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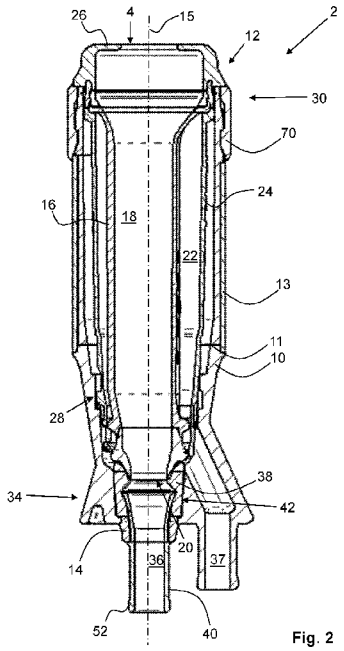

Fig. 2

(57) Abstract: The disclosure concerns a teatcup (2) comprising a shell (10), an exchangeable cartridge (12) arranged in the shell (10), and an outlet member (14). The outlet member (14) comprises a resilient sealing portion (38) and a rigid pipe portion (40), the rigid pipe portion (40) is configured for connection to a milk tube. The outlet member (14) extends through a through hole (32) of the shell and the resilient sealing portion (38) is surrounding the through hole (32), wherein the rigid pipe portion (40) is arranged partially inside the resilient sealing portion (38) and partially outside the shell (10). A radially outer surface portion (42) of the resilient sealing portion (38) seals against the shell (10). An inner surface portion (44) and/or an axial end surface portion (46) of the resilient sealing portion (38) seals against the exchangeable cartridge (12) at a milk outlet opening (20) thereof.

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Teatcup

TECHNICAL FIELD

The invention relates to a teatcup comprising a shell, an exchangeable cartridge arranged in the shell, and an outlet member. The exchangeable cartridge includes an in-built liner that defines a teat space, a milk outlet opening arranged in fluid communication with the teat space, a pulsation space arranged around and delimited from the teat space by the in-built liner, and a sleeve extending circumferentially around the in-built liner to form the pulsation space between the in-built liner and the sleeve. The shell has a longitudinal centre axis, and the exchangeable cartridge is insertable into the shell at a first end portion of the shell. The shell is provided with a through hole at a second end portion of the shell, the second end portion being arranged opposite to the first end portion seen along the longitudinal centre axis, wherein the outlet member defines a milk outlet passage.

BACKGROUND

EP 2793559 discloses a teatcup and a cartridge to be comprised by the teatcup. The teatcup is configured to be attached to a teat of an animal to be milked. The cartridge comprises a sleeve having an upper end and a lower end, and a teatcup liner mounted in the sleeve and having an inner space for receiving the teat. A pulsation space or chamber is provided between an inner side of the sleeve and an outer side of the teatcup liner. The teatcup liner comprises an upper end portion located at the upper end of the sleeve, a barrel portion and a lower end portion extending beyond the lower end of the sleeve. The lower end portion forms an end nozzle beyond the lower end of the sleeve. The end nozzle has a tapering external shape configured to be received in a milk conduit for transporting the milk from the cartridge to the milk conduit.

Since the cartridge comprises the teacup liner, replacement of the teatcup liner in the teatcup is performed by replacing the entire cartridge. Accordingly, replacement of the cartridge does not require separate handling of the liner. Thus, in the teatcup comprising the cartridge, the liner replacement is facilitated in comparison with replacement of a liner in a traditional teatcup.

The milk conduit disclosed in EP 2793559 is a so-called short milk conduit or tube i.e., the short milk tube extending between the teatcup and a claw of a milking cluster. The milking cluster is configured for conventional milking of all udder partitions, such as all udder quarters of a cow. Milking of the udder is thus, controlled based on e.g., the milk flow from the udder as a whole. In traditional/ordinary teatcup liners, the short milk tube may form a

part of the teatcup liner but due to the construction of the cartridge of EP 2793559, the short milk conduit or tube is provided separately from the cartridge, which includes the teatcup liner, as discussed above.

