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National Aeronautics and
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Washington, D.C.
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Reply to Attn of:

NASA Case No. MFS-28328-1

Print Figure 1

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Serial Number 07/458,065
Date Filed Dec 28, 1989

TECHNICAL ABSTRACT

NASA Case MFS-28328

This invention relates to a fitting for clamping and sealing a cylindrical member to pressure containers or to one another.

A device 10 for sealing and clamping a cylindrical element which is to be attached to an object such as a wall, a pressurized vessel or another cylindrical element. The device includes a gland 12 having an inner cylindrical wall 16, which is threaded at one end 18 and is attached at a bendable end 23 to a deformable portion 22, which in turn is attached to one end of a conical cantilever structure 20. The other end of the cantilever structure 20 connects at a bendable area 26 to one end of an outer cylindrical wall 24. The opposite end of cylindrical wall 24 terminates in a thickened portion 28, the radially outer surface of which is adapted to accommodate a tool for rotating the gland 12. The terminal end of cylindrical wall 24 also includes an abutment surface 35, which is adapted to engage a seal 36, which in turn engages a surface 32 of a receiver 14. Receiver 14 further includes a threaded portion 30 for engagement with the threaded portion 18 of gland 12 whereby a tightening rotation of gland 12 relative to receiver 14 will cause relative movement between cylindrical walls 16 and 24 of gland 12. This movement causes a rotation of the conical structure 20 and thus a bending action at bending area 26 and at the bending end 23 of the upper end of inner cylindrical wall 16. These rotational and bending actions result in a forcing of the deformable portion 22 radially inwardly so as to contact and deform a pipe 37. This forcible contact creates a seal between gland 12 and pipe 37, and simultaneously clamps the pipe in position.

The novelty of this invention is the provision of a cantilever shaped device for producing a swagging action on a cylindrical element to provide a clamping and sealing force around the element.

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Employer: United Technologies/Pratt & Whitney
Date Filed: December 28, 1989

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CANTILEVER CLAMP FITTING

ORIGIN OF THE INVENTION

The invention described herein was made in the performance of work under a NASA contract and is subject to the provisions of Section 305 of the National Aeronautics and Space Act of 1958, Public Law 85-568 (72 Stat. 435; 42 U.S.C. 2457).

TECHNICAL FIELD

The present invention relates to a device which utilizes the lever action of a cantilever shaped device to produce a ~~swagging~~ swaging action on a cylindrical element so as to clamp the element in place, to create a reliable seal around the element or to clamp and seal the element simultaneously. The cylindrical element may be a pipe, a probe or any cylindrical element which requires a clamping or sealing action. PBM 11/1

BACKGROUND OF THE INVENTION

It has long been a problem to clamp and seal cylindrical members to pressure containers or to one another. Typically the fittings used for this purpose are complex and in many cases unsatisfactory. Such fittings may require five or more parts and often require the use of special tools for flaring or ~~swagging~~ swaging. Use of such fittings also requires several procedural steps. In addition to the placement and alignment of the several parts, separate flaring or ~~swagging~~ swaging operations are often required. These operations require accurate measurements and proper technique which must be accomplished by technicians trained in this field of endeavor. PBM 11/15/89 PBM 11/15/8

Therefore, it is an object of this invention to provide an effective fitting which utilizes a minimum number of parts.

It is another object of this invention to provide a

fitting which is simple in operation whereby it may be utilized effectively by persons without special training.

It is another object of this invention to provide a fitting which is capable of providing an effective swaged connection to a cylindrical element by simply tightening the fitting and thereby obtaining simultaneously an effective clamping and sealing action.

It is another object of the invention to provide a fitting which is capable of being easily inspected due to external sealing as compared to the internal sealing of most prior art fittings.

Other objects of the present invention are to obviate the above mentioned and other shortcomings of the prior fittings described above.

SUMMARY OF THE INVENTION

The present invention is a device which utilizes the leverage of a cantilever type structure to produce a sealing and/or a clamping action on a cylindrical element. The device is particularly well suited to be used as a pipe/probe fitting.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is an elevational view of the invention being utilized as a pipe fitting or a clamp wherein a portion of the device is shown in section, and wherein the sealing or clamping area is exaggerated for clarity.

