United States Patent [19]

Frassica

[11] **3,826,396**

[45] **July 30, 1974**

[54] **DOUBLE SEAL CLOSURE PLUG**

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[73] Assignee: **C. R. Bard, Inc.,** Murray Hill, N.J.

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[52] **U.S. Cl.** **215/234,** 277/135

[51] **Int. Cl.** **B65d 41/24**

[58] **Field of Search** 215/6, 40, 47, 56, 74, 215/80; 138/89; 277/135

[56] **References Cited**

UNITED STATES PATENTS

1,451,937	4/1923	Arnold	215/74
3,072,831	1/1963	Kurland	215/80
3,164,279	1/1965	Towns	215/47
3,499,568	3/1970	Riera	215/43
R25,146	3/1962	Huck	215/13

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Assistant Examiner—R. E. Hart
Attorney, Agent, or Firm—C. E. Martine, Jr.

[57] **ABSTRACT**

A closure plug for a tubular opening as in the neck of a receptacle or at the end of a conduit, wherein a plug portion enters the opening with a close fit to constitute a mechanical seal, while an outer skirt portion of the plug forms an annular enclosed recess about the exterior of the opening, an axially movable piston in the top of the plug being forced into a cylindrical chamber in the plug to drive a quantity of sealing (sterilizing) liquid from said chamber into the recess to form a liquid barrier seal around the exterior of the opening, the lip of the opening being thus enclosed externally and internally.

