

This invention relates to a process and a device for aseptically filling with a fluid a pack provided with a spout incorporating an outer tearable membrane.

5 EP 72 699 already describes a device for aseptically filling a pack with a fluid comprising a filling head with a valve for regulating the flow rate of the fluid into a pack provided with a spout incorporating an outer tearable membrane. This device has a number of disadvantages. Firstly, during the filling process, it
10 is the pressure of the fluid which tears the outer membrane, leading to totally unpredictable tears which can extend into the sealing zone for the closure of the pack and can thus lead to breaks in the fluid-tightness of the pack. On the other hand, the device according to
15 the patent in question comprises a system with two independent movements on the vertical shaft for the delivery of the fluid on the one hand and to create a vacuum in the head space on the other hand. Finally, this device necessitates the presence on the vertical
20 shaft of seals of which the useful life is limited and which can cause bacterial infection when they are worn.

EP 23 6107 also relates to a system for aseptically filling containers which also comprises a fluid inlet valve. To operate this system the valve has to be
25 lowered to tear the spout and then raised to allow the fluid to enter. This double movement is a disadvantage.

The present invention enables a process and a system with none of the above-mentioned disadvantages to be placed at the disposal of the user. According to the
30 invention, the outer membrane tears cleanly in a defined manner, the valve for regulating the delivery rate of the fluid has only a single movement and hence only one drive and there is no seal to be replaced at frequent intervals.

35 The present invention relates to a process for

aseptically filling with a fluid a pack provided with a spout incorporating an outer tearable membrane in which, the pack being sterile and closed, the filling head space and the outer part of the tearable membrane are sterilized and, on completion of the filling process, the delivery of fluid is shut off and steam or sterile air is admitted to displace the remaining fluid from the filling head space to an emptying pipe, the outer tearable membrane is cut and the fluid is concomitantly admitted into the pack and the steam or sterile air is admitted perpendicularly in relation to the direction in which the fluid is displaced.

The preliminary sterilization of the filling head space takes place for 2 to 30 seconds at a temperature between 135 and 165°C and under a steam pressure of 2 to 6 atmospheres.

On completion of the filling cycle, the cleaning operation takes place with steam under a pressure of 1 to 4 atmospheres for a time of 0.5 to 2 seconds at a temperature in the range from 120 to 150°C. Where sterile air is used, it is introduced under a pressure of from 0.5 to 3 atmospheres and at ambient temperature.

The invention also relates to a device for carrying out this process, comprising a filling head with a valve to regulate the fluid delivery rate and the cutting means, a pack support disposed beneath the filling head and designed to seal the pack on completion of the filling cycle, a fluid inlet and outlet pipe and, at the bottom of the filling head, a steam inlet valve and a valve with a steam outlet and emptying pipe for the cleaning operation at the end of the filling cycle, in which the valve for regulating the fluid delivery rate is such that its cutting means cut the tearable membrane during opening of the valve, the valve has an axis which is perpendicular to the axis of the fluid

inlet and outlet pipe and the steam inlet valve and the valve with a steam outlet pipe are arranged perpendicularly in relation to the axis of the fluid inlet and outlet pipe.

5 In the context of the invention, a pack is understood to be both a plastic pack and a cardboard pack or any other type of pack for the food or medical field. By fluid is meant both an aqueous solution and
10 also milk juices of fruits or vegetable or more viscous products, such as jam, marmalade and the like with or without pieces.

 Normally, the fluid inlet and outlet pipes are extensions of one another. The pack support is formed by jaws to hold the pack in place and a sealing head.

15 Before the filling process, the filling head space and the outer surface of the tearable membrane are sterilized. This is done by means of the steam inlet valve. The other valve arranged laterally at the bottom
20 of the filling head is used on the one hand for the removal of steam during sterilization and on the other hand for the removal of residual fluid on completion of filling. These two valves are situated either on each side or parallel on the same side of the plane formed by
25 the axis of the fluid inlet and outlet pipe and the axis of the valve for regulating the fluid delivery rate and perpendicularly of the axis of the fluid inlet and outlet pipe. It is obvious that the fluid inlet and
outlet pipe is also sterilized before filling.

