

The present invention relates to a closure device for a pressure container, in particular for the pressure container of a steam pressure coffee maker, the pressure container comprising a flange and a cap able to be fitted thereon, which by rotation about the central axis of the flange can be brought from an open into a closed position and vice versa and with means for locking the cap in the closed position, if an excess pressure prevails inside the pressure container.

In steam pressure coffee makers, which are to be found in many households, a pressure container is provided, which is filled with water and which comprises a heating device for heating the water introduced. Normally this pressure container has a cap with a rotary closure, in order to facilitate filling with water and in order to be able to close the pressure container in a gas-tight manner. Also provided on the pressure container is an outlet pipe, in which an excess pressure valve is incorporated. As soon as a predetermined excess pressure has developed inside the pressure container, the heated water is able to escape through this pipe into the coffee-brewing arrangement.

During operation, considerable pressure values occur inside the container, so that precautions must be taken to ensure that the cap of the pressure container cannot be loosened or removed, as long as an excess pressure prevails inside the pressure container. If, namely the user attempted to remove the cap in such a situation, for example in order to fill the container with fresh water, the danger would exist that steam or hot water escapes suddenly upon loosening the cap, with the consequence that the operator could be scalded.

GB-PS 2 170 995 discloses a closure device of the

aforementioned type. This closure device comprises locking grooves on the free, lower edge of the screw cap and adjacent to the flange, onto which the cap is screwed, a piston/cylinder arrangement. The piston of this arrangement is connected to the inside of the pressure container and is held by spring force in an inoperative position, in which the cap can be rotated. As soon as a certain pressure has built up inside the pressure container, the piston is moved against the action of the spring, so that a pin of the piston able to slide axially and opening out below the edge of the cap is moved towards the cap and engages in the locking grooves in the cap. The cap of the pressure container is thus reliably prevented from being screwed off, if excess pressure prevails inside the pressure container, yet the arrangement described in this GB-PS is not only complicated and therefore expensive to manufacture, but also susceptible to disturbances, because in particular with water containing lime, seizing of the actuating piston in the cylinder may easily occur.

A similar solution is described in DE-GM 88 02 277. The danger of calcification and thus seizing of the actuating piston should be avoided due to the fact that the latter is surrounded by bellows. Otherwise the operating principle of the locking device is substantially the same. This device is also complicated in construction and therefore expensive to manufacture, in addition the bellows being exposed to high thermal and mechanical stresses, which can lead to rapid aging and premature damage to the latter.

It is the object of the present invention to design a closure device of the aforementioned type to be substantially simpler, namely without moving parts on the pressure container itself, but which nevertheless reliably prevents a removal of the closure cap, as long as an excess pressure prevails in the pressure container.

According to the invention, this object is achieved due to the fact that the means for locking the cap comprise on the one hand a sealing member of elastically deformable material, located in the cap, which is in turn provided with means for non-rotary connection to the cap, and on the other hand a flange part projecting into the inside of the flange, which part is provided with a peripheral sealing rib and with locking members arranged around the periphery and above the sealing rib, the locking members engaging in locking recesses disposed along the inner peripheral surface of the flange at the time of excess pressure in the pressure container.

In this way, the means for locking the cap are formed substantially by an elastically deformable sealing member located in the cap, which is necessary anyhow for the gas-tight sealing of the pressure container. No moving parts need to be located on the pressure container itself; the inner peripheral surface of the pressure container flange must be provided solely with the aforementioned locking recesses.

In a preferred development of the object of the invention, when the cap is fitted to the pressure container, the sealing rib already bears with pretension against the inside of the flange of the pressure container, before the formation of an excess pressure in the pressure container. Due to this the necessary pressure difference between the interior of the pressure container and the space between the flange part and the inner wall of the flange can be produced earlier, due to which the engagement of the locking members in the locking recesses is facilitated.

Furthermore, the gap extending between the flange of the pressure container and the flange part of the sealing member and separated by the sealing rib from the inside

of the pressure container can preferably be connected to the atmosphere. Due to this, the engagement of the locking members in the locking recesses on account of the considerable pressure differences between the interior of the pressure container and the gap between the flange part and the inner wall of the flange is guaranteed in every case.

In order to achieve a simple assembly of the sealing member in the cap, with means for protecting against torsion acting reliably, the sealing member may comprise a top member of substantially circular contour, which is provided with one or more locking projections projecting above the top member, which for producing a non-rotary connection between the sealing member and cap engage in corresponding recesses formed in the cap.

For the simple production of a connection of the gap between the flange part and inner wall of the flange to the atmosphere, the diameter of the top member can be smaller than the inside width of the flange of the pressure container.

A simply constructed safety mechanism for preventing the sealing member from dropping out of the cap can be achieved due to the fact that the locking projections of the top member project radially beyond its diameter and engage in a peripheral groove formed on the cap.