12 Claims, 7 Drawing Figures

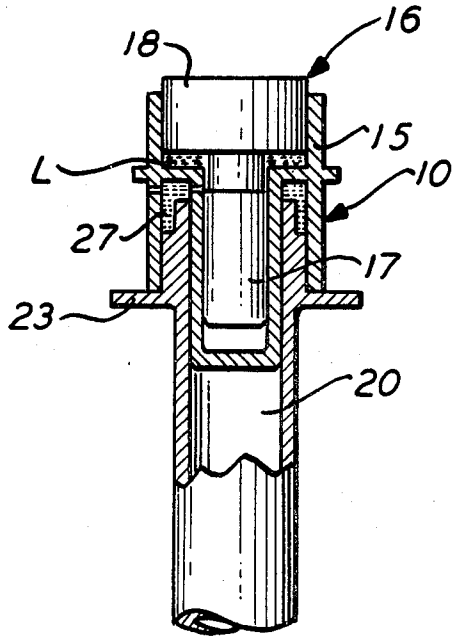


FIG. 1

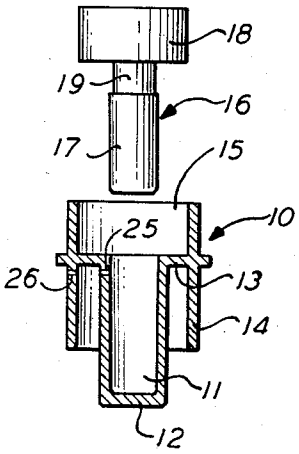


FIG. 2

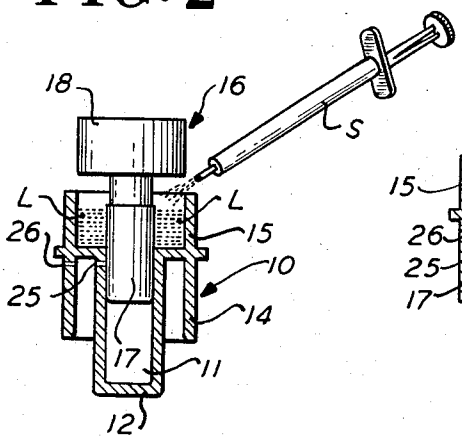


FIG. 3

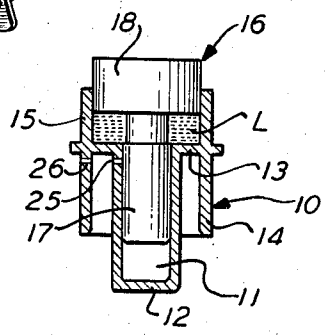


FIG. 4

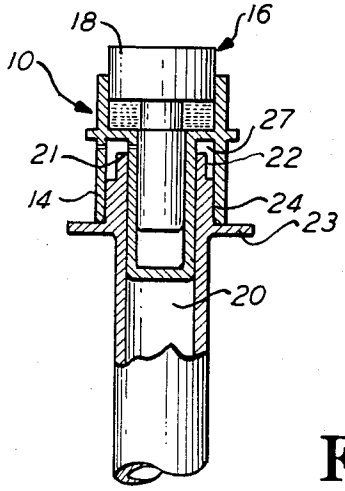


FIG. 5

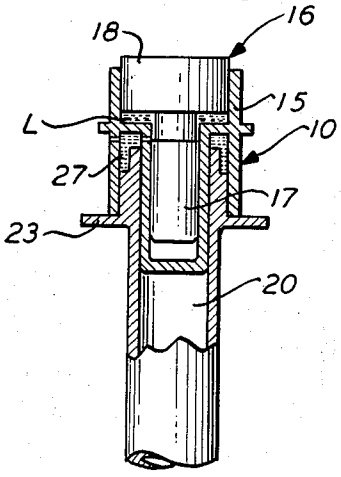


FIG. 6

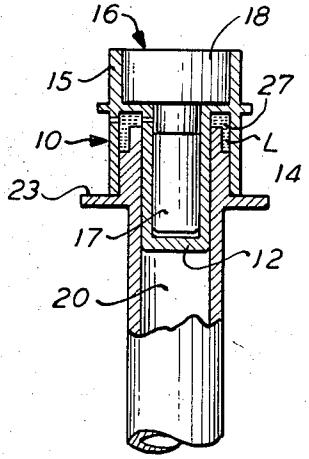
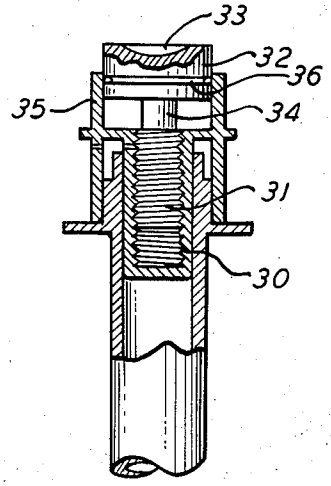


FIG. 7



DOUBLE SEAL CLOSURE PLUG

It is known to provide receptacles and the like with closures which extend both into and around the neck and lip of the receptacle, whether the latter is inside finished or outside finished or neither. Examples of such closures appear in U.S. Pats. to Towns No. 3,164,279; Huck No. Re.25,146; Riera No. 3,499,568; and see also Arnold No. 1,451,937 and Morane No. 3,439,823. Such dry closures may be quite effective for many purposes while not necessarily being tight enough to maintain sterility of the part of the receptacle to which they are applied. The present closure plug is designed to make two liquid-proof mechanical seals, inside and outside, and to provide also a barrier seal of liquid, confined between the mechanical seals, which liquid may be in the nature of a sterilant in order to establish and maintain the sterility of the neck and lip of a receptacle (or the end of a conduit).

The closure plug is a two-part device, the plug body being adapted to fit snugly into the passage to be closed and being connected to an integrally formed skirt which fits snugly on the outside of the receptacle neck or conduit end while leaving an annular space about the lip of the neck(or end of the conduit). The plug body has a first outwardly open cylindrical recess connected by a small hole near its upper end to the annular space, and a second, larger outwardly open cylindrical recess into which the first recess opens. The second part of the plug is a double piston, having a stem portion adapted to fit snugly into the first recess and a head portion fitting snugly into the second recess. A portion of the stem adjacent to the head is of a reduced diameter. When the plug is being prepared for use in the neck or conduit end to be closed, the stem of the piston is partially engaged in the first recess, the annular well formed around the stem by the walls of the second recess is partially filled with a quantity of liquid (sterilant) and the piston parts are forced into their respective recesses, the head of the of the piston engaging the wall of the second recess to enclose the liquid. The operation of sealing the opening in a neck or conduit is described below.

