United States Patent

[11] **3,572,539**

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[54] **PRESSURE-LOCKED CAP**
7 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **220/40**
[51] **Int. Cl.** **B65d 41/04**
[50] **Field of Search** 220/24
(R.C.), 40, 40—S, 55 (Locks), 60 (A), 55 (P.C.); 215/9

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ABSTRACT: The application discloses a cap for closing a nipple or tube, the cap having a rotatable collar and a locking mechanism operated thereby for securing the cap on the end of the nipple. The cap is provided with an internal actuator and seal ring assembly responsive to pressure for the purpose of automatically locking the collar against rotation and thereby preventing the locking mechanism from being released.

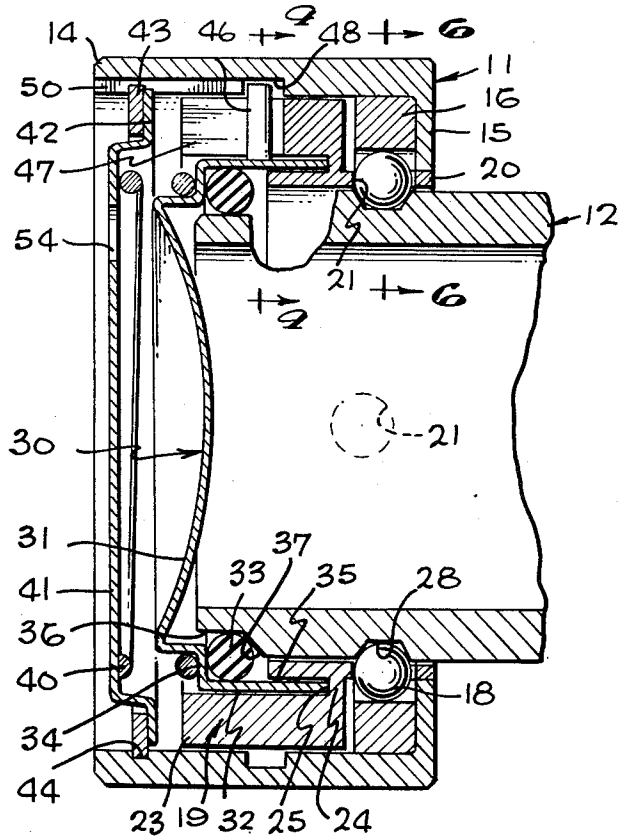


Fig. 1

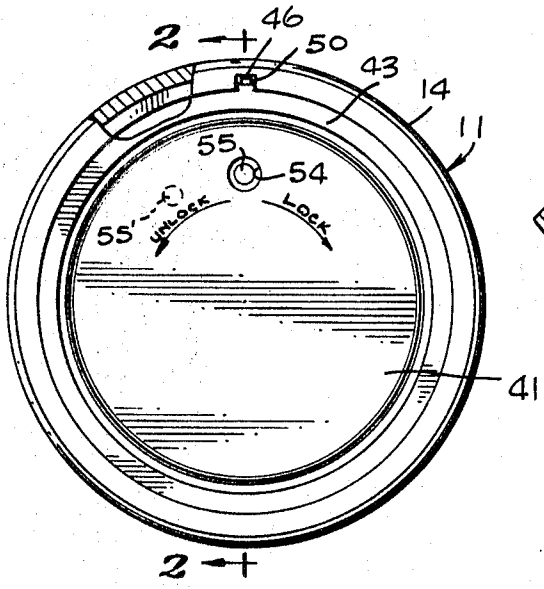


Fig. 4

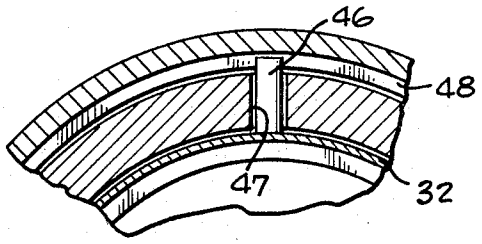
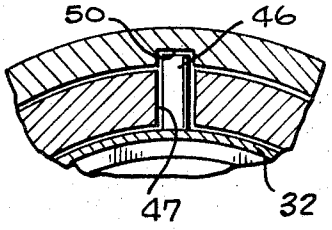