Figure 2 is an elevational view of the invention illustrating alternate sealing means and wherein the invention is utilized as a pipe fitting, wherein a portion of the device is shown in section, and wherein the sealing or clamping area is exaggerated for clarity.

Figure 3 is an elevational view of another alternate sealing form of the invention, wherein the invention is being utilized as a pipe fitting wherein a portion of the device is shown in section, and wherein the sealing or clamping area is exaggerated for clarity.

DETAILED DESCRIPTION OF THE DRAWINGS

The present invention is a device which utilizes the leverage of a conical cantilever type structure to produce a sealing and/or a clamping action on a cylindrical element. The device is particularly well suited for use as a pipe fitting and such use is illustrated in the drawings.

Referring now to Figure 1 the device is shown generally by numeral 10. The device, as illustrated, is a pipe fitting and consists of two primary elements, a gland 12 and a receiver 14. The gland 12 consists of a first cylindrical wall 16 located on the radially inner portion of gland 12. The cylindrical wall 16 includes a threaded portion 18 at one end thereof. The other end 23 of the cylindrical wall 16 is a bending area (indicated generally by circle A) which joins one end of a conical cantilever structure 20 to form a deformable end portion 22. The conical cantilever structure enlarges radially from said deformable end portion and connects at its radially larger end to one end of a second cylindrical wall 24 which is spaced radially outwardly from said first cylindrical wall 16. As shown, the second cylindrical wall extends toward the receiver 14 and terminates at or adjacent to said receiver when the gland 12 and the receiver 14 are threadedly engaged. A rocking or bending area 26 (indicated by circle B) is formed at the connection between the larger radial end of the conical cantilever structure 20 and the second cylindrical wall 24. As will be discussed in further detail later in this application, bending in area 26 may be controlled by variation of its' wall thickness. The terminal end of the second or outer cylindrical wall 24 is provided with a thickened portion 28, the radially outer surface 39 of which is formed for reception of a tool for rotation of the gland. The terminal end of cylindrical wall 24 also includes a flat abutment surface 35. The receiver 14 may be retained as an integral part of a wall or pressure vessel 15, as shown, or may be provided with a surface for reception of a tool

similar to the thickened portion 28 of the gland 12. The receiver 14 is provided with a threaded portion 30 which is adapted to receive the threaded portion of the gland 12. The receiver 14 is also provided with shoulder portions 32 and 34 either of which may be engaged directly or indirectly by the terminal abutment surface 35 of the second cylindrical wall 24 of the gland 12. As shown in Figure 1, contact between shoulder 32 and cylindrical wall 24 is made indirectly through a rigid seal 36. It is apparent however that the device is also functional without the use of a seal such as 36. It will be noted that the gland 12 and receiver 14 surround and are in close proximity with a pipe 37 which has been swaged in the area of the deformable end 22 of gland 12. Referring now to Figure 2, it is obvious that most basic elements of the disclosed device are similar to those illustrated in Figure 1. However, important differences exist in the construction of the deformable end portion of gland 42 and in the sealing surface between receiver 44 and gland 42. It will be noted that the conical cantilever portion 52 of the gland 42 includes a protrusion 53 which extends deeply into the pipe 69 which is to be sealed or clamped. This protrusion, depending upon its length, will deform the pipe a greater or lessor amount with a given rotation of the conical cantilever portion 52 as it is rotated radially inwardly by the bending of area 56. The greater the length of the protrusion 53 the greater will be the deformation of the clamped and/or sealed member 69. Prior to the illustrated tightened position the radially inner dimensions of the protrusion 53 will, of course, be larger than the outer dimensions of the element, in this case pipe 69, to which it is to be attached. The configuration illustrated in Figure 2 also includes a male extension 65 on the terminal end of the second or outer cylindrical wall 54. This extension 65 is adapted to abut shoulder 62 of receiver 44. As gland 42 is threadably tightened into receiver 44 a soft seal 66 is compressed on a beveled