A more gentle and efficient milking of an animal than conventional milking of all udder partitions may be achieved when a milking of each udder partition of the animal, such as each udder quarter of a cow, is controlled separately. Accordingly, in the case of milking cows, reference is made to so-called quarter milking. The control of quarter milking is based on e.g., the milk flow from each udder quarter individually. Individual quarter milking is provided in automatic milking systems. Milking of each udder quarter starts after attachment of the respective teatcup to each of the teats. The milking of each udder quarter may have different durations and may depend inter alia on the amount of milk in the respective udder quarter. A consequence of quarter milking is that each teatcup is detached individually when the milking of the udder quarter is finished. Moreover, the milking vacuum and pulsation for each teat can be controlled (adjusted) automatically.

The normal way of providing quarter milking is to supply milking vacuum individually to each teatcup and to conduct milk from each teatcup via a long milk tube connected to each teatcup. The long milk tube is also accompanied by a long pulse tube for providing a pulsation vacuum to the teatcup.

In some automatic milking systems, a flexible or bendable tubing is further provided between the (relatively stiffer) long tubes and each teatcup for facilitating handling thereof during attachment/detachment and the individual quarter milking of cows.

WO 00/12924 discloses such an easily bendable or flexible tubing for conducting two separate fluids, a liquid (milk) and a gas (pulsation vacuum), between the teatcup and the long milk/pulse tubes. The flexible tubing comprises two laterally spaced flexible tubes, which are spaced apart by flexible connecting means extending between the tubes. On opposite sides of the flexible tubing there are provided, in the tube wall of each flexible tube, transverse, spaced apart recesses arranged side by side at intervals in a respective row along each flexible tube. At one end of the flexible tubing, it is configured to be connected to a teatcup. At an opposite end, the flexible tubing is configured to be connected to a long milk tube and a long pulse tube. Thus, the flexible tubing is intended for use in an automatic milking system set up for quarter milking i.e., wherein milking of each udder quarter of an animal is individually controllable.

SUMMARY

It is an object of the present invention to provide a teatcup for individual udder partition milking, such as quarter milking, wherein a replacement of a teatcup liner is facilitated. In particular, it would be desirable to enable a teatcup comprising an exchangeable cartridge to be used in an automatic milking system set up for individual udder partition milking. To better address one or more of these concerns a teatcup having the features defined in the independent claim is provided.

Thus, according to the invention, there is provided a teatcup comprising a shell, an exchangeable cartridge arranged in the shell, and an outlet member. The exchangeable cartridge includes an in-built liner that defines a teat space, a milk outlet opening arranged in fluid communication with the teat space, a pulsation space arranged around and delimited from the teat space by the in-built liner, and a sleeve extending circumferentially around the in-built liner to form the pulsation space between the in-built liner and the sleeve. The shell has a longitudinal centre axis, and the exchangeable cartridge is insertable into the shell at a first end portion of the shell. The shell is provided with a through hole at a second end portion of the shell, the second end portion being arranged opposite to the first end portion seen along the longitudinal centre axis, wherein the outlet member defines a milk outlet passage. The outlet member comprises a resilient sealing portion and a rigid pipe portion, the rigid pipe portion being configured for connection to a flexible milk tube, wherein the outlet member extends through the through hole and the resilient sealing portion is surrounding the through hole, wherein the rigid pipe portion is arranged partially inside the resilient sealing portion and partially outside the shell, wherein a radially outer surface portion of the resilient sealing portion seals against the shell, and wherein an inner surface portion and/or an axial end surface portion of the resilient sealing portion seals against the cartridge at its milk outlet opening such that the teat space of the cartridge is in fluid communication with the milk outlet passage of the outlet member.

In this way, the teatcup liner is easily replaced by the exchangeable cartridge being insertable into the shell of the teatcup. The teatcup hereby provides a gas and liquid tight connection between the exchangeable cartridge, outlet member and shell by the radially outer surface portion of the resilient sealing portion that seals (abuts) against the shell, and the inner surface portion and/or the axial end surface portion of the resilient sealing portion that seals (abuts) against the cartridge at its milk outlet opening such that the teat space of the cartridge is in fluid communication with the milk outlet passage of the outlet member. The outlet member of the teatcup further provides a liquid tight connection to a flexible milk tube

via the rigid pipe portion and is thus, configured for use in an automatic milking system that provides individual udder partition/quarter milking of animals.

