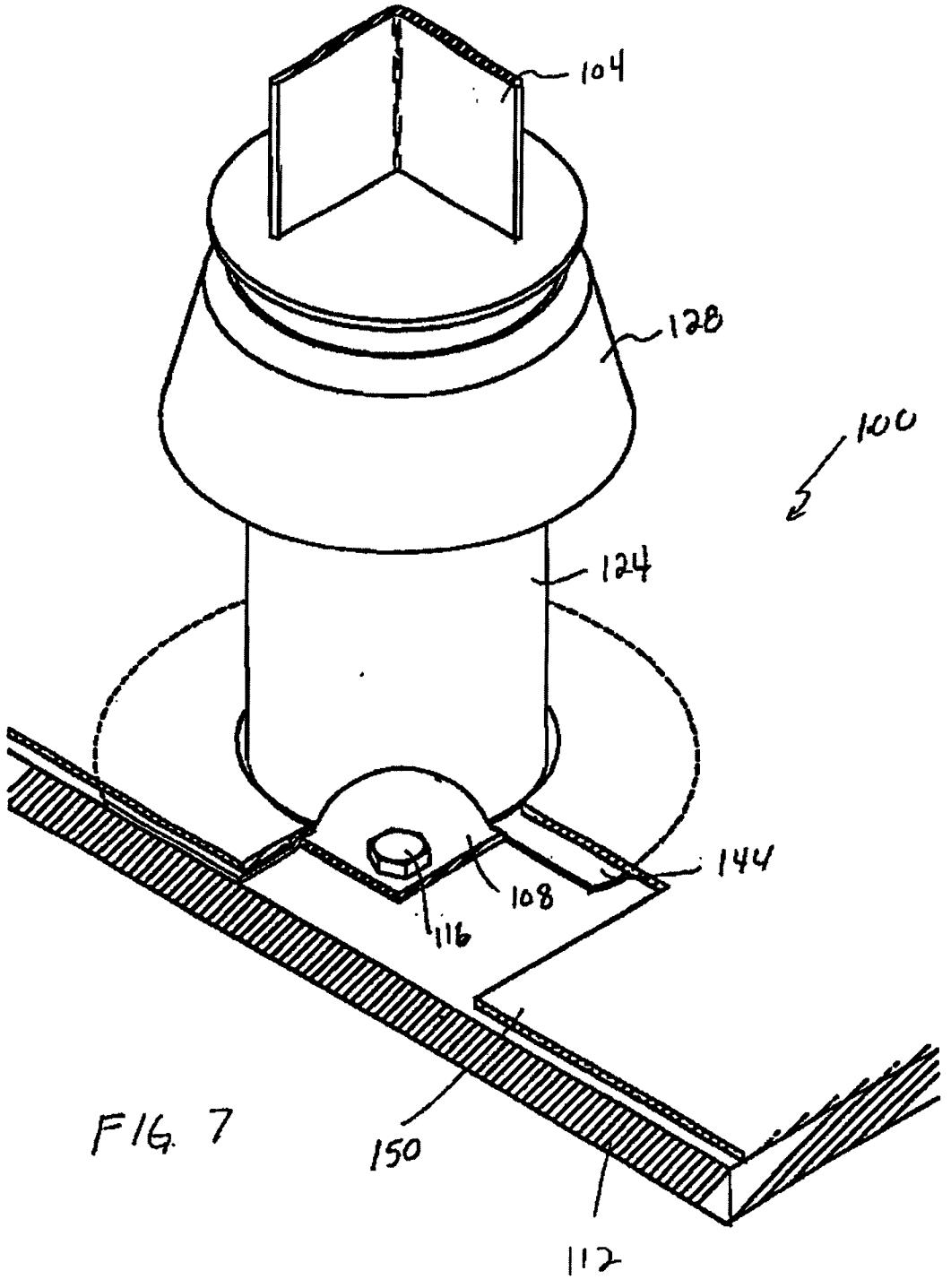

FIG. 7

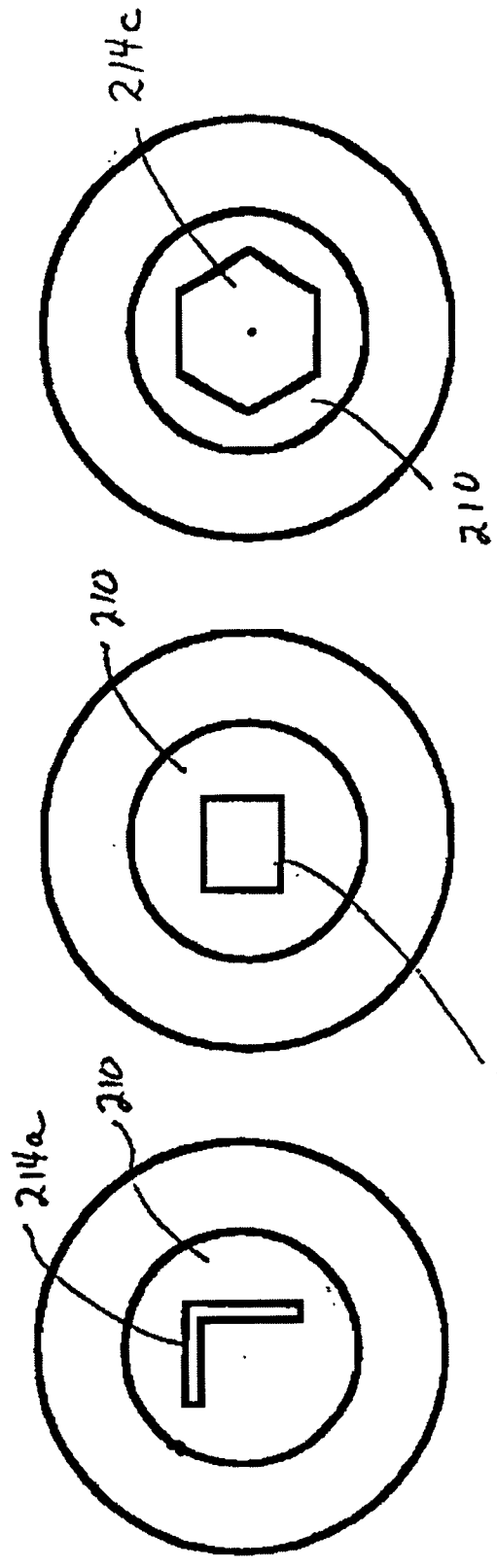

FIG. 8c

FIG. 8b

FIG. 8a

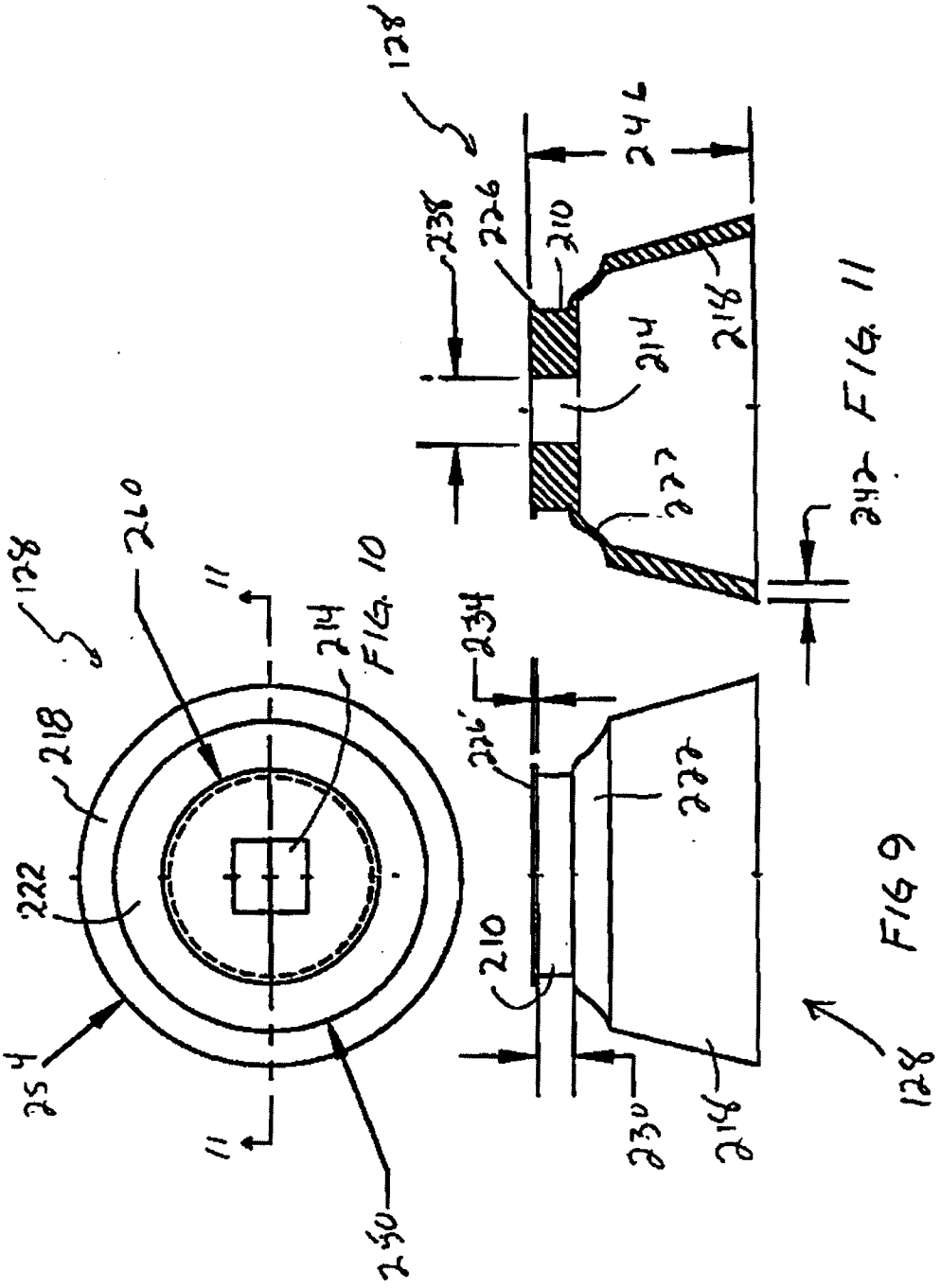

FIG. 11

FIG. 10

FIG. 9

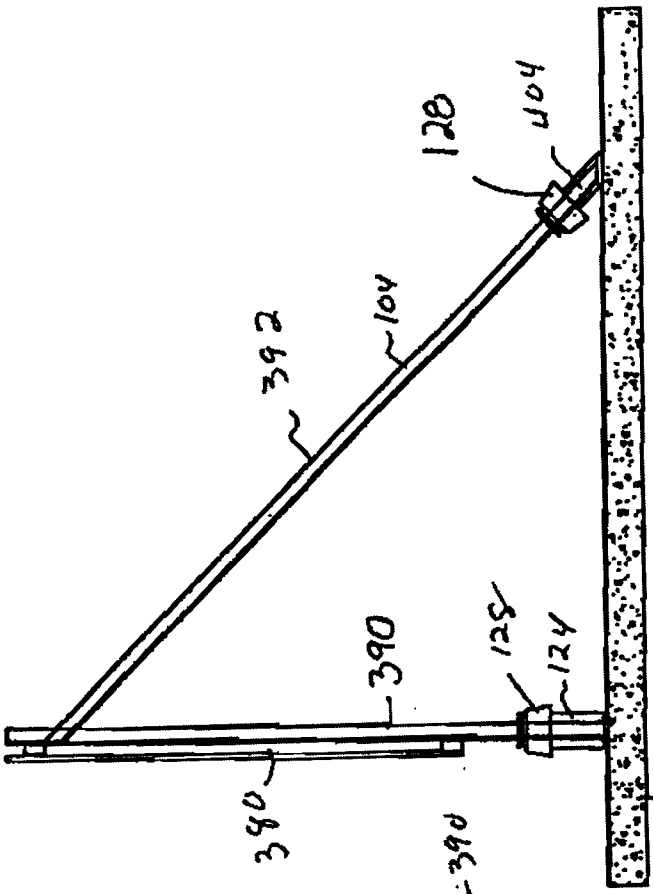
128
104
392
104
390
125
124
340
112

FIG. 13

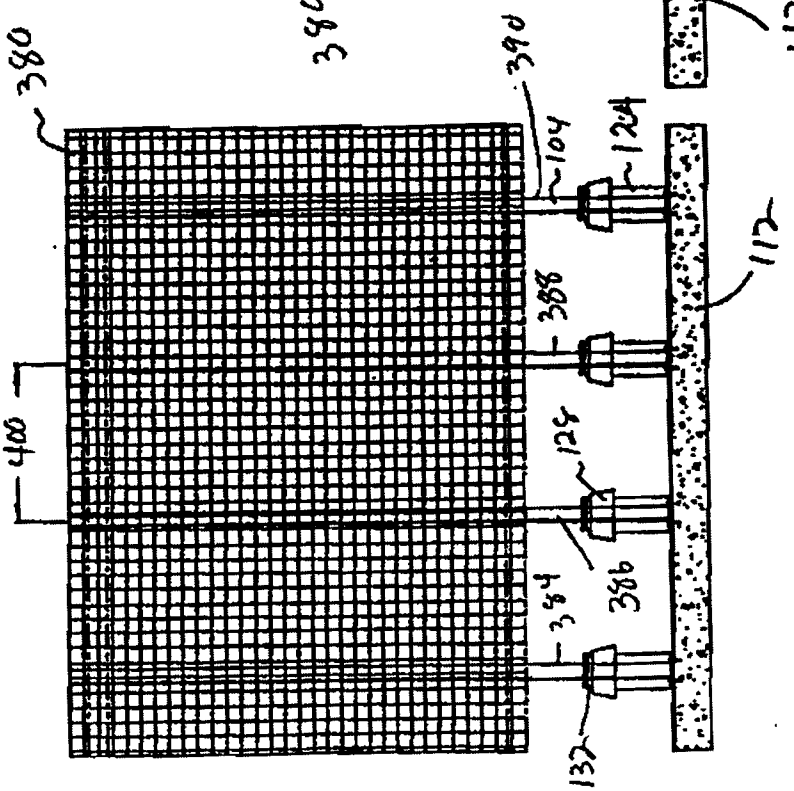
380
390
104
124
112
386
400
125
384
386
132

FIG. 12

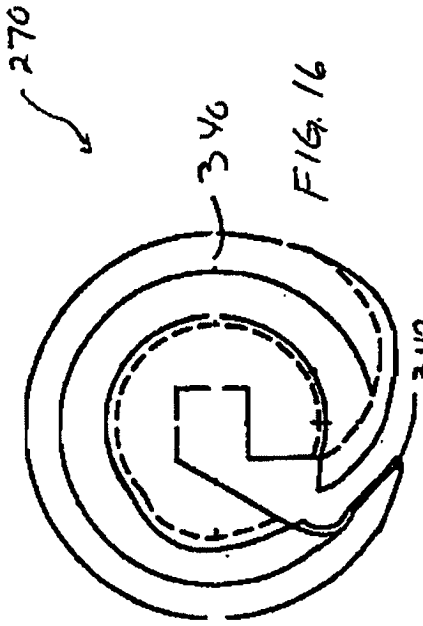

FIG. 16

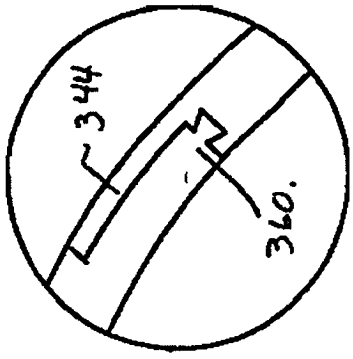

FIG. 17

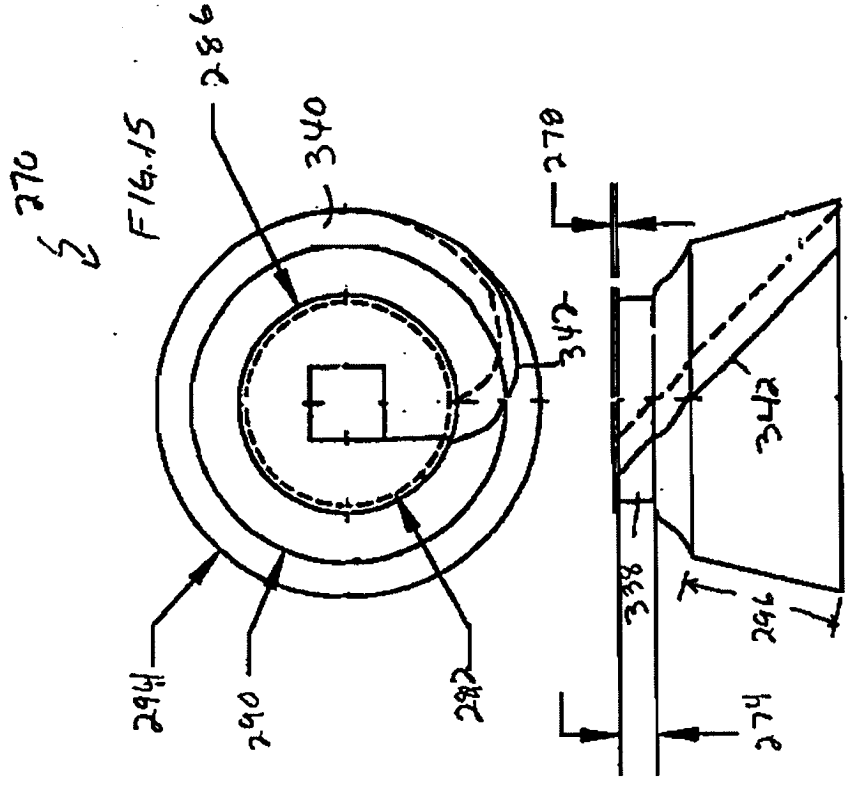

FIG. 14

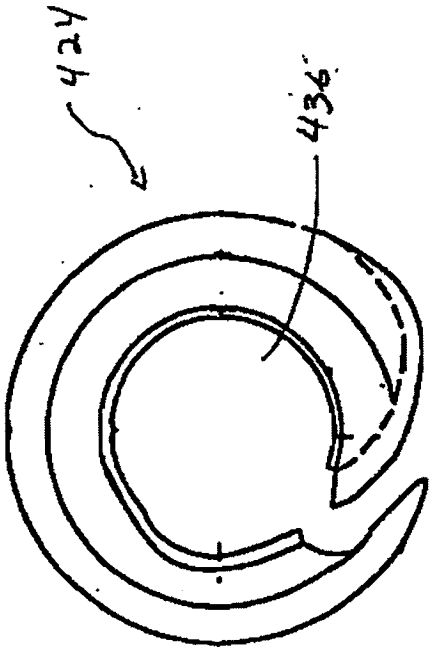

FIG. 21

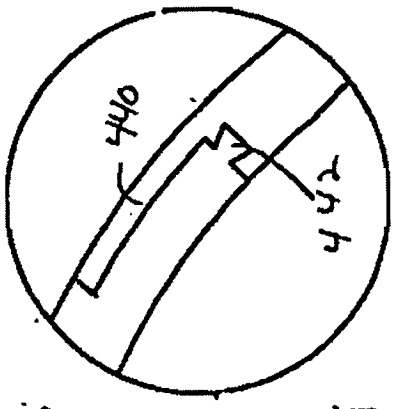

FIG. 22

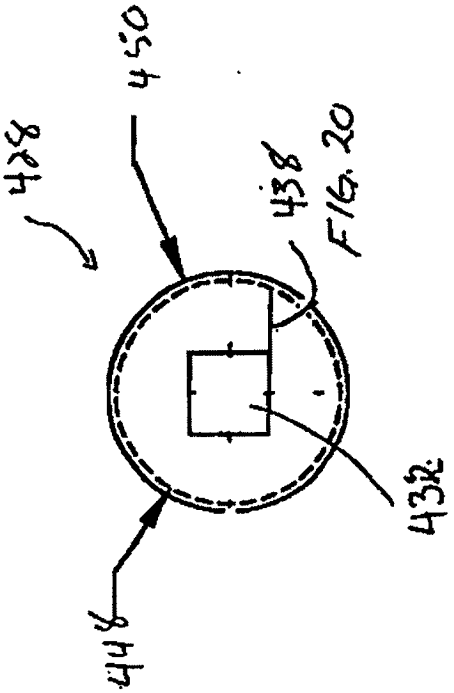

FIG. 20

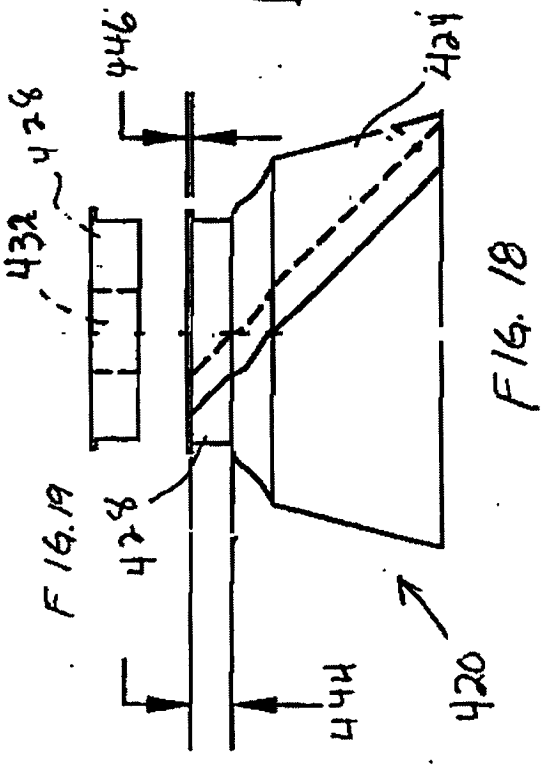

FIG. 19

FIG. 18

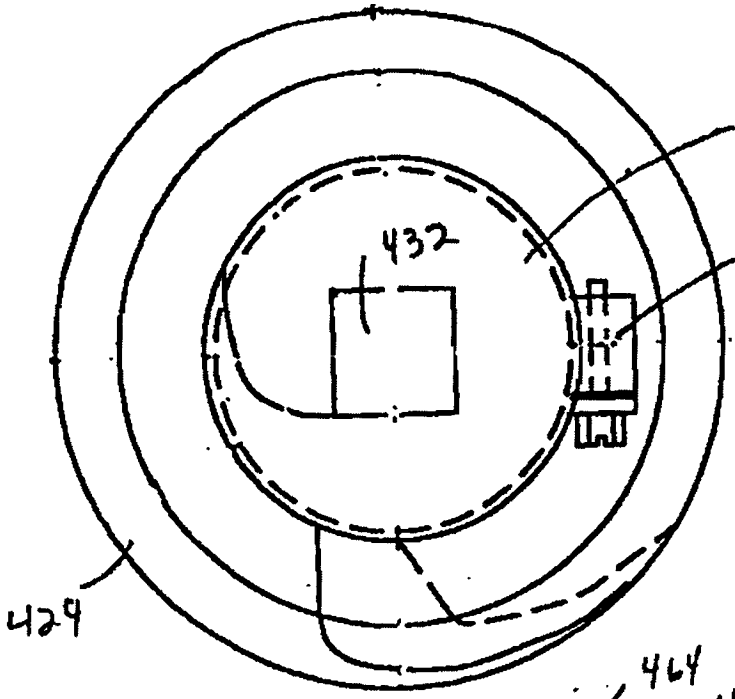

FIG. 24

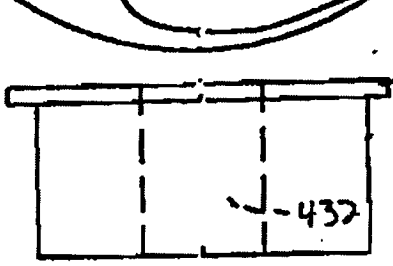

FIG. 25

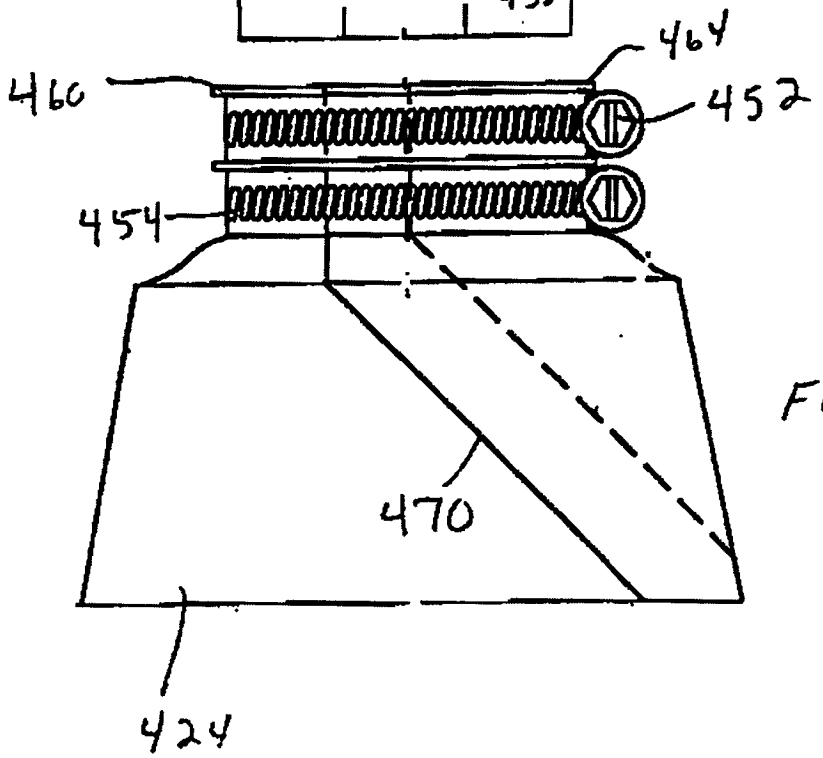

FIG. 23

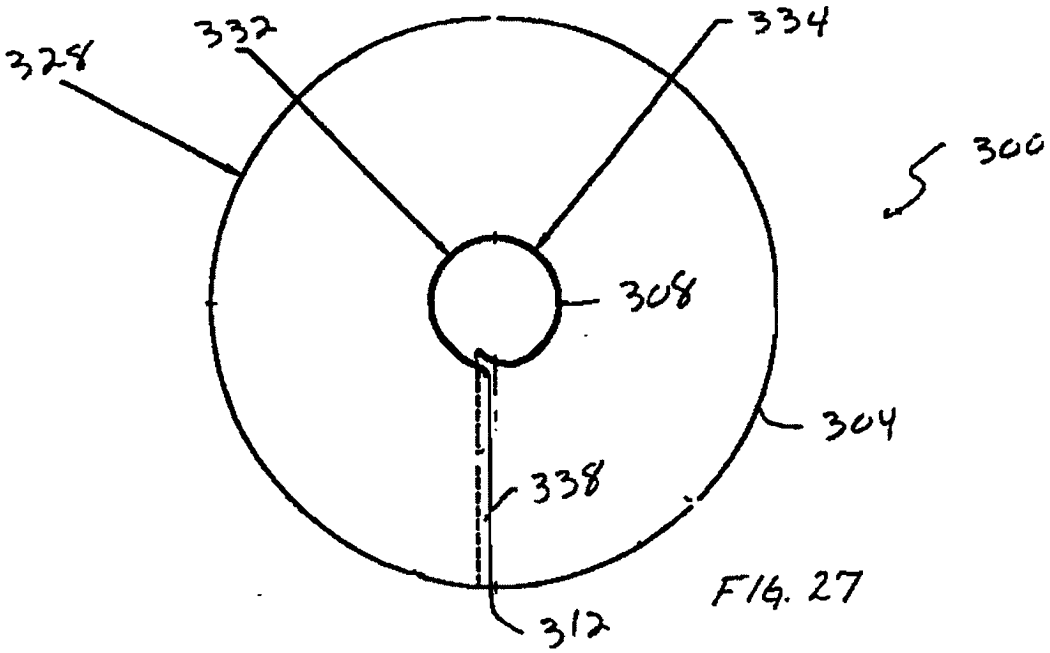

FIG. 27

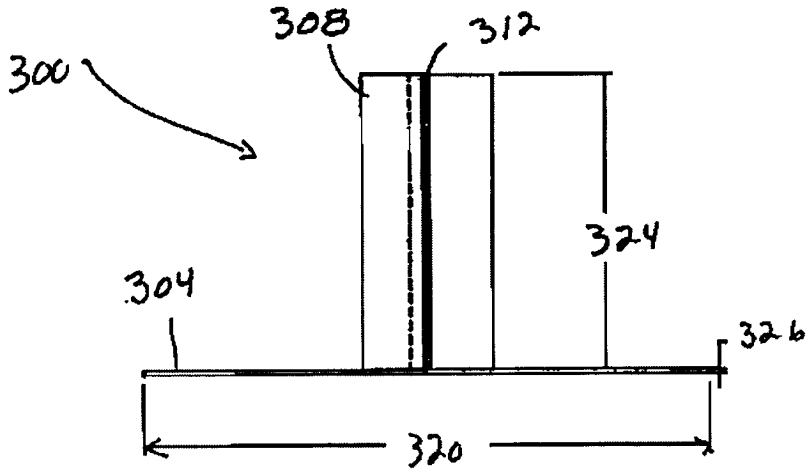

FIG. 26

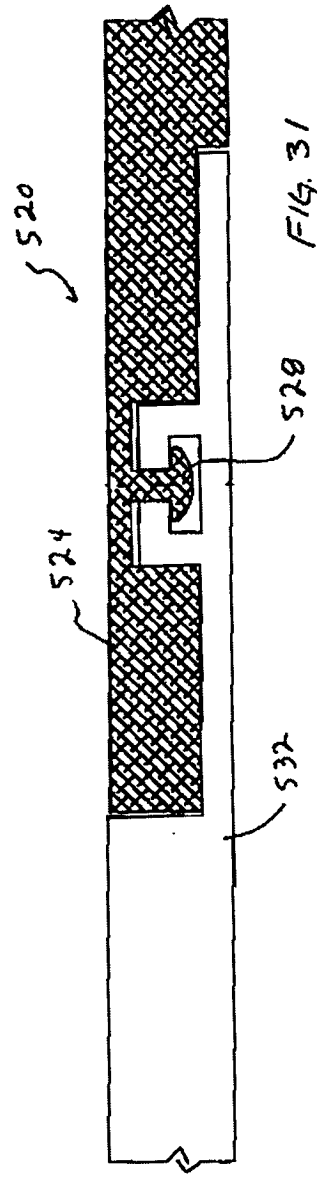

FIG. 31

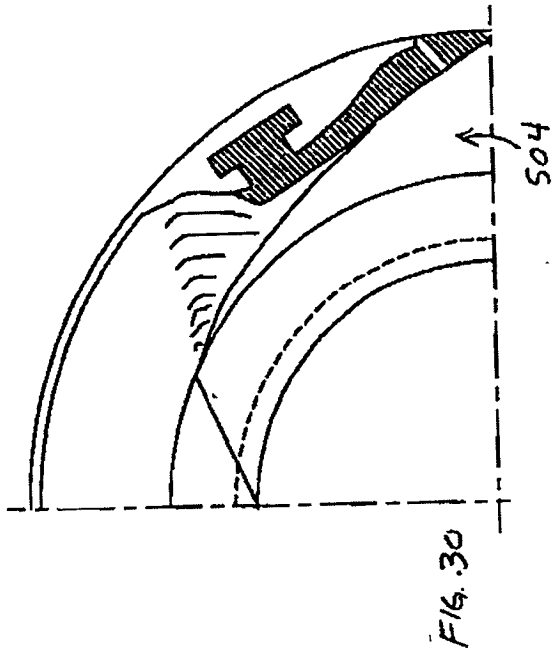

FIG. 30

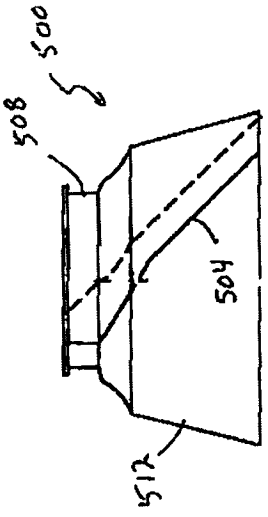

FIG. 28

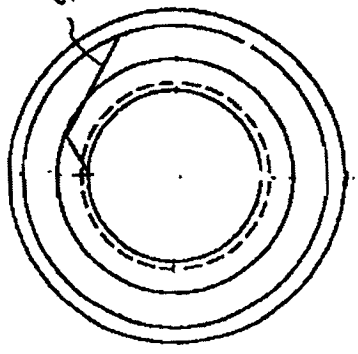

FIG. 29

WATERPROOF ROOF DECK POST CONSTRUCTION

BACKGROUND OF THE INVENTION

The present invention relates to constructions and methods for installing and waterproofing roof deck posts, and particularly those having non-circular cross-sections.