surface 67 so as to retain desired pressure differential between the outside area surrounding the gland and the area within a pressure vessel (not shown) to which the retainer may be attached. Such an attachment may be made by welding or any desirable means. The modification as illustrated in Figure 3 is similar to that illustrated in Figure 2, except for the sealing means between the gland 72 and the receiver 74. It will be noted that a tapered male extension 95 is provided on the terminal end of the radially outer cylindrical wall 84. In the illustrated threadably tightened position, the tapered male extension 95 abuts the tapered surface 97 so as to form a seal between the gland 72 and the receiver 74. It will be noted that the angles of the tapers diverge slightly so as to provide a more effective conical seal. It will be further noted that the flat surfaces 94 and 96 of the gland 72 and receiver 74 respectively also contact one another. The contact between surfaces 94 and 96 prevents excessive deformation of the sealing surfaces of extension 95 and the surface 97 as the gland 72 and the receiver 74 are threadedly tightened.

Operation of this sealing and clamping device is best illustrated by reference to Figure 1 wherein the gland 12 and the receiver 14 are illustrated in a threadably tightened engagement. It is noted that prior to the tightening of the fitting, the radially inner surface of cylindrical wall 16 is formed as a straight cylinder. Thus this inner cylindrical surface is positioned in a parallel, radially spaced apart but proximate relationship with the radially outer surface of pipe 37. While a pipe is used in the illustrations, the fitting will operate equally well over a probe, or any similar structure. In operation, it will be understood that as a tightening rotational torque is applied to the threaded gland 12 opposing forces will be applied to the inner and outer cylindrical walls 16 and 24 respectively. As the tightening continues a leverage caused by the configuration of the conical cantilever structure 20 creates a bending moment which results in a

bending action at area 26 and generally along the upper bending portion 23 of the inner cylindrical wall 16. It is apparent that the described bending actions will cause the deformable end portion 22 to move radially inwardly so as to contact and deform or swage the pipe 37. The mating surfaces of the deformed portion 22 of the gland 12 and the corresponding deformed portion of the pipe create an effective clamping and sealing action between the gland 12 and the pipe 37. The modifications of the device, as illustrated in Figures 2 and 3, operate in a similar manner but utilize variations in the deformable or swaging portions of the gland which contact the pipe, and in the manner of the sealing between the gland and the receiver. It should be noted also that when the device is used in connection with a pressure vessel 15 as illustrated in Figure 1 the sealing of the gland will be pressure assisted when the pressure surrounding the gland is greater than that in the vessel.

It will be readily apparent that the construction of this device may be easily varied for different applications. For example, the thickness of the bending areas may be varied to produce the desired ratio of gland tightening torque to swaging depth. The resiliency of the gland material may be varied to suit a particular application. For example, a gland made from a relatively resilient material would return to it's original shape when loosened, thus permitting it's reuse. A more malleable material may be utilized to achieve desired sealing characteristics.

This device is also adaptable for use as a pipe coupler. Such an application would require only a receiver adapted to receive a gland and a pipe on either end.

While I have shown my invention in but one form it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications without departing from the spirit thereof.

ABSTRACT

A device 10, for sealing and clamping a cylindrical element which is to be attached to an object such as a wall, a pressurized vessel or another cylindrical element. The device includes a gland 12 having an inner cylindrical wall 16, which is threaded at one end 18 and is attached at a bendable end 23 to a deformable portion 22, which in turn is attached to one end of a conical cantilever structure 20. The other end of the cantilever structure 20 connects at a bendable area 26 to one end of an outer cylindrical wall 24. The opposite end of cylindrical wall 24 terminates in a thickened portion 28, the radially outer surface of which is adapted to accommodate a tool for rotating the gland 12. The terminal end of cylindrical wall 24 also includes an abutment surface 35, which is adapted to engage a seal 36, which in turn engages a surface 32 of a receiver 14. Receiver 14 further includes a threaded portion 30 for engagement with the threaded portion 18 of gland 12 whereby a tightening rotation of gland 12 relative to receiver 14 will cause relative movement between cylindrical walls 16 and 24 of gland 12. This movement causes a rotation of the conical structure 20 and thus a bending action at bending area 26 and at the bending end 23 of the upper end of inner cylindrical wall 16. These rotational and bending actions result in a forcing of the deformable portion 22 radially inwardly so as to contact and deform a pipe 37. This forcible contact creates a seal between gland 12 and pipe 37, and simultaneously clamps the pipe in position.