Fig. 5



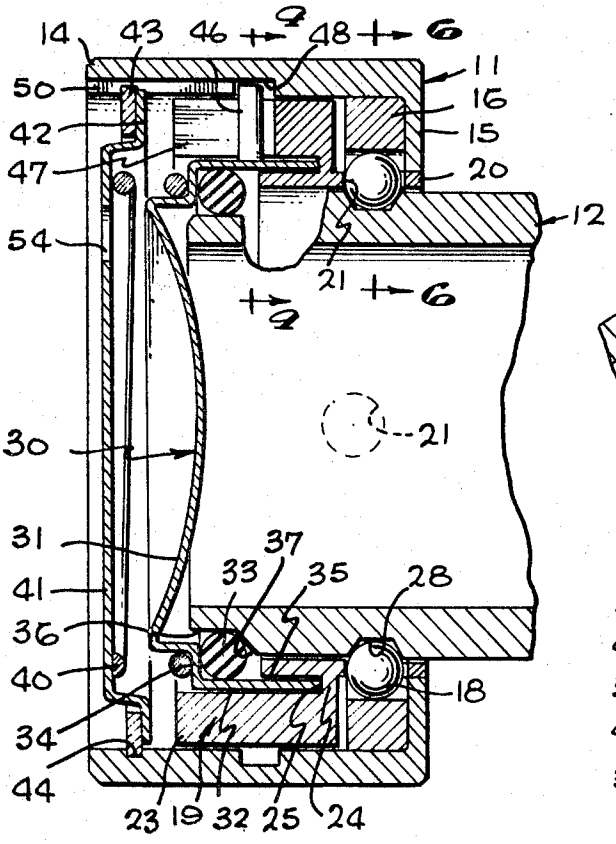
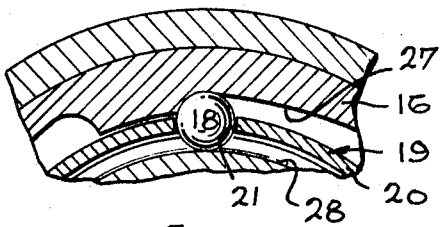


Fig. 2

Fig. 6



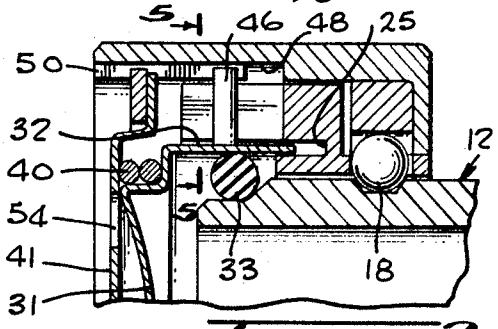


Fig. 3

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PRESSURE-LOCKED CAP

The invention relates generally to detachable closures for nipples, tubes and the like and particularly to caps designed for use where the pressure in the system exceeds atmospheric, and having means to prevent their removal when pressurized.

An object of the invention is to provide a new and improved manually attachable cap embodying novel pressure actuated means for locking the cap in secured position on a nipple or the like.

Another object is to provide a simplified cap construction embodying only a single seal ring in conjunction with a movable internal actuator shell designed to lock the cap against removal when subjected to pressure in which the seal ring serves to effect a seal between the cap and the nipple on which it is mounted and serves to enable the actuator shell to respond to pressure and effect a pressure lock of the cap.

In the summary, the invention includes a cap assembly embodying an outer collar rotatable to lock or unlock mechanical means for gripping the tubular element on which the cap is to be fitted together with an internal axially movable actuator member and seal ring assembly designed to prevent unlocking of the mechanical means when subjected to pressure.

