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THERMAL SENSITIVE ELEMENT

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Fig. 1

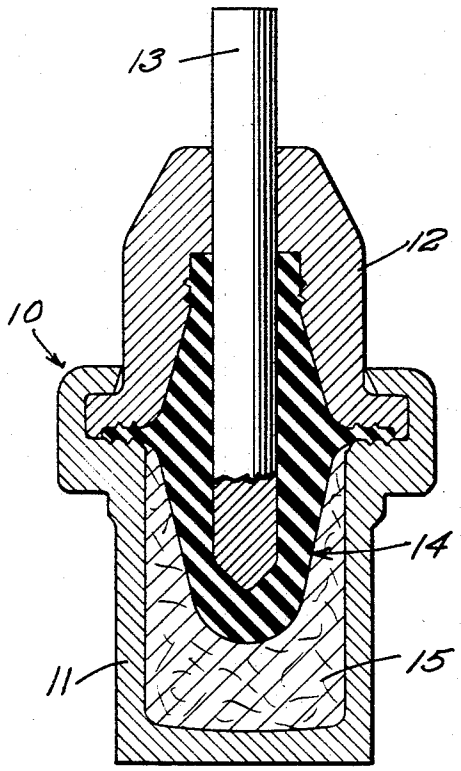
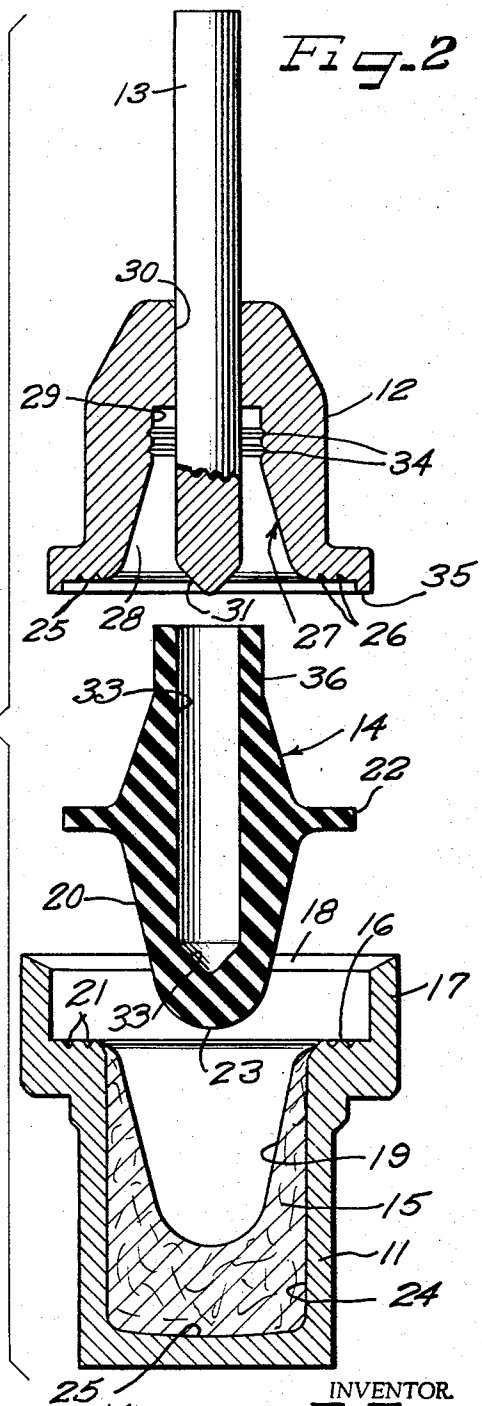


Fig. 2



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THERMAL SENSITIVE ELEMENT

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The present invention relates to a temperature responsive force transmitting device of the type having a diaphragm or piston boot which is seated within the casing thereof and more particularly relates to a novel and improved means for maintaining a positive fluid type seal between the casing and the boot.

Temperature responsive force transmitting devices of this general type customarily have a diaphragm or piston boot which has a peripheral lip or bead sandwiched between the upper and lower halves of the casing. Some difficulty has been experienced, however, in that the piston boot is subjected to considerable strains in use and the peripheral lip or bead tends to pull out of its original position. In doing so the casing to boot seal may be rendered imperfect and the life of the unit thereby shortened. Still further, in those devices which employ a boot of the type that fits over the inner end of the element piston, it has been found important to provide a means for preventing the boot from pulling away from the casing walls as the piston moves relative to the casing.