 In the device according to the invention, the
30 axis of the valve for regulating the fluid delivery rate forms an angle of 40 to 80° with the axis of the steam inlet valve and with the axis of the steam outlet and emptying valve.

 The major advantage of the device according to
35 the invention is that it provides a filling system in

which it is possible, in a single movement and hence with a single drive, to tear the outer membrane and at the same time to admit the fluid into the pack.

5 It is the lower part of the valve for regulating the fluid delivering rate which serves as a closure/opening for entry of the fluid. The opening is frusto-conical or cylindrical in shape. In the case of a fluid containing pieces, it is better to choose a cylindrical opening because there is then little danger of the
10 pieces remaining jammed during closure of the valve. The seals on the closure are arranged either at the bottom of the valve or at the opening where the fluid enters the pack.

The bottom of the valve for regulating the fluid
15 delivery rate also comprises the cutting means. In the case of a fluid with no pieces, it is better to choose radial and vertical cutters, for example two cutters arranged perpendicularly, as the cutting means. However, it is also possible to provide more than two
20 cutters. In the case of a fluid containing pieces, it is better to choose cutting means in the form of U-shaped cutters and, in this case, an intermediate flow chamber is provided between the fluid delivery pipe and the pack.

25 At least two types of pack may be envisaged: either a pack with a spout comprising an inner closure membrane, of the type shown in the drawings and in EP 72 699, or a pack with a spout with no inner closure membrane. In this case, the pack is closed by direct
30 sealing of the face of the pocket against the spout.

The valve for regulating the fluid delivery rate comprises a flexible membrane or an expanding membrane which establishes fluid-tightness between the passage of the fluid and the purely mechanical parts.

35 During the introduction of a new pack, it is also

possible to leave the steam inlet valve at least partially open in order to avoid any bacterial infection.

By means of the filling device according to the invention, it is possible to construct an entire aseptic
5 filling line in which at least two of the devices described above are arranged in series. Between two and eight filling devices are preferably provided.

The invention is described in more detail in the following with reference to the accompanying drawings,
10 wherein:

Figure 1 is a section through the device according to the invention with the fluid inlet valve in its closed position.

Figure 2 is a partial section on the line II-II
15 of Fig. 1 through a first embodiment with the fluid inlet valve in its open position.

Figure 3 is a partial section on the line II-II of Fig. 1 through a second embodiment with the fluid inlet valve in its open position.

Figure 4 is a section on the line IV-IV of Fig.
20 3.

Figure 5 is a section through a third embodiment of the device according to the invention.

Figure 6 is a section on the line VI-VI of Fig.
25 5.

The filling head denoted by the reference (1) comprises a fluid inlet and outlet pipe (2), (3), a valve (4) for regulating the fluid delivery rate, a steam inlet valve (5) and steam outlet and emptying
30 valve (6) for residual fluid. The pins of the valves (5) and (6) are displaceable by pneumatic or similar systems (not shown).

A pack (7) comprising a spout (8) with a tearable membrane (9) and a closure membrane (10) partially
35 sealed against the spout (8) to allow filling is placed

beneath the actual filling head. The pack is held in place by jaws (11) beneath which is arranged the sealing head (31) which closes the pack on completion of filling. The sealing head comprises a sealing ring (12).

5 The filling head comprises a flexible membrane (13) held between the two parts (14,15) fixed together by the locking ring (16). This flexible membrane consists of polytetrafluoroethylene or of rubber or of any flexible material of high mechanical and thermal
10 stability. The pin of the valve (4) is vertically displaceable by pneumatic or similar systems (not shown) between bushings (17).