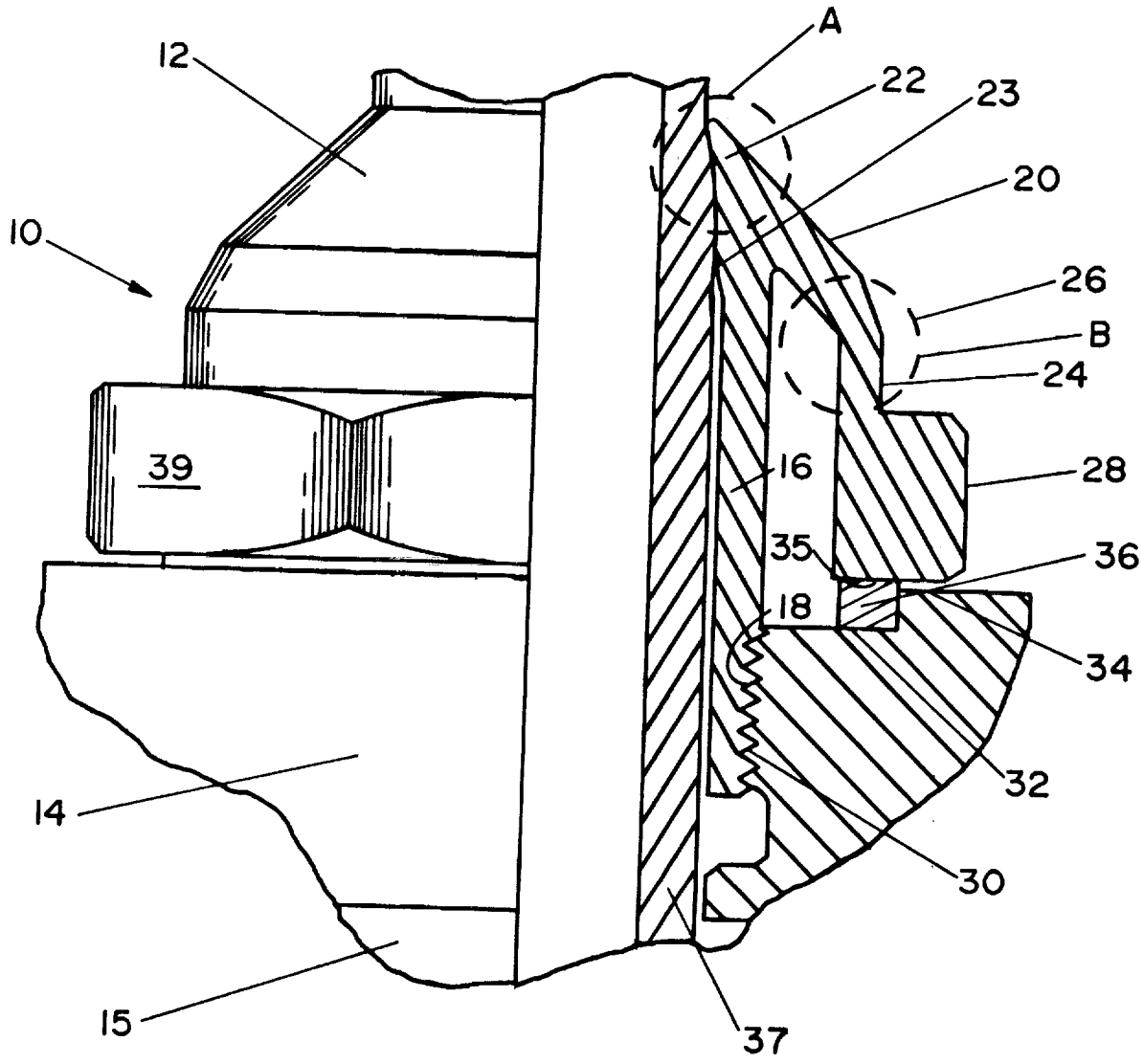

FIG. 1