The tops of buildings or roof decks are often used to mount various items, which typically support the use or function of the building or benefit the building's occupants in some way. These items include signs, fences, helicopter landing zones, equipment supports and even swimming pools.

When a fence, for example, is installed on top of a building, it must be installed securely so that it will not fall or blow off of the building. Additionally, the support members or posts of the fence must be attached in such a way as to maintain the water integrity of the roof. If the fence supports are bolted into the roof deck, each support will cut through or penetrate the building roof jeopardizing the water integrity of the roof unless adequate waterproofing measures are taken.

A waterproofing construction of the prior art used when the support or post is round is shown in FIG. 1 generally at **50**. Referring thereto, the round post **54** is secured to structural framing **58**, and is provided to support another structure such as fencing or a structural frame. An umbrella overlapping jack **64** is used to waterproof the support. The pipe jack **64** is a cone that fits snugly around the penetration and creates a waterproof seal above the roof line. FIG. 1 shows a sheet metal roof jack **66** extending at least eight inches above the roofing, and the umbrella pipe jack **64** overlaps the roof jack by a radius of three to four inches. A drawband **70** secures the upper collar portion of the pipe jack **64** to the round post **54**, and caulk with sealant is applied around the top circumference. Construction **50** works where the projection or post is round; however, if the post is other than round, the pipe jack does not fit snugly and leaks result.

Thus, for other than round posts, another waterproofing construction is used, an example of which is depicted in FIG. 2 and is commonly referred to as "Pitch Pocket." This term describes the encasing of an odd-shaped penetration (such as a steel angle iron support) in a pool of asphalt that is held in a metal bowl mounted onto the roof. When the asphalt dries or cools the penetration located inside of it is tightly encased to prevent water penetrating into the building.

Referring to FIG. 2, a method of installing the Pitch Pocket will now be described with the construction being shown generally at **76**. A steel angle iron brace (support or post) **80** with a four hole mounting plate **84** welded thereto is bolted with bolts **88** to a roof deck **90**. A sheet metal contractor slides a four-sided metal pitch pan **92** over the top of the brace **80**. The pan **92**, which is at least two inches deep, hangs loose waiting for a later installation step. The roofing contractor installs first ply layers (typically three) of roofing materials under the pitch pan **92** and onto the entire building roof. He then nails the flange **94** of the pan **92** onto the roof deck and through the ply layers. Roofing plies will be striped or layered over the flange **94** to laminate the flange between the roofing plies. A finish coat of roofing materials **96**, such as gravel or granule rolled roofing, is installed. Hot asphalt **98** or other pourable sealer is then poured into the pitch pan **92** until full and with a minimum two inch depth, and the asphalt is allowed to cool.

Pitch Pockets (**76**) work well until the asphalt shrinks or cracks and the pan or concave bowl fills with water. This

cracking can be caused by the sun's direct heat, by impact on the post construction, by strong winds or by the building shaking as from an earthquake. When the cracks form the water in the pocket is funneled into the building, resulting in the problem which the pitch pocket was specifically provided to prevent. Also, since the post is fixed in place by the asphalt, when a strong force is exerted on the post, the asphalt around the post compresses, loosening the securement of the post relative to the roof, and requiring repair.

SUMMARY OF THE INVENTION

Directed to remedying the problems and disadvantages of the prior art, disclosed herein are an improved waterproof deck post construction and method and a waterproofing assembly (or watertight umbrella) useful therein. The assembly has a collar with an opening therethrough and a skirt hanging down from the collar. The opening is configured to match the cross-sectional shape of the deck post, and this invention is thereby particularly well suited for deck posts which are not round. The assembly is preferably an elastomeric material or specifically is EPDM molded rubber.

The post is secured to the roof deck. A flanged sleeve is slid over the post and the flange secured to the roof deck. The flanged sleeve can be a lead jack such as are used today on stink pipes and vent pipes. The waterproofing assembly is slid onto the post. With the collar surrounding the post just above the top of the sleeve and the skirt extending down over the top of the sleeve, a band is secured around the collar securing the collar in a watertight manner to the post. The band is preferably a hose clamp.

When the post is already secured to the deck and it is not convenient to slide the waterproofing assembly down over the post, an alternative embodiment of the waterproofing assembly of this invention is used. This embodiment has a split joint through the skirt and the collar which allows the unit to be opened up and wrapped around the post. A watertight flap of the unit seals the joint closed. In this construction, a split lead flashing jack can be used as the flanged sleeve. The flashing jack is opened up and wrapped around the post and its seam then soldered closed.

The shape of the opening of the collar is selected to match the shape of the outside surface of the post. For example, it can be an L or a square shape. The skirt can have the same configuration for all post shapes. Thus, another embodiment of the waterproofing assembly constructs the skirt and collar as separate pieces with an inventory of collars having different opening shapes provided. The collar with the desired opening shaped to match the post being used will be selected and plugged into the skirt. In other words, the detachable EPDM collars or inserts are interchangeable to allow various geometric shapes. This plug-type collar and skirt can have split joints allowing them to be wrapped around the post. Additionally, the collar can have a longer configuration to accommodate two hose clamps, one above the other, if desired.

Other objects and advantages of the present invention will become more apparent to those persons having ordinary skill in the art to which the present invention pertains from the foregoing description taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective cut-away view of a round post roof-mounted construction of the prior art;

FIG. 2 is a perspective cut-away view of an angle iron brace roof-mounted ("Pitch Pocket") construction of the prior art;

FIG. 3 is a side elevational view of a waterproof roof deck construction of the present invention;

FIG. 4 is an enlarged top plan view of the construction of FIG. 3;

FIG. 5 is a reduced cross-sectional view taken on line 5—5 of FIG. 4;

FIG. 6 is an enlarged top plan view of FIG. 5;

FIG. 7 is a perspective, partially cut-away view of the construction of FIG. 3, but without the hose clamp for illustrative purposes;

FIG. 8*a* is a top plan view of the waterproofing assembly of the construction of FIG. 7;

FIGS. 8*b* and 8*c* are first and second alternative designs, respectively, of the unit of FIG. 8*a* to accommodate posts of different corresponding cross-section configurations;

FIG. 9 is a side elevational view of an alternative waterproofing assembly of the present invention usable in the construction of FIG. 3, for example;

FIG. 10 is a top plan view of the unit of FIG. 9;

FIG. 11 is a cross-sectional view taken on line 11—11 of FIG. 10;

FIG. 12 is a side elevational view of a construction assembly of the present invention used to support rooftop fencing or screening structure;

FIG. 13 is a side elevational view of the assembly of FIG. 12;

FIG. 14 is a view similar to FIG. 9 illustrating an open seam waterproofing assembly of the present invention;

FIG. 15 is a top elevational view of the unit of FIG. 14;

FIG. 16 is a view similar to FIG. 15 illustrating the unit in an open position;

FIG. 17 is an enlarged view illustrating a portion of the seam of FIG. 14;

FIG. 18 is a view similar to FIG. 14 illustrating an alternative waterproofing assembly of the present invention;

FIG. 19 is a side elevational view of the plug of the assembly of FIG. 18;

FIG. 20 is a top plan view of the plug of FIG. 19;

FIG. 21 is a top plan view of the assembly of FIG. 18 without the plug and in an open position;

FIG. 22 is an enlarged view of a portion of the seam of FIG. 18;

FIG. 23 is a side elevational view of another alternative waterproofing assembly of the present invention similar to that of FIG. 18 but with a detachable plug configured to accommodate two hose clamps as shown;

FIG. 24 is a top plan view of the unit of FIG. 23 with the hose clamps;

FIG. 25 is a side elevational view of the plug of the unit of FIG. 23 illustrated in isolation;

FIG. 26 is a side elevational view of a split lead pipe jack usable with the waterproofing assemblies of FIGS. 14, 18 and 23, for example, in a waterproof roof deck construction like that of FIG. 3;

FIG. 27 is a top plan view of the split lead pipe jack of FIG. 26;

FIG. 28 is a view similar to FIG. 14 of an alternative assembly;

FIG. 29 is a bottom plan view of the assembly of FIG. 28;

FIG. 30 is an enlarged, sectional bottom view of the slip joint of the assembly of FIG. 22; and

FIG. 31 is cross-sectional view of the snap-in slip joint.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT OF THE INVENTION

Referring to the drawings, a waterproof roof deck post construction of the present invention is illustrated generally at **100**. The method of constructing it is quick and easy. The steel contractor bolts the post **104** with a four-hole mounting bracket **108** welded thereto to the roof deck **112** using bolts **116**. The post **104** can have generally any cross-sectional shape (unlike the prior art of FIG. 2) including non-round shapes. An "L" shape is illustrated by post **104**, which more specifically is an angle iron brace. The steel contractor then slides a lead pipe jack **124**, a waterproofing assembly **128** of the present invention and a stainless steel hose clamp **132** over the top of the brace or post **104** and lets them fall to the deck for later installation.

Next, the roofing contractor installs roofing plies (typically three plies) over the entire building. He nails with nails **140** (FIG. 6) the flange **144** of the lead pipe jack **124** through the ply layers and into the roof deck **112**. The lead pipe jack **124** will typically have a three or four inch diameter and a four pound lead thickness. Instead of a lead jack, a cheaper standard galvanized steel roof jack can be used. Roofing plies **150** are stripped over the flange **144** thereby laminating the flange into the roof system. The finish layer of roofing materials (such as gravel or granule roll roofing) are installed over the ply layers.

The roofing contractor then slides the waterproofing assembly **124** over the leak flashing with its cone shape facing down. The stainless steel hose clamp **132** is placed in position on the waterproofing assembly and the clamp **158** tightened down. FIG. 5 shows dimensions **162, 166, 170, 174, 178, 182, 186, 190, 192, 194, 196, 198, 200, 202, 204** of 6.27, 3.64, 0.20, 0.07, 5.27, 0.25, 2.54, 0.80, 0.53, 0.07, 0.75, 3.04, 0.20, 1.50, and 7.87 inches, respectively. These are just sample dimensions, however, and it is within the scope of the invention to change dimensions, style, materials and heights above the roof deck as would be apparent to those skilled in the art.

The waterproofing assembly **128** is shown in isolation in FIGS. **9, 10** and **11**. It is seen therein that it has a collar portion **210** having an opening **214** therethrough, a downwardly-depending skirt **218**, a shoulder **222** connecting the collar with the skirt, and a top rim or flange **226**. These components according to one embodiment of this invention are integrally formed of EPDM molded rubber in a thermal process. This elastomeric construction allows the collar portion **210** to be squeezed by the hose clamp **132** to secure in a watertight manner the collar to the post **104**, preventing water from leaking between the opening and the post. Sample dimensions **230, 234, 238, 242, 246, 250, 254** and **260**, 0.51, 0.06, 1.00, 0.25, 3.11, R2.15, R2.63 and R1.50 inches, respectively, are shown in these figures.

The opening **214** will be configured to have the same shape as the cross-section of the post (brace) **104** to which it is to be attached. Common shapes for the openings **214** are illustrated in FIGS. 8*a*, 8*b* and 8*c* as L shaped, square and hexagonal, respectively, at **214***a*, **214***b* and **214***c*.

If a post **104** (angle iron or other shaped brace) is already on a building and the waterproofing assembly **128** cannot be slid into position, a retrofit waterproofing assembly of this invention can be used as depicted in FIGS. **14–16** generally at **270**. It has dimensions **274, 278, 282, 286, 290, 294** and **296** of 0.51, 0.06, R1.38, R1.50, R2.15, R2.63 and 2.10 inches, respectively. It is used together with a split lead flashing jack (which is a commercially available product) as illustrated generally at **300** in FIGS. 26 and 27. As shown in

FIGS. 26 and 27, the split lead flashing jack 300 has a bottom flange 304 at the bottom of the sleeve 308, and an open seam 312 extends all of the way down the side. The split lead jack 300 can be a standard jack which is cut at the site to allow installation or it can be a special pre-cut jack. The split lead jack 300 has preferred dimensions 320, 324, 326, 328, 332 and 334 of 15.50, 8.00, 0.125, R7.750 and R1.750, R1.813 inches, respectively.

The lead jack 300 is pulled open and wrapped around the existing support post (104). The lead metal of the jack 300 is soft enough to allow the jack to be opened and closed without using a separate hinge. The open seam 312 is then silver soldered closed with a propane torch. Lead, material 338 overlaps to facilitate soldering.

Similar to construction 100, the roofing contractor installs his ply sheets and the flange 304 of the lead jack 300 is nailed through the ply sheets to the roof deck. Extra ply sheets are stripped over the flange to laminate it into the roof systems. The finish layer of roofing materials are installed onto the roof plies.

The retrofit collar 338 and skirt 340 of retrofit waterproofing assembly 270 is opened on its seam 342 and fit around the support post (104). With the assembly in place, the slip joint 344 on the collar 338 and skirt 340 is slid or snapped into place. The watertight flap 360 will be positioned facing downward, as shown in FIG. 17. A stainless steel hose clamp (132) is then positioned on the collar and clamped tight.

The support post construction (100) of this invention using either waterproofing assembly 124 or retrofit waterproofing assembly 270 can be used to support generally any rooftop construction as is done today. An example is to support fencing or an equipment screen, as shown in FIGS. 12 and 13 generally at 380. Roof mounted equipment fences or screens are often used at the perimeters of buildings to hide roof mounted machinery from ground view. The design as shown uses four front upright posts 384, 386, 388, 390 and four angled constructions 392 of this invention. The four front upright posts 384, 386, 388, 390 are mounted about sixteen inches apart as shown by dimension 400. The angled (angle iron brace) constructions 392 are at a forty-five degree angle and are welded at their tops to the upright constructions. They have a forty-five degree lead jack 404 and use the same waterproofing assemblies 128 or 270 as discussed above.

The collar portion of the waterproofing assembly can be formed as a separate unit from the skirt portion as shown in FIGS. 18-21 by waterproofing assembly 420. This can be for the standard or for the open-seam wrap around embodiments. This has the advantage that a single skirt portion 424 can be used for all types and shapes of support posts (104), and it is only the collar portion 428 with its different shapes of openings 432 (see FIGS. 8a, 8b and 8c) which varies. The separate collar 428 then acts like a plug to fit into the opening 436 at the top of the skirt 424 when pulled open as shown in FIG. 21. The collar 428 has a parting line 438 which opens to allow for installation. The slip joint 440 and watertight flap 442 are illustrated in the enlarged view of FIG. 22. Preferred dimensions 444, 446, 448, 450 are 0.51, 0.06, R1.38 and R1.48 inches, respectively. The (stainless steel) hose clamp (132) compresses and secures the plug 428 in place relative to the skirt 424 and the post (104). If needed, two clamps can be used, one above the other, as shown in FIG. 23 by hose clamps 452, 454. The two clamp embodiment will likely require a longer or taller collar (plug) 460 as depicted in FIG. 25.

The rim or flange 464 on the plug 460 allows for a positive stopping point when installing it into the construction. Also, it is a good waterproofing technique to let water that is flowing off the top of the plug 460 pass over the seam 470 of the collar and not into the seam. The flange 464 will overlap to the outside of the base of the collar.

FIGS. 28 and 29 show generally at 500 an alternative retrofit waterproofing assembly of this invention. It includes a slip joint 504 on the collar 508 and skirt 512. FIG. 30 is an enlarged view of the upper right portion of FIG. 29 showing in greater detail the slip joint 504 which allows the collar 508 to open.

Referring now to FIG. 31, an assembled EPDM rubber snap joint with flap is illustrated generally at 520 with the male insert 524 snapped with snap 528 into the female adapter 532. It functions generally similar to a ZIP LOCK bag. Unlike a typical plastic ZIP LOCK bag, the present assembly is made of rubber and its cross-section is different. Also, the snap and adapter areas are preferably made using a harder rubber than the rubber in the base collar. The collar is manufactured laying flat and then turned around to the point that the snap joint 520 can be pushed in by finger pressure. This is the only known roofing product that locks in place without tools.

Thus, the waterproof roof deck post constructions of this invention do not deform or shrink and thus prevent water from flowing into the roof penetration. Unlike the asphalt of the prior art Pitch Pocket, the waterproofing assembly will not crack over time requiring maintenance. The present constructions are also considerably cheaper and more attractive than the Pitch Pocket design. Additionally, the constructions of this invention are easier and quicker to install.

From the foregoing detailed description, it will be evident that there are a number of changes, adaptations and modifications of the present invention which come within the province of those skilled in the art. However, it is intended that all such variations not departing from the spirit of the invention be considered as within the scope thereof.

What is claimed is:

1. A waterproof roof deck post construction, comprising:

a deck post having a post cross-section and secured relative to a roof deck;

a sleeve surrounding a lower portion of the post;

a flange secured to a lower end of the sleeve and extending out therefrom, the flange being secured relative to the roof deck;

a waterproofing assembly including a collar and a skirt, the collar having an opening having generally the same cross-section as that of the post cross-section, the post being disposed in the opening, the collar surrounding the post above a top of the sleeve, and the skirt extending down from the collar and out over the top of the sleeve; and

a band surrounding the collar and securing in a generally watertight manner the collar to the post; and

the collar being formed as a plug which is a separate piece from the skirt and is adapted to be fitted into an opening in the skirt, and the plug having a seam that allows the plug to open and wrap around the deck post.

2. The construction of claim 1 wherein the post cross-section is non-circular.

3. The construction of claim 1 wherein the skirt is generally frusto-conical in shape, a lowermost perimeter edge of the skirt is spaced a distance above a top surface of the roof deck thereby exposing a portion of the sleeve between the edge of the skirt and the top surface of the roof deck.

4. A waterproofing assembly, comprising:

a collar;

a skirt;

the skirt and collar including a split joint allowing the collar and skirt to be opened up, wrapped around an elongate member, and closed in a watertight manner with the collar generally above the skirt and secured thereto; and

the collar being formed as a plug which is a separate piece from the skirt and is adapted to be fitted into an opening in the skirt, and the plug having a seam that allows the plug to open and wrap around the elongate member.

5. A waterproof roof deck post construction, comprising:

a deck post having a post cross-section and secured relative to a roof deck;

a sleeve surrounding a lower portion of the post;

a flange secured to a lower end of the sleeve and extending out therefrom, the flange being secured relative to the roof deck;

a waterproofing assembly including a collar and a skirt, the collar having an opening having generally the same cross-section as that of the post cross-section, the post being disposed in the opening, the collar surrounding the post above a top of the sleeve, and the skirt extending down from the collar and out over the top of the sleeve;

a band surrounding the collar and securing in a generally watertight manner the collar to the post; and

a split joint on the collar and the skirt, the split joint including a female adapter and a male component which is snapped in place into the female adapter to secure the waterproofing assembly, the male component being detachable from the female adapter for retrofitting the waterproofing assembly;

wherein the post cross-section is non-circular.

6. The construction of claim 5 wherein the non-circular cross-section of the opening is a polygonal shape.

7. The construction of claim 5 wherein the non-circular shape is an L shape.

8. A waterproof roof deck post construction, comprising:

a deck post having a post cross-section and secured relative to a roof deck;

a sleeve surrounding a lower portion of the post;

a flange secured to a lower end of the sleeve and extending out therefrom, the flange being secured relative to the roof deck;

a waterproofing assembly including a collar and a skirt, the collar having an opening having generally the same cross-section as that of the post cross-section, the post being disposed in the opening, the collar surrounding the post above a top of the sleeve, and the skirt extending down from the collar and out over the top of the sleeve;

a band surrounding the collar and securing in a generally watertight manner the collar to the post; and

a split joint on the collar and the skirt, the split joint including a female adapter and a male component which is snapped in place into the female adapter to secure the waterproofing assembly, the male component being detachable from the female adapter for retrofitting the waterproofing assembly;

wherein the collar comprises an elastomeric material.

9. A waterproof roof deck post construction, comprising:

a deck post having a post cross-section and secured relative to a roof deck;

a sleeve surrounding a lower portion of the post;

a flange secured to a lower end of the sleeve and extending out therefrom, the flange being secured relative to the roof deck;

a waterproofing assembly including a collar and a skirt, the collar having an opening having generally the same cross-section as that of the post cross-section, the post being disposed in the opening, the collar surrounding the post above a top of the sleeve, and the skirt extending down from the collar and out over the top of the sleeve;

a band surrounding the collar and securing in a generally watertight manner the collar to the post; and

a split joint on the collar and the skirt, the split joint including a female adapter and a male component which is snapped in place into the female adapter to secure the waterproofing assembly, the male component being detachable from the female adapter for retrofitting the waterproofing assembly;

wherein the waterproofing assembly includes a top rim extending about a circumferential top outer edge of the collar.

10. The construction of claim 9 wherein the waterproofing assembly includes a circumferential shoulder interconnecting the collar and the skirt.

11. The construction of claim 10 wherein the waterproofing assembly is an EPDM molded rubber construction.

12. A waterproof roof deck post construction, comprising:

a deck post having a post cross-section and secured relative to a roof deck;

a sleeve surrounding a lower portion of the post;

a flange secured to a lower end of the sleeve and extending out therefrom, the flange being secured relative to the roof deck;

a waterproofing assembly including a collar and a skirt, the collar having an opening having generally the same cross-section as that of the post cross-section, the post being disposed in the opening, the collar surrounding the post above a top of the sleeve, and the skirt extending down from the collar and out over the top of the sleeve;

a band surrounding the collar and securing in a generally watertight manner the collar to the post; and

a split joint on the collar and the skirt, the split joint including a female adapter and a male component which is snapped in place into the female adapter to secure the waterproofing assembly, the male component being detachable from the female adapter for retrofitting the waterproofing assembly;

wherein the collar is formed as a plug which is a separate piece from the skirt and is adapted to be fitted into an opening in the skirt.

13. A waterproof roof deck post construction, comprising:

a deck post secured to a roof deck;

a sleeve assembly wrapped around the post and having a seam thereof sealed closed, the sleeve assembly including a lower flange which is secured to the roof deck;

a waterproofing assembly including a collar and a skirt, and a split joint through the skirt and collar;

the collar surrounding the post above a top of the sleeve assembly, the skirt extending down from the collar and out over the top of the sleeve assembly, and the split joint is closed in a watertight manner;

a split joint including a female adapter and a male component which is snapped in place into the female

adapter to secure the waterproofing assembly, the male component being detachable from the female adapter for retrofitting the waterproofing assembly; and

a band surrounding the collar and securing in a generally watertight manner the collar to the post;

wherein the post cross-section is non-circular; and

wherein the waterproofing assembly has a post receiving opening having a non-circular cross-section, corresponding to the non-circular cross-section of the deck post.

14. The construction of claim 13 wherein the non-circular cross-section of the opening is a polygonal shape.

15. A waterproof roof deck post construction, comprising:

a deck post secured to a roof deck;

a sleeve assembly wrapped around the post and having a seam thereof sealed closed, the sleeve assembly including a lower flange which is secured to the roof deck;

a waterproofing assembly including a collar and a skirt, and a split joint through the skirt and collar;

the collar surrounding the post above a top of the sleeve assembly, the skirt extending down from the collar and out over the top of the sleeve assembly, and the split joint is closed in a watertight manner;

a split joint including a female adapter and a male component which is snapped in place into the female adapter to secure the waterproofing assembly, the male component being detachable from the female adapter for retrofitting the waterproofing assembly; and

a band surrounding the collar and securing in a generally watertight manner the collar to the post;

wherein the collar comprises a plug formed as a separate piece from the skirt and adapted to fit into an opening in the skirt.

16. A waterproof roof deck post construction, comprising:

a deck post secured to a roof deck;

a sleeve assembly wrapped around the post and having a seam thereof sealed closed, the sleeve assembly including a lower flange which is secured to the roof deck;

a waterproofing assembly including a collar and a skirt, and a split joint through the skirt and collar;

the collar surrounding the post above a top of the sleeve assembly, the skirt extending down from the collar and out over the top of the sleeve assembly, and the split joint is closed in a watertight manner;

a split joint including a female adapter and a male component which is snapped in place into the female adapter to secure the waterproofing assembly, the male component being detachable from the female adapter for retrofitting the waterproofing assembly; and

a band surrounding the collar and securing in a generally watertight manner the collar to the post;

wherein the sleeve assembly includes a watertight flap which secures the split joint closed.

17. A waterproofing assembly, comprising:

a collar;

a skirt;

the skirt and collar including a split joint allowing the collar and skirt to be opened up, wrapped around an elongate member, and closed in a watertight manner with the collar generally above the skirt and secured thereto; and

the split joint including a female adapter and a male component which is snapped in place into the female adapter to secure the waterproofing assembly, the male component being detachable from the female adapter for retrofitting the waterproofing assembly;

wherein the collar and skirt are formed as two separate pieces with the collar defining a plug which fits into an opening of the skirt.

18. The assembly of claim 17 wherein the plug has a through-opening with a non-circular cross-section.

19. The assembly of claim 18 wherein the non-circular cross-section is an L shape, a rectangular shape, a polygonal shape, a T shape or a U shape.