The teatcup is a two-chamber teatcup, wherein the teat space forms one of the chambers which, during milking, holds a teat to be milked and is subjected to a milking vacuum. The pulsation space forms the second (pulsation) chamber of the two chambers and is subjected to a pulsating pressure change during milking of the teat. The operational principles of a two-chamber teatcup are well known. The pulsation space (chamber) of the present teatcup is formed inside the exchangeable cartridge between the in-built liner and an outer sleeve on the exchangeable cartridge as also described in EP 2793559. The sleeve of the exchangeable cartridge hereby comprises a through hole configured to permit a pulsation vacuum to be applied in the pulsation space (chamber) of the exchangeable cartridge.

The in-built liner of the exchangeable cartridge is flexible such that it is moved by the interaction between the milking vacuum in the teat space and the pulsation vacuum in the pulsation space during use of the teatcup.

Milking of an individual teat of an animal may hereby be performed by utilising any automatic milking algorithm suited for use with the teatcup. Mentioned purely as examples, such a milking algorithm may vary one or more of the milking vacuum, the pulsation vacuum, the pulsation ratio and/or rate based on one or more of a current milk flow rate from the teat, duration of a current milking operation, and historic milking data of an individual animal.

The exchangeable cartridge, which herein alternatively may be referred to as the cartridge, is easily replaced manually by hand without the use of any tool. In contrast, a replacement of a liner in an automatic milking system used today is both a time consuming and difficult job that requires tools along with experienced service personnel. The teatcup of the present invention on the other hand provides a significantly faster and easier replacement of the liner. However, a cartridge replacement that is more easily performed using a tool than purely by hand, or that may require a tool for its exchange is also encompassed by the present disclosure.

For instance, the cartridge may be secured to the shell by a bayonet coupling. Thus, service personnel may loosen a used cartridge from the shell by twisting the cartridge, in relation to the shell, about the longitudinal centre axis and thereafter pull the used cartridge out of the shell. A new cartridge is inserted into the shell through the opening in the shell at its first end

portion. The new cartridge is twisted in an opposite direction about the longitudinal centre axis to secure the cartridge in the shell.

Axial and radial reference made herein are seen in relation to the longitudinal centre axis.

As mentioned above, the teat space of the cartridge is hereby in fluid tight communication with the milk outlet passage of the outlet member due to the inner surface portion and/or the axial end surface portion of the resilient sealing portion sealing (abutting) against the cartridge at its milk outlet opening. Thus, without negatively influencing the hygienic properties of the teatcup, the milk extracted from the relevant teat can flow from the teat space through the outlet passage of the outlet member into the flexible milk tube that is connected to the rigid pipe portion.

At an end opposite to the milk outlet opening, the cartridge is provided with a teat receiving opening, around which a lip extends. During milking a teat of an animal extends through the teat receiving opening into the teat space. The lip seals against the teat and/or udder.

The outlet member with its resilient sealing portion and rigid pipe portion, as defined above, serves at least two purposes namely, to seal against the cartridge at its milk outlet opening and to provide for connection of a flexible milk tube to the teatcup.

The flexible milk tube may preferably be configured as the easily bendable tubing disclosed in WO 00/12924, but may alternatively be configured as a long milk tube that leads from the teatcup e.g., to a milk meter or to a milk receiver unit of an automatic milking system.

Accordingly, the teatcup may be used in an automatic milking system devised for individual udder partition milking, such as quarter milking in the case of milking cows.

According to embodiments, as seen along the longitudinal centre axis, a portion of the resilient sealing portion overlaps a portion of the rigid pipe portion providing a sealing abutment between the resilient sealing portion and the rigid pipe portion. In this manner, a fluid tight transition between the resilient sealing portion and the rigid pipe portion is provided. Thus, the milk outlet passage of the outlet member is formed, at least in part, by a passage through the resilient sealing portion and the rigid pipe portion.

According to embodiments, the rigid pipe portion comprises a first end portion, the first end portion of the rigid pipe portion being arranged within the shell, and the first end portion of the

rigid pipe portion has an outer diameter that is larger than a diameter of the through hole. In this manner, the outlet member is securely positioned within the shell.

More specifically, the first end portion of the rigid pipe portion being arranged within the shell and having an outer diameter that is larger than the diameter of the through hole of the shell means that the first end portion of the rigid pipe portion cannot pass through the through hole. In other words, when the outlet member is assembled in a mounted position, it cannot be displaced beyond the mounted position out of the through hole of the shell. Moreover, as discussed above, the inner surface portion and/or the axial end surface portion of the resilient sealing portion seals against the cartridge. This means that the outlet member is securely fixated and further cannot move axially in a direction towards the first end portion of the shell when the cartridge is mounted in the shell.