In order to achieve a non-slip protection against torsion, the recesses correspond in size and arrangement to the locking projections of the top member of the sealing member.

The flange part of the sealing member may be constructed to have a substantially cylindrical surface, along its upper edge is formed in one piece with the top member

of the sealing member and on its opposite lower edge is provided with the peripheral sealing rib, so that a one-piece construction of the top member, flange part and sealing rib results.

In order to facilitate an easy insertion of the flange part into the opening of the flange, the flange part having a cylindrical surface may taper conically towards its lower edge.

In a preferred embodiment of the object of the invention, the locking member may consist of a plurality of axis parallel ribs distributed over the periphery and constructed on the flange part of the sealing member having a cylindrical surface, on its outer side, the locking recesses consisting of grooves extending axis parallel and constructed on the inner peripheral surface of the flange. Due to this, the greatest possible action of the forces produced by the excess pressure is achieved as regards the protection against torsion.

The measure that the width of the grooves is slightly greater than the width of the ribs ensures that a reliable engagement of the ribs takes place as a whole in the associated grooves. If, furthermore, both the ribs as well as the grooves are distributed uniformly over the periphery of the flange part or the inner peripheral surface of the flange, it is ensured that as many ribs as possible may engage in a matching groove. This advantage can be further increased due to the fact that the number of grooves amounts to a whole multiple of the number of ribs on the flange part having a cylindrical surface.

If, at the transition from the flange part to the top member, a peripheral notch is formed, the flange part may have a more flexible construction with respect to

the top part, which improves the sealing action. A further improvement in the flexibility may be provided by the measure that the section formed radially inside the flange part on the top member comprises a cup-shaped design, the base of the cup-shaped section extending approximately at the height of the lower edge.

The closure device according to the invention will be described hereafter in connection with a pressure container for a steam pressure coffee maker. However reference should be made to the fact that with corresponding adaptations, which lie within the scope of the knowledge and ability of a man skilled in the art, the closure device according to the invention can be used in virtually all types of pressure containers.

In the following detailed description of the embodiments, reference is made to the accompanying drawings, in which:

Figure 1 is an axial partial section through a pressure container in the region of the cap, in the pressureless state;

Figure 2 is a corresponding partial section to that of Figure 1, but in a state in which excess pressure prevails inside the pressure container;

Figure 3 is a view of the sealing member from above;

Figure 4 is an axial section through the sealing member, on line IV-IV of Figure 3;

Figure 5 is a cross-section through the sealing member, on line V-V of Figure 4; and

Figure 6 is a cross-section through a sealing member according to a further embodiment.

The pressure container designated by the reference numeral 1 in Figure 1 has a flange 2, which generally has a cylindrical shape and is provided with an external thread 3. A closure cap designated by the reference numeral 4 has a correspondingly constructed internal thread 5, in order to be able to be screwed onto the flange 2. The cap 4 is provided with a sealing member designated generally by the reference numeral 6, which in principle is inserted loosely in the cap 4 and is held by an undercut peripheral groove 7 formed in the cap 4.

The sealing member 6 is made from elastically deformable material, for example rubber, neoprene or another suitable synthetic material. It has a top part, which has substantially the shape of a flat plate 13, which in the present example is constructed to be circular, as is apparent in particular from Figures 3 and 4. Adjoining this top part is a flange part generally designated by the reference numeral 9, which has a substantially cylindrical shape. It will be understood that the flange part 9 may preferably be constructed in one piece with the top part 13. The flange part 9 has a somewhat smaller outer diameter than the inner diameter of the flange 2 of the pressure container 1, so that the cap 4 with the inserted sealing member 6 can be fitted effortlessly to the pressure container 1.

Located in the region of the free edge 10 of the flange part 9 is a peripheral sealing rib 11, which projects beyond the outer surface of the cylindrical flange part 9. The peripheral edge of the sealing rib 11 is intended to bear against the inner surface of the flange 2 of the pressure container 1. Preferably the arrangement is such that when the cap 4 is fitted to the pressure container 1, the sealing rib 11 bears with pretension against the inside of the flange 2 of the pressure container 1. This

can be achieved for example due to the fact that the inner surface of the flange 2 is constructed to be slightly conical, with a diameter decreasing from the top downwards. In order to facilitate the introduction of the sealing member 6 into the flange 2 and thus to simplify the fitting of the cap 4 on the pressure container 1, the edge 10 of the cylindrical flange part 9 passing into the sealing rib 11 may be constructed conically with a diameter decreasing towards the free end of the flange part 9.