20. A method of constructing a waterproof roof deck post construction, comprising:

(a) securing a deck post having a post cross-section to a roof deck;

(b) securing a sleeve positioned over and surrounding the post to a roof deck;

(c) providing a waterproofing assembly including a collar and a skirt, the collar having an opening which has generally the same cross-section as that of the post cross-section;

(d) positioning the waterproofing assembly such that the deck post extends through the collar opening and the skirt extends down over a top of a pipe jack;

(e) snapping a male component into a female adapter to position the waterproofing assembly relative to the deck post; and

(f) after (d), applying a band around the collar to secure the collar in a generally watertight manner to the post;

wherein the collar has an opening with a non-circular cross-sectional shape which corresponds to a cross-sectional shape of the post.

21. A method of constructing a waterproof roof deck post construction, comprising:

(a) securing a deck post having a post cross-section to a roof deck;

(b) securing a sleeve positioned over and surrounding the post to a roof deck;

(c) providing a waterproofing assembly including a collar and a skirt, the collar having an opening which has generally the same cross-section as that of the post cross-section;

(d) positioning the waterproofing assembly such that the deck post extends through the collar opening and the skirt extends down over it top of a pipe jack;

(e) snapping a male component into a female adapter to position the waterproofing assembly relative to the deck post; and

(f) after (d), applying a band around the collar to secure the collar in a generally watertight manner to the post;

wherein the collar comprises a plug which is a separate piece from the skirt, and further comprising inserting the plug into an opening in the skirt.

* * * * *

US006640503B1

(12) **United States Patent**
Evensen et al.

(10) **Patent No.: US 6,640,503 B1**
(45) **Date of Patent: Nov. 4, 2003**

(54) **WATERPROOF ROOF DECK POST CONSTRUCTION AND METHOD**

(75) Inventors: **Lawrence P. Evensen**, 29254 Greenwater Rd., Malibu, CA (US) 90265; **Mark Andersen**, Woodland Hills, CA (US); **Richard Spindel**, Granada Hills, CA (US)

(73) Assignee: **Lawrence P. Evensen**, Westlake Village, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 219 days.

(21) Appl. No.: **09/628,598**

(22) Filed: **Jul. 28, 2000**

Related U.S. Application Data

(63) Continuation-in-part of application No. 09/240,807, filed on Feb. 1, 1999.

(51) **Int. Cl.**[7] **E04D 3/38**

(52) **U.S. Cl.** **52/60**; 52/58; 52/199; 52/741.4; 277/602; 277/607; 277/625; 277/644; 285/42

(58) **Field of Search** 52/199, 58, 59, 52/60, 219, 741.4; 285/83, 82, 42; 277/212, 602, 607, 625, 626, 644

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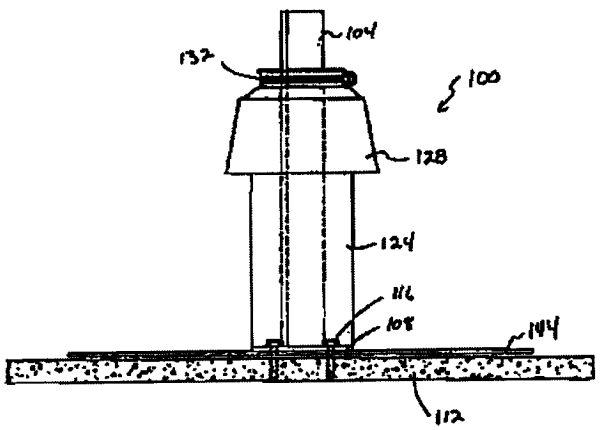
Primary Examiner—Carl D. Friedman
Assistant Examiner—Jennifer I. Thissell
(74) *Attorney, Agent, or Firm*—Oppenheimer Wolff & Donnelly LLP

(57) **ABSTRACT**

A deck post (or brace) having a non-circular cross-section is secured to a roof deck. A lead pipe jack (sleeve) is slid over the post. A waterproofing assembly having a collar and a skirt is provided; the collar has an opening with generally the same non-circular cross-section as that of the post. The collar opening is positioned on the deck post, and the unit is slid down the post until the collar is at the top of the sleeve, the skirt extending down over the sleeve. A clamp is then positioned and tightened around the collar to provide a watertight seal on the deck post. When the post is already installed on a roof deck and the sleeve and the waterproofing assembly cannot be slid into place on the post, a modified retrofit waterproofing assembly and sleeve are used to provide the waterproofing. The modified sleeve is a split lead flashing jack with an open seam on one side. The sleeve is opened up, wrapped around the post and soldered closed. The modified waterproofing assembly has a split joint through the skirt and collar. To position this assembly on the post at the top of the split lead flashing jack, the joint is opened up, the assembly wrapped around the post and the slip joint closed with a watertight flap. A locking closure can be provided having a locking clasp and a locking slot. Another alternative waterproofing assembly forms the collar as a plug separate from the skirt; the skirt is opened and the plug inserted therein. This arrangement allows a plug having the desired opening configuration to be selected from an inventory of different plugs and used with a single skirt design. Another alternative of the waterproofing assembly provides a series of flanged tabs on the top edge of the collar for connecting to the collar plug. The flanged tabs may each have a projection on them which increases the pull-out resistance between a connected skirt and collar. The collar plug may also have a series of cavities which line up with the flanged tabs of the skirt. The collar plug may have a recess for the clamp. As an alternative assembly, multiple skirts can be connected together using their locking clasps and locking slots and the resulting larger skirt can then be connected to a collar.

47 Claims, 20 Drawing Sheets



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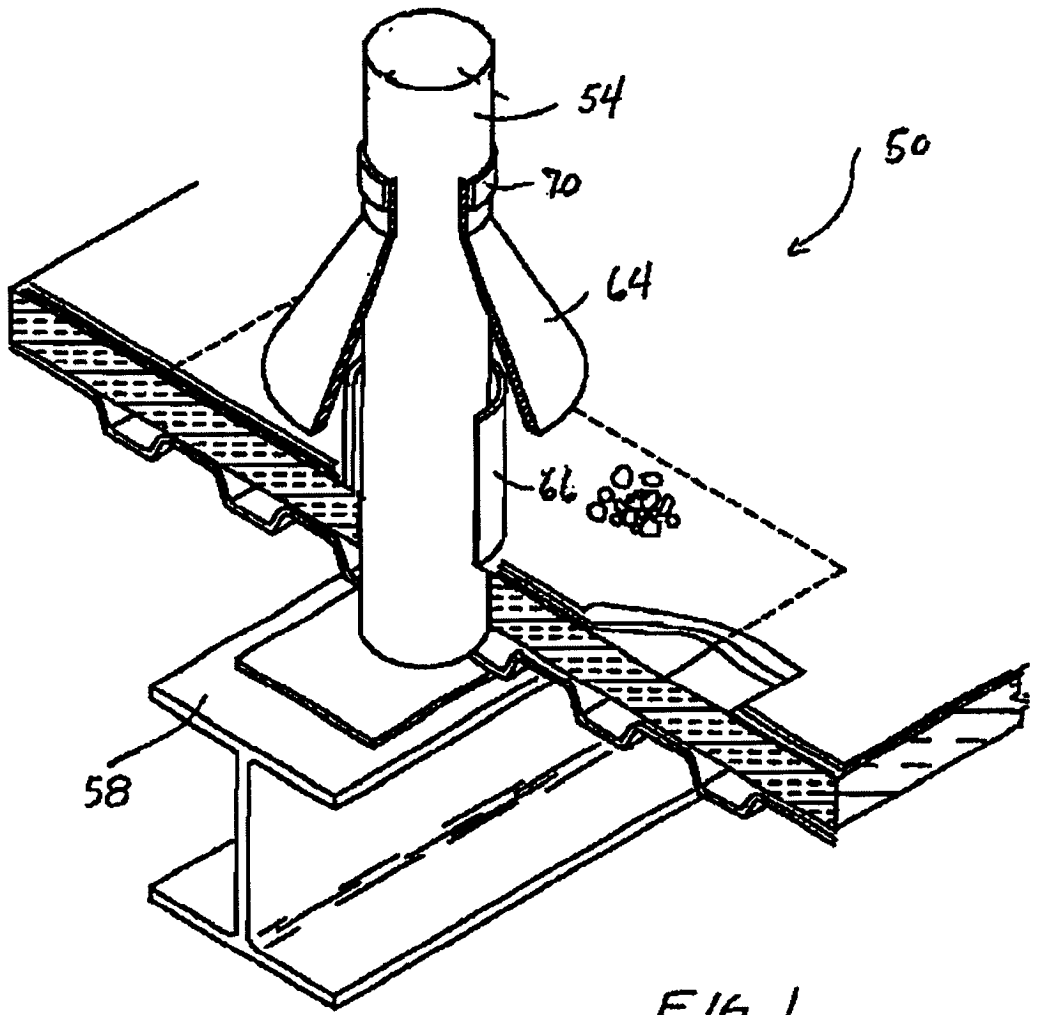

FIG. 1
(PRIOR ART)

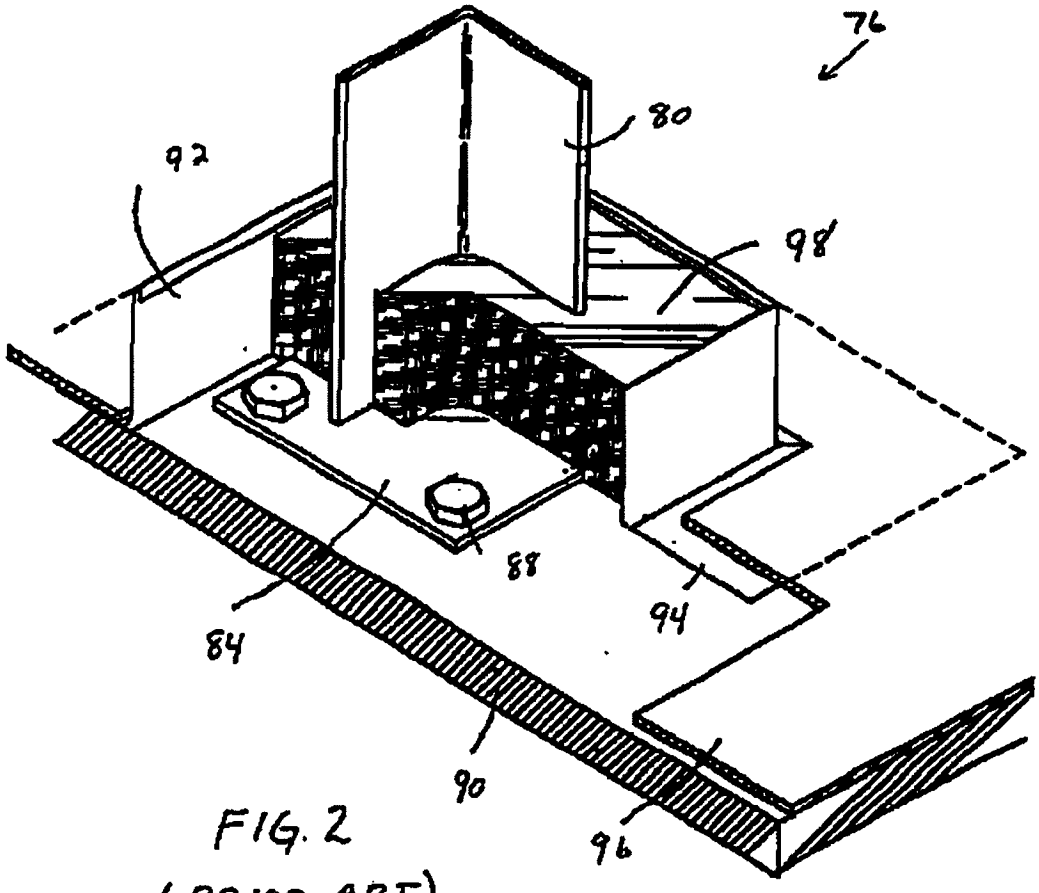

FIG. 2
(PRIOR ART)

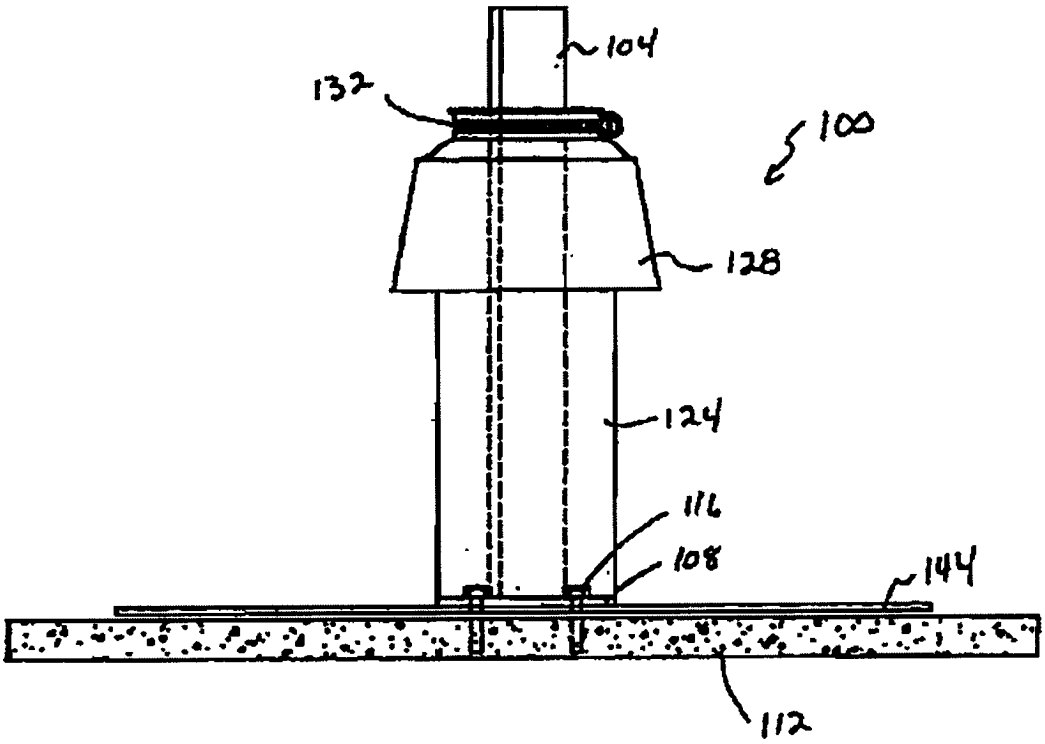

FIG. 3

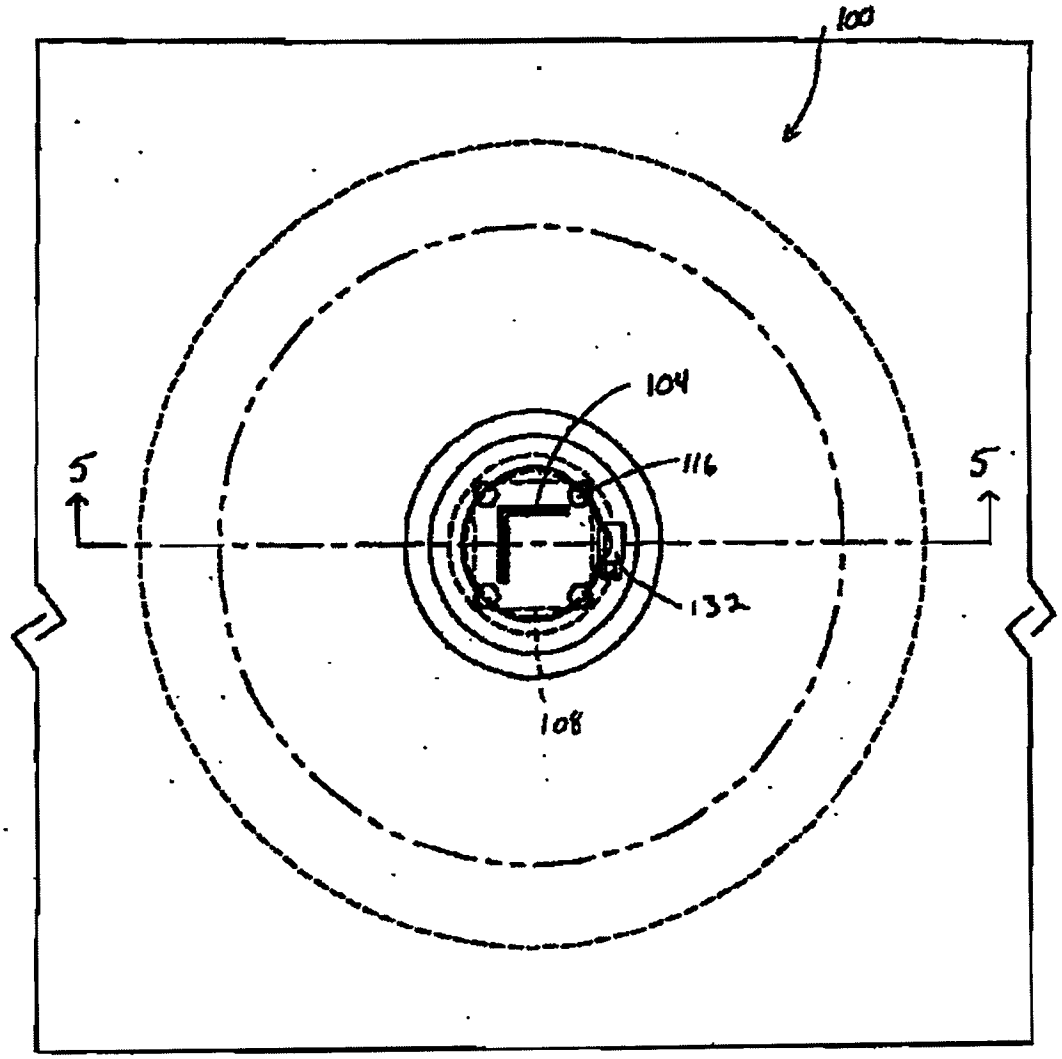

FIG 4

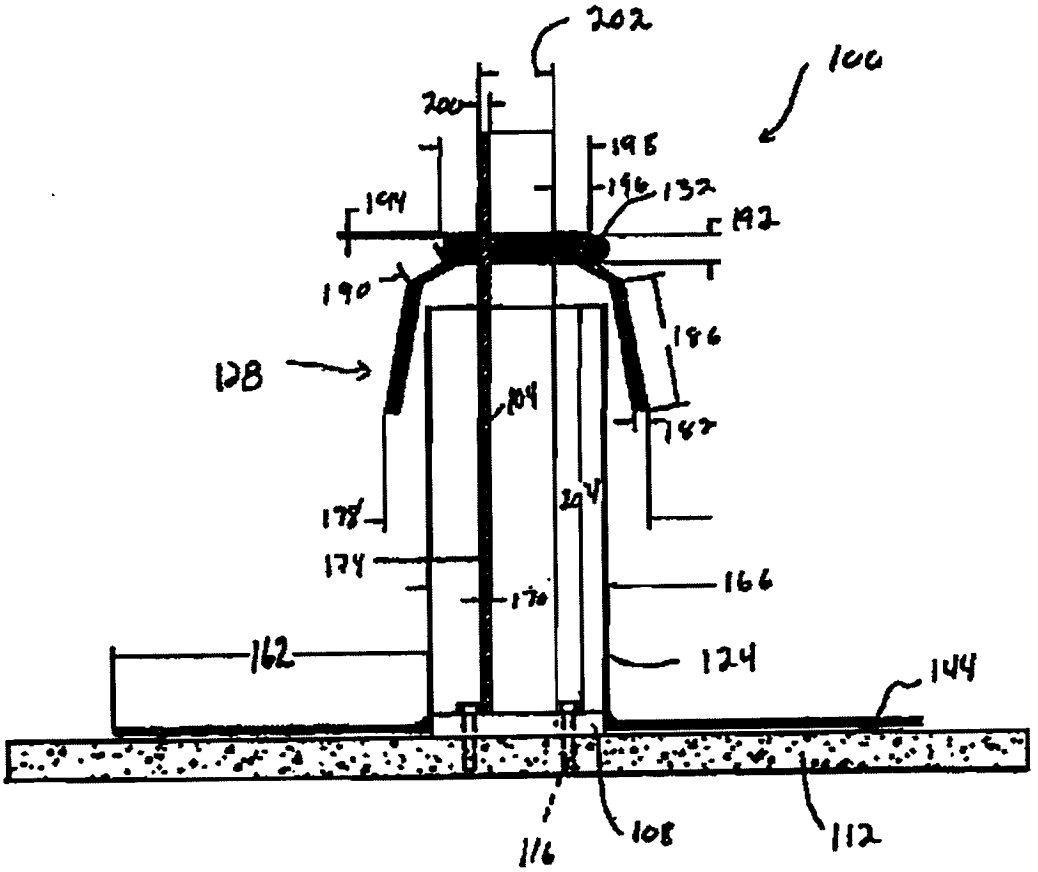
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FIG. 5