According to embodiments, the rigid pipe portion comprises a second end portion opposite to its first end portion, seen along the longitudinal centre axis, and the second end portion has an outer diameter that is smaller than the diameter of the through hole of the shell. In this manner, the outlet member is removable from the shell after the cartridge has been removed from the shell by pushing the outlet member in a direction towards the first end portion of the shell. Thus, the outlet member is exchangeable e.g., if required or if service intervals of the teatcup should so dictate.

According to embodiments, the second end portion of the rigid pipe portion is arranged outside the shell, and the rigid pipe portion at its second end portion is provided with a circumferentially extending external bead configured for engagement with the flexible milk tube. In this manner, a more secure engagement between the flexible milk tube and the outlet member is provided.

For instance, such a secure engagement between the flexible milk tube and the outlet member enables handling of the teatcup in connection with automatic (robotic) milking of an animal with a reduced risk of the flexible milk tube coming loose from the teatcup.

According to embodiments, the inner surface portion and/or the axial end surface portion of the resilient sealing portion, that seals against the exchangeable cartridge at its milk outlet opening, includes a first funnel shaped portion. In this manner, it is ensured that when the cartridge is placed in the shell, the inner surface portion and/or the axial end surface portion of the resilient sealing portion reliably seals against the cartridge at its milk outlet opening. The milk outlet opening of the cartridge is preferably formed as an end nozzle having a

tapering external shape configured to be received in the first funnel shaped portion. The tapering end nozzle of the cartridge hereby provides a very reliable seal with the first funnel shaped portion of the resilient sealing portion, so that the milk will flow in a very reliable manner from the teatcup liner into the outlet member of the teatcup.

According to embodiments, the rigid pipe portion is provided with a radially outer annular shoulder, and the resilient sealing portion abuts in an axial direction against the radially outer annular shoulder. In this manner, a reliable positioning of the resilient sealing portion on the rigid pipe portion is provided. Namely, the radially outer annular shoulder prevents the resilient sealing portion from sliding on the rigid pipe portion towards its second end portion.

According to embodiments, the resilient sealing portion is sleeve-shaped and provided with a circumferentially extending groove, and the shell is provided with an annular rim portion, which extends around the shell at the through hole and into the circumferentially extending groove. In this manner, by the engagement of the annular rim portion in the circumferentially extending groove, the outlet member is more securely positioned along the longitudinal centre axis in relation the shell.

According to embodiments, seen along the longitudinal centre axis, a diameter of an inner surface of the shell at its second end portion is tapering towards the through hole, in such a way that the diameter is smaller towards the through hole than towards the first end portion of the shell. In this manner, the outlet member is more securely positioned within the tapering second end portion of the shell.

More specifically, the radially outer surface portion of the resilient sealing portion, which preferably tapers in a corresponding manner, is guided and securely positioned by the tapering of the inner surface of the second end portion of the shell to position the outlet member in relation to the through hole of the shell. The embodiment also provides a more reliable sealing (abutment) between the tapering radially outer surface portion of the resilient sealing portion and the corresponding tapering inner surface of the shell. The positioning and sealing effects are further enhanced by the mounted cartridge pushing axially and radially against the resilient sealing portion.

According to embodiments, the outlet member is manually detachable from the shell by pushing the outlet member in a direction towards the first end portion of the shell. In this manner, exchange of the outlet member is also easily performed by service personnel e.g., in connection with the exchange of the cartridge.

According to embodiments, the shell comprises an injection moulded plastic portion and an outer metal sleeve extending at least partially along the injection moulded plastic portion. In this manner, a robust teatcup is provided by the outer metal sleeve protecting the inner injection moulded plastic portion from being damaged. The inner injection moulded plastic portion may be manufactured in a cost-efficient manner including all of the inner surfaces (interfaces) for connecting the cartridge and the outlet member. During milking a teatcup may accidentally fall off due to for instance kick-off by an animal. The outer metal sleeve thereby safeguards the integrity and dimensional stability on the inner injection moulded plastic portion (preventing for instance deformation of its round basic shape).