These and other objects will be apparent from the drawing and the following description. Referring to the drawing:

FIG. 1 is a face view, partially broken away, of the outer end of a cap embodying the invention;

FIG. 2 is a sectional view on line 2–2 of FIG. 1, but on a larger scale;

FIG. 3 is a fragmentary sectional view similar to FIG. 2, but showing the parts in a different position;

FIG. 4 is a fragmentary sectional view on line 4–4 of FIG. 2;

FIG. 5 is a fragmentary sectional view on line 5–5 of FIG. 3; and

FIG. 6 is a fragmentary sectional view on line 6–6 of FIG. 2.

Referring now in more detail to the drawing, numeral 11 generally designates a cap embodying the invention which in FIG. 2 is shown mounted upon the end of a tube or nipple 12. The cap includes a cylindrical external collar 14 provided with an inwardly extending flange 15 at its inner end. Rigidly mounted in the collar is a cam ring 16 encircling a plurality of locking balls 18 in a ball cage 19 that is housed within the collar. The cage includes a thin cylindrical inner section 20 provided with a plurality of evenly spaced ball-receiving apertures 21, a relatively thick cylindrical outer section 23 of greater diameter and a web 24 therebetween. The cage is provided with an axially facing groove 25. It will be apparent that by rotating the collar clockwise, balls 18 are cammed inwardly by cam surfaces 27 in the cam ring 16 and thus may be caused to seat in a peripheral groove 28 on the nipple 12. When turned in the opposite direction, the cap may be removed from the nipple since the balls then may move radially outward.

The cap is provided with an actuator assembly 30 comprising a caplike actuator 31 of concave-convex shape having a stepped axially -extending wall section 32 the end portion of which is receivable in groove 25 and a seal ring such as the O-ring 33. The latter is seated between shoulder 34 and internal surface 35 of the actuator on the one side and reduced peripheral end surface 36 and adjacent beveled surface 37 of the nipple. Normally the actuator is releasably forced to the position shown in FIG. 2 by compression coil spring 40 interposed between the shoulder 34 on the actuator and a cover disc 41. The latter has an offset rim 42 extending behind a retaining ring 43 in a groove 44 in the collar.

The actuator 31 is provided with a radially projecting pin 46 fixed thereto in any suitable manner that is received in an axial slot 47 of the ball cage and has its outer end portion received in a circumferential groove 48 in the collar. Intersecting the groove 48 is an axial groove 50 provided at one point in the collar so that when the pin is aligned with this groove, the actuator assembly can move axially from the position of FIG. 2 to that of FIG. 3 against the force of spring 40 under the influence of pressure in the nipple.

In operation, referring to FIG. 1, if the collar is turned counterclockwise approximately 40° from the position in which it is shown, the cap can be removed from or applied to the nipple. To lock the cap on the nipple, the collar is turned clockwise (movement being limited by the length and shape of cam faces 27) thereby moving the locking balls into firm engagement with the walls of groove 28 of the nipple and mechanically locking the parts. This turning action of the collar aligns groove 50 with pin 46 of the actuator member. In the event pressure within the nipple is greater or becomes greater than atmospheric by an amount sufficient to move the actuator element 31 against the force of spring 40 from the position of FIG. 2 to the position of FIG. 3, the pin 46 enters the groove 50 and thus locks the collar and its cam ring against rotation relative to the ball cage thereby preventing removal of the cap and in effect pressure-locking the cap in place. Reduction of pressure to near atmospheric will allow spring 40 to return the actuator element in the position of FIG. 2 from which the pin 46 can enter groove 48 when the collar is turned to unlock the cap.

If desired, the cover disc 41 may have a viewing aperture 54 through which a portion of the actuator 31 is visible, and the latter provided with indicia or paint spots 55 and 55′ of different colors to provide a visible indication of whether the cap is in released or secured position.