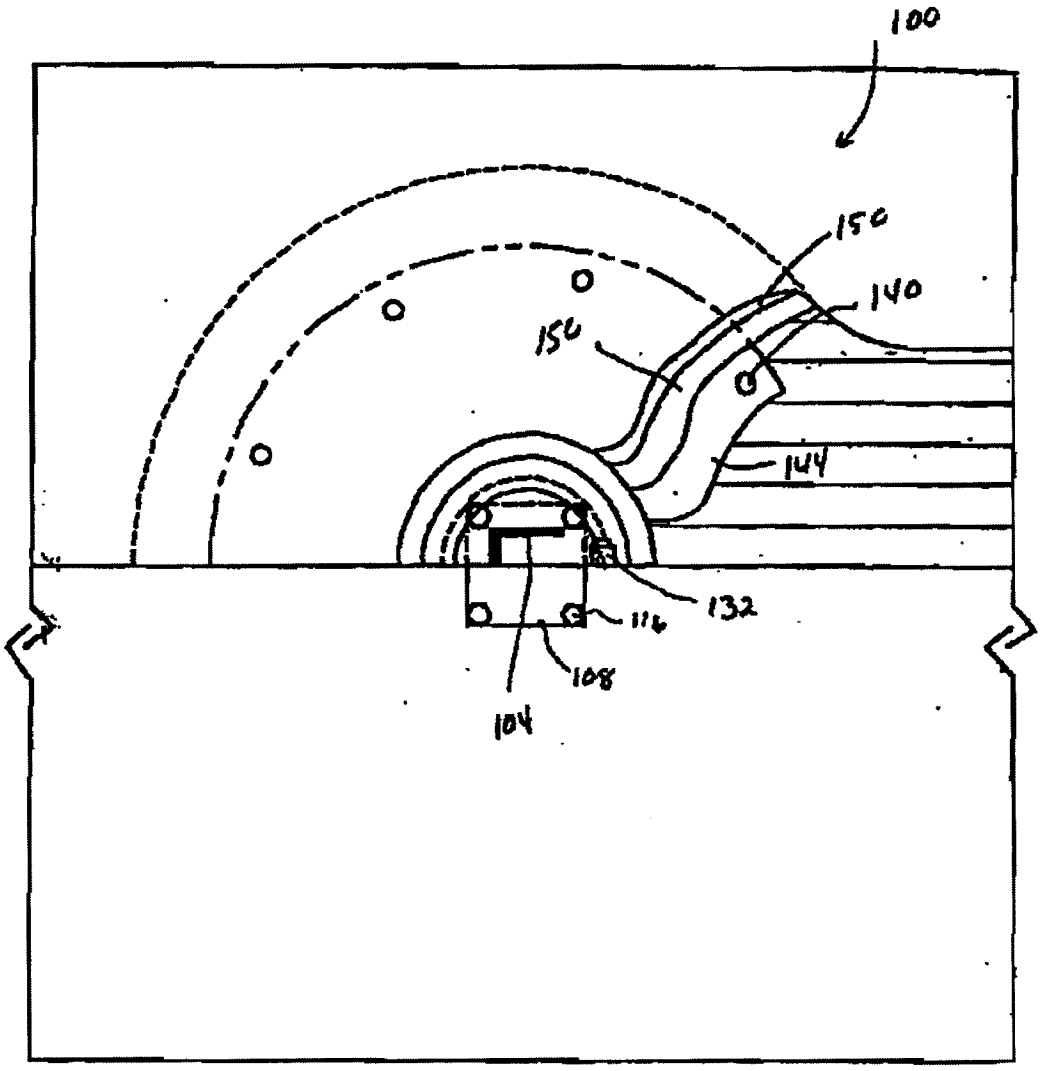

FIG. 6

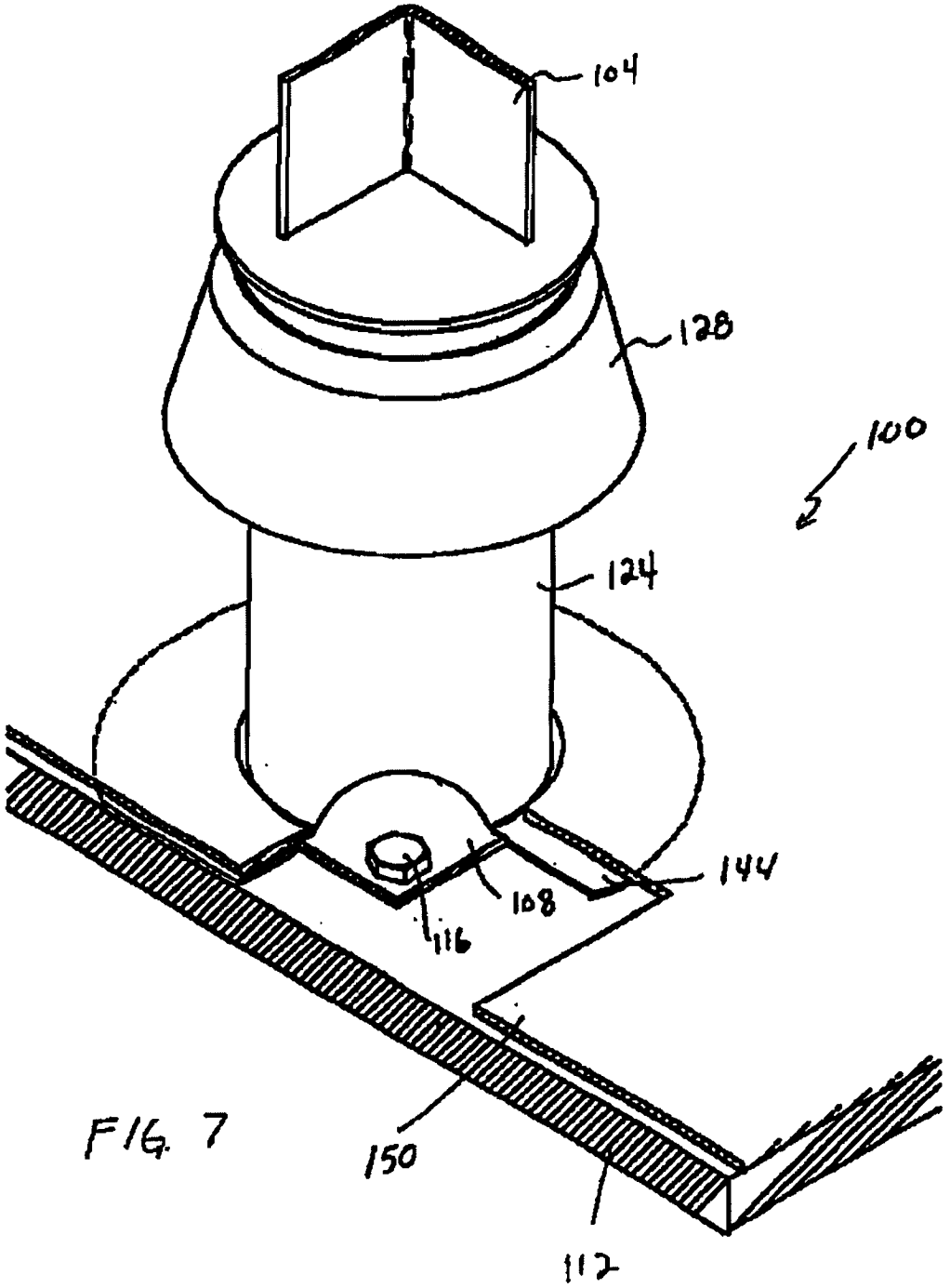

FIG. 7

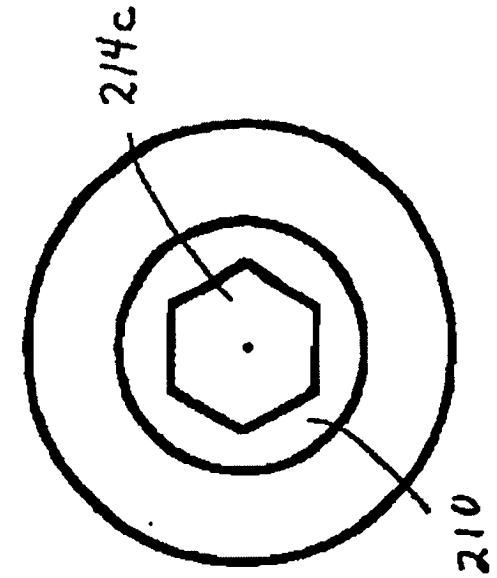

FIG. 8c

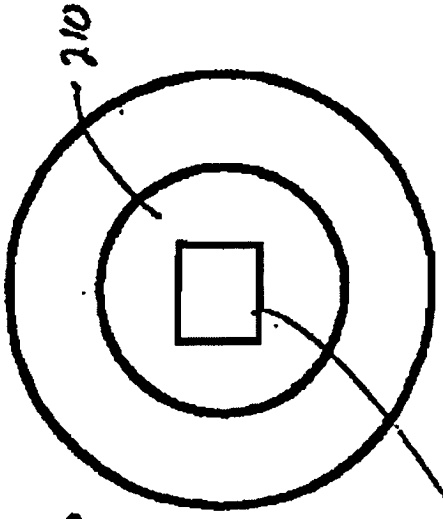

FIG. 8b

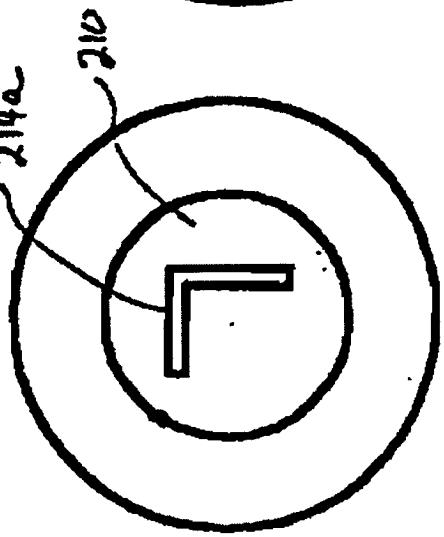

FIG. 8a

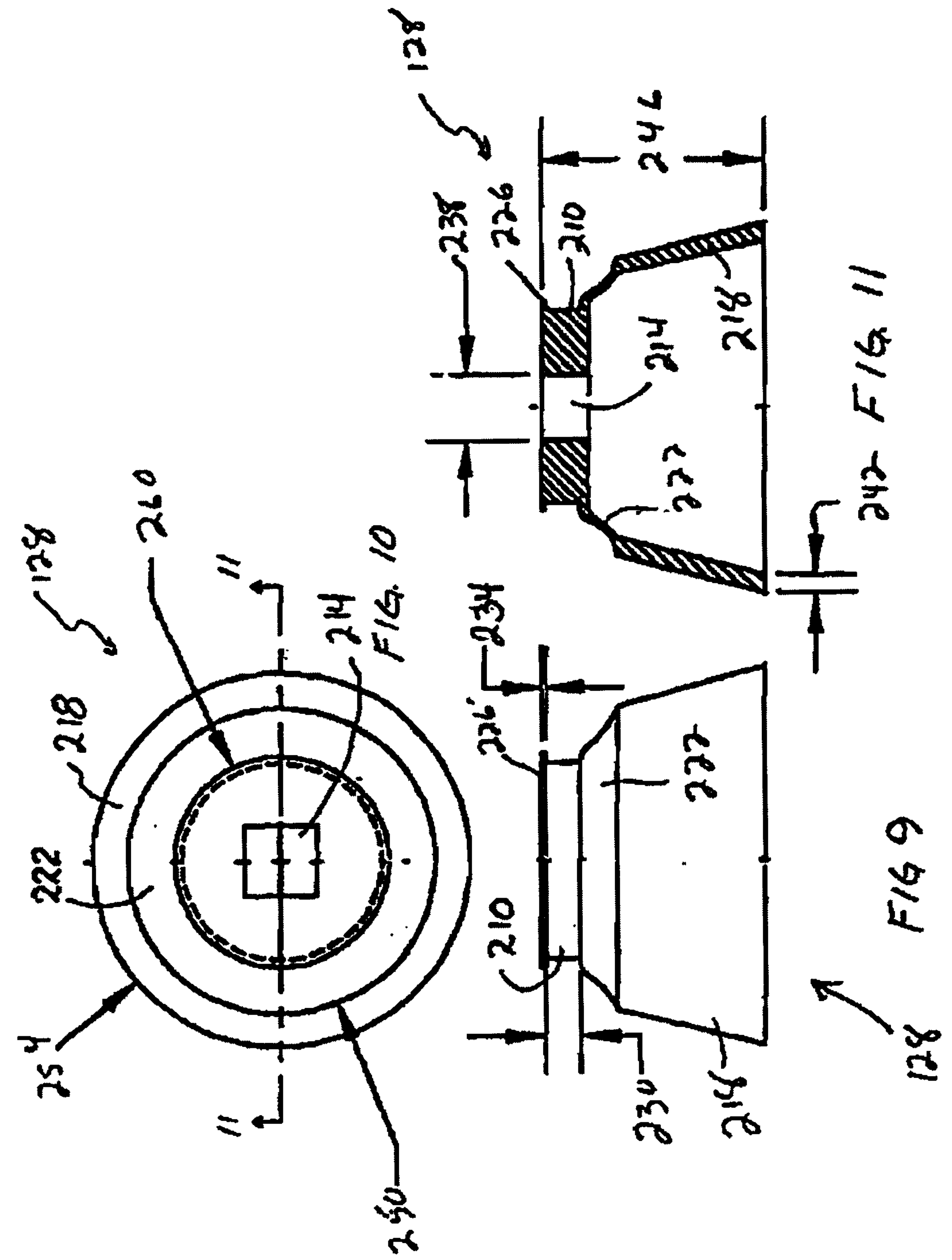

FIG. 10

FIG 9

FIG 11

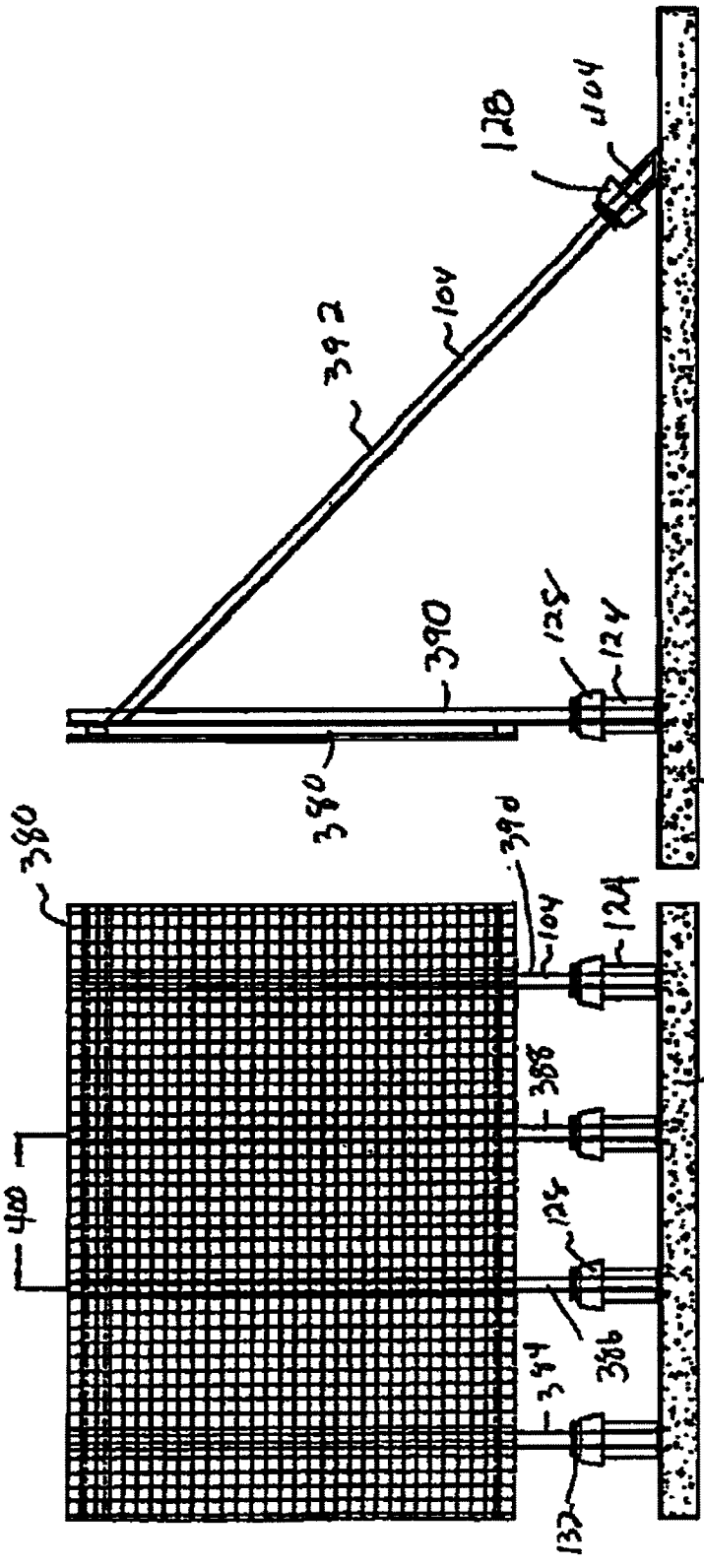

FIG. 13

FIG. 12

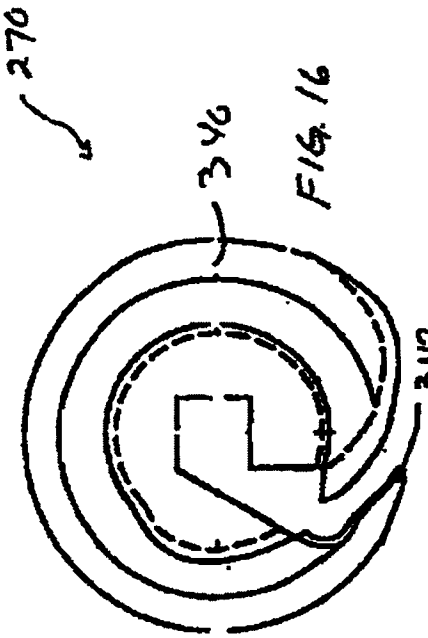

FIG. 16

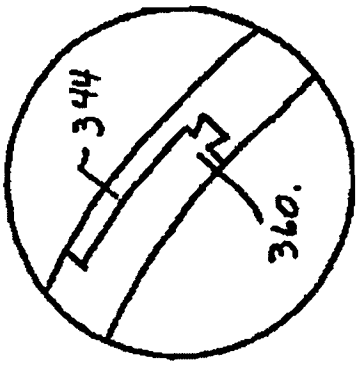

FIG. 17

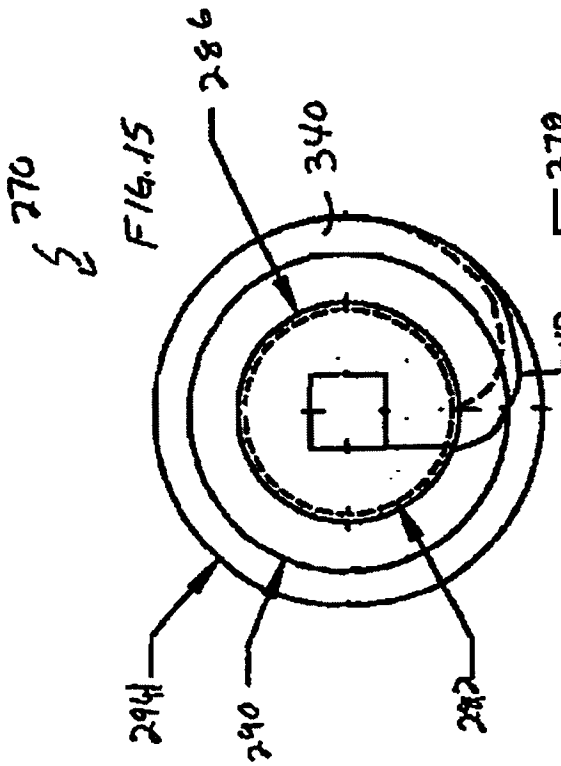

FIG. 15

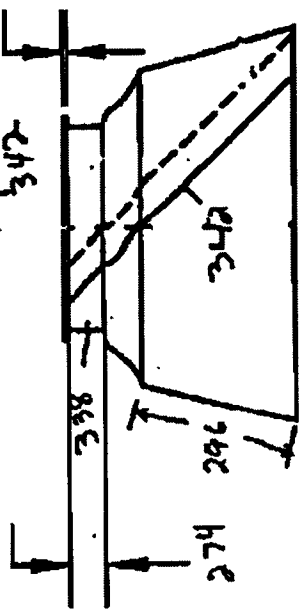

FIG. 14

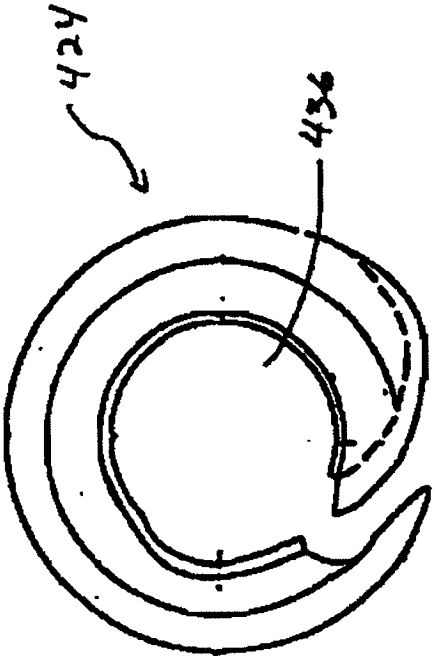

FIG. 21

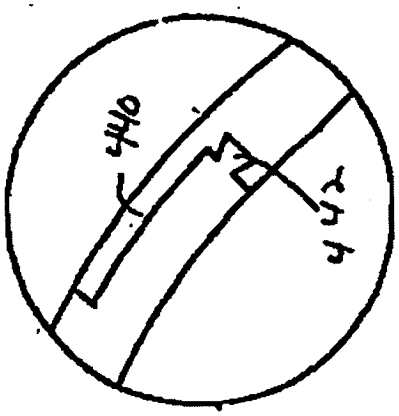

FIG. 22

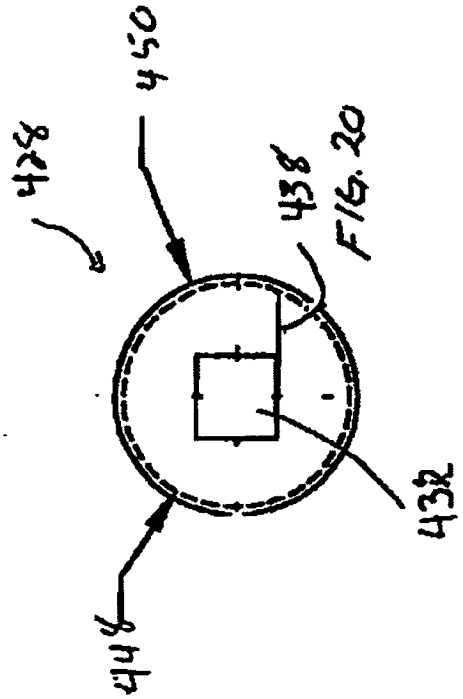

FIG. 20

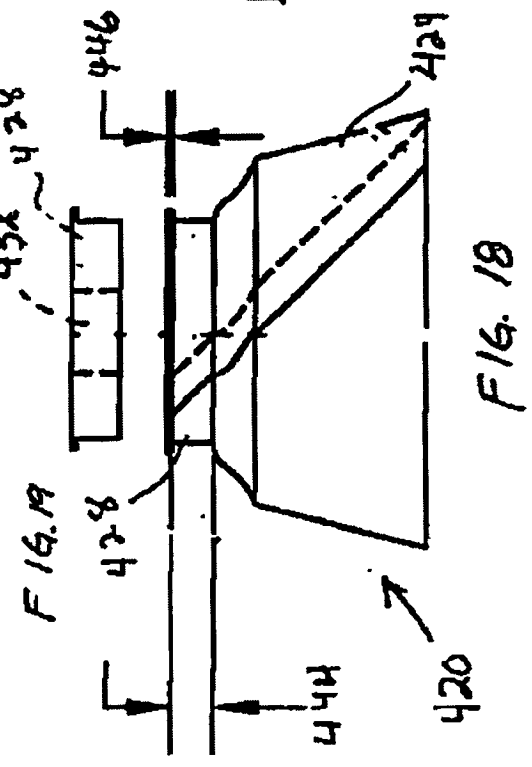

FIG. 19

FIG. 18

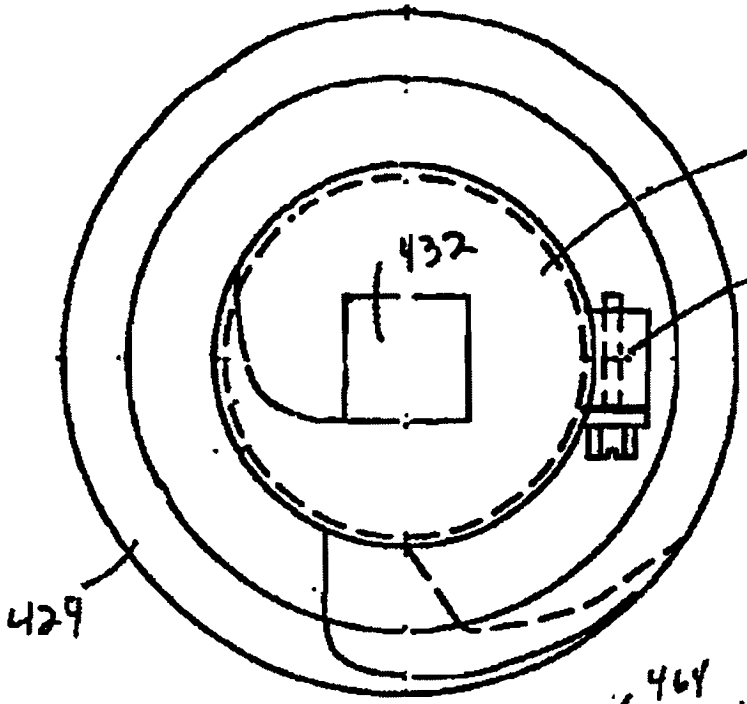

FIG. 24

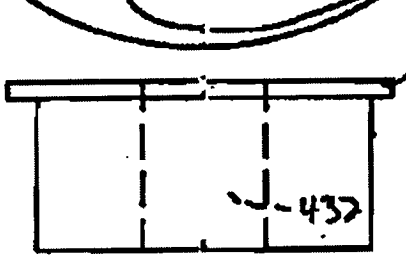

FIG. 25

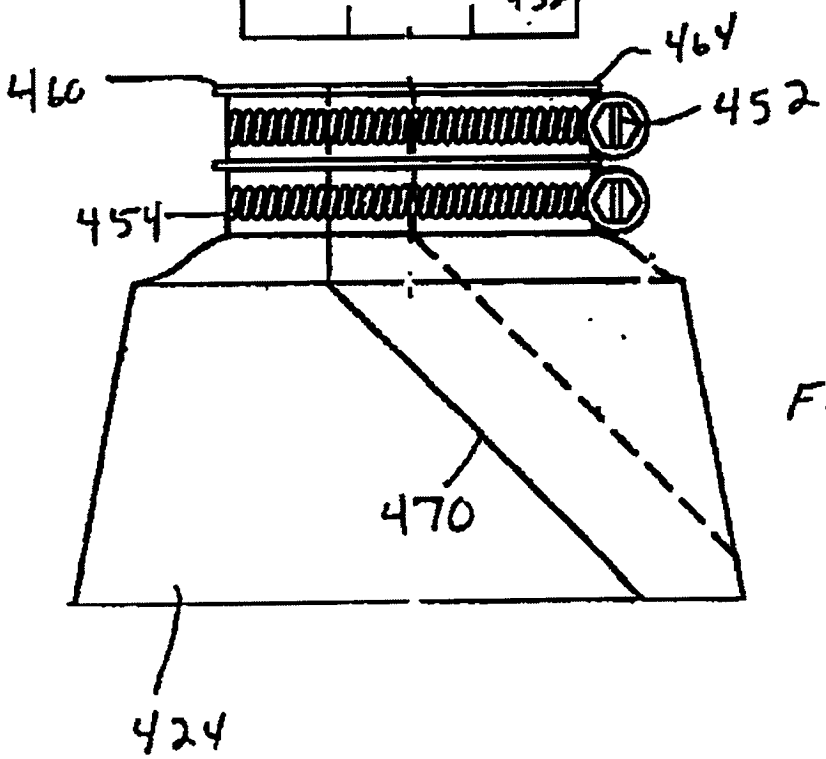

FIG. 23

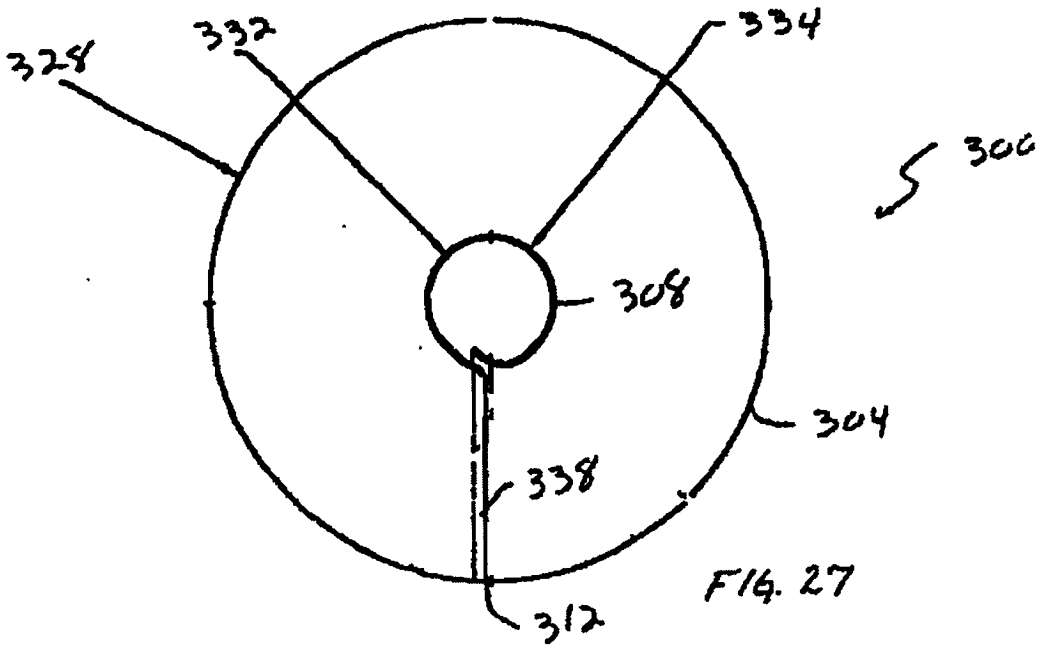

FIG. 27

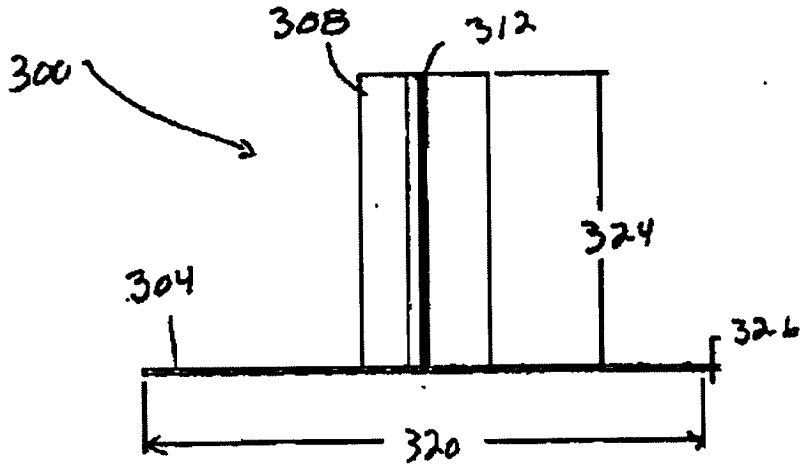

FIG. 26

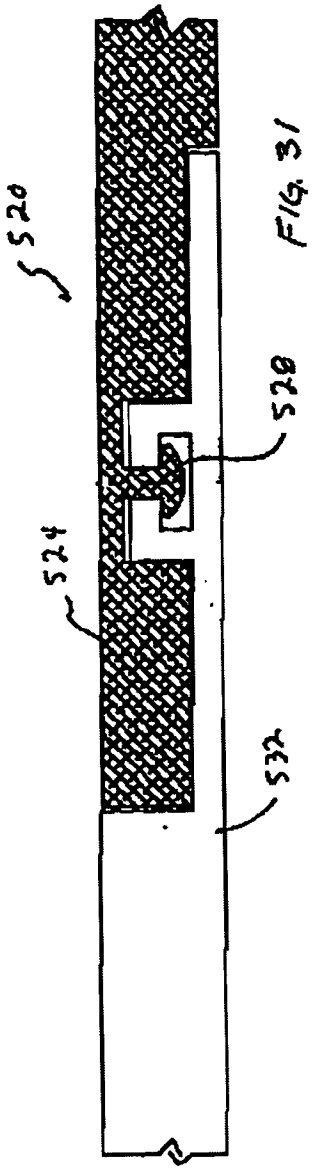

FIG. 31

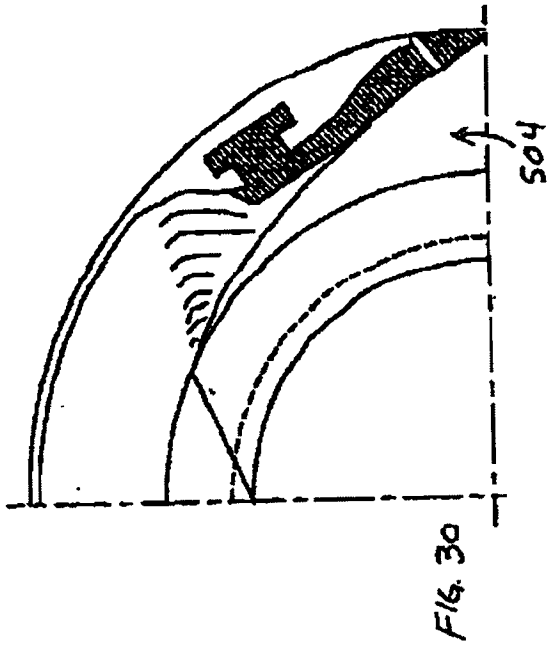

FIG. 30

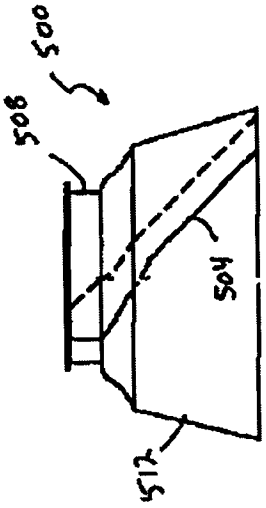

FIG. 28

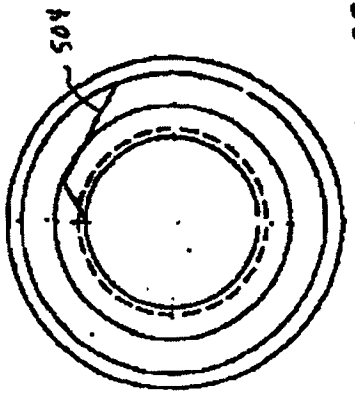

FIG. 29

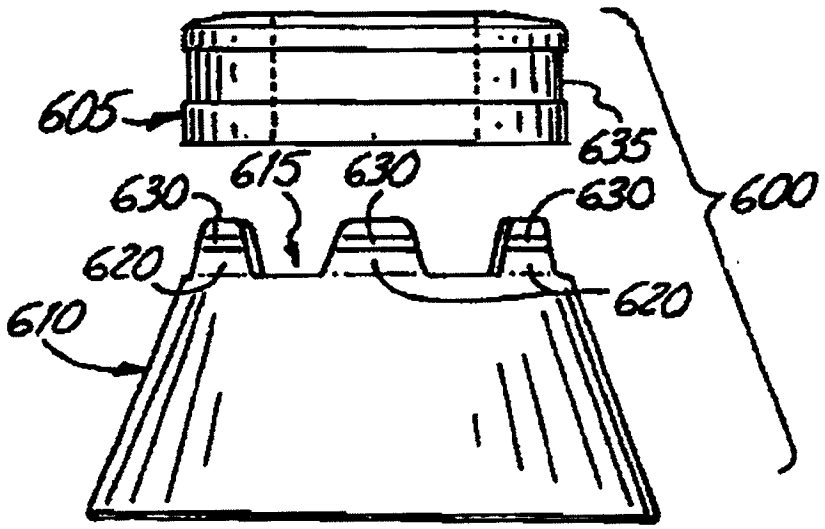

Fig. 32

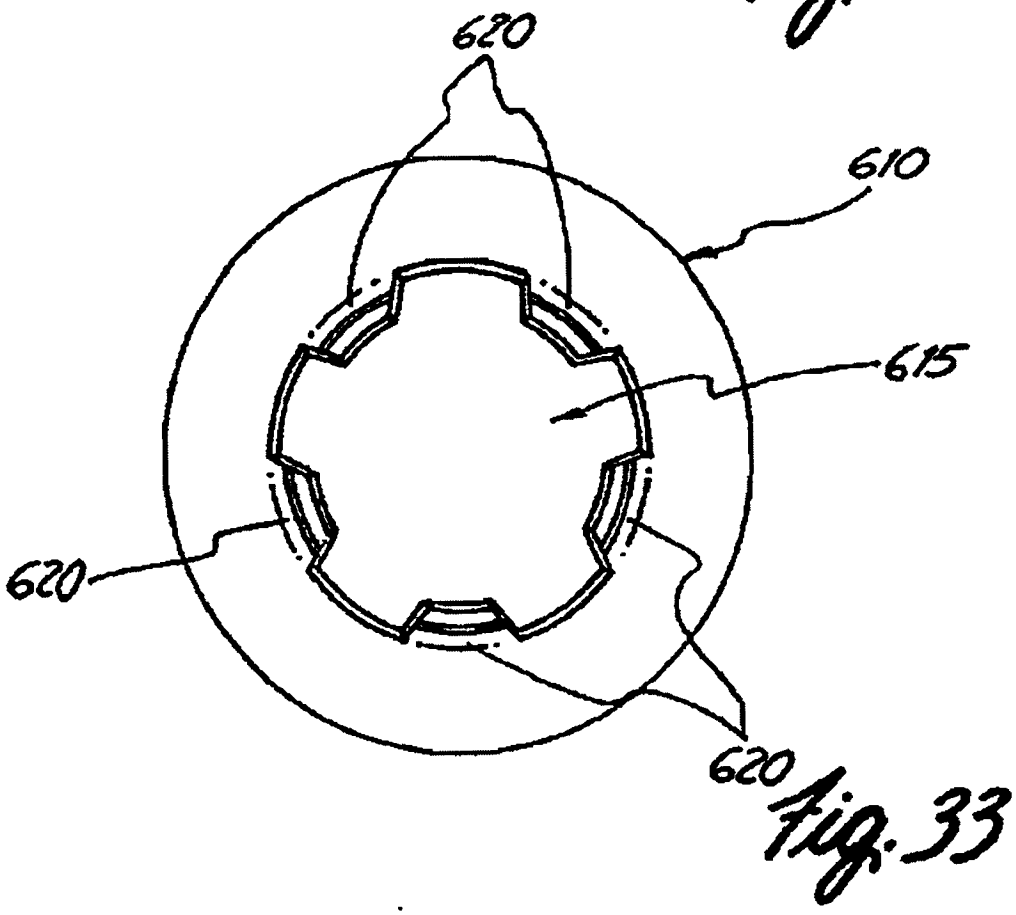

Fig. 33

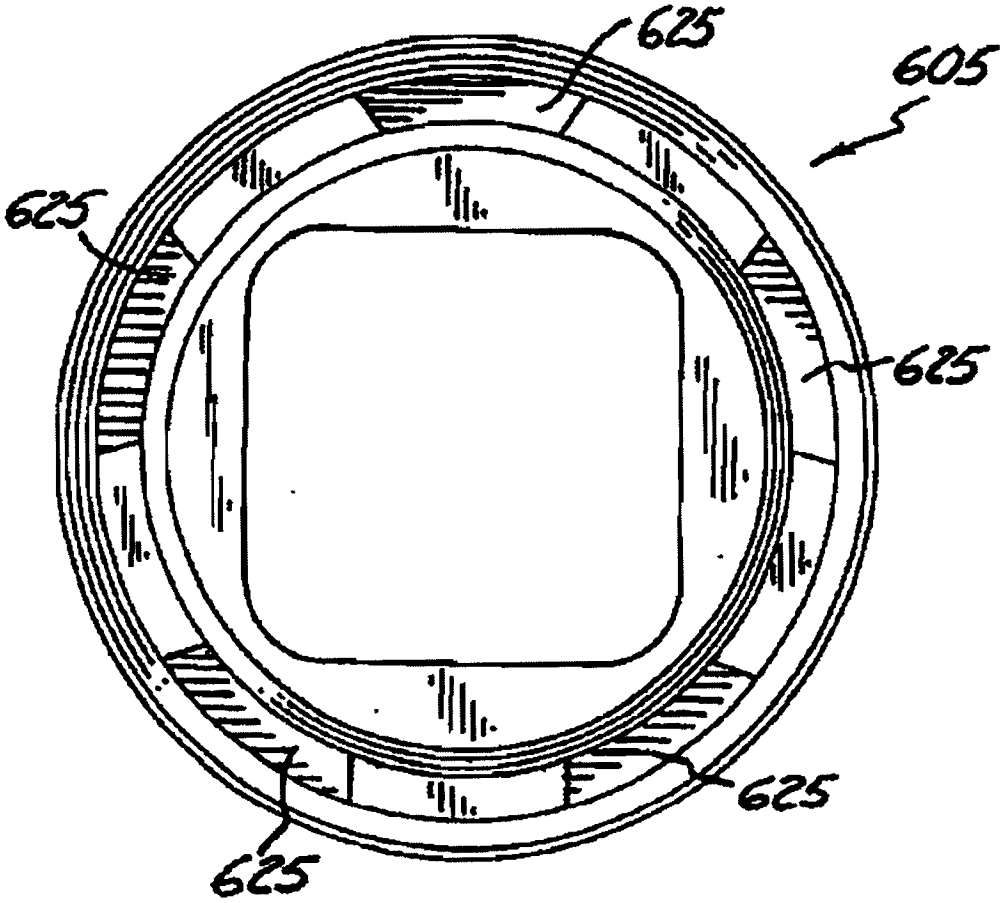

Fig. 34

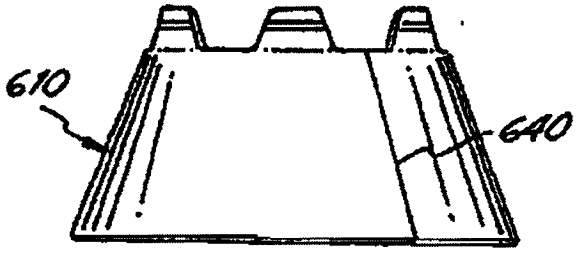

Fig. 35

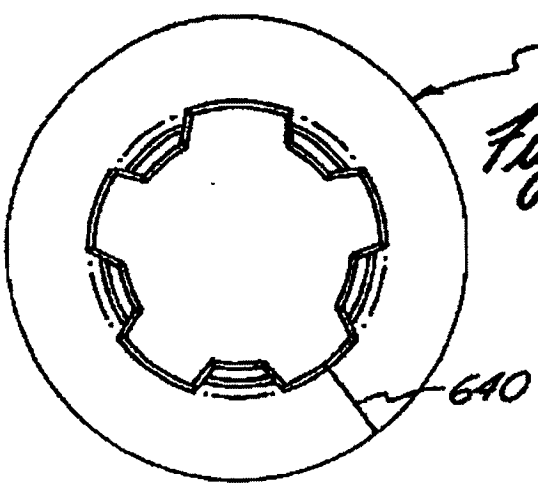

Fig. 36

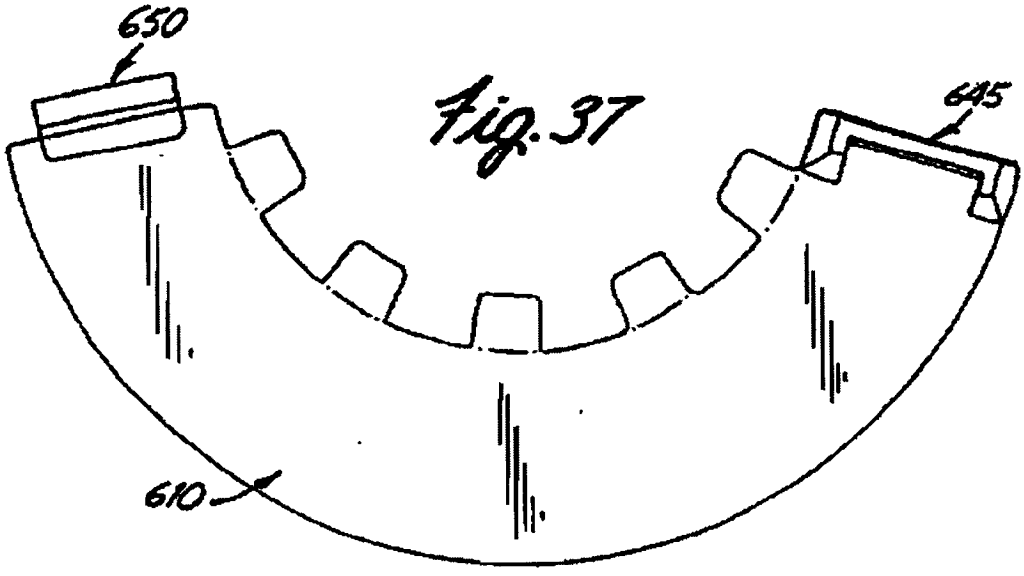

Fig. 37

Fig. 38

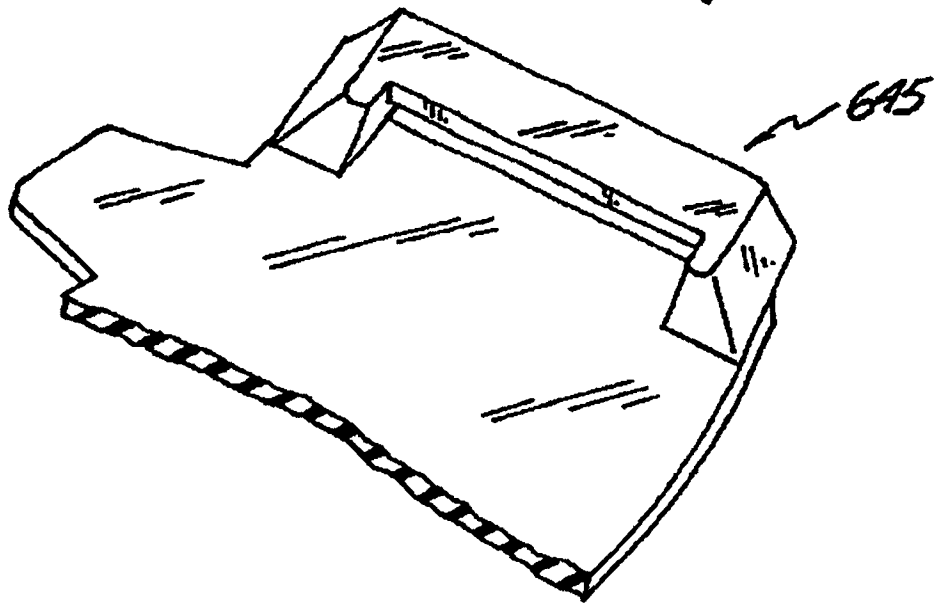

Fig. 39

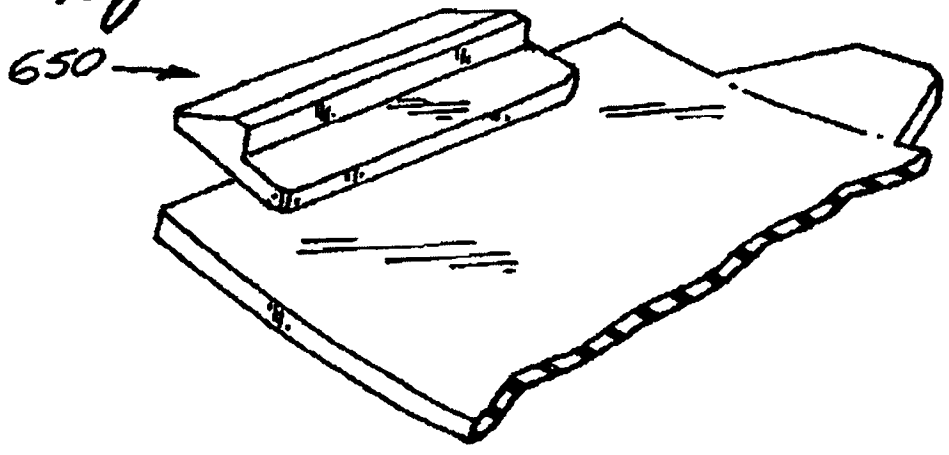

Fig. 40

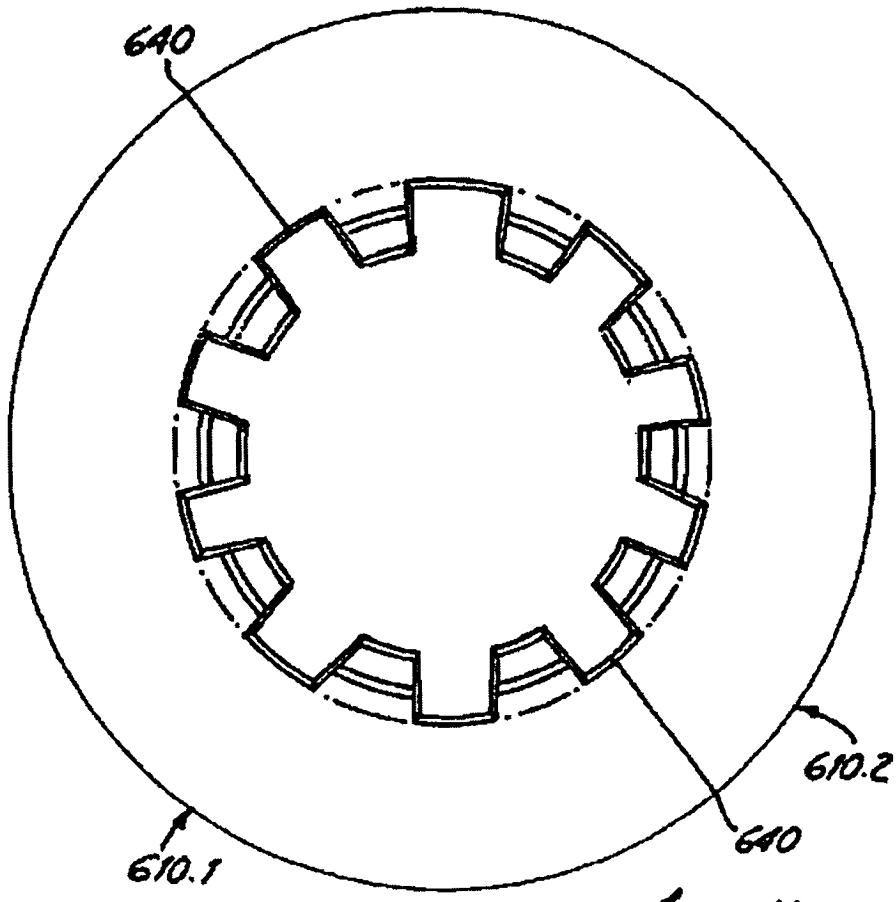

Fig. 41

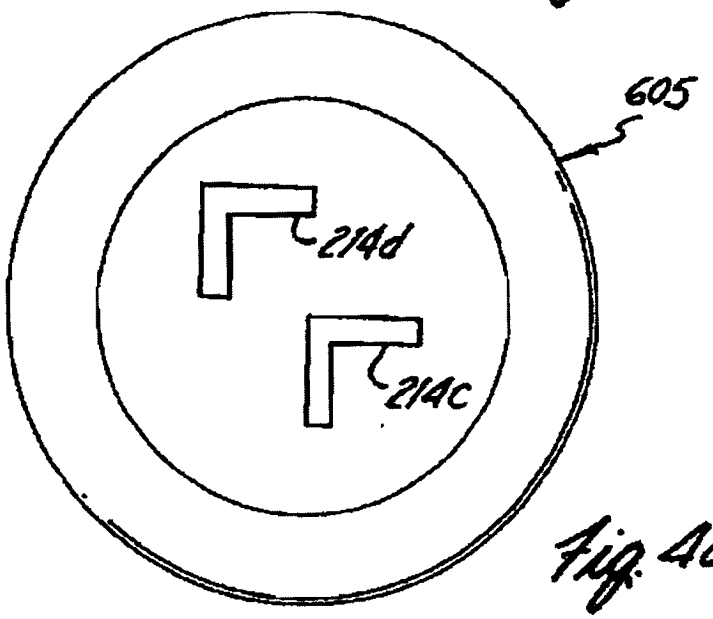

Fig. 42

WATERPROOF ROOF DECK POST CONSTRUCTION AND METHOD

CROSS-REFERENCE TO RELATED APPLICATION

This is a continuation-in-part of copending application Ser. No. 09/240,807, filed Feb. 1, 1999 and whose entire contents are herein incorporated by reference.

BACKGROUND OF THE INVENTION

The present invention relates to constructions, assemblies and methods for installing and waterproofing roof deck posts, and particularly those having non-circular cross-sections.

The tops of buildings or roof decks are often used to mount various items, which typically support the use or function of the building or benefit the building's occupants in some way. These items include signs, fences, helicopter landing zones, equipment supports and even swimming pools.

When a fence, for example, is installed on top of a building, it must be installed securely so that it will not fall or blow off of the building. Additionally, the support members or posts of the fence must be attached in such a way as to maintain the water integrity of the roof. If the fence supports are bolted into the roof deck, each support will cut through or penetrate the building roof jeopardizing the water integrity of the roof unless adequate waterproofing measures are taken.

A waterproofing construction of the prior art used when the support or post is round is shown in FIG. 1 generally at **50**. Referring thereto, the round post **54** is secured to structural framing **58**, and is provided to support another structure such as fencing or a structural frame. An umbrella overlapping jack **64** is used to waterproof the support. The pipe jack **64** is a cone that fits snugly around the penetration and creates a waterproof seal above the roof line. FIG. 1 shows a sheet metal roof jack **66** extending at least eight inches above the roofing, and the umbrella pipe jack **64** overlaps the roof jack by a radius of three to four inches. A drawband **70** secures the upper collar portion of the pipe jack **64** to the round post **54**, and caulk with sealant is applied around the top circumference. Construction **50** works where the projection or post is round; however, if the post is other than round, the pipe jack does not fit snugly and leaks result.

Thus, for other than round posts, another waterproofing construction is used, an example of which is depicted in FIG. 2 and is commonly referred to as "Pitch Pocket." This term describes the encasing of an odd-shaped penetration (such as a steel angle iron support) in a pool of asphalt that is held in a metal bowl mounted onto the roof. When the asphalt dries or cools the penetration located inside of it is tightly encased to prevent water penetrating into the building.

Referring to FIG. 2, a method of installing the Pitch Pocket will now be described with the construction being shown generally at **76**. A steel angle iron brace (support or post) **80** with a four hole mounting plate **84** welded thereto is bolted with bolts **88** to a roof deck **90**. A sheet metal contractor slides a four-sided metal pitch pan **92** over the top of the brace **80**. The pan **92**, which is at least two inches deep, hangs loose waiting for a later installation step. The roofing contractor installs first ply layers (typically three) of roofing materials under the pitch pan **92** and onto the entire building roof. He then nails the flange **94** of the pan **92** onto the roof deck and through the ply layers. Roofing plies will

be striped or layered over the flange **94** to laminate the flange between the roofing plies. A finish coat of roofing materials **96**, such as gravel or granule rolled roofing, is installed. Hot asphalt **98** or other pourable sealer is then poured into the pitch pan **92** until full and with a minimum two inch depth, and the asphalt is allowed to cool.

Pitch Pockets (**76**) work well until the asphalt shrinks or cracks and the pan or concave bowl fills with water. This cracking can be caused by the sun's direct heat, by impact on the post construction, by strong winds or by the building shaking as from an earthquake. When the cracks form, the water in the pocket is funneled into the building, resulting in the problem which the Pitch Pocket was specifically provided to prevent. Also, since the post is fixed in place by the asphalt, when a strong force is exerted on the post, the asphalt around the post compresses, loosening the securement of the post relative to the roof, and requiring repair.

SUMMARY OF THE INVENTION

According to one embodiment of a waterproof roof deck post of the invention, a deck post having a non-circular cross-section is secured relative to a roof deck. A sleeve surrounds the lower portion of the deck post. A waterproofing assembly has a collar and a skirt. The collar has an opening that is generally the same non-circular cross-section as that of the deck post. The deck post is disposed in the collar's opening. The collar is formed as a plug that is separate from the skirt. The collar is adapted to be fitted into an opening in the skirt. The skirt may be connected to the collar with a series of flanged tabs on the top portion of the skirt being inserted into a series of tab receiving cavities in the collar. The tabs may have projections used to increase the tabs' pull-out resistance. The collar surrounds the deck post above the top of the sleeve. The skirt extends down from the collar and out over the top of the sleeve. The skirt may have a split joint which locks together with a clasp and a locking slot on the skirt. The skirt may even be made up of a series of smaller skirt pieces that are joined together using their clasps and locking slots. A band surrounds the collar (perhaps situated in a recess formed in the collar of that purpose) and secures the collar to the deck post in a generally watertight manner.

According to another definition of the invention, disclosed herein are an improved waterproof deck post construction and method and a waterproofing assembly (or watertight umbrella) useful therein. The assembly has a collar with an opening therethrough and a skirt hanging down from the collar. The opening is configured to match the cross-sectional shape of the deck post, and this invention is thereby particularly well suited for deck posts which are not round. The assembly is preferably an elastomeric material or specifically is EPDM molded rubber.