It is a principal and important object of the instant invention to obviate some of these and other disadvantageous characteristics of prior types of temperature responsive force transmitting devices.

More specifically, it is an object of the present invention to groove portions of the boot engaging casing walls and to put portions of the boot under compression to force portions thereof into the grooves to provide a better casing to boot grip so as to prevent relative movement between portions of the boot and the casing walls in those areas where such movement retardation is desired.

These and other objects, advantages and features of the present invention will become apparent from time to time as the following specification proceeds and with reference to the accompanying drawings, wherein:

FIGURE 1 is a vertical sectional view through a temperature responsive force transmitting device constructed in accordance with the principles of the present invention and showing a portion of the element piston in side elevation; and

FIGURE 2 is an exploded view of the device illustrated in FIGURE 1.

The temperature responsive force transmitting device **10** illustrated in the drawing comprises a base cup **11**, a piston guide cup **12**, a piston **13** guided for movement within the guide **12**, and a boot **14** which is positioned within the casing defined by the cup **11** and guide **12**. The cup **11** is filled with a thermally expansible wax **15** and is itself formed of a thermally conductive material. As is well known in the art, rises in temperature ambient the cup **11** will cause the wax **15** to expand and such wax expansion will act through the boot **14** to force the piston **13** to move extensibly from the guide **12**. Upon cooling of the wax **15** the piston **13** can be returned to the position shown in FIGURE 1.

As is best viewed in FIGURE 2, the base cup **11** has an outturned annular flange **16** formed about the open end thereof. An annular wall **17** extends upwardly from the periphery of the flange **16** and terminates in an inwardly chamfered lip **18**. In assembly, the wax **15** is preferably in the form of a pellet having an external surface conforming to the inner wall of the cup **11** and having a depression **19** formed therein which conforms generally to the shape of the base portion **20** of the boot **14**.

A pair of spaced V-shaped concentric continuous grooves **21** are formed in the upper surface of the flange **16** and constitute an important feature of the instant invention.

As has previously been noted, the base portion **20** of the boot **14** preferably conforms to the depression **19** formed in the solid wax pellet **15**. At any rate, the base portion **20** of the boot **14** depends from an outwardly extending resilient annular lip or bead **22** which bead is designed to seat upon the upper surface of the flange **16**. It will be observed that the base portion **20** of the boot **14** tapers to a rounded end **23** from the bead **22** and this rounded end is spaced from the inner side wall **24** of the base cup **11** and from the bottom **25** of the cup so that expansion of the wax **15** surrounding the base portion **20** will force the same upwardly and will thereby force the piston **13** to move extensibly from the guide **12**.

It will be observed that in the unstressed condition shown in FIGURE 2, the diameter of the annular bead **22** is great enough so that the bead extends over the outermost groove **21** but terminates short of the upstanding annular wall **17**.

The piston guide cup **12** has an outturned annular flange **25** which has a diameter equal to the inner diameter of the upstanding annular wall **17** so that the periphery thereof fits snugly within the annular wall **17** and this flange also has a pair of spaced V-shaped concentric continuous grooves **26** formed on the under surface thereof. A well **27** is formed within the guide **12** and converges along a tapered section **28** to a cylindrical section **29** which is adjacent and coaxial with a bore **30**. The cylindrically shaped piston **13** is guided for movement within the bore **30** and has a conical inner end **31** which fits within a well **33** of the boot **14** having a V-shaped inner end **33**.

A pair of spaced V-shaped concentric and continuous grooves **34** are formed within the cylindrical section **29** of the well **27** to provide a positive fluid tight seal between the boot **14** and the casing.

A rim **35** depends from the periphery of the annular flange **25** a distance which is somewhat less than the thickness of the bead **22** when that bead is in an unstressed condition. The thickness of the rim **35** is also somewhat less than the distance between the outermost groove **21** and the upstanding annular wall **17**. The inner diameter of the rim **35** is, in fact, approximately equal to the outer diameter of the annular bead **22**.