I claim:

1. A pressure-locked cap, comprising a tubular collar, a tubular cage rotatably mounted in the collar, means carried by one of said collar and cage for gripping a nipple or the like upon which the cap is placed, said means being movable into gripping position by relative rotary movement between the collar and cage in a given direction and movable out of gripping position by relative movement thereof in an opposite direction, an actuator within said cage keyed for axial movement relative thereto and restrained against rotary movement relative thereto, a seal ring within said actuator for receiving the nipple on which the cap is to be fitted, said actuator providing an uninterrupted closure wall axially beyond the seal ring and across the same whereby to seal the open end of the nipple on which the cap is placed, spring means yieldably urging said actuator toward the inner end of the cap, and interengaging pressure-actuated locking means on said actuator and collar effective, in a predetermined relative rotary position of the cage and collar, to permit said actuator to move axially against the force of said spring means under the influence of fluid pressure in a nipple to which the cap is applied and, upon such movement, prevent relative rotation of the cage and collar, said actuator being restrained against axial movement except in said predetermined relative rotary position of said cage and collar.

2. The cap set forth in claim 1 in which the interengaging locking means on said actuator and collar comprises a radial projection on the actuator, a circumferential groove on an inner circular surface of the collar into which the projection extends and an axial groove is said collar intersecting said circumferential groove.

3. The cap set forth in claim 1 in which said actuator comprises a central main wall having an outwardly stepped axially extending section defining radial shoulder intermediate with ends of the section, and in which said seal ring is seated inside said section between said shoulder and the end edge of the section.

4. The cap set forth in claim 3 in which said spring means yieldably urging the actuator toward the inner end of the cap comprises a coil compression spring between said radial shoulder on the axially extending section of the actuator and an abutment forwardly thereof.

5. A pressure-locked cap adapted to be mounted on a nipple or the like having a peripheral groove adjacent its end, comprising a cylindrical collar, a cylindrical cage rotatably mounted within the collar, radially displaceable locking members carried by said cage, cam means in the collar engageable with said locking members to displace them radially inwardly

in response to relative rotary movement of said collar relative to said cage in a given direction for engagement of said locking members in the groove of said nipple, an actuator within said cage, interengaging means on said actuator and said cage permitting axial movement of said actuator relative to the cage and preventing relative rotary movement between said actuator and said cage, a seal ring in said actuator for receiving the nipple on which the cap is fitted and effecting a seal between the nipple and actuator, said actuator providing an uninterrupted closure wall across the seal ring, spring means yieldably urging said actuator toward the inner end of said cap, and interengaging pressure-actuated locking means on said actuator and said collar effective, in a predetermined relative rotary position of the cage and collar, to permit said actuator to move axially against the force of said spring means under the influence of fluid pressure in a nipple to which the cap is applied, and effective, upon such movement, to prevent relative rotation of the cage and collar, said interengaging locking means between said actuator and collar preventing relative axial movement thereof except in said predetermined relative rotary position.

6. A pressure-locked cap, comprising a cylindrical collar, a cage in the collar and rotatable relative thereto, locking members carried by the cage for gripping a nipple or the like on which the cap is to be placed, cam means carried by said collar, effective upon rotation of the collar relative to the cage in a given direction, to force said locking members radially inward, an actuator within said cage including a main uninterrupted wall terminating in an axially extending outwardly stepped section defining an annular shoulder intermediate the ends of such section, a seal ring seated within said stepped section between said shoulder and the end of said section for receiving the end portion of a nipple on which the cap is mounted, a pin fixed to said actuator and extending radially thereof, said cage having na axial groove freely receiving said pin, said collar having an internal circumferentially extending groove and having an axially extending groove intersecting the same, the end portion of said pin on said actuator normally extending into said circumferentially extending groove and being received in said axially extending groove when said collar and cage are oriented in a position to urge the locking members radially inward and said actuator is subjected to fluid pressure from the nipple upon the actuator member, and spring means yieldably urging said actuator toward the end of the cap receiving the nipple.

7. The cap set forth in claim 6 which a closure disc is mounted in said collar at the outer end thereof and in which said spring means is interposed between said disc and said actuator.