The inner surface of the flange 2 is provided with a number of axis parallel grooves 12 distributed over the periphery of the flange 2. The latter extend over a part of the total height of the flange 2, substantially between the transition point of the flange part 9 into the top part 13 of the sealing member 6 downwards to above the projection of the sealing rib 11. Intended to cooperate with these grooves 12 are ribs 14 distributed over the periphery of the flange part 9 on the outer side, the elevation of which with respect to the outer surface of the cylindrical flange part 9 is somewhat less than the elevation of the sealing rib 11. This can be seen in particular from Figures 3 and 5.

The width of the grooves 12 in the inner peripheral surface of the pressure container flange 2 in this case corresponds essentially to the width of the axis parallel ribs 14 on the outer surface of the cylindrical flange part 9 of the sealing member 6. It is recommended to provide a relatively large number of ribs 14, in order to guarantee locking, as will be described hereafter, in virtually every rotary position of the cap 4. In the present embodiment, twenty ribs are provided, which should generally suffice. The number of grooves 12 in the inner peripheral surface of the pressure container flange 2 may correspond to the number of ribs 14. In any case,

however, it is advantageous if the number of grooves 12 and the number of ribs 14 are in an integral ratio with respect to each other.

Another possibility also consists in that only a few, for example four or six ribs 14 are provided, which cooperate with a substantially larger number of axis parallel grooves 12 located in the inner peripheral surface of the flange 2.

In order that, due to the cooperation of ribs 14 and grooves 12, as will be described hereafter, locking of the cap 4 can take place at the time of excess pressure inside the pressure container 1, it must be ensured that the cap 4 cannot rotate relative to the sealing member 6. For this purpose, the top part 13 of the sealing member is provided with locking projections 15. As can be seen in particular in Figure 3, in the present case these locking projections 15 consist of lugs integrally formed in one piece on the top part 13, which lugs project on one side above the upper surface of the top part 13 and on the other side beyond its periphery. Depending on the material of the sealing member 6 and on the size thereof, or of the cap 4, a greater or smaller number of these locking projections 15 may be provided; in the present example according to Figure 3, six locking projections 15 are provided.

The locking projections 15 engage on the one hand by their outer edge region in the aforementioned peripheral groove 7 in the cap 4, in order to anchor the sealing member 6 mechanically in the cap 4 and to prevent it from falling out. On the other hand, the cap 4 is provided on the inner surface of its upper part with recesses 16, which correspond in shape and number to the locking projections 15. Due to this a positive, non-rotary connection

between the sealing member 6 and cap 4 is ensured.

In Figure 1, the pressure container 1 is illustrated with the fitted cap 4 in the pressureless state. The sealing rib 11 bears against the inner peripheral surface of the pressure container flange 2 below the grooves 12 and seals the inside of the pressure container 1 with respect to the outside. Since the remaining parts of the sealing member 6 do not bear over their full surface neither against the flange 2 nor against the cap 4, only the sealing rib 11 takes over the task of sealing. Although in Figure 1, the impression could be given that a wider sealing between the top part 13, cap 4 and upper edge of the flange 2 takes place, this is not so, since solely the parts of the locking projections 15 projecting beyond the periphery of the top part 13 rest on the upper edge of the flange 2. Due to this the gap 18 between the flange part 9 and inner wall of the container flange 2 is connected to the atmosphere.

After the build-up of pressure inside the pressure container 1, the flange part 9 is deformed radially outwards in its central region, as shown in Figure 2. This deformation is not opposed, since, as mentioned, sealing does not take place above the sealing rib 11, so that the air trapped between the flange part 9 and the flange 2 is able to escape. Due to the radial deformation of the central region of the flange part 9, the ribs 14 engage in the grooves 12 of the flange 2. A rotation of the cap is thus made impossible, since the sealing member 6 is pressed by its top part 13 against the cap and since in particular the locking projections 15 are pushed into the recesses 16 in the cap. The higher the pressure difference between the inside and outside of the pressure container 1, the more forceful is this positive locking, so that the cap 4 can no longer be removed without applying force and destroying the closure device.

As mentioned, the sealing member 6 consists of elastically deformable material. This means that at the time of a reduction in the excess pressure inside the pressure container 1, the central part of the flange part 9 of the sealing member 6 moves back into its original position shown in Figure 1, with the result that the positive connection between the ribs 14 and grooves 12 is cancelled and the cap 4 can be opened.

The troublefree operation can be assisted due to the fact that the diameter of the top part 13 of the sealing member 6 is smaller than the inside width of the flange 2, thus sealing does not occur at the upper edge of the flange 2 and thus there is no appreciable opposition to the deformation of the central region of the flange part 9.

Figure 6 shows a further embodiment of the sealing member 6 in cross-section. The construction of this embodiment corresponds generally to that of the sealing member 6 illustrated in the preceding Figures. However, according to Figure 6, it has a peripheral notch 19 at the transition point from the flange part 9 to the top member 13. Due to this measure, the flange part 9 is more flexible with respect to the top part 13, which improves the sealing action. Furthermore, the section 20 constructed radially inside the flange part 9 on the top member 13 has a cup-shaped design. The base 21 of the cup-shaped section 20 extends approximately at the height of the lower edge 10. The flexibility of the flange part 9 is further increased by these measures.