 The membrane (13) is holed at its centre and traversed by the pin of the valve (4). This pin is in
15 three parts: the upper part (18) into which the part (19) holding the flexible membrane (13) is screwed by the bolt (21). The locking screw (22) ensures a good hold and, hence, fluid tightness of the membrane (13). Finally, the pin comprises a lower part (20) screwed
20 into the element (19) by means of the bolt (23). This part (20), which comprises a cone (51), serves as an opening/closure for filling of the pack. It comprises a seal (24) and two perpendicularly arranged radial cutters (25). These cutters form a central point (26)
25 enabling cutting of the membrane (9) to be even further improved. An annular protuberance (27) provides for effective holding of the membrane (9) during the downward movement of the cutting element (25) and during sterilization. Several concentric annular protuberances
30 may be provided in order further to improve holding of the membrane (9). In the case of Figs. 1, 2 and 3, the opening (28) for the passage of the fluid is frustoconical in shape. This opening also forms the seat for the cone (51).

35 The device operates as follows:

With the valve (4) in its closed position (Fig. 1) and the pack (7) in place, the head space (52) and the membrane (9) are sterilized by opening of the steam inlet valve (5). The steam arrives through the pipe (29). It leaves through the pipe (30) via the valve (6). On completion of sterilization, the two valves (5) and (6) are closed and the valve (4) is opened (Fig. 2). The element (20) descends and the cutters (25) open the tearable membrane (9). At the same time, the fluid is released and enters the pack (7) through the opening (28). It is obvious that, during filling, the sealing head (31) is in its lower position. On completion of filling, the sealing head ascends, the valves (5) and (6) are opened so that the steam displaces the residual product which flows out through the pipe (30). During or after this cleaning operation, the sealing ring (12) is heated, thus closing the pack (7). The jaws (11) may then release the pack.

To avoid infection of the filling head space while the pack is being changed, the steam inlet valve (5) is left open or half-open.

Figures 3 and 4 show the device according to the invention in a second embodiment. The elements which are identical with those of Figs. 1 and 2 are denoted by the same reference numerals. This device differs from that shown in Figs. 1 and 2 in that the steam inlet valve (32) and steam outlet and emptying valve (33) are disposed on the same side of the plane formed by the axis of the fluid inlet and outlet pipe and the axis of the valve for regulating the fluid delivery rate. The device is otherwise identical with the previous embodiment. The pins of the valves (32) and (33) are displaced under the power of the same drive, for example a single pneumatic system (not shown). Accordingly, this represents the major advantage over the device shown in

Figs. 1 and 2. Each valve pin has a seal (34) and (35) and needles (36) and (37) of different shape. The steam arrives through the pipe (39) and leaves through the pipe (40). Because the pins of the valves (32) and (33) have the same drive, they slide synchronously.

The advantage of having different needles (36) and (37) is as follows: when the valves (32) and (33) are closed after sterilization of the filling head space or after cleaning, the valve (32) closes first, thus leaving the possibility for the steam or the residual products to leave by the pipe (40). The remaining operations are the same as in Figs. 1 and 2.

Figures 5 and 6 show a third embodiment of the device according to the invention in which the cutters have a specific shape. This shape is more especially suitable for the filling of a pack with a fluid containing pieces. Since the pack and the sealing head are the same as for Figs. 1 to 4, they have been denoted by the same reference numerals. The fluid inlet pipe (41) is closed by the valve (42). This valve has a U-shaped cutter (43). The filling head (44) comprises an intermediate chamber (45) between the pipe (41) and the spout (8) of the pack (7). The valve (46) comprises a steam inlet pipe (48) while the valve (47) comprises an emptying pipe (49). It should be noted that the valves (46) and (47) are not side-by-side, but superposed. They may also have a single drive which synchronously opens and closes them. The mode of operation is the same as for Figs. 1 to 4. The filling head space and the membrane (9) are sterilized by opening of the valves (46) and (47). These valves are then closed again and the fluid inlet valve (42) is opened. During the downward movement of the valve (42), the cutter (43) cuts the membrane (9) and filling takes place. The chamber (45) provides for smooth flow of the fluid,

particularly in cases where pieces are present. On completion of filling, the valve (42) is closed and the intermediate chamber (45) is cleaned. The sealing head (31) is then raised and the sealing ring (12) seals the closure membrane (10) against the spout (8). In the absence of a closure membrane, it is directly the wall of the pack which is sealed against the spout (8).