The post is secured to the roof deck. A flanged sleeve is slid over the post, and the flange secured to the roof deck. The flanged sleeve can be a lead jack such as are used today on stink pipes and vent pipes. The waterproofing assembly is slid onto the post. With the collar surrounding the post just above the top of the sleeve and the skirt extending down over the top of the sleeve, a band is secured around the collar securing the collar in a watertight manner to the post. The band is preferably a hose clamp.

When the post is already secured to the deck and it is not convenient to slide the waterproofing assembly down over the post, an alternative embodiment of the waterproofing assembly of this invention is used. This embodiment has a split joint through the skirt and the collar which allows the

unit to be opened up and wrapped around the post. A watertight flap of the unit seals the joint closed. In this construction, a split lead flashing jack can be used as the flanged sleeve. The flashing jack is opened up and wrapped around the post and its seam then soldered closed.

The shape of the opening of the collar is selected to match the shape of the outside surface of the post. For example, it can be an L or a square shape. The skirt can have the same configuration for all post shapes. Thus, another embodiment of the waterproofing assembly constructs the skirt and collar as separate pieces with an inventory of collars having different opening shapes provided. The collar with the desired opening shaped to match the post being used will be selected and plugged into the skirt. In other words, the detachable EPDM collars or inserts are interchangeable to allow various geometric shapes. This plug-type collar and skirt can have split joints allowing them to be wrapped around the post. Additionally, the collar can have a longer configuration to accommodate two hose clamps, one above the other, if desired.

Other objects and advantages of the present invention will become more apparent to those persons having ordinary skill in the art to which the present invention pertains from the foregoing description taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective cut-away view of a round post roof-mounted construction of the prior art;

FIG. 2 is a perspective cut-away view of an angle iron brace roof-mounted ("Pitch Pocket") construction of the prior art;

FIG. 3 is a side elevational view of a waterproof roof deck construction of the present invention;

FIG. 4 is an enlarged top plan view of the construction of FIG. 3;

FIG. 5 is a reduced cross-sectional view taken on line 5—5 of FIG. 4;

FIG. 6 is an enlarged top plan view of FIG. 5;

FIG. 7 is a perspective, partially cut-away view of the construction of FIG. 3, but without the hose clamp for illustrative purposes;

FIG. 8*a* is a top plan view of the waterproofing assembly of the construction of FIG. 7;

FIGS. 8*b* and 8*c* are first and second alternative designs, respectively, of the unit of FIG. 8*a* to accommodate posts of different corresponding cross-section configurations;

FIG. 9 is a side elevational view of an alternative waterproofing assembly of the present invention usable in the construction of FIG. 3, for example;

FIG. 10 is a top plan view of the unit of FIG. 9;

FIG. 11 is a cross-sectional view taken on line 11—11 of FIG. 10;

FIG. 12 is a side elevational view of a construction assembly of the present invention used to support rooftop fencing or screening structure;

FIG. 13 is a side elevational view of the assembly of FIG. 12;

FIG. 14 is a view similar to FIG. 9 illustrating an open seam waterproofing assembly of the present invention;

FIG. 15 is a top elevational view of the unit of FIG. 14;

FIG. 16 is a view similar to FIG. 15 illustrating the unit in an open position;

FIG. 17 is an enlarged view illustrating a portion of the seam of FIG. 14;

FIG. 18 is a view similar to FIG. 14 illustrating an alternative waterproofing assembly of the present invention;

FIG. 19 is a side elevational view of the plug of the assembly of FIG. 18;

FIG. 20 is a top plan view of the plug of FIG. 19;

FIG. 21 is a top plan view of the assembly of FIG. 18 without the plug and in an open position;

FIG. 22 is an enlarged view of a portion of the seam of FIG. 18;

FIG. 23 is a side elevational view of another alternative waterproofing assembly of the present invention similar to that of FIG. 18 but with a detachable plug configured to accommodate two hose clamps as shown;

FIG. 24 is a top plan view of the unit of FIG. 23 with the hose clamps;

FIG. 25 is a side elevational view of the plug of the unit of FIG. 23 illustrated in isolation;

FIG. 26 is a side elevational view of a split lead pipe jack usable with the waterproofing assemblies of FIGS. 14, 18 and 23, for example, in a waterproof roof deck construction like that of FIG. 3;

FIG. 27 is a top plan view of the split lead pipe jack of FIG. 26;

FIG. 28 is a view similar to FIG. 14 of an alternative assembly;

FIG. 29 is a bottom plan view of the assembly of FIG. 28;

FIG. 30 is an enlarged, sectional bottom view of the slip joint of the assembly of FIG. 22;

FIG. 31 is cross-sectional view of the snap-in slip joint;

FIG. 32 is a side elevational view of an improved waterproofing assembly for use in a waterproof roof deck construction;

FIG. 33 is a top plan view of the skirt portion of the assembly of FIG. 32;

FIG. 34 is a bottom plan view of the collar plug portion of the assembly of FIG. 32;

FIG. 35 is a side elevational view of an improved waterproofing assembly as shown in FIG. 32, but with a split joint for retrofitting the skirt;

FIG. 36 is a top plan view of the skirt shown in FIG. 35;

FIG. 37 is a top plan view of the skirt shown in FIG. 35, before the skirt is formed into its generally cylindrical shape by locking its clasp into its locking slot;

FIG. 38 is a detailed view of the locking slot of FIG. 37;

FIG. 39 is a detailed view of the clasp of FIG. 37;

FIG. 40 is another detailed view of the clasp of FIG. 37;

FIG. 41 is a top plan view of the skirt portion of FIG. 32 when the skirt is formed with a series of skirting pieces locked together; and

FIG. 42 is a top plan view of an alternative design for the waterproofing assembly that accommodates two posts.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

Referring to the drawings, a waterproof roof deck post construction of the present invention is illustrated generally at 100. The method of constructing it is quick and easy. The steel contractor bolts the post 104 with a four-hole mounting bracket 108 welded thereto to the roof deck 112 using bolts 116. The post 104 can have generally any cross-sectional

shape (unlike the prior art construction of FIG. 2) including non-round shapes. An "L" shape is illustrated by post **104**, which more specifically is an angle iron brace. The steel contractor then slides a lead pipe jack **124**, a waterproofing assembly **128** of the present invention and a stainless steel hose clamp **132** over the top of the brace or post **104** and lets them fall to the deck for later installation.

Next, the roofing contractor installs roofing plies (typically three plies) over the entire building. He nails with nails **140** (FIG. 6) the flange **144** of the lead pipe jack **124** through the ply layers and into the roof deck **112**. The lead pipe jack **124** will typically have a three or four inch diameter and a four pound lead thickness. Instead of a lead jack, a cheaper standard galvanized steel roof jack can be used. Roofing plies **150** are stripped over the flange **144** thereby laminating the flange into the roof system. The finish layer of roofing materials (such as gravel or granule roll roofing) are installed over the ply layers.

The roofing contractor then slides the waterproofing assembly **128** over the leak flashing with its cone shape facing down. The stainless steel hose clamp **132** is placed in position on the waterproofing assembly and the clamp **158** tightened down. FIG. 5 shows dimensions **162, 166, 170, 174, 178, 182, 186, 190, 192, 194, 196, 198, 200, 202, 204** of 6.27, 3.64, 0.20, 0.07, 5.27, 0.25, 2.54, 0.80, 0.53, 0.07, 0.75, 3.04, 0.20, 1.50, and 7.87 inches, respectively. These are just sample dimensions, however, and it is within the scope of the invention to change dimensions, style, materials and heights above the roof deck as would be apparent to those skilled in the art.