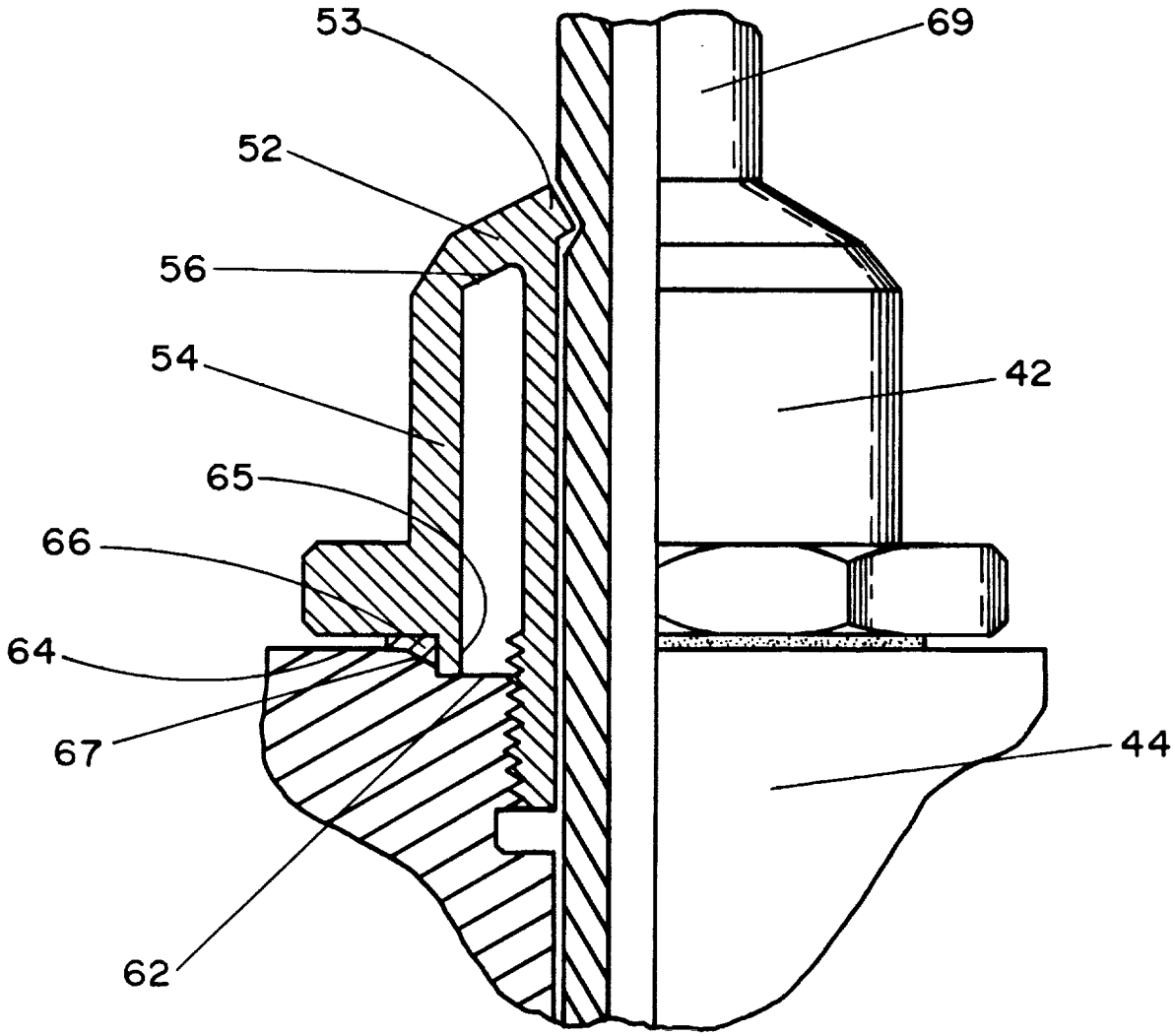

FIG. 2