According to embodiments, the teatcup comprises a resilient band arranged circumferentially around an exterior of the shell at its first end portion. The resilient band is separate from the cartridge and the resilient band forms an impact absorbing member. In this manner, the teatcup is protected by the resilient band when bumping e.g. into the ground or portions of a milking stall. The teatcup is intended for an automatic milking system, such as the DeLaval voluntary milking system VMS. During teatcup detachment, it may happen that the teatcup accidentally hits the ground or portions of the milking stall. Conversely, should the teatcup come into contact with an animal being milked, the impact may be reduced by the resilient band, and the animal may be spared discomfort.

Further features of, and advantages with, the invention will become apparent when studying the appended claims and the following detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

Various aspects and/or embodiments of the invention, including its particular features and advantages, will be readily understood from the example embodiments discussed in the following detailed description and the accompanying drawings, in which:

Figs. 1a and 1b illustrate a teatcup according to embodiments of the invention,
Fig. 2 illustrates a longitudinal section along a longitudinal centre axis of the teatcup, and
Figs. 3a – 3c illustrate separate longitudinal sections through an exchangeable cartridge, a shell, and an outlet member of the teatcup.

DETAILED DESCRIPTION

Aspects and/or embodiments of the invention will now be described more fully. Like numbers refer to like elements throughout. Well-known functions or constructions will not necessarily be described in detail for brevity and/or clarity.

Figs. 1a and 1b illustrate a teatcup 2 according to embodiments. In **Figs. 1a and 1b** the teatcup 2 is shown in two different perspective views.

The teatcup 2 is configured for milking a teat of an animal such as a cow, a sheep, a goat, a water buffalo, etc.

The teatcup 2 forms a milk extraction portion of an automatic milking system devised for milking animals. The teatcup 2 is included in a set of teatcups. The number of teatcups of the set of teatcups is adapted to the kind of animal intended to be milked and more specifically, to the number of teats or udder partitions of the relevant kind of animals. For instance, in the case of the animal being a cow, the set of teatcups includes four teatcups 2.

The teatcup 2 has a teat receiving opening 4. In use of the teatcup 2, a teat of an animal to be milked is inserted into the teat receiving opening 4. At a second end of the teacup 2 opposite to the teat receiving opening 4, a milking vacuum is applied, and milk is lead from the teatcup 2 via a non-shown flexible milk tube. At the second end opposite to the teat receiving opening 4 also, a pulsation vacuum is applied to the teatcup 2.

According to the illustrated embodiment, the teatcup 2 is configured for being handled by a robot arm i.e., the teatcup 2 forms part of an automatic milking system, in which the teatcups of the automatic milking system are automatically attached to the teats of animals by the robot arm. In a known manner, the teatcup 2 is for this purpose provided with a handle 8 for grasping by a gripper of the robot arm.

The teatcup 2 may also be manually attached to the teat of an animal. For instance, if an animal is new or milked for the first time in the automatic milking system or the animal has a difficult teat anatomy for the automatic milking system and/or the robot arm is exhibiting attachment problems, the teatcup 2 may also be attached manually by hand in a manual mode of the automatic milking system.

The teatcup 2 comprises a shell 10, an exchangeable cartridge 12 arranged in the shell 10, and an outlet member 14, see further below with reference to **Figs. 2 – 3c**.

Fig. 2 illustrates a longitudinal section along a longitudinal centre axis 15 of the teatcup 2 shown in **Figs. 1a and 1b**.

As mentioned above, the teatcup 2 comprises a shell 10, an exchangeable cartridge 12 arranged in the shell 10, and an outlet member 14. The shell 10 has the longitudinal centre axis 15.

The cartridge 12 includes an in-built liner 16 that defines a teat space 18, a milk outlet opening 20 arranged in fluid communication with the teat space 18, and a pulsation space 22 arranged around and delimited from the teat space 18 by the in-built liner 16. The cartridge 12 comprises a sleeve 24, which extends circumferentially around the liner 16. The pulsation space 22 is formed between the liner 16 and the sleeve 24.

Seen along the longitudinal centre axis 15, the teat receiving opening 4 and the milk outlet opening 20 are arranged at opposite ends of the cartridge 12.