A practical embodiment of the invention is shown in the accompanying drawing, wherein:

FIG. 1 represents a vertical axial section through the plug body, with the piston (in elevation) in position for initial assembly;

FIG. 2 represents a section and an elevation of the parts, as in FIG. 1, with the piston partially engaged in the body and sterilizing liquid added;

FIG. 3 is similar to FIG. 2 with the parts in ready-to-use position;

FIG. 4 is a vertical axial section through the end of a conduit, to be closed and sealed, with the closure plug engaged therewith to establish a first (mechanical) seal;

FIG. 5, represents a view similar to FIG. 4 with the piston head partially engaged in the upper recess of the plug body and liquid sterilant being forced into its outer sealing space;

FIG. 6 represents a view similar to FIG. 5 with the piston fully seated in the plug body, and

FIG. 7 represents a view similar to FIG. 4 but showing a modified form in which the piston is screw threaded.

Referring to the drawing, the plug body **10** comprises a hollow cylindrical portion **11**, closed at its bottom

end **12**; an annular wall **13** extending radially outward from the top edge of the portion **11**; a cylindrical skirt **14** projecting downward from the wall **13**, spaced from and parallel to the wall of the portion **11**; and a cylindrical collar **15** projecting upward from the wall **13** and being substantially an upward continuation of the skirt **14**.

The piston **16** comprises a cylindrical stem **17** and head **18**, the stem being of a size to fit snugly within the portion **11** of the plug and the head fitting tightly within the collar **15** of the plug. A portion **19** of the stem, just below the head, is of slightly reduced diameter, for a purpose to be explained.

The opening **20** to be closed, whether it is in the neck of a receptacle or in a fitting on the end of a pipe, tube or other conduit (all hereinafter designated as "tube adapter") is preferably of a special design, as indicated in FIGS. **4,5,6** and **7**, in that its end **21** is externally annularly rabetted (or beveled) as shown at **22**, and an annular radially projecting flange **23** is spaced axially from the end **21** by a distance less than the axial length of the skirt **14**, a portion **24** of the tube adapter wall (e.g., adjacent the flange **23**) being of a size to fit snugly within said skirt.

A radial passage **25** is provided through the wall of the portion **11** a short distance below the wall **13** and an air bleed hole **26** may be provided in the upper part of the skirt **14**, the hole **26** (if present) being filled with a microporous material, not shown, to permit passage of air while restricting leakage of liquid.

The two-part plug is prepared for use by engaging the piston **16** with the body portion 10 approximately as shown in FIG. **2**. A quantity of liquid (sterilant) L is placed, as from a syringe S, in the well formed by the collar **15** and stem **17**, the quantity being limited to permit depression of the piston head **18** into engagement with the collar **15**, as shown in FIG. **3**. Liquid-filled plugs according to FIG. **3** may be packaged individually or in bulk, and preferably sterile, for use when needed.

When it is desired to close the opening in a tube adapter **20**, having the special features described above, the plug **10** is fully seated within the tube adapter opening (FIG. **4**), the skirt **14** engaging the wall portion **24** and its lower edge resting on the flange **23** so as to hold the wall **13** a short distance above the end **21** of the adapter, whereby the passage **25** remains open and in communication with the annular space **27** resulting from the rabetting or beveling **22** of the adapter end **21**. As the piston **16** is forced downward (FIG. **5**) the liquid L is put under pressure and, with the reduced portion **19** in register with passage **25**, flows past the reduced portion, through the passage and into the space **27**. The air occupying said space is vented through the hole **26** (or leaks out past the skirt **14** if the hole **26** is omitted) and when the piston head **18** has been fully seated within the collar **15**, as shown in FIG. **6**, the seal is complete. The interior of the tube **20** is closed by the plug body portion **11**, the edge **21** is immersed within the sealing liquid filling the space **27** and the skirt **14** is engaged with the wall portion **24**. The piston **16** cannot be withdrawn because its head is flush with the top edge of the collar **15**,, but the whole plug can be removed from the tube adapter whenever desired by pulling, with or without a twisting component.

A modified form of plug is shown in FIG. 7 wherein the plug body **30** and piston stem **31** are threaded and the piston head **32** is provided with a slot **33.** The threaded stem **31** has a reduced diameter portion **34,** corresponding to the portion **19** (FIGS. **1** to **6**) and the sealing operation is the same as described above except that depression of the piston is effected by screwing instead of mere downward pressure.