Accordingly, several devices of the type shown in Figs. 1 to 6 may be arranged in series in an aseptic filling line.

The invention thus provides an aseptically very safe device which is simpler in design than known devices in the field in question and which enables a very clean cut to be made in the tearable membrane.

CLAIMS

1. A process for aseptically filling with a fluid a pack (7) provided with a spout (8) incorporating an outer tearable membrane (9) in which, the pack being
5 sterile and closed, the filling head space (52) and the outer part of the tearable membrane are sterilized and, on completion of the filling process, the delivery of fluid is shut off and steam or sterile air is admitted to displace the remaining fluid from the filling head
10 space (52) to an emptying pipe, characterized in that the outer tearable membrane (9) is cut and the fluid is concomitantly admitted into the pack (7) and in that the steam or sterile air is admitted perpendicularly in relation to the direction in which the fluid is dis-
15 placed.
2. A process as claimed in claim 1, characterized in that the filling head space (52) is sterilized for 2 to 30 seconds at a temperature between 135 and 165°C and under a steam pressure of 2 to 6 atmospheres.
- 20 3. A process as claimed in claim 1, characterized in that on completion of the filling cycle, steam under a pressure of 1 to 4 atmospheres and at a temperature of 120 to 150°C or sterile air at ambient temperature and under a pressure of 0.5 to 3 atmospheres is injected for
25 0.5 to 2 seconds.
4. A device for carrying out the process claimed in claims 1 to 3, comprising a filling head (1) with a valve (4) to regulate the fluid delivery rate and the cutting means (25), a pack support (11,31) disposed
30 beneath the filling head and designed to seal the pack (7) on completion of the filling cycle, a fluid inlet and outlet pipe (2,3) and, at the bottom of the filling head, a steam inlet valve (5) and a valve (6) with a steam outlet and emptying pipe for the cleaning opera-
35 tion at the end of the filling cycle, characterized in



that the valve (4) for regulating the fluid delivery rate is such that its cutting means (25) cut the tearable membrane during opening of the valve, the valve (4) has an axis which is perpendicular to the axis of the fluid inlet and outlet pipe (2,3) and the steam inlet valve (5) and the valve (6) with a steam outlet pipe are arranged perpendicularly in relation to the axis of the fluid inlet and outlet pipe (2,3).

5. A device as claimed in claim 4, characterized in that the steam inlet valve (5) and the steam outlet and emptying valve (6) are disposed on either side of the plane formed by the axis of the fluid inlet and outlet pipe (2,3) and the axis of the valve (4) for regulating the fluid delivery rate and perpendicularly of the axis of the fluid inlet and outlet pipe (2,3).

6. A device as claimed in claim 4, characterized in that the steam inlet valve (5) and the steam outlet and emptying valve (6) are disposed parallel on the same side of the plane formed by the axis of the fluid inlet and outlet pipe (2,3) and the axis of the valve (4) for regulating the fluid delivery rate and perpendicularly of the fluid inlet and outlet axis (2,3).

7. A device as claimed in any of claims 4 to 6, characterized in that the axis of the valve (4) for regulating the fluid delivery rate forms an angle of 40 to 80° with the axis of the steam inlet valve (5) and with the axis of the steam outlet and emptying valve (6).

8. A device as claimed in any of claims 4 to 6, characterized in that the opening (28) at the filling head for the entry of fluid into the pack is frustoconical or cylindrical in shape.

9. A device as claimed in any of claims 4 to 8, characterized in that the cutting means (25) are formed by radial and vertical cutters.



10. A device as claimed in any of claims 4 to 8, characterized in that the cutting means (43) are formed by U-shaped cutters and in that there is an intermediate flow chamber (45) between the fluid inlet and outlet pipe and the pack.
- 5 11. A device as claimed in any of claims 4 to 10, characterized in that the valve (4) for regulating the fluid delivery rate comprises a flexible membrane (13) or an expanding membrane (15).
- 10 12. An aseptic filling line, characterized in that it comprises at least two devices of the type claimed in any of claims 4 to 11 arranged in series.