A flexible lip 26 extends around the teat receiving opening 4. The flexible lip 26 ensures that the teatcup 2 seals against an udder and/or a teat of an animal being milked. Also, the liner 16 is flexible in order to ensure a proper cyclic opening and closing as well as proper milking function of the teatcup 2. The sleeve 24, on the other hand, is rigid such that during use of the teatcup 2, a pulsating vacuum in the pulsation space 22 will affect the flexible liner 16 and such that the cartridge 12 can be secured in the shell 10. For the latter purpose, a bayonet coupling 28 may be provided between the sleeve 24 and the shell 10.

During use of the of the teatcup 2, a milk outlet passage 36 through the outlet member 14 forms a fluid connection to the teat space 18 for application of a milking vacuum and outflow of extracted milk. A further pulsation passage 37 for a pulsation connection to the pulsation space 22 in the cartridge 12 is formed in and via the shell 10.

Figs. 3a – 3c illustrate respective separate longitudinal sections through the cartridge 12, the shell 10, and the outlet member 14 of the teatcup 2 discussed above with reference to **Figs. 1 and 2**.

The cartridge 12 is separately shown in **Fig. 3a**, such that inter alia the liner 16, the milk outlet opening 20, the sleeve 24, and a portion of the bayonet coupling 28 may be clearly identified.

With reference to **Fig. 3b**, an opening 29 is provided at a first end portion 30 of the shell 10. The shell 10 is provided with a through hole 32 at a second end portion 34 of the shell 10. The second end portion 34 is arranged opposite to the first end portion 30 seen along the longitudinal centre axis 15.

The shell 10 comprises at least one part.

In the illustrated embodiments, the shell 10 comprise an injection moulded plastic portion 11 and an outer metal sleeve 13 (shown in **Fig. 2**) extending at least partially along the injection moulded plastic portion 11. The injection moulded plastic portion 11 may be made e.g., from Nylon, PA66, PBT-HI and it may be fibre reinforced. The outer metal sleeve 13 may be made from e.g., stainless steel.

As can be seen in **Fig. 2**, the exchangeable cartridge 12 is insertable into the shell 10 at the first end portion 30 of the shell 10. That is, the cartridge 12 fits into the shell 10 through the opening 29.

With reference to **Fig. 3c**, the outlet member 14 defines a milk outlet passage 36. The outlet member 14 comprises a resilient sealing portion 38 and a rigid pipe portion 40. The rigid pipe portion 40 is configured for connection to a flexible milk tube (not shown).

The resilient sealing portion 38 may be made from e.g., silicone, thermoplastic elastomer, natural rubber, or synthetic rubber. The rigid pipe portion 40 may be made from metal such as stainless steel or a rigid plastic material such as nylon, PA66, PBT-HI, and it may be fibre reinforced.

As can be seen in **Fig. 2**, the outlet member 14 is mounted and extends through the through hole 32 of the shell 10. The resilient sealing portion 38 is arranged partially within the shell 10 and the pipe portion 40 is arranged partially outside the shell 10. More precisely, as can be seen, the resilient sealing portion 38 is mounted in and surrounding the through hole 32, wherein the pipe portion 40 is arranged partially inside the resilient sealing portion 38 and partially outside the shell 10.

With reference to **Figs. 2 - 3c**, a radially outer surface portion 42 of the resilient sealing portion 38 seals against an inner surface of the shell 10. An inner surface portion 44 and/or an axial end surface portion 46 of the resilient sealing portion 38 seals in a fluid tight manner against the cartridge 12 at its milk outlet opening 20 such that the teat space 18 of the

cartridge 12 is in fluid communication with the milk outlet passage 36 of the outlet member 14.

Accordingly, a flexible milk tube of a milking system is connectable to the teatcup 2 via the rigid pipe portion 40. Thus, in use in an automatic milking system, the teatcup 2 can be freely handled and positioned e.g., during attachment thereof to a teat of an animal. Moreover, during milking, milk extracted from the teat can flow, without leakage, from the teat space 18 through the outlet passage 36 of the outlet member 14 into the flexible milk tube that is connected to the rigid pipe portion 40 of the outlet member 14.

Seen along the longitudinal centre axis 15, a portion of the resilient sealing portion 38 overlaps a portion of the rigid pipe portion 40 and thus, provide a sealing abutment between the resilient sealing portion 38 and the rigid pipe portion 40.

Hence, a fluid tight outlet member 14 comprising the resilient sealing portion 38 and the rigid pipe portion 40 and forming the milk outlet passage 36 is provided.