The piston head **18** or **32** must, in either form, have a leak-proof fit within the collar **15** or **35** (FIG. 7) and this may be ensured by the provision of an O-ring **36** (FIG. 7) or a slight interference fit or by the use of some other sealing means.

The closure plug could, if desired, be used to close the end of a plain tube or hose, or the neck of a container with neither inside nor outside finish, if the diameters of the plug body and skirt are suitably coordinated with the I.D. and O.D. of the tube, hose or container and the plug is applied only to a distance such that the wall **13** is spaced from the lip of the tube, hose or container, thus leaving an annular channel above the lip to receive sealing liquid.

It is evident that the closure plug disclosed herein can be used in connection with any suitably formed tube adapter, particularly in situations where the opening is required to be maintained in a clean and sterile condition, since the liquid seal around the lip of the opening between inner and outer mechanical seals reliably prevents the entry of any air or liquid borne contaminent. As a specific example of one field of utility reference may be made to Tolle et al. U.S. Pat. No. 3,653,359, Apr. 4, 1972, Method and Apparatus for Milking Dairy Animals by Means of a Catheter, wherein the present closure plug may desirably be substituted for the cap **5** (FIG. **1**) or valve and spigot (FIG. **13**) to maintain sterility of the system, as required.

It will be understood that various changes may be made in the form, construction and arrangement of the several parts without departing from the spirit and scope of the invention and hence I do not intend to be limited to the details shown or described herein except as the same are included in the claims or may be required by disclosures of the prior art.

What I claim is:

1. A closure plug for a tubular opening comprising a plug body portion and a piston, the plug body portion having a cylindrical part adapted to fit in the opening to be closed, a skirt portion located radially outward from the cylindrical part and adapted to fit against an outer surface of the device having a tubular opening, means connecting the skirt portion and the cylindrical part to form therebetween an inverted annular channel, an annular collar projecting upwardly from said means and presenting a smooth cylindrical inner wall surface, and the piston having a stem and a head, the stem being adapted to fit within the cylindrical part, the head being adapted to fit within the collar and the stem having a reduced cross-sectional area adjacent the under side of the head, the wall of the cylindrical part being traversed by a radial passage connecting the interior of said part with the annular channel.

2. A closure plug according to claim **1** wherein the height of the piston head is substantially equal to the height of the collar.

3. A closure plug according to claim **1** wherein the skirt is provided with a radially disposed air vent.

4. A closure plug according to claim **3** wherein the radial passage and the air vent are located at points near the connecting means.

5. A closure plug according to claim **1** which includes a quantity of liquid confined in the annular space defined by the wall surface of the collar, the under side of the head, and the reduced area portion of the piston stem.

6. A closure plug according to claim **1** wherein the cylindrical part and the piston stem are complementarily screw threaded.

7. In combination, a tube adapter having a tubular opening to be closed and presenting cylindrical inside and outside surfaces adjacent said opening, with a lip between said surfaces and a closure plug for said opening, the closure plug comprising a plug body portion and a piston, the plug body portion having a cylindrical part fitting against said inside surface, a skirt portion located radially outward from the cylindrical part and fitting against said outer surface, means connecting the skirt portion and the cylindrical part to form therebetween an inverted annular channel, an annular collar projecting upwardly from said means and presenting a smooth cylindrical inner wall surface, and the piston having a stem and a head, the stem being fitted within the cylindrical part, the head being fitted within the collar and the stem having a reduced cross-sectional area adjacent the under side of the head, the lip being spaced from the connecting means to form an annular sealing space and the wall of the cylindrical part being traversed by a radial passage connecting the interior of said part with the annular sealing space.

8. The combination according to claim **7** wherein the height of the piston head is substantially equal to the height of the collar.

9. The combination according to claim **7** wherein the skirt is provided with a radially disposed air vent.

10. The combination according to claim **7** wherein the radial passage and the air vent are located at points near the connecting means.

11. The combination according to claim **7** which includes a quantity of liquid within the sealing space adjacent to the lip.

12. The combination according to claim **11** wherein the tube adapter is shaped to provide an enlarged sealing space radially outward from the lip, between the lip and the cylindrical outside surface.

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