The waterproofing assembly **128** is shown in isolation in FIGS. **9, 10** and **11**. It is seen therein that it has a collar portion **210** having an opening **214** therethrough, a downwardly-depending skirt **218**, a shoulder **222** connecting the collar with the skirt, and a top rim or flange **226**. These components according to one embodiment of this invention are integrally formed of EPDM molded rubber in a thermal process. This elastomeric construction allows the collar portion **210** to be squeezed by the hose clamp **132** to secure in a watertight manner the collar to the post **104**, preventing water from leaking between the opening and the post. Sample dimensions **230, 234, 238, 242, 246, 250, 254** and **260**, 0.51, 0.06, 1.00, 0.25, 3.11, R2.15, R2.63 and R1.50 inches, respectively, are shown in these figures.

The opening **214** will be configured to have the same shape as the cross-section of the post (brace) **104** to which it is to be attached. Common shapes for the openings **214** are illustrated in FIGS. *8a*, *8b* and *8c* as L shaped, square and hexagonal, respectively, at **214***a*, **214***b* and **214***c*.

If a post **104** (angle iron or other shaped brace) is already on a building and the waterproofing assembly **128** cannot be slid into position, a retrofit waterproofing assembly of this invention can be used as depicted in FIGS. **14–16** generally at **270**. It has sample dimensions **274, 278, 282, 286, 290, 294** and **296** of 0.51, 0.06, R1.38, R1.50, R2.15, R2.63 and 2.10 inches, respectively. It is used together with a split lead flashing jack (which is a commercially available product) as illustrated generally at **300** in FIGS. **26** and **27**. As shown in FIGS. **26** and **27**, the split lead flashing jack **300** has a bottom flange **304** at the bottom of the sleeve **308**, and an open seam **312** extends all of the way down the side. The split lead jack **300** can be a standard jack which is cut at the site to allow installation or it can be a special pre-cut jack. The split lead jack **300** has sample dimensions **320, 324, 326, 328, 332** and **334** of 15.50, 8.00, .125, R7.750 and R1.750, R1.813 inches, respectively.

The lead jack **300** is pulled open and wrapped around the existing support post (**104**). The lead metal of the jack **300** is soft enough to allow the jack to be opened and closed without using a separate hinge. The open seam **312** is then silver soldered closed with a propane torch. Lead material **338** overlaps to facilitate soldering.

Similar to construction **100**, the roofing contractor installs his ply sheets and the flange **304** of the lead jack **300** is nailed through the ply sheets to the roof deck. Extra ply sheets are stripped over the flange to laminate it into the roof systems. The finish layer of roofing materials are installed onto the roof plies.

The retrofit collar **338** and skirt **340** of retrofit waterproofing assembly **270** is opened on its seam **342** and fit around the support post (**104**). With the assembly in place, the slip joint **344** on the collar **338** and skirt **340** is slid or snapped into place. The watertight flap **360** will be positioned facing downward, as shown in FIG. **17**. A stainless steel hose clamp (**132**) is then positioned on the collar and clamped tight.

The support post construction (**100**) of this invention using either waterproofing assembly **128** or retrofit waterproofing assembly **270** can be used to support generally any rooftop construction as is done today. An example is to support fencing or an equipment screen, as shown in FIGS. **12** and **13** generally at **380**. Roof-mounted equipment fences or screens are often used at the perimeters of buildings to hide roof mounted machinery from ground view. The design as shown uses four front upright posts **384, 386, 388, 390** and four angled constructions **392** of this invention. The four front upright posts **384, 386, 388, 390** are mounted about sixteen inches apart as shown by dimension **400**. The angled (angle iron brace) constructions **392** are at a forty-five degree angle and are welded at their tops to the upright constructions. They have a forty-five degree lead jack **404** and use the same waterproofing assemblies **128** or **270** as discussed above.

The collar portion of the waterproofing assembly can be formed as a separate unit from the skirt portion as shown in FIGS. **18–21** by waterproofing assembly **420**. This can be for the standard or for the open-seam wrap around embodiments. This has the advantage that a single skirt portion **424** can be used for all types and shapes of support posts (**104**), and it is only the collar portion **428** with its different shapes of openings **432** (see FIGS. *8a*, *8b* and 8c) which varies. The separate collar **428** then acts like a plug to fit into the opening **436** at the top of the skirt **424** when pulled open as shown in FIG. **21**. The collar **428** has a parting line **438** which opens to allow for installation. The slip joint **440** and watertight flap **442** are illustrated in the enlarged view of FIG. **22**. Preferred dimensions **444, 446, 448, 450** are 0.51, 0.06, R1.38 and R1.48 inches, respectively. The (stainless steel) hose clamp (**132**) compresses and secures the plug **428** in place relative to the skirt **424** and the post (**104**). If needed, two clamps can be used, one above the other, as shown in FIG. **23** by hose clamps **452, 454**. The two clamp embodiment will likely require a longer or taller collar (plug) **460** as depicted in FIG. **25**.

The rim or flange **464** on the plug **460** allows for a positive stopping point when installing it into the construction. Also, it is a good waterproofing technique to let water that is flowing off the top of the plug **460** pass over the seam **470** of the collar and not into the seam. The flange **464** will overlap to the outside of the base of the collar.

FIGS. **28** and **29** show generally at **500** an alternative retrofit waterproofing assembly of this invention. It includes a slip joint **504** on the collar **508** and skirt **512**. FIG. **30** is

an enlarged view of the upper right portion of FIG. 29 showing in greater detail the slip joint 504 which allows the collar 508 to open.

Referring now to FIG. 31, an assembled EPDM rubber snap joint with flap is illustrated generally at 520 with the male insert 524 snapped with snap 528 into the female adapter 532. It functions generally similar to a ZIP LOCK bag. Unlike a typical plastic ZIP LOCK bag, the present assembly is made of rubber and its cross-section is different. Also, the snap and adapter areas are preferably made using a harder rubber than the rubber in the base collar. The collar is manufactured laying flat and then turned around to the point that the snap joint 520 can be pushed in by finger pressure. This is the only known roofing product that locks in place without tools.

Thus, the waterproof roof deck post constructions of this invention do not deform or shrink and thus prevent water from flowing into the roof penetration. Unlike the asphalt of the prior art Pitch Pocket, the waterproofing assembly will not crack over time requiring maintenance. The present constructions are also considerably cheaper and more attractive than the Pitch Pocket design. Additionally, the constructions of this invention are easier and quicker to install.

Also described herein is a waterproofing assembly 600, which includes several improvements to the waterproofing assembly 128 and the retrofit waterproofing assembly 270 (or 420). Although an improved waterproof roof deck post construction is described herein, construction details, methods and alternatives as previously described for other embodiments may be incorporated herein for this embodiment as would be apparent to those skilled in the art. Referring to FIG. 32, as with waterproofing assembly 420, the collar 605 of the improved waterproofing assembly 600 can be formed as a separate unit from the skirt 610. Again, this has the advantage that a single skirt 610 can be used for all types and shapes of support deck posts (104). Only the collar 605 with its different shapes of openings (see FIGS. 8*a*, 8*b* and 8*c*) varies. The collar 605 acts like a plug by fitting into the skirt opening 615. The collar 605 can also be constructed to accept more than one support deck post. For example, FIG. 42 shows a collar 605 with openings 214*d* and 214*e* to accept two L-shaped deck posts. The collar 605 and the skirt 610 can be formed of E.P.D.M. (Ethylene Propylene Diene Terpolymer) rubber.

In the improved waterproofing assembly 600, the collar 605 connects to skirt 610 by inserting a series of flanged tabs 620 located on the top circumferential shoulder of the skirt 610. In one embodiment, there are five flanged tabs. Other embodiments have more or fewer flanged tabs 620. The flanged tabs 620 allow the skirt 610 to wrap around a full three hundred and sixty degrees without distortion. In the previous waterproofing assemblies, which lacked the flanged tabs, there is a possibility that the skirt may distort and not bend well. The flanged tabs 620 minimize this problem.

To further improve the connection of the skirt 610 to collar 605, the collar may be provided with a series of tab-receiving cavities 625. In such an assembly, the flanged tabs 620 are inserted each into a tab-receiving cavity 625 to connect collar 605 with skirt 610. In another embodiment, the flanged tabs 610 may each also be provided with a projection 630. The flanged tabs 610 are inserted into the tab-receiving cavities 625 past the point of the projections 630. The projections 630 increase the pull-out resistance of the collar 605 from the skirt 610, thereby improving the connection of the collar 605 to the skirt 610.

As a further improvement, collar 605 may be built with a clamping recess 635 molded around the circumference of the collar 605. The hose clamp (132) or other such band can be placed within the clamping recess 635 before it is tightened to secure the collar 605 and skirt 610 about the deck post (104).

In prior embodiments, the collar or skirt may have been created with a split joint so that the waterproofing assembly could be retrofitted around a deck post (see FIGS. 14-17). In the retrofitted assembly, the collar and the skirt have split joints so that they can 17). In the retrofitted assembly, the collar and the skirt have split joints so that they can be wrapped around the deck post and then secured closed. Another improvement to the waterproofing assembly in one embodiment is the use of an improved system to securely close the skirt. In FIGS. 35 and 36, there is a skirt 610 with a split joint 640. FIG. 37 shows the skirt 610 in its state prior to being wrapped around a deck post and secured close. The split joint is closed by inserting the clasp 650 into the locking slot 645. When locked, the split joint is generally waterproof. The clasp 650 and locking slot 645 may be designed in several configurations. One such configuration is to have the clasp 650 shaped as a rectangular wedge and the locking slot 645 designed so that the rectangular wedge is forced through the locking slot's rectangular hole, locking the split joint. FIGS. 38 through 40 show the clasp 650 and locking slot 645 in greater detail.

The use of clasp 650 and locking slot 645 to close the split joint has another advantage, as can be understood from FIG. 41. In one embodiment, more than one skirt (referred to herein as 'skirting pieces') 610 can be connected together to form a larger overall skirt. In FIG. 41, two skirting pieces 610.1 and 610.2 are connected together to form a skirt. The clasp of skirting piece 610.1 has been forced into the locking slot of skirting piece 610.2 and the clasp of skirting piece 610.2 has been forced into the locking slot of skirting piece 610.1 so that the two skirting pieces form one skirt. By linking skirts together, one can increase the diameter of the skirt.

An advantage to this system is that different sizes of collars can be manufactured for use with smaller and larger deck posts. These various sized collars can all be assembled using just one size of skirt. For smaller collars, just one skirting piece is used to form the skirt. For larger collars, two or more skirting pieces are interconnected to form the skirt. For example, a small plug (perhaps with five tab-receiving cavities) may be used for waterproofing 2" by 2" metal deck posts using a single skirting piece for the skirt. A larger plug (perhaps equipped with ten tab-receiving cavities) may be manufactured for waterproofing 4" by 4" metal deck posts using two skirting pieces linked together as the skirt. Using this methodology, even larger plugs could be created to support more than two skirting pieces linked together.

In summary, disclosed herein are geometric collars created to waterproof various non-standard geometric shaped roof penetrations, such as fence posts, signs, and parapet wall supports. The construction of these collars are unique because they fit around existing roof penetrations by splitting apart, so that they can then wrap around roof penetrations, and locking onto them. This assembly creates a watertight umbrella, and watertight umbrellas are recommended in the roofing industry for counter flashing, standard flashings or roof jacks.

These geometric collars also fulfill N.R.C.A. (National Roofing Contractors Association) requirements. *The Handbook of Accepted Roofing Knowledge* (HARK) page 7,

Section VIII., *Mechanical Curbs and Penetrations states*: "The use of so-called 'pitch boxes' or 'pitch pockets' around penetrations should be avoided because they pose a constant maintenance problem." The present geometric collars are a low cost method for eliminating Pitch Pockets, as shown in FIG. 2. By utilizing a two or three piece design the size of the collar can be expanded to accommodate many different roof penetration sizes. Also, the diameter of the umbrella cone can be expanded by attaching two skirts together and using a larger diameter geometric plug.

From the foregoing detailed description, it will be evident that there are a number of changes, adaptations and modifications of the present invention which come within the province of those skilled in the art. However, it is intended that all such variations not departing from the spirit of the invention be considered as within the scope thereof.

What is claimed is:

1. A waterproof roof deck post construction, comprising:

a deck post having a cross-section and secured relative to a roof deck;

a sleeve surrounding a lower portion of the deck post; and

a waterproofing assembly including a collar and a skirt, the collar having an opening having generally the same cross-section as that of the deck post, the deck post being disposed in the opening, the collar formed as a plug, which is a separate piece from the skirt and adapted to be fitted into an opening in the skirt, the collar surrounding the deck post above a top of the sleeve, and the skirt extending down from the collar and out over the top of the sleeve;

wherein the skirt includes a circumferential shoulder having a plurality of flanged tabs for connecting the collar and the skirt.

2. The construction of claim 1 wherein the cross-section of the desk post is non-circular.

3. The construction of claim 1 wherein the collar is fitted with a series of tab-receiving cavities for accepting the plurality of flanged tabs.

4. The construction of claim 1 wherein the flanged tabs each include a projection for increasing the pull-out resistance between the connection of the collar and the skirt.

5. The construction of claim 1 further comprising a band surrounding the collar and securing in a generally watertight manner the collar to the deck post.

6. The construction of claim 5 wherein the collar includes a clamping recess for accepting the band surrounding the collar.

7. The construction of claim 1 wherein the skirt includes a split joint through the skirt, the split joint including a clasp and a locking slot, the locking slot fitted for the clasp, for closing the split joint in a generally watertight manner.

8. The construction of claim 7 wherein the clasp is a rectangular wedge.

9. The construction of claim 1 wherein the skirt includes a plurality of skirting pieces, the skirting pieces each having a split joint through the skirting piece, the split joint including a clasp and a locking slot, the locking slot fitted for the clasp, the skirting pieces interconnected in a generally watertight manner to form the skirt by locking the clasp of one skirting piece to the locking slot of an adjoining skirting piece.

10. The construction of claim 1 wherein the deck post defines a first deck post, and further comprising a second deck post having a cross-section and secured relative to a roof deck, and wherein the collar has an opening having generally the same cross-section as that of the second deck post.

11. A waterproofing assembly, comprising:

a collar for surrounding a deck post and being secured thereto in a generally watertight manner;

a skirt extending down from the collar and out over the deck post; and

the collar being formed as a plug which is a separate piece from the skirt and is adapted to be fitted into an opening in the skirt;

wherein the skirt includes a circumferential shoulder having a plurality of flanged tabs for connecting the collar and the skirt.

12. The waterproofing assembly of claim 11 wherein the collar is fitted with a series of tab-receiving cavities for accepting the plurality of flanged tabs.

13. The waterproofing assembly of claim 11 wherein the plurality of flanged tabs each include a projection for increasing the pull-out resistance between the interconnection of the collar and the skirt.

14. The waterproofing assembly of claim 11 wherein the collar has an opening having generally the same non-circular cross-section as that of the deck post.

15. The waterproofing assembly of claim 11 further comprising a band surrounding the collar and securing the collar to the deck post in a generally watertight manner.

16. The waterproofing assembly of claim 15 wherein the collar includes a clamping recess for accepting the band surrounding the collar.

17. The waterproofing assembly of claim 11 wherein the skirt includes a split joint through the skirt, the split joint including a clasp and a locking slot, the locking slot fitted for the clasp for closing the split joint in a generally watertight manner.

18. The waterproofing assembly of claim 17 wherein the clasp is a rectangular wedge.

19. The waterproofing assembly of claim 11 wherein the skirt is made from a plurality of skirting pieces, the skirting pieces each having a split joint through the skirting piece, the split joint including a clasp and a locking slot, the locking slot fitted for the clasp, and the skirting pieces interconnected in a generally watertight manner to form the skirt by locking the clasp of one skirting piece to the locking slot of the adjoining skirting piece.

20. The waterproofing assembly of claim 11 wherein deck post defines a first deck post, and the collar further has a second opening having generally the same cross-section as that of a second deck post.

21. The waterproofing assembly of claim 11 wherein the deck post is a roof deck post.

22. A method of constructing a waterproof roof desk post construction, comprising:

(a) securing a deck post having a cross-section to a roof deck;

(b) securing a sleeve surrounding a lower portion of the deck post;

(c) providing a waterproofing assembly including a collar and a skirt, the collar having an opening having generally the same cross-section as that of the deck post; the collar formed as a plug which is a separate piece from the skirt and adapted to be fitted into an opening in the skirt; and

(d) positioning the waterproofing assembly such that the deck post extends through the opening in the collar and the skirt extends down over a top of the sleeve;

wherein the providing a waterproofing assembly includes providing a circumferential shoulder on the skirt, the circumferential shoulder including a plurality of flanged tabs for connecting the collar and the skirt.

23. The method of claim 22 wherein the providing a waterproofing assembly includes fitting the collar with a series of tab-receiving cavities for accepting the plurality of flanged tabs.

24. The method of claim 22 wherein the providing a waterproofing assembly includes providing a projection on each of the plurality of flanged tabs, the projections increasing the pull-out resistance between the connection of the collar and the skirt.

25. The method of claim 22 further comprising applying a band around the collar to secure the collar in a generally watertight manner to the deck post.

26. The method of claim 25 wherein the applying a band around the collar includes applying the band within a clamping recess on the collar.

27. The method of claim 22 wherein the providing a waterproofing assembly includes providing a split joint through the skirt, the split joint including a clasp and a locking slot, the locking slot fitted for the clasp, for closing the split joint in a generally watertight manner.

28. The method of claim 27 wherein the providing a waterproofing assembly includes providing the clasp in a rectangular wedge form.

29. The method of claim 22 wherein the providing a waterproofing assembly includes providing the skirt made from a plurality of skirting pieces, the skirting pieces each having a split joint through the skirting piece, the split joint including a clasp and a locking slot, the locking slot fitted for the clasp, and interconnecting the skirting pieces in a generally watertight manner to form the skirt by locking the clasp of one skirting piece to the locking slot of the adjoining skirting piece.

30. The method of claim 22 wherein the deck post defines a first deck post, and further comprising securing a second deck post having a cross-section to a roof deck; and wherein the providing a waterproofing assembly includes the collar having a second opening having generally the same cross-section as that of the second deck post.

31. A method of constructing a waterproof roof desk post construction, comprising:

(a) providing a sleeve surrounding a lower portion of a deck post secured to a roof deck, the deck post having a non-circular cross-section;

(b) providing a waterproofing assembly including a collar and a skirt, the collar having an opening having generally the same non-circular cross-section as that of the deck post, the collar formed as a plug which is a separate piece from the skirt and adapted to be fitted into an opening in the skirt; and

(c) positioning the waterproofing assembly such that the deck post extends through the opening in the collar and the skirt extends down over a top of the sleeve;

wherein the providing a waterproofing assembly includes providing a circumferential shoulder on the skirt, the circumferential shoulder comprised of a plurality of flanged tabs, and connecting the collar to the skirt with the flanged tabs.

32. The method of claim 31 wherein the providing a waterproofing assembly includes providing the collar with a series of tab-receiving cavities and connecting the collar to the skirt by inserting the flanged tabs into the tab-receiving cavities.

33. The method of claim 31 wherein the providing a waterproofing assembly includes providing a projection on each of the plurality of flanged tabs, and inserting the flanged tabs on the skirt into the collar past the location of the projections on the flanged tabs so that the pull-out resistance between the collar and the skirt is increased.

34. The method of claim 31 further comprising after positioning the waterproofing assembly, applying a band around the collar to secure the collar in a generally watertight manner to the deck post.

35. The method of claim 34 wherein the applying a band around the collar includes placing the band within a clamping recess on the collar and then securing the band to the collar.

36. The method of claim 31 wherein the providing a waterproofing assembly includes the steps of providing a split joint through the skirt; the split joint including a clasp and a locking slot, opening the split joint, wrapping the skirt around the deck post at the top of the sleeve and locking the skirt in a generally watertight manner by inserting the clasp into the locking slot.

37. The method of claim 31 wherein the providing a waterproofing assembly includes the steps of providing a plurality of skirting pieces, the skirting pieces each having a split joint through the skirting piece, the split joint including a clasp and a locking slot, the locking slot fitted for the clasp, and then forming the skirt around the deck post at the top of the sleeve by locking the skirting pieces together in a ring formation by locking the clasp of one skirting piece into the locking slot of the adjoining skirting piece.

38. The method of claim 31 wherein the deck post defines a first deck post, the opening defines a first opening and the providing a waterproofing assembly includes the collar having a second opening having generally the same cross-section as that of a second deck post.

39. A waterproof roof deck post construction, comprising:

a deck post having a cross-section and secured relative to a roof deck;

a sleeve surrounding a lower portion of the deck post; and

a waterproofing assembly including a collar and a frusto-conical skirt, the collar having an opening having generally the same cross-section as that of the deck post, the deck post being disposed in the opening, the collar formed as a plug, which is a separate piece from the skirt and adapted to be fitted into an opening in the skirt, the collar surrounding the deck post above a top of the sleeve, and the skirt extending down from the collar and out over the top of the sleeve;

the skirt having a single split joint angled relative to a longitudinal axis of the skirt, allowing the collar and skirt to be opened up, wrapped around an elongate member securable to a roof deck, and closed in a watertight manner with a male-female arrangement and with the collar generally above the skirt and secured thereto.

40. A waterproof roof deck post construction, comprising:

a deck post having a cross-section and secured relative to a roof deck;

a sleeve surrounding a lower portion of the deck post; and

a waterproofing assembly including a collar and a frusto-conical skirt, the collar having an opening having generally the same cross-section as that of the deck post, the deck post being disposed in the opening, the collar formed as a plug, which is a separate piece from the skirt and adapted to be fitted into an opening in the skirt, the collar surrounding the deck post above a top of the sleeve, and the skirt extending down from the collar and out over the top of the sleeve;

wherein the skirt includes a plurality of skirting pieces, the skirting pieces each having a split joint through the skirting piece, the split joint including a clasp and a locking slot, the locking slot fitted for the clasp, the

skirting pieces interconnected in a generally watertight manner to form the skirt by locking the clasp of one skirting piece to the locking slot of an adjoining skirting piece.

41. The construction of claim 40 wherein the cross-section is non-circular.

42. A method of constructing a waterproof roof desk post construction, comprising:

(a) providing a sleeve surrounding a lower portion of a deck post secured to a roof deck, the deck post having a cross-section;

(b) providing a waterproofing assembly including a collar and a skirt, the collar having an opening having generally the same cross-section as that of the deck post, the collar formed as a plug which is a separate piece from the skirt and adapted to be fitted into an opening in the skirt; and

(c) positioning the waterproofing assembly such that the deck post extends through the opening in the collar and the skirt extends down over a top of the sleeve;

wherein the providing a waterproofing assembly includes providing a plurality of skirting pieces, the skirting pieces each having a split joint through the skirting piece, the split joint including a clasp and a locking slot, the locking slot fitted for the clasp, and then forming the skirt around the deck post at the top, of the sleeve by locking the skirting pieces together in a ring formation by locking the clasp of one skirting-piece into the locking slot of the adjoining skirting piece.

43. The method of claim 42 wherein the cross-section is non-circular.

44. A waterproof roof deck post construction, comprising:

a deck post having a cross-section and secured relative to a roof deck;

a sleeve surrounding a lower portion of the deck post; and

a waterproofing assembly including a collar and a skirt, the collar having an opening having generally the same cross-section as that of the deck post, the deck post being disposed in the opening, the collar formed as a plug, which is a separate piece from the skirt and adapted to be fitted into an opening in the skirt, the collar surrounding the deck post above a top of the sleeve, and the skirt extending down from the collar and out over the top of the sleeve;

wherein the skirt includes a single split joint through the skirt, the split joint including a clasp and a locking slot, the locking slot fitted for the clasp, for closing the split joint in a generally watertight manner, the skirt being a continuous solid piece from one side of the split joint to the other; and

wherein the skirt includes a circumferential shoulder having a plurality of flanged tab for connecting the collar and the skirt.

45. The construction of claim 44 wherein the collar is fitted with a series of tab-receiving cavities for accepting the plurality of flanged tabs.

46. The construction of claim 44 wherein the flanged tabs each include a projection for increasing the pull-out resistance between the connection of the collar and the skirt.

47. The construction of claim 46 wherein the clasp is a rectangular wedge.

* * * * *

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Bishop

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(54) **DRAIN PIPE CONNECTOR**

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(58) Field of Search 52/302.1; 285/42; 277/608; 210/163

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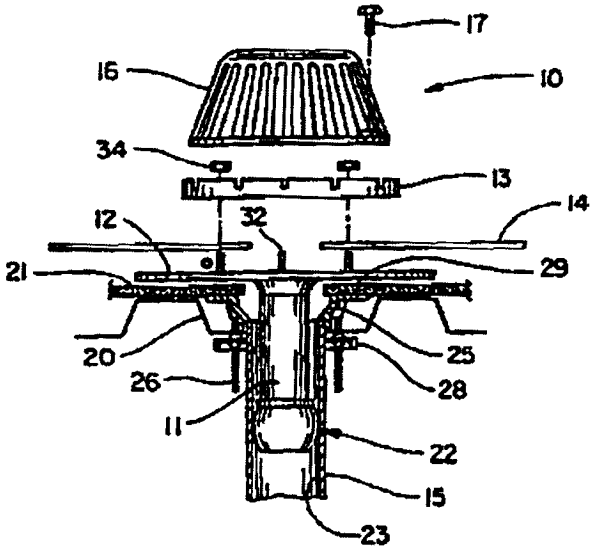
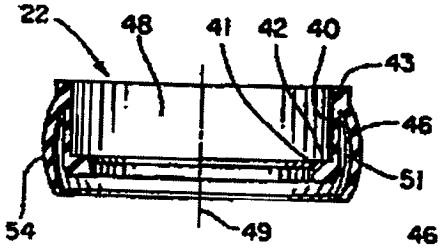
(57) **ABSTRACT**

A means to engage two vertical pipes or tubes of unlike and increasing size that have been co-inserted such as with a roof or floor drain, in a manner that prevents the contained fluid from overspilling when the said pipes become full or when the fluid flows in a direction opposite from normal gravity flow, which is generally considered as flow from the smaller to the larger pipe. The means of engagement closes the void between the inside diameter larger pipe and outside diameter smaller pipe to withstand fluid pressure in a way that accounts for angular misalignment, pipe or tube eccentricity, manufacturing tolerance, as well as tube condition and debris attached to either pipe sidewall. More specifically, a roof drain system for existing roofs or new construction including a flanged outlet pipe for insertion into the roof drain pipe with the flange mounted on top of the roof. A water straining system is mounted on top of the flange. The outlet pipe is sealed to the interior of the drain pipe by a one-piece rubber molding seal that flexes to easily slide into the drain pipe and withstands high backup water pressures from the drain pipe without leaking. The seal has a Shore A durometer in the range of 30 to 95 and has an annular portion engaging the outer surface of the outlet pipe and an integral flange portion extending outwardly and downwardly from the upper end of the annular portion that seals the inner surface of the drain pipe.