It will be understood that in place of the axis parallel ribs 14 on the outer surface of the cylindrical flange part 9 and instead of the axis parallel grooves 12 on the inner surface of the flange 2, corresponding locking

means of another shape may be provided. Furthermore, it is conceivable to release the non-rotary locking of the sealing member 6 in the cap 4 in another way, for example by omitting the recesses 16 and with the formation of the peripheral groove 7 in the cap 4 with an alternately different radius, the end regions of the locking projections 15 engaging in the radial recesses formed in this way.

Finally, the possibility also exists of a kinematic reversal: instead of providing the flange part 9 with ribs 14 and the inside of the flange 2 with grooves 12, the outside of the flange part 9 may be provided with locking recesses and the inside of the flange 2 with locking projections, in order to achieve a corresponding locking action when an excess pressure occurs inside the pressure container 1.

Claims

1. Closure device for a pressure container (1), in particular for a steam pressure coffee maker, the pressure container (1) comprising a flange (2) and a cap (4) able to be fitted thereon, which by rotation about the central axis (y) of the flange can be brought from an open into a closed position and with means for locking the cap (4) in the closed position, which are effective if an excess pressure prevails inside the pressure container (1), characterised in that the means for locking the cap (4) comprise on the one hand a sealing member (6) of elastically deformable material, located in the cap (4), which is in turn provided with means (15) for non-rotary connection to the cap (4), and on the other hand a flange part (9) projecting into the inside of the flange (2), which part (9) is provided with a peripheral sealing rib (11) and with locking members (14) arranged around the periphery and above the sealing rib (11), the locking members (14) engaging in locking recesses (12) disposed along the inner peripheral surface of the flange (2) at the time of excess pressure in the pressure container (1).

2. Closure device according to Claim 1, characterised in that when the cap (4) is fitted to the pressure container (1), the sealing rib (11) already bears with pretension against the inside of the flange (2) of the pressure container (1), before the formation of an excess pressure in the pressure container (1).

3. Closure device according to Claim 1, characterised in that the gap (18) extending between the flange (2) of the pressure container (1) and the flange part (9) of the sealing member (6) and separated by the sealing rib (11) from the inside of the pressure container (1) remains connected to the atmosphere.



4. Closure device according to Claim 1, characterised in that the sealing member (6) comprises a top member (13) of substantially circular contour, which is provided with one or more locking projections (15) projecting above the top member (13), which for producing a non-rotary connection between the sealing member (6) and cap (4) engage in corresponding recesses (16) formed in the cap (4).

5. Closure device according to Claim 4, characterised in that the diameter of the top member (13) is smaller than the inside width of the flange (2) of the pressure container (1).

6. Closure device according to Claim 4, characterised in that the locking projections (15) of the top member (13) project radially beyond its diameter and engage in a peripheral groove (7) formed on the cap (4).

7. Closure device according to Claim 4, characterised in that the recesses (16) correspond in size and location to the locking projections (15) of the top member (13) of the sealing member (6).

8. Closure device according to Claim 4, characterised in that the flange part (9) of the sealing member (6) is constructed to have a substantially cylindrical surface, along its upper edge (17) is formed in one piece with the top member (13) of the sealing member (6) and on its opposite lower edge (10) is provided with the peripheral sealing rib (11).

9. Closure device according to Claim 8, characterised in that the flange part (9) having a cylindrical surface tapers conically towards its lower edge (10).

10. Closure device according to one of the preceding



Claims, characterised in that the locking member (14) consists of a plurality of axis parallel ribs (14) distributed over the periphery and constructed on the flange part (9) of the sealing member (6) having a cylindrical surface, on its outer side and that the locking recesses consist of grooves (12) extending axis parallel and constructed on the inner peripheral surface of the flange (2).

11. Closure device according to Claim 10, characterised in that the width of the grooves (12) is slightly greater than the width of the ribs (14).

12. Closure device according to Claim 10, characterised in that both the ribs (14) as well as the grooves (12) are distributed uniformly over the periphery of the flange part (9) or the inner peripheral surface of the flange (2).

13. Closure device according to Claim 12, characterised in that the number of grooves (12) amounts to a whole multiple of the number of ribs (14) on the flange part (9) having a cylindrical surface.

14. Closure device according to Claim 8, characterised in that a peripheral notch (19) is formed at the transition from the flange part (9) to the top member (13).

15. Closure device according to Claim 8, characterised in that the section (20) formed radially inside the flange part (9) on the top member (13) comprises a cup-shaped design, the base (21) of the cup-shaped section (20) extending approximately at the height of the lower edge (10).