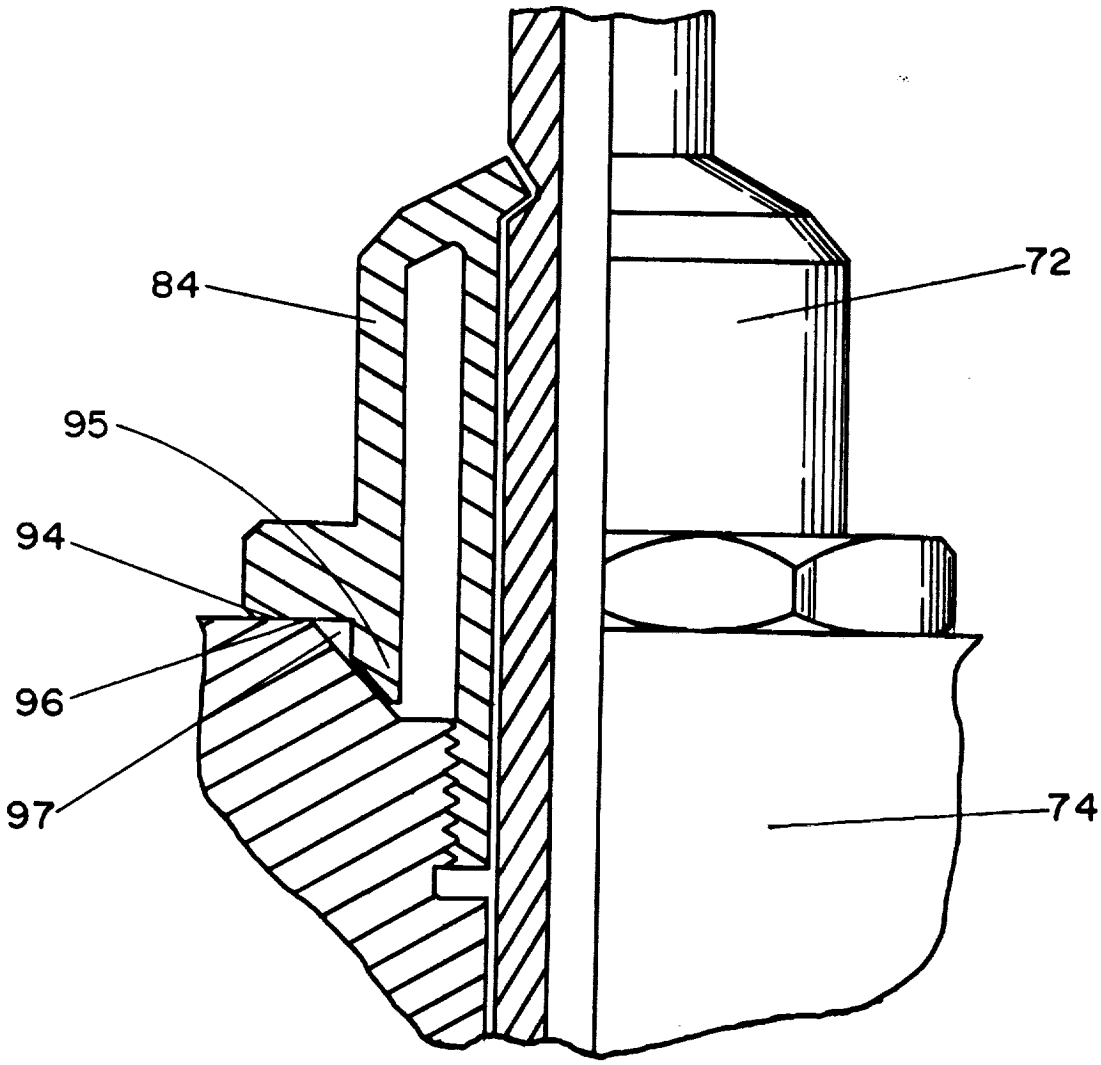

FIG. 3