13 Claims, 2 Drawing Sheets





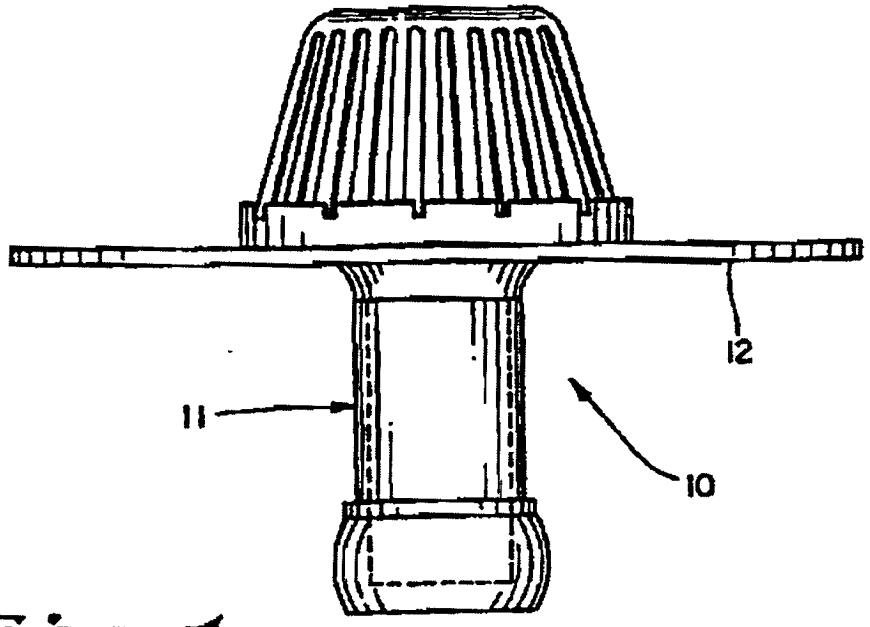


Fig. 1

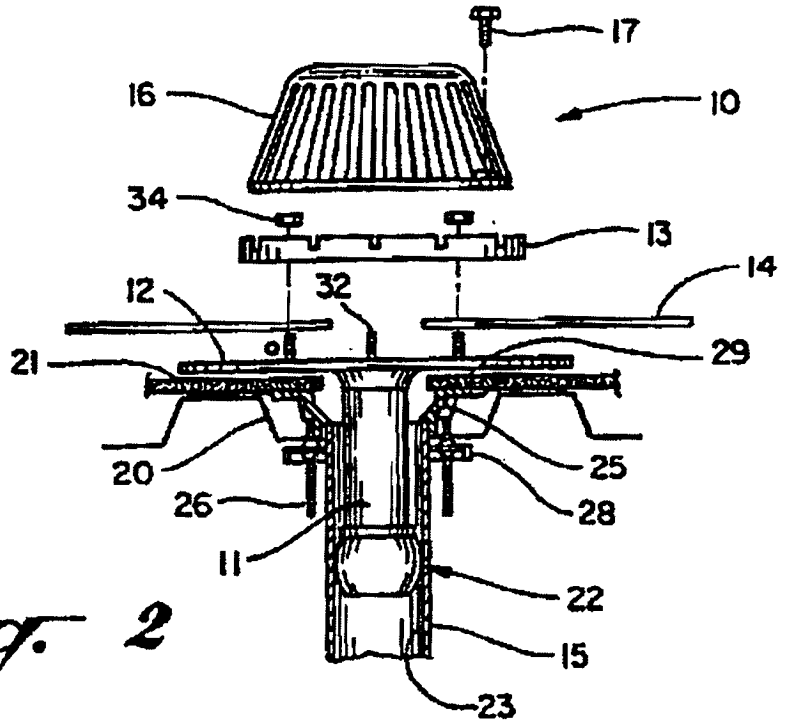


Fig. 2

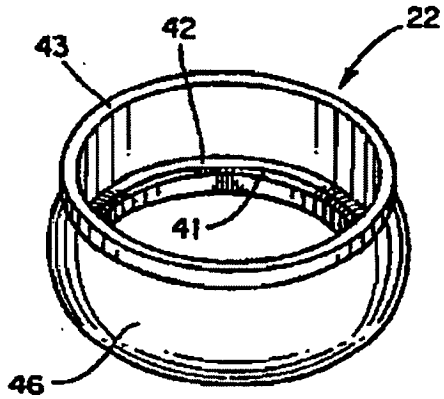


Fig. 3

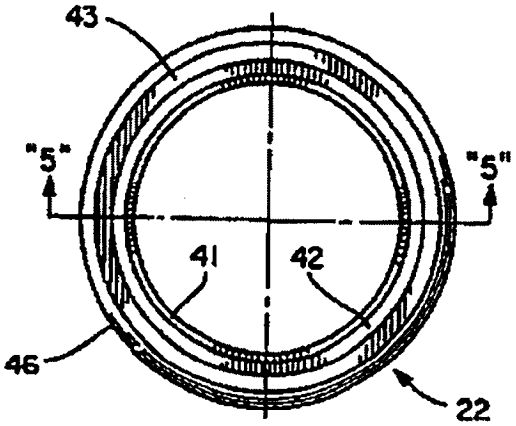


Fig. 4

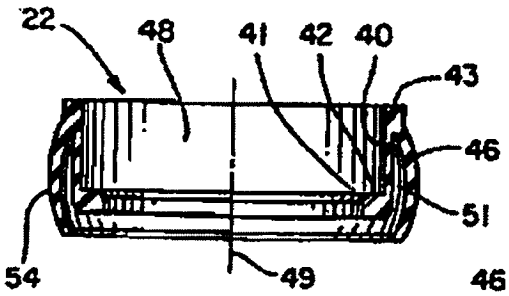


Fig. 5

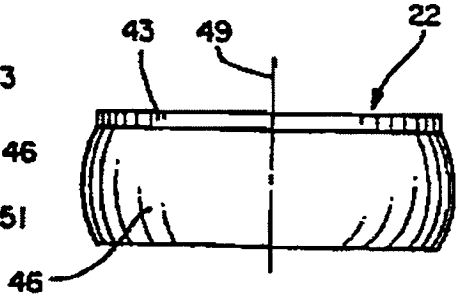


Fig. 6

DRAIN PIPE CONNECTOR

BACKGROUND OF THE INVENTION

The present invention relates to a flexible membrane device that assumes the gap between two unlike sized pipes or tubes, where as the smaller of the two pipes is inserted vertically downward into the larger pipe and the flexible membrane prevents egress of internal fluids outside of the pipe confines if, for example, the pipes become full and fluid pressure occurs, or if fluid flow direction is reversed and velocity pressure occurs. More specifically, the present invention relates to roof draining systems that are adapted to be retrofitted into existing roof drain pipes usually at the time the roof is re-roofed. It should be understood, however, that the principles of the present invention can be utilized in new construction as well as in re-roofing systems. Generally, re-roofing drain systems include an outlet pipe having an upper flange mountable on roof insulation or roofing material. In some cases, the outlet pipe is sealed to the interior of the drain pipe by a pre-compressed foam material but other forms of seals described below have been used as well. A rib on the top of this flange sometimes mates with a groove on a cast aluminum gravel guard collar, which in essence is a ring element that provides a flashing lock to the flange with a roofing membrane clamped between the collar and the flange. The flange and the outlet tube are frequently available in stainless steel, PVC, aluminum or high temperature ABS and are available to accommodate but not limited to 2, 3, 4, 5, and 6 inch drains. The drain can be installed on an existing roof top without special tools and the hardware is frequently stainless steel. A straining system is sometimes provided on top of the clamping ring that includes a one-piece dome-type strainer.

When re-roofing is necessary, the original drain systems must be replaced in part because of rusted bolts and frequently the gravel ring breaks upon removal.

The present invention relates particularly to the methodology for sealing the outlet pipe to the interior of the drain pipe. This is an essential function in re-roof drain systems because backup water pressure from the drain pipe, if it escapes around the outlet pipe, will find its way to an area underneath the roof and into the building interior.

One system for sealing designed by the assignee of the present invention is a pre-compressed foam tape glued to the exterior of the outlet pipe. Just prior to installation of the outlet pipe, the installer removes the pre-compressed tape permitting the foam to expand as the outlet pipe is inserted into the existing drain pipe. This system has been found satisfactory but in some cases, insertion into the drain pipe has been found difficult and if the outer diameter of the pre-compressed foam is decreased to facilitate insertion into the drain pipe, some leakage will occur particularly upon backup water pressures of 50 column feet or more. Immediately upon removing the tape and prior to the full expansion of the foam, the smaller pipe is inserted and positioned in the larger pipe. The foam continues to expand at a rate effected by ambient temperature and other conditions until restricted by the void between the two pipes. This system has been found satisfactory in some cases, but insertion into the drain pipe has been found difficult based on installer skill or speed, and ambient conditions. Unlike the present invention, this type seal may experience some leakage around the wrapped joint or through the foam material when subjected to fluid pressure.

Other roofing systems include one-piece rubber seals that are somewhat more relevant to the present invention than the above-described assignee's expandable foam system. One such seal is manufactured by Zurn Industries, Inc. of Pittsburgh, Pa., and it includes a one-piece elastomeric seal having a plurality of thin annular rings there-around that are integral with the seal.

Another re-roofing seal is made by Thaler Metal Industries, Inc., Model No. M-22, and this system includes a one-piece elastomeric seal constructed of EPDM Posiseal that is similar in construction to the Zurn seal described above.

U-Flow, Inc. has a mechanical compression seal adapter positioned immediately below the roof deck. This annular seal, Model Nos. UF-3 to UF-6 include a heavy annular section with an even heavier lower annular seal portion that engages the inside diameter of the drain pipe. This seal is largely inflexible. This seal requires axial compression with a plurality of threaded members after insertion into the drain pipe to effect radial expansion and sealing against the drain pipe, making it very difficult to operate and unpredictable. This product has a U.S. Pat. Nos. 4,505,499 and 4,799,713.

Marathon Roofing Products, Inc. of Buffalo, N.Y., has a U.S. Pat. No. 4,759,163, on a one-piece elastomeric seal that must be expanded in a similar manner to the U-Flow seal described above.

The RAC Roof Accessories Company, Inc., U.S. Pat. No. 5,141,633, includes a rubber seal to seal against back flow, constructed of a one-piece urethane member that extends below a frusto-conical lower end of the outlet pipe in the system that assists in urging the seal outwardly against the drain pipe. This seal is essentially just a thin annular ring except for the lower frusto-conical portion.

Other prior art utilizes a one-piece elastomeric seal having a plurality of thin annular rings there-around that are integral with the seal. One such manufacturer is Zurn Industries, Inc. of Pittsburgh, Pa. Another re-roofing seal is made by Thaler Metal Industries, Inc., Model No. M-22, and this system includes a one-piece elastomeric seal constructed of EPDM Posiseal that is similar in construction to the Zurn seal described above. Unlike the present invention, this type seal does not account for misalignment and could leak when witnessing high fluid pressure.

In all cases, prior art has shortcomings since each has its own unique problem with assembly methods, installer skill or tool requirements, self-alignment, and their inability to withstand high pressure when the drain becomes full and/or flow is reversed.

In short, the above prior art systems have been found to be both difficult to insert into the existing drain pipe and include difficult and complicated mechanisms for expanding the seal, and have not been found under testing to prevent leakage at backup pressures in excess of 50 column feet.

For the above reasons, it is a primary object of the present invention to provide a roof drain system with a seal for sealing the drain system to the drain pipe interior and eliminate the many problems noted above in prior art seals.

SUMMARY OF THE PRESENT INVENTION

In accordance with the present invention, a roof drain system is provided for existing roofs or new construction including a flanged outlet pipe for insertion into the roof drain pipe with the flange mounted on top of the roof. A water straining system is mounted on top of the flange. The outlet pipe is sealed to the interior of the drain pipe by a one-piece rubber molding seal that flexes to easily slide into the drain pipe and withstands high backup water pressures

from the drain pipe without leaking. The seal has a Shore A durometer in the range of 30 to 95 and has an annular portion engaging the outer surface of the outlet pipe and an integral flange portion extending outwardly and downwardly from the upper end of the annular portion that seals the inner surface of the drain pipe.

The present seal eliminates the necessity for complicated seal expanding components noted above in many of the prior art drain pipe sealing devices in roof drain systems. Toward these ends, the present seal includes the annular portion noted above that has a radial flange that engages the extreme lower end of the outlet pipe and this axially locates the seal with respect to the outlet pipe and furthermore resists upward movement of the seal relative to the outlet pipe upon backup water pressure in the drain pipe.

The seal is constructed of rubber but could also be constructed of other materials such as poly-urethane. It is a one-piece molding and the flange is spheroidal in configuration and has a radius of about 1.5 inches about a center spaced about 0.535 inches from the axial center line of the seal. In the 4 inch seal, i.e.; designed to seal against a 4 inch diameter drain pipe, the flange is flexible and forms a hydrostatic pocket between itself and the outer surface of the seal annular portion. Water pressure in this pocket serves to expand the frusto-spheroidal flange into engagement with the drain pipe interior as backup water pressure increases, providing a very effective seal and eliminating any seal leakage at backup pressures as high as 50 column feet or more.

Other objects and advantages of the present invention will appear more clearly from the following detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front plan view of a roof drain system according to the present invention;

FIG. 2 is an exploded, partly in section view, of the roof drain system according to the present invention shown installed into an existing roof and drain pipe assembly;

FIG. 3 is a perspective view of the present roof drain seal;

FIG. 4 is a top view of the roof drain seal shown in FIG. 3;

FIG. 5 is a longitudinal section of the roof drain seal according to the present invention, and;

FIG. 6 is a front plan view of the roof drain seal according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings and particularly FIGS. 1 and 2, a roof draining system is illustrated generally designated by the reference numeral 10 and is seen to include an outlet pipe 11 adapted to be inserted into an existing drain pipe 15, having fixed thereto a flat upper annular flange 12, to which a gravel guard collar or ring 13 is fastened, clamping a roofing membrane 14 there-between, and a dome-type straining molding 16 fastened to the ring by a plurality of fasteners 17.

The existing roof construction illustrated in FIG. 2 includes a corrugated sheet metal roof 20 covered by an insulation panel 21.

The flange 12 is fixed to the upper end of the outlet pipe 11 and the outlet pipe 11 has an annular seal 22, according to the present invention, that seals the outlet pipe to drain pipe interior surface 23. The upper end of the drain pipe 15 carries a bell housing 25 that is attached thereto by a plurality of fasteners 26 that extend through a drain pipe collar 28 and into a bell housing flange 29.

The outlet pipe flange 12 has a plurality of fasteners 32 projecting upwardly therefrom that extend through gravel collar 13 and are attached thereto by a plurality of nuts 34.

As seen in FIGS. 3 to 6, the seal 22 is a one-piece elastomeric molding preferably constructed of EPDM rubber, but other materials such as polyurethane with a similar durometer could be substituted. The seal 22 has a Shore A durometer in the range of 30 to 95, but preferably about Shore A 55 to minimize back pressure leakage from the drain pipe 15.

The seal 22 includes an annular portion 40 that engages the outer diameter of the lower end of the outlet pipe 11 and annular portion 40 has an inner diameter slightly less than the outer diameter of the outlet pipe 11 to securely hold the seal on the end of the outlet pipe. To further axially position the seal 22 with respect to the outlet pipe, a radially inward directed rim portion 41 is provided on the lower end of the annular portion 40 and it has an upper surface 42 that engages the radial end surface at the lower end of the outlet pipe 11 and this design further assists in resisting back pressure or upward pressure on the seal 22 caused by back pressure in the drain pipe 15. The annular portion, including the rim 41, has an axial length of about 1.250 inches for the 4 inch model of the present drain seal(all dimensions herein are for the 4 inch model), and it should be understood that the seal assemblies for the other size drain pipes are proportionately similar. Annular portion 40 has a wall thickness of about 0.075 inches below a heavier annular upper portion 43, which has a thickness of about 0.200 inches. Just below annular portion 43, a semi-spheroidal annular flange portion 46 is provided that engages the inner surface 23 of the drain pipe 15 to seal the outlet pipe 11 to the drain pipe and prevent back leakage from the drain pipe upwardly into the roof area.

The flange portion 46 has a radius of about 1.500 inches (again in the 4 inch version) scribed about a center 48 that is offset radially from seal axis 49 about 0.535 inches. The flange portion 46 has a decreasing wall thickness from annular portion 43 to its end 49 beginning at approximately 0.125 inches, decreasing to about 0.080 inches. The flange portion 46 forms an annular pocket 51 between its inner surface and the outer surface of the annular portion 40 which provides a hydrostatic reservoir for water back pressure within the drain pipe 15. This hydrostatic pressure in pocket 51 forces the flange portion 46 radially outwardly against the interior 23 of the drain pipe 15 increasing the sealing characteristics of the seal in response to increasing water back pressure. The relaxed maximum outer diameter of the flange portion 46 taken at about 54 in FIG. 5 is 4.060 inches, somewhat greater than the interior diameter of 4.00 inches of the existing drain pipe.

What is claimed is:

1. A roof drain system for annular roof drain pipes connected to a generally flat roof, comprising: a drain outlet pipe adapted to be inserted into the annular roof drain pipe, said outlet pipe having a flange for attachment to the roof, and a seal on the outside of the outlet pipe having a relaxed diameter about the same as the internal diameter of the roof drain pipe, said seal being constructed of a molded elastomeric material having an annular portion engaging the outer surface of the outlet pipe and an integral flange portion extending outwardly and downwardly from an upper portion of the annular portion, and means for preventing backup water pressure from escaping around the seal including said

integral flange portion expanding against the roof drain pipe in response to backup water pressure against the inside of the integral flange portion.

2. A roof drain system as defined in claim 1, wherein the seal is constructed of a one-piece rubber elastomer having a Shore A durometer in the range of 30 to 95.

3. A roof drain system as defined in claim 1, wherein the seal has a Shore A durometer about 55.

4. A roof drain system as defined in claim 1, wherein the annular portion of the seal has an annular flange portion at the lower end thereof adapted to engage the lower end of the outlet pipe and to axially locate the seal relative to the outlet pipe.

5. A roof drain system as defined in claim 1, wherein the flange portion is semi-spheroidal in shape.

6. A roof drain as defined in claim 1, wherein the flange portion is arcuate in cross-section and has an inner surface radially spaced from the outer surface of the annular portion.

7. A roof drain system for annular roof drain pipes connected to a generally flat roof, comprising: a drain outlet pipe adapted to be inserted into the annular roof drain pipe, said outlet pipe having a flange for attachment to the roof, and a seal on the outside of the outlet pipe having a relaxed diameter about the same as the internal diameter of the roof drain pipe, said seal being constructed of a molded elastomeric material having an annular portion engaging the outer surface of the outlet pipe and an integral flange portion extending outwardly and downwardly from an upper portion of the annular portion, the seal being constructed of a one-piece rubber elastomer having a Shore A durometer in the range of 30 to 95, and the annular portion of the seal having an annular rim portion at the lower end thereof adapted to engage the lower end of the outlet pipe and to axially locate the seal relative to the outlet pipe, and means for preventing backup water pressure from escaping around the seal including said integral flange portion expanding against the roof drain pipe in response to backup water pressure against the inside of the integral flange portion.

8. A roof drain system for annular roof drain pipes connected to a generally flat roof, comprising: a drain outlet pipe adapted to be inserted into the annular roof drain pipe, said outlet pipe having a flange for attachment to the roof, and a seal on the outside of the outlet pipe having a relaxed diameter about the same as the internal diameter of the roof drain pipe, said seal being constructed of a molded elastomeric material having an annular portion engaging the outer surface of the outlet pipe and an integral flange portion extending outwardly and downwardly from an upper portion of the annular portion, the flange portion being semi-spheroidal in shape, and the flange portion being arcuate in cross-section and having an inner surface radially spaced from the outer surface of the annular portion, and means for preventing backup water pressure from escaping around the seal including said integral flange portion expanding against the roof drain pipe in response to backup water pressure against the inside of the integral flange portion.

9. A roof drain system for annular roof drain pipes connected to a generally flat roof, comprising: a drain outlet pipe adapted to be inserted into the annular roof drain pipe, said outlet pipe having a flange for attachment to the roof, and a seal on the outside of the outlet pipe having a relaxed diameter about the same as the internal diameter of the roof drain pipe for preventing the entry of backup water from the roof draining to the area beneath the roof including said seal being constructed of a molded elastomeric material having an annular portion engaging the outer surface of the outlet pipe and an integral flange portion extending outwardly and downwardly from an upper portion of the annular portion, the flange portion being semi-spheroidal in shape, and the flange portion being arcuate in cross-section and having an inner surface radially spaced from the outer surface of the annular portion, said flange portion being sufficiently flexible to permit the insertion of the outlet pipe into the drain pipe and to increase sealing pressure against the drain pipe upon water backup from the drain pipe, and means for preventing backup water pressure from escaping around the seal including said integral flange portion expanding against the roof drain pipe in response to backup water pressure against the inside of the integral flange portion.

10. A roof drain system as defined in claim 8, wherein the seal is constructed of a one-piece rubber elastomer having a Shore A durometer in the range of 30 to 95 to minimize backup leakage past the seal.

11. A roof drain system as defined in claim 8, wherein the seal has a Shore A durometer about 55.

12. A roof drain system as defined in claim 8, wherein the annular portion of the seal has an annular rim portion at the lower end thereof adapted to engage the lower end of the outlet pipe and to axially locate the seal relative to the outlet pipe, the flange portion is semi-spheroidal in shape, and the flange portion is arcuate in cross-section and has an inner surface radially spaced from the outer surface of the annular portion.

13. A roof drain system for annular roof drain pipes connected to a generally flat roof, comprising: a drain outlet pipe adapted to be inserted into the annular roof drain pipe, said outlet pipe having a flange for attachment to the roof, and a seal on the outside of the outlet pipe having a relaxed diameter about the same as the internal diameter of the roof drain pipe, said seal being constructed of a molded elastomeric material having an annular portion engaging the outer surface of the outlet pipe and an integral flange portion extending outwardly and downwardly from an upper portion of the annular portion, the flange portion being semi-spheroidal in shape, and the flange portion being arcuate in cross-section and having an inner surface radially spaced from the outer surface of the annular portion, said seal being constructed of a one-piece rubber elastomer having a Shore A durometer about 55, the annular portion of the seal having an annular rim portion at the lower end thereof adapted to engage the lower end of the outlet pipe and to axially locate the seal relative to the outlet pipe, and the flange portion being arcuate in cross-section and having an inner surface radially spaced from the outer surface of the annular portion, and means for preventing backup water pressure from escaping around the seal including said integral flange portion expanding against the roof drain pipe in response to backup water pressure against the inside of the integral flange portion.

* * * * *

Firestone
SPECIALTY PRODUCTS

To: Dave Smith Fax: 574-522-228

Alpha Systems

From: Paul E. Oliveira Date: 7/19/2006

Re: EPDM Pipe Seal with tape Specs ,etc Pages: 21

CC: Mark Munley

☐ Urgent ☑ For Review ☐ Please Comment ☐ Please Reply ☐ Please Recycle

Dave,

Attached please find our purchasing specifications for our EPDM Pipe Flashings and QuickSeam Pipe Flashings, Pipe Flashing Clamps and our TPO Pipe Boots.

Please note the physical property and warranty requirements for all of the products including the clamping rings.

I believe this should give you all the information needed to quote and sample Firestone with parts produced by your company.

If you have any questions call me at my office 1-317-575-7186.

Thanks,

Paul

AS HOLDINGS vs. H&C MILCOR
Opposition No. 91182064
Serial No. 76/461,157
Deft. No. 14

ALP00529

4.35

PRODUCT SPECIFICATION
FOR
EPDM PIPE FLASHINGS
AND
QUICKSEAM PIPE FLASHINGS

Prepared By: Bill Wasitis 1/9/04
Bill Wasitis,
Accessory Engineer

Approved By: 1/9/04
Jeff Henegar,
Accessory and System Engineering Manager

Approved By: 1/2/04
Paul Oliveira,
Accessory Product Manager

ALP00530

Product Specification
For
EPDM Pipe Flashings
And
QuickSeam Pipe Flashings

1.0 Scope

1.1 This specification is for EPDM Pipe Flashings and QuickSeam Pipe Flashings which are to be used in conjunction with Firestone RubberGard® and Triumph Roofing Systems. The EPDM Pipe Flashing is a pre-fabricated pipe boot and the QuickSeam Pipe Flashing is a fabricated pipe boot that has a tape adhesive laminated to the bottom flange. Both boot types are to be used to flash pipes, rods or other similar penetrations on roofs. Both boot types can be used to flash a variety of pipe sizes from 1" O.D. to 6.875" O.D.

2.0 Typical Physical Requirement

2.1 Pipe Flashings (W56-RAC-1033 and-1063) - The pipe flashings shall be made of EPDM. Either Firestone Building Products Compound [redacted] or a Firestone approved alternate compound is acceptable. Any changes to an accepted compound must be submitted in writing to Firestone for approval before making the change.

2.2 QuickSeam Tape Material – For the QuickSeam Pipe Flashing, the tape adhesive shall be SP-510 for ADCO or an alternate approved by Firestone.

2.3 Primer - The QuickSeam tape shall be adhered to the pipe flashing with QuickPrime Plus or HSSP-1 primer.

2.4 Release Paper – The tape shall be covered with a piece of Firestone approved release paper that extends from the inside edge of the tape to the outside edge. The paper shall have one full-width cut through it for ease of removal during installation.

3.0 Physical Properties

3.1 The QuickSeam Pipe Flashing shall pass the dead load shear test when tested in accordance with the Test Specification W56-358-1002.

3.2 The EPDM compound used for pipe flashings must meet the minimum values as listed in B-1000 on Page 8 of this specification.

4.0 Physical Dimensions

4.1 The pipe flashings shall conform dimensionally to Figure 3 of this specification and the requirements listed in the Quality Assurance Test Form on Page 6 of this specification.

4.2 The QuickSeam tape thickness shall be .030"-.040".

4.3 The QuickSeam tape shall be flush to 1/8" beyond the flange edge.

5.0 First Article Submission and Inspections

5.1 Vendor shall submit to Firestone Technology one complete unit to this specification for First Article Inspection before production will be approved. The submission shall include a filled-out copy of the report form on page 6

ALP00531

of this specification or an alternate form approved by Firestone.

5.2 The vendor shall inspect finished pipe flashings at a frequency that will ensure Firestone receives only parts that meet this specification. A written certification indicating the lot number and test results shall be required with each shipment. Certification forms shall be sent to the attention of the Purchasing Agent.

5.3 Firestone may inspect samples of incoming material to assure that the product meets the requirements of paragraphs 2, 3, and 4.

6.0 **Packaging and Marking**

6.1 Packaging shall include 10 loose Breeze Jet clamps (Part Number 600-104 [illegible]) with the ten pipe flashings. The clamps shall meet the latest revision for Firestone Specification FBP-6090.

6.2 The box used for packaging shall be approximately [illegible] and for QuickSeam Pipe Flashings shall include a die cut divider to prevent the tape sticking to the inside of the box.

6.3 Box marking shall be by a label adhered to one side of the box and extending onto the top of the box. The label shall be type 1 in accordance with Labeling Specification FBP-12703. Label size shall be 5-1/2 x 11" and shall contain the information from Table 2 of the labeling specification. An example of the Firestone label is shown in Figure 1, and the Triumph label in Figure 2. The "WARNING" information should go on the top of the box.

6.4 A date code (month and year) shall be molded on the top surface of the pipe flashing flange.

6.5 A molded-in detail showing where to cut the pipe flashing for the desired pipe O.D. shall be molded on the top surface of the flange.

6.6 A date of packaging and lot number shall be ink stamped on the box for traceability. Size of font shall be 16 minimum.

6.7 The letters "BFDP" and "EPDM" shall be molded on the body of the large diameter as shown by Note 1 in Figure 3. Letters shall be approximately 5/16" high, Arial font. The letter sets shall be centered with each other and spaced approximately ¼" apart. The area containing the letters shall be rectangular unless otherwise approved.

7.0 **Warranty**

7.1 Supplier shall warrant the workmanship and the integrity of the pipe flashings for a period of 20 years to perform as intended when installed in accordance with manufacturer's specifications.

ALP00532

WARNING:

Do not store on roof in direct sunlight or at temperatures above 80°F (26.7°C). Keep box dry.

Firestone

QuickSeam Pipe Flashing
W56-RAC-1063

1" (2.5 cm) x 6" (15.2 cm) ID
QUANTITY: 10 Flashings and 10 Clamps, and Instruction Sheet

Firestone
BUILDING PRODUCTS
NOBODY COVERS YOU BETTER.®
525 Congressional Blvd.
Carmel, IN 46032-5607
11/02 Label No. Made in U.S.A.

Figure 1 – Firestone Label

ALP00533

WARNING:

Do not store on roof in direct sunlight or at temperatures above 80°F (26.7°C). Keep box dry.

Triumph

QuickSeam Pipe Flashing
W56-TRP-5761

1" (2.5 cm) to 6" (15.2 cm) ID
QUANTITY: 10 Flashings and 10 Clamps, and Instruction Sheet

1900 Lititz Rd.
825 Congressional Blvd.
Carmel, IN 46032-5607
Made in U.S.A.

Figure 2 – Triumph Label

ALP00534

EPDM PIPE FLASHING AND QUICKSEAM PIPE FLASHING TEST REPORT FORM

Supplier_____ Material_____

Date Assembled_____ By_____

Date Tested_____ Lot #_____

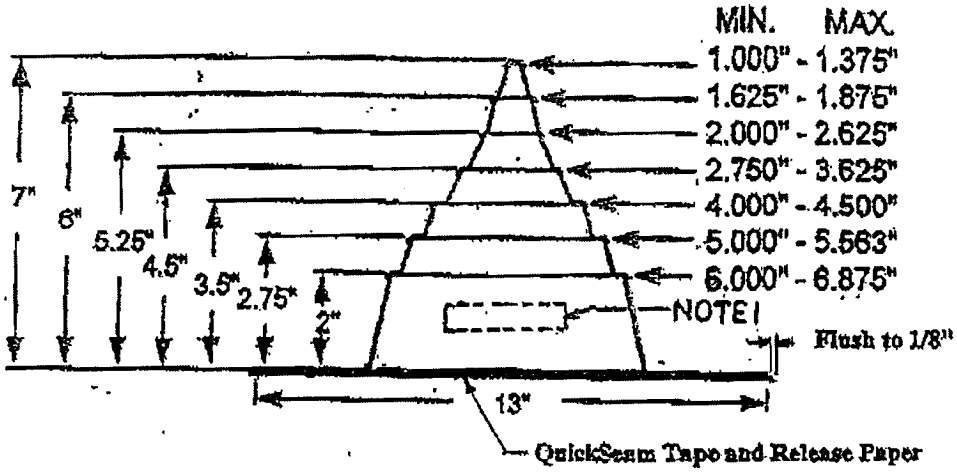
QUALITY ASSURANCE TEST REQUIREMENTS FOR PIPE FLASHINGS

Test		Specification
Base Polymer	_____	100 % EPDM
Color	_____	Black
Shore A Hardness (reading at 3 seconds)	_____	55 - 70
Dimensions (see Figure 3)		
1. (Thickness of flange and wall)	_____	0.055" - 0.075"
2. (Flange OD)	_____	13"
3. (Legibility of date code and all printing on parts)	_____	Paragraph 6.4-6.7
4. (Voids, air traps, splits, pitting, cured in flash, or surface blemishes or blisters)	_____	None
5. (Tensile strength, room temperature)	_____	1400 psi, minimum
6. (Elongation, room temperature)	_____	350%, minimum
7. (Die C tear, room temperature)	_____	190 lbf/in, minimum
8. (Tensile strength, after heat aging)*	_____	1300 psi, minimum
9. (Elongation, after heat aging)*	_____	250%, minimum
10. (Die C tear, after heat aging)*	_____	150 lbf/in, minimum
11. (Durometer, after heat aging)*	_____	80 Shore A, maximum
12. (QuickSeam Dead Load Shear Test) slippage	_____	less than 0.125"
13. (QuickSeam Tape Thickness)	_____	.030"-.040"
14. (QuickSeam Tape beyond flange)	_____	Flush to 1/8"

28 days @ 240F

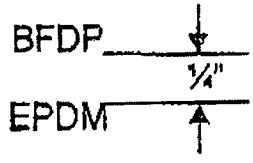
*Perform heat age testing on pipe flashings quarterly and submit data to Firestone.