As a consequence, when the base cup **11** and the guide cup **12** are placed in assembled relation the rim **35** is seated on the flange **16** so that the amount of compression of the bead **22** is exactly determined and such squeezing of the bead **22** acts through the relatively incompressible rubber boot **14** to force parts of the neck portion **36** of the boot into the grooves **34** as portions of the bead **22** are likewise forced into the grooves **21**. To this end, the outer diameter of the neck portion **36** is somewhat greater than the inner diameter of the cylindrical section **29**. The resilient bead **22** and the neck portion **36** may be said to be "non-conforming" to the cooperable surfaces of the casing. By "non-conforming" it is meant that the bead and neck do not take on the general shape of the grooved associated casing surfaces when in an unstressed condition. When placed under suitable pressure, however, the non-conforming surfaces become conforming, as the boot material is resiliently forced into the grooves. It will be understood that all beads of this character will to some degree deform or become more conforming to the abutting surfaces. But, here, "non-conforming" refers to a difference in the general character of the material configuration.

It will also be noted that the grooves **21** and **26** are non-aligned when the flanges are secured together as shown in FIGURE 1. This nonalignment allows the bead material to be more tightly forced into the grooves. If the grooves were aligned, for instance, voids would exist on both sides of the bead at the same radial point and at that point, there would be no abutting flange to resiliently force the boot material into the grooves.

The base cup **11** and guide cup **12** are maintained in this assembled relation by peening or spinning the annular wall **17** over the flange **25** in the manner shown in FIGURE 1.

It will be understood that this embodiment of the instant invention has been used for illustrative purposes only and that various modifications and variations in the invention may be effected without departing from the spirit and scope of the novel concepts thereof.

I claim as my invention:

1. A temperature responsive force transmitting device comprising:

a cup containing a thermally expansible material and having an out-turned flange,

a piston guide having an out-turned flange,

one annular groove formed within each flange,

a resilient boot having an integral annular bead formed therearound and having a nonconforming surface overlying said annular groove,

means interconnecting said flanges and compressing said bead therebetween and causing the bead material to be resiliently forced into and conforming to the groove.

said groove in the cup flange and the groove in the guide flange being circumferentially non-aligned,

a piston guided for rectilinear movement within said guide and seated on the boot,

whereby expansion of the thermally expansible material will cause said piston to move extensively from said guide and wherein the resilient forcing of the bead material into the groove seals the flanges and resists radial inward forces exerted on the bead.

2. A temperature responsive force transmitting device in accordance with claim **1** wherein at least two grooves are formed in each of said flanges and wherein the grooves in the cup and the grooves in the guide are circumferentially non-aligned.

3. A temperature responsive force transmitting device comprising:

a cup containing a thermally expansible material and having an out-turned flange,

a resilient boot having an integral annular bead formed therearound and lying on said flange and having a base portion extending within said cup and a neck portion extending in an opposite direction from the said bead,

a piston guide having an out-turned flange seated on said bead and having a well fitting snugly around said neck portion of said boot,

a piston guided for rectilinear movement in said guide and extending through said neck portion of said boot seated on the said base portion thereof,

whereby expansion of the said thermally expansible material will cause said piston to move extensibly from said guide,

a continuous groove formed about the inner wall of said guide within the said well,

said neck portion having an initially non-conforming surface overlying said groove,

means interconnecting said flanges with one another and placing said neck portion of said boot and said bead under compression and resiliently forcing portions of said boot into said groove and causing said neck portion to conform to said groove.

4. A temperature responsive force transmitting device comprising:

a base cup formed of a heat exchange material and containing a thermally expansible material and having an out-turned annular flange,

a resilient boot having an integral annular bead formed therearound and lying on said flange and having a base portion depending therefrom within said base cup and a neck portion extending upwardly therefrom,

a piston guide cup having a well fitting snugly around the said neck portion of said boot and having an out-turned flange seated on said bead,

a rim formed about the periphery of one of said flanges and extending therefrom a distance less than the thickness of said bead in its unstressed condition,

a piston guided for rectilinear movement within said guide and seated on said base portion of said boot,

whereby expansion of the said thermally expansible material will cause said piston to move extensibly from said guide,

a plurality of continuous spaced grooves formed along the inner wall of said guide cup within said well and within the bead engaging faces of each of said flanges,

said bead and said neck portion being initially non-conforming to said grooves,

an annular wall extending outwardly from one of said flanges around the other of said flanges and crimped over the other of said flanges and maintaining said rim in engagement with the first mentioned flange and resiliently forcing said bead and said neck portion of said boot into the said grooves, and causing said non-conforming surfaces to conform to said grooves.

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