The rigid pipe portion 40 comprises a first end portion 48. In the teatcup 2, the first end portion 48 of the rigid pipe portion 40 is arranged within the shell 10. The first end portion 48 of the rigid pipe portion 40 has an outer diameter d1 that is larger than a diameter D of the through hole 32 of the shell 10.

The diameter difference d1 vs D between the first end portion 48 of the rigid pipe portion 40 and the through hole 32 of the shell 10 will prevent the outlet member 40 from being forced through the through hole 32. Accordingly, the cartridge 12 can be secured and positioned in sealing abutment with the outlet member 14 without risking that the outlet member 14 is pushed out of the shell 10.

If the outlet member 14 is to be removed from the shell 10, this is done through the opening 29 at the first end portion 30 of the shell 10.

The rigid pipe portion 40 comprises a second end portion 50 opposite to its first end portion 48, seen along the longitudinal centre axis 15. The second end portion 50 has an outer diameter d2 that is smaller than the diameter D of the through hole 32 of the shell 10.

Thus, the outlet member 14 fits with the second end portion 50 of the rigid pipe portion 40 through the through hole 32 for the rigid pipe portion 40 to be accessible for connection of the flexible milk tube to the teat cup 2.

Also, the smaller diameter d2 of the second end portion of the rigid pipe portion 40 provides for the outlet member 14 to be removed from the shell 10 after the cartridge 12 has been removed from the shell 10.

The second end portion 50 of the rigid pipe portion 40 is arranged outside the shell 10. The rigid pipe portion 40, at its second end portion 50 is provided with a circumferentially extending external bead 52 configured for engagement with the flexible milk tube.

The bead 52 may provide a regionally increased frictional engagement between the rigid pipe portion 40 and the flexible milk tube when it is connected to the outlet member 14. A secure engagement between the teatcup 2 and the flexible milk tube thus, may be provided.

The outer diameter d2 of the second end portion 50 of the rigid pipe portion 40 may be the outer diameter of the circumferentially extending external bead 52.

The inner surface portion 44 and/or the axial end surface portion 46 of the resilient sealing portion 38, that seals against the exchangeable cartridge 12 at its milk outlet opening 20, includes a first funnel shaped portion 54.

Thus, a fluid tight passage between the teat space 18 of the cartridge 12 and the milk outlet passage 36 of the outlet member 14 is provided in the shown embodiment.

According to some embodiments, such as the illustrated embodiment, the rigid pipe portion 40, at its first end portion 48 is provided with a conical portion 56, and the conical portion 56 is arranged in sealing abutment with a second funnel-shaped portion 58 at an inner surface portion of the resilient sealing portion 38. In this manner, the rigid pipe portion 40 and the resilient sealing portion 38 are arranged in a fluid tight manner in relation to each other. This further ensures that the milk outlet passage 36 through the outlet member 14 is fluid tight.

The rigid pipe portion 40 is provided with a radially outer annular shoulder 60, and the resilient sealing portion 38 abuts in an axial direction against the radially outer annular shoulder 60.

Thus, the resilient sealing portion 38 is reliably connected and positioned on the rigid pipe portion 40.

For instance, in conjunction with the conical portion 56 of the rigid pipe portion 40 and the second funnel-shaped portion 58 of the resilient sealing portion 38, which may bias the resilient sealing portion 38 in a direction towards the second end portion 50 of the rigid pipe portion 40, the annular shoulder 60 prevents sliding of the resilient sealing portion 38 towards the second end portion 50 along the rigid pipe portion 40.

According to some embodiments, such as the illustrated embodiments, an outer surface 62 of the exchangeable cartridge 12, at its milk outlet opening 20, has a tapering shape towards the outlet member 14. In this manner, forming of the seal between the cartridge 12 and the inner surface portion 44 and/or the axial end surface portion 46 of the resilient sealing portion 38 is facilitated or made more reliable.

Accordingly, in some embodiments, such as in the illustrated embodiment, the outer surface 62, at the milk outlet opening 20 of the exchangeable cartridge 12, which has the tapering shape, seals against the first funnel-shaped portion 54 of the resilient sealing portion 38.

According to some embodiments, the resilient sealing portion 38 is made from one or more of silicone, thermoplastic elastomer, natural rubber, synthetic rubber. In this manner, the sealing properties of the resilient sealing portion 38, against the cartridge 12 and the rigid pipe portion 40 is provided.