AL000535



NOTES:

1. "BFDP" and "EPDM" to be molded and spaced as shown by Detail "A".
2. Tolerance on dimensions shown is ±0.06" unless otherwise noted.
3. Drawing shown is for QuickSeam Pipe Flashing. EPDM Pipe Flashing does not have tape on the flange.



Detail "A"

Figure 3: QuickSeam Pipe Flashing Dimensions

ALP005536

EPDM MATERIAL SPECIFICATIONS
B-1000

PROPERTY	TEST METHOD	PERFORMANCE
Specific Gravity	ASTM D-297	1.15 ± .05
Tensile Strength	ASTM D-412 (Die C)	1400 psi, minimum (9.6 MPa)
Elongation	ASTM D-412 (Die C)	350%, minimum
Tear Resistance	ASTM D-624 (Die C)	190 lbf/in, minimum (33.3 N/mm)
Shore A Durometer	ASTM D-2240	55 - 70
Ozone Resistance 7 days @ 100pphm@ 100°F with 50%extension	ASTM D-1149	No Cracks
Heat Aging 28 days @ 240°F	ASTM D-573	
Tensile Strength	ASTM D-412	1300 psi, minimum (8.9 MPa)
Elongation	ASTM D-412 (Die C)	250%, minimum
Tear Resistance	ASTM D-624 (Die C)	150 lbf/in, minimum (26.3 N/mm)
Shore A Durometer	ASTM D-2240	80 maximum
Brittleness Temperature	ASTM D-2137	-49°F (-45°C)
Resistance to Water change in weight after immersion 7 days @ 158°F, maximum, %	ASTM D-471	+8, -2
Water Vapor Permeability, max., perm mils	ASTM E-96	2.0
Tolerance on Nominal Thickness, %	ASTM D-751	± 10
Pipe Flashing Composition	ASTM D-297	
Weight percent of Polymer that is EPDM, %		100
Weight percent of material that is EPDM Polymer, %		30 minimum

ALP000537

THIS REVISION SUPERSEDES ALL PREVIOUS ISSUES 1.13

PRODUCT SPECIFICATION

FOR

PIPE FLASHING CLAMPS

Prepared By: William A. Wasitis 1/29/03
William A. Wasitis, Project Engineer

Approved By: 1-29-03
Paul Oliveira, Product Manager Accessories

ALP00538

Product Specification
For
Pipe Flashing Clamps

1.0 Scope

1.1 This specification is for Firestone Pipe Flashing Clamps, which are to be used in conjunction with all Firestone Single Ply Roofing Systems. Pipe Flashing Clamps are metal fastening devices used to secure Pipe Flashings, QuickSeam Pipe Flashings and Conduit Flashings to circular roof penetrations, and are expected to perform for the life of the Pipe Flashing.

2.0 Typical Physical Requirement

2.1 Pipe Flashing Clamps shall be of the [redacted] with a closed drive screw.

2.2 Material - [redacted] passivated. The clamps shall be warranted for the intended outside application for 20 years.

3.0 Physical Dimensions

3.1 The width of the clamp band shall be a 9/16" minimum and shall conform to the dimensions as shown in Figure 1 of this specification.

3.2 The clamps supplied under this specification shall have the following clamping ranges and part numbers:

3.2.1 UltraPly TPO and UltraPly 78+ Flashings – 1-1/16" to 4" – [redacted]

3.2.2 UltraPly TPO and UltraPly 78+ Flashings – 3 1/2" to 8 1/2" – [redacted]

3.2.3 Universal and Universal QuickSeam Flashings 1" – 6.875" – [redacted]

3.3.4 Conduit Flashing – ½" – 29/32" – 63008H B
7/8"-2 ¾" – [redacted]

4.0 Inspection

4.1 The Pipe Flashing vendor shall certify that the clamps meet this specification. The certification shall be included with the pipe flashing certification.

4.2 Firestone may inspect samples of incoming material to assure that the product meets the requirements of paragraphs 2.0 and 3.0. Parts not in compliance shall be returned.

ALP00539

5.0 **Packaging and Source of Supply**

5.1 Clamps shall be packaged loose, 10 clamps per carton, except for the Conduit Flashing, which shall have one 3 ¾" x 3" x 6" box of 10 clamps each size (20 total) per carton.

5.2 Approved Source of Supply:

[redacted]

6.0 **Warranty**

6.1 Clamps approved to this specification shall not be changed without the written approval of Firestone.

6.2 Clamps furnished to this specification shall be free of workmanship and material defects for a period of 20 years.

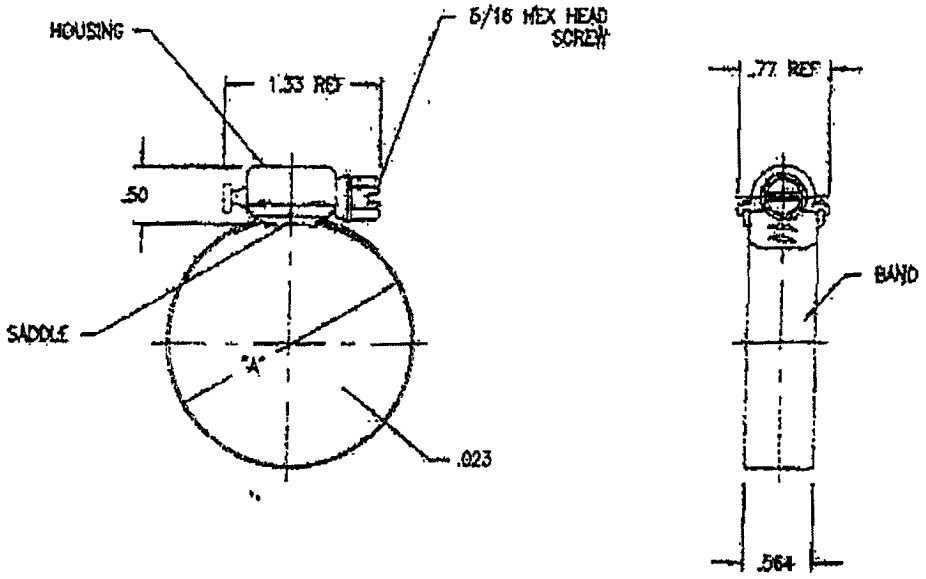


Figure 1: Clamp Dimensions

ALP00540

3.23

THIS COPY SUPERSEDES ALL PREVIOUS COPIES

PRODUCT SPECIFICATION

FOR

ULTRAPLY TPO

SMALL AND LARGE PIPE BOOTS

* See Note on 1.1

Prepared By: Bill Wasitis 1/29/03
Bill Wasitis, Project Engineer

Approved By: Richard Peng 1/29/03
Richard Peng, Technical Director

Approved By: 1-30-03
Paul Oliveira, Product Manager Accessories

ALP00541

Product Specification
for
UltraPly TPO
Small and Large Pipe Boots

1.0 Scope

1.1 This specification is for UltraPly TPO Pipe Boots to be used with Firestone UltraPly TPO Roofing Systems. Base polymer and weatherability of the UltraPly TPO Pipe Boots shall be the same as the UltraPly TPO Unsupported Flashing.

2.0 Typical Physical Properties

2.1 Base Polymer: Thermoplastic Polyolefin

2.2 Color: White, Gray or Tan

2.3 Dimensions

a. For Small Pipe Boot refer to Drawing W56-TPO-3012 on Page 8

b. For Large pipe Boot refer to Drawing W56-TPO-3013 on Page 9

2.4 Table I lists other physical properties for the UltraPly TPO Pipe Boots when tested in accordance with the respective ASTM test specification listed.

TABLE I

Physical Properties - Unaged	Test Method	Specification
Thickness	None	as per drawing
Tensile Strength	ASTM D-412	2500 psi (min)
Elongation	ASTM D-412	500% (min)
Tear Resistance	ASTM D-624 (die C)	250 lbs (min)
Low Temperature Brittleness	ASTM D-1790	-40°F or lower
Water weight change	ASTM D-570	4% (max)
Shore A Durometer	ASTM D-2240	80 ±10
Peel Strength	ASTM D-413-82	membrane tear

Physical Properties after Heat Aging 166 hours @ 240°F per ASTM D-573

Physical Properties - Aged	Test Method	Specification
Tensile Strength	ASTM D-412	2250 psi (min)
Elongation	ASTM D-412	450% (min)
Tear Resistance	ASTM D-624 (die C)	225 lbs (min)

AL000542

2.5 Clamps: Clamps shall be 300 Series stainless steel Oetiker Clamps, purchased from Breeze Industrial Products Corporation, Saltsburg, PA, 15681-9594. Refer to Firestone Specification FBP-6090 for clamp details.

- Large Pipe Boot Clamp – Part Number 6009128H1270B
- Small Pipe Boot Clamp – Part Number 6009562H1902B

3.0 **Qualification Tests and First Article Inspection**

3.1 Firestone shall conduct a series of qualification tests on each vendor's product. Successful passing of these tests shall qualify a vendor's product for use by Firestone. In addition, Firestone shall conduct such qualifications tests in-house as required to assure that a vendor's product continues to meet this product specification.

3.2 The qualification tests shall consist of the following as a minimum:

a. Tensile Strength per ASTM D-412
b. Elongation per ASTM D-412
c. Shore A Durometer per ASTM D-2240
d. Low Temperature Brittleness per ASTM D-1790
e. Peel Strength per ASTM D-413-82 conducted on 1" strip from the base flange of the UltraPly TPO Pipe Boot which is heat welded to Firestone UltraPly TPO membrane. Machine test speed shall be 2" per minute, 180° peel.

3.3 Prior to production vendor shall submit a complete unit for First Article Inspection by Firestone. The unit shall be representative of the final product, including the carton, label, marking, boots and clamps, unless otherwise specified by Firestone.

4.0 **Quality Assurance Tests**

4.1 Quality Assurance Tests listed in Table II shall be performed as a minimum by Firestone.

TABLE II

Physical Property	Test Method	Specification
Thickness	none	as per drawing
Tensile Strength	ASTM D-412	2500 psi (min)
Elongation	ASTM D-412	500% (min)
Tear Resistance	ASTM D-624 (die C)	250 lbs (min)
Dimensions	ASTM D-751	as per drawing

ALP000543

5.0 Inspection

5.1 Unless otherwise specified in the purchase order, a certificate of compliance to this specification will be accepted for individual lot shipments in lieu of actual test values.

5.2 Firestone shall inspect samples of incoming material to assure that the product meets the requirements of section 4.0, Quality Assurance Tests.

6.0 Reporting

6.1 All numeric data generated shall be recorded on the form provided in this specification or a certificate of compliance generated by the supplier and approved by Firestone.

6.2 One report form shall be used for each UltraPly TPO Pipe Boot tested. All test samples shall be retained for 30 days after testing.

7.0 Packaging and Marking

7.1 Packaging shall consist of 10 boots and 10 clamps per container. Containers to be 16 7/8"x16 7/8"x12" ESC Plain 32 ECT inside. The clamps shall be placed on the inside of the pipe boot stack inside the carton.

7.2 Marking shall be a hot stamp on the flange of the UltraPly TPO Pipe Boot with the Firestone "Shield" and "TPO" in PMS -185 Red.

7.3 The mold form number shall be metal stamped 1/8" nominal height so that the number is visible on the top of the flange in one place.

7.4 Each package shall have a Firestone Type 1 Label attached with the information shown in Table III. Label Numbers assigned boots to this specification are as follows:

- TPO Small Pipe Boot – Label No. 4
- TPO Large Pipe Boot – Label No. 5
- TPO Gray Small Pipe Boot – Label No. 9
- TPO Gray Large Pipe Boot – Label No. 10
- TPO Tan Small Pipe Boot – Label No. 11
- TPO Tan Large Pipe Boot – Label No. 12

7.5 Each package shall have a lot identification number either on a separate label adhered to the outside of the container or printed on the container a minimum size, 16 font.

7/18/06

8.0 WARRANTY.

8.1 SUPPLIER SHALL WARRANT THE WORKMANSHIP AND INTEGRITY OF THE PIPE FLASHING FOR A PERIOD OF 20 YEARS TO PERFORM AS INTENDED WHEN INSTALLED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.

ALP00544

Table III - Type 1 Label

Required Field	Firestone Logo in Red (size 48), PMS-185
Required Field	Product Name and Color in parenthesis (other than white or black) first line, (Arial, 48, Black), second line (Arial, 44, Black)
Required Field	Product Number (Arial, 44, Black)
Required Field	Quantity (Arial, 12, Black)
Optional Field	Instructions (Arial, 12, Black)
Required Field	Building Products Logo (12, Red Firestone only)
Required Field	Nobody Covers You Better Logo (Arial, 10, Black)
Required Field	Address (Arial, 10, Black)
Required Field	Label Design Date and No. (left side), (Arial, 6, Black)
Required Field	Made in U.S.A. (right side), (Arial, 10 Bold, Black)

Example Type 1 Label (not to size)

Firestone

UltraPly TPO - Gray
Molded Pipe Boots (Large)
W56-TPO-G013

Quantity: 10 Boots &10 Clamps
Fits 4" (101.6mm) to 8" (203.2mm) Outside Diameters

Firestone
BUILDING PRODUCTS

NOBODY COVERS YOU BETTER ®
226 Congressional Blvd.
Carmel, IN 46032-5607

Made in U.S.A.

ALP00545

UltraPly TPO
Small and Large Pipe Boot
Qualification Test Report Form

Supplier _____ Material _____
Date tested _____ Tested by _____

QUALIFICATION TESTS

Unaged Physical Properties	Sample 1	Sample 2	Accepted Value
Thickness			as per drawing
Dimensions			as per drawing
Tensile strength			2500 psi (min)
Elongation			500% (min)
Tear resistance			250 lbs (min)
Low temperature brittleness			-40°F or lower
Water weight change			4% (max)
Shore A durometer			80 ±10
Peel strength			membrane tear

Physical Properties after Heat Aging 166 hours @ 240°F per ASTM D-573

Aged Physical Properties	Sample 1	Sample 2	Accepted Value
Tensile Strength			2250 psi (min)
Elongation			450% (min)
Tear Resistance			225 lbs (min)

ALP005546

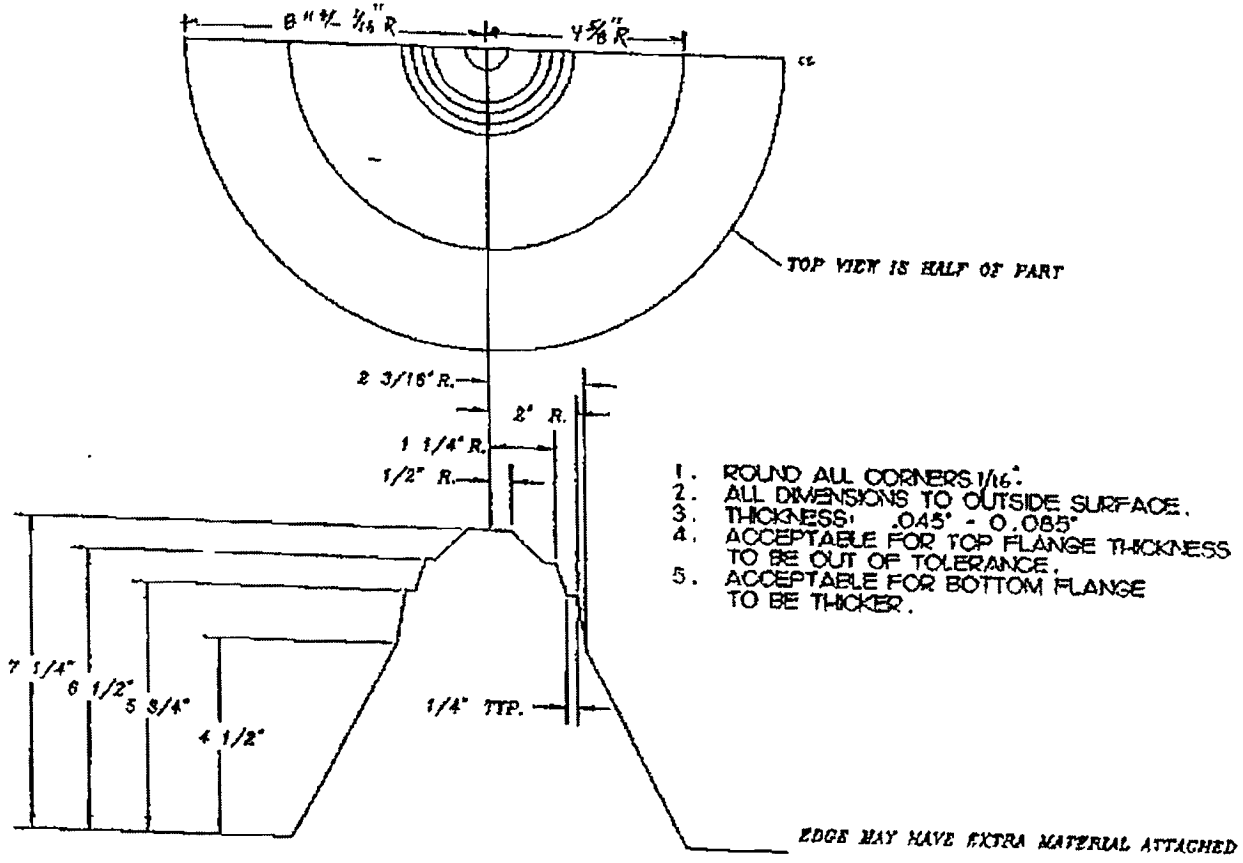
UltraPly TPO
Small and Large Pipe Boot
Quality Assurance Test Report Form

Supplier _____ Material _____
Date tested _____ Tested by _____

PHYSICAL REQUIREMENTS

Unaged Physical Properties	Sample 1	Sample 2	Accepted Value
Thickness			as per drawing
Dimensions			as per drawing
Tensile strength			2500 psi (min)
Elongation			500% (min)
Tear resistance			250 lbs (min)

AL000547



1. ROUND ALL CORNERS 1/16".
2. ALL DIMENSIONS TO OUTSIDE SURFACE.
3. THICKNESS: .045" - 0.085"
4. ACCEPTABLE FOR TOP FLANGE THICKNESS TO BE OUT OF TOLERANCE.
5. ACCEPTABLE FOR BOTTOM FLANGE TO BE THICKER.

NOTES:
1. ROUND ALL CORNERS
2. ALL DIMENSIONS TO OUTSIDE SURFACE.
3. THICKNESS: .045" - .085"
4. ACCEPTABLE FOR TOP FLANGE THICKNESS TO BE OUT OF TOLERANCE.
5. ACCEPTABLE FOR BOTTOM FLANGE TO BE THICKER.

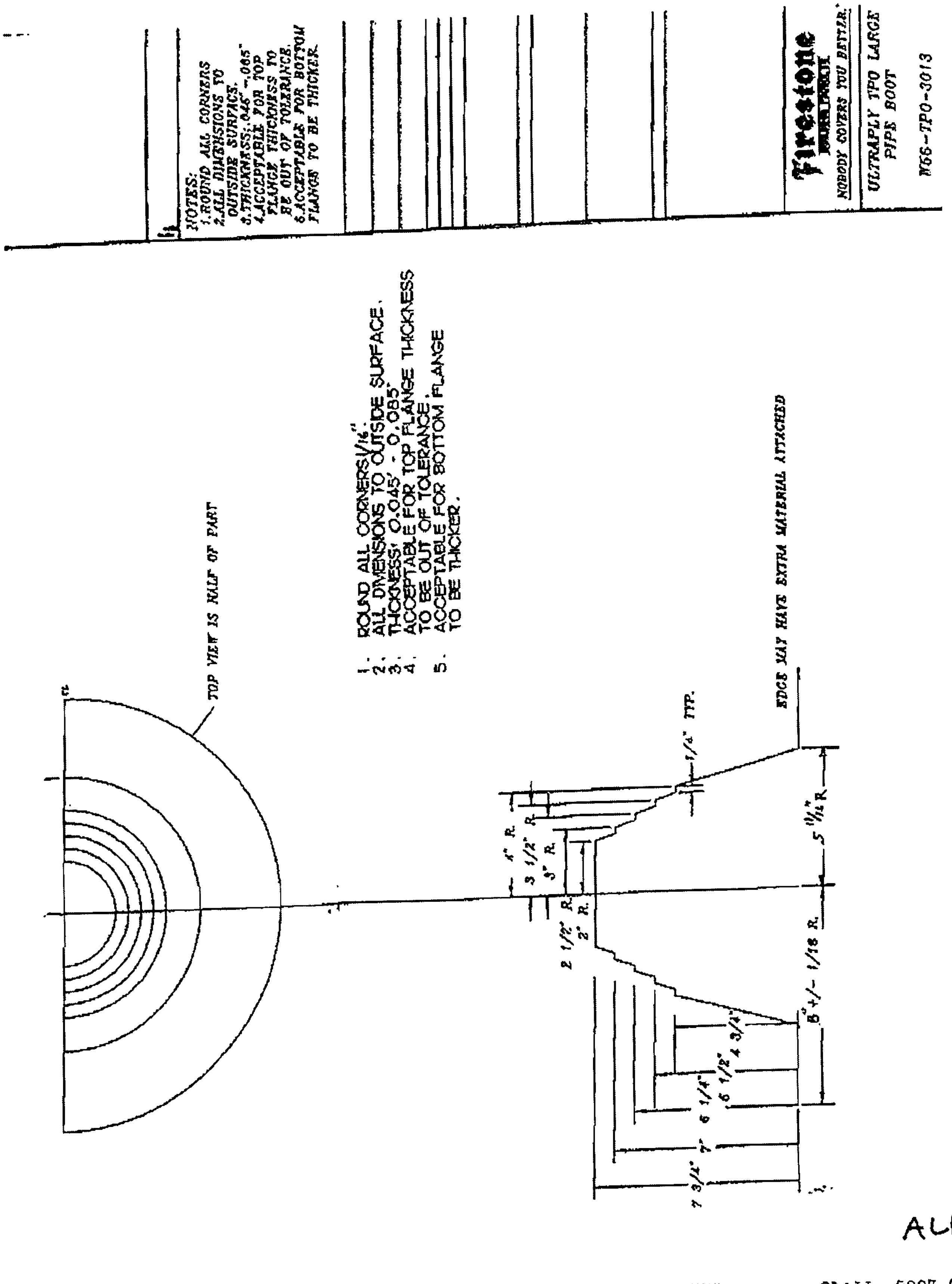
Firestone
NOBODY COVERS YOU BETTER.

ULTRAPLY TPO SMALL PIPE BOOT

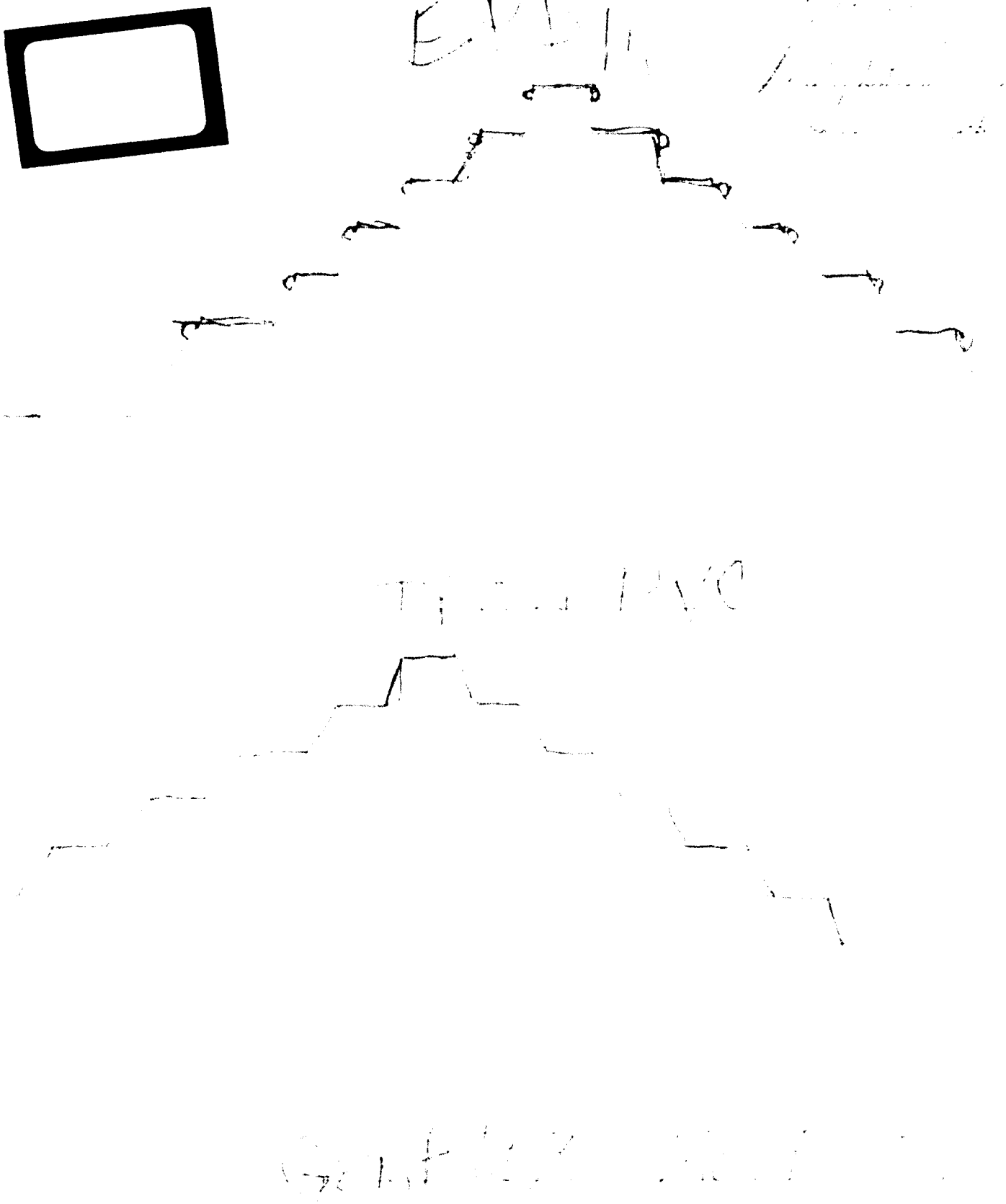
W56-TPO-3012

W56-TPO-3012, -3013
Issued November 12, 1998
Revised January 28, 2003
Page 8 of 9

ALP00548


NOTES:
1.ROUND ALL CORNERS
2.ALL DIMENSIONS TO OUTSIDE SURFACE.
3.THICKNESS:.045"-.085"
4.ACCEPTABLE FOR TOP FLANGE THICKNESS TO BE OUT OF TOLERANCE.
5.ACCEPTABLE FOR BOTTOM FLANGE TO BE THICKER.
Firestone
NOBODY COVERS YOU BETTER.
ULTRAPLY TPO LARGE PIPE BOOT
W56-TPO-3013
TOP VIEW IS HALF OF PART
1. ROUND ALL CORNERS 1/16".
2. ALL DIMENSIONS TO OUTSIDE SURFACE.
3. THICKNESS: 0.045" - 0.085"
4. ACCEPTABLE FOR TOP FLANGE THICKNESS TO BE OUT OF TOLERANCE.
5. ACCEPTABLE FOR BOTTOM FLANGE TO BE THICKER.
EDGE MAY HAVE EXTRA MATERIAL ATTACHED
1/4" TYP.
4" R.
3 1/2" R.
3" R.
2 1/2" R.
2" R.
5 11/16" R.
8" +/- 1/16 R.
4 3/4"
5 1/2"
6 1/4"
7"
7 3/4"

ALP0054



AS HOLDINGS vs. H&C MILCOR
Opposition No. 91182064
Serial No. 76/461,157
Deft. No. 15