From certain regulatory aspects, it may be preferred that of the resilient sealing portion 38 is made from silicone.

The resilient sealing portion 38 is sleeve-shaped and provided with a circumferentially extending groove 64, and the shell 10 is provided with an annular rim portion 66, which extends around the shell 10 at the through hole 32 and into the circumferentially extending groove 64.

The thus, achieved engagement between the rim portion 66 and the groove 64, ensures that the outlet member 14 is securely positioned in the shell 10 along the longitudinal centre axis 15.

Seen along the longitudinal centre axis 15, a diameter of an inner surface 68 of the shell 10 at its second end portion 34 is tapering towards the through hole 32, in such a way that the diameter is smaller towards the through hole 32 than towards the first end portion 32 of the shell 10.

Thus, the radially outer surface portion 42 of the resilient sealing portion 38 may be positioned by the tapering of the inner surface 68 of the shell 10 at its second end portion 34.

The outlet member 14 is manually detachable by hand from the shell 10.

For instance, with no flexible milk tube connected to the outlet member 14 and with the cartridge 12 removed from the shell 10, providing axial pressure or pushing against the second end portion 50 of the rigid pipe portion 40 causes the resilient sealing portion 38 to disengage from the shell 10 such that the outlet member 14 can fall out of the shell 10 when the first end portion 30 thereof is tilted downwardly.

With reference to **Fig. 2**, the teatcup 2 comprises a resilient band 70 arranged circumferentially around an exterior of the shell 10 at its first end portion 30. The resilient band 70 is separate from the cartridge 12. Also, the resilient band 70 is separate from the shell 10. The resilient band 70 forms an impact absorbing member.

For instance, the resilient band 70 may be made from one or more of silicone, thermoplastic elastomer, natural rubber, synthetic rubber. The resilient band 70 being separate from the cartridge 12 means that the resilient band 70 is a part separate from the cartridge 12 and is attachable to the shell 10 separately from connecting the cartridge 12 to the shell 10.

It is to be understood that the foregoing is illustrative of various example embodiments and that the invention is defined only by the appended claims. A person skilled in the art will realize that the example embodiments may be modified, and that different features of the example embodiments may be combined to create embodiments other than those described herein, without departing from the scope of the invention, as defined by the appended claims.

CLAIMS

1. A teatcup (2) comprising a shell (10), an exchangeable cartridge (12) arranged in the shell (10), and an outlet member (14), wherein

the exchangeable cartridge (12) includes an in-built liner (16) that defines a teat space (18), a milk outlet opening (20) arranged in fluid communication with the teat space (18), a pulsation space (22) arranged around and delimited from the teat space by the in-built liner (16), and a sleeve (24) extending circumferentially around the in-built liner (16) to form the pulsation space (22) between the in-built liner (16) and the sleeve (24), wherein

the shell (10) has a longitudinal centre axis (15), and the exchangeable cartridge (12) is insertable into the shell (10) at a first end portion (30) of the shell (10), wherein

the shell (10) is provided with a through hole (32) at a second end portion (34) of the shell (10), the second end portion (34) being arranged opposite to the first end portion (30) seen along the longitudinal centre axis (15), wherein

the outlet member (14) defines a milk outlet passage (36),

characterised in that

the outlet member (14) comprises a resilient sealing portion (38) and a rigid pipe portion (40), the rigid pipe portion (40) being configured for connection to a flexible milk tube, wherein

the outlet member (14) extends through the through hole (32) and the resilient sealing portion (38) is surrounding the through hole (32), wherein the rigid pipe portion (40) is arranged partially inside the resilient sealing portion (38) and partially outside the shell (10), wherein

a radially outer surface portion (42) of the resilient sealing portion (38) seals against the shell (10), and wherein

an inner surface portion (44) and/or an axial end surface portion (46) of the resilient sealing portion (38) seals against the exchangeable cartridge (12) at its milk outlet opening (20) such that the teat space (18) of the exchangeable cartridge (12) is in fluid communication with the milk outlet passage (36) of the outlet member (14).

2. The teatcup (2) according to claim 1, wherein seen along the longitudinal centre axis (15), a portion of the resilient sealing portion (38) overlaps a portion of the rigid pipe portion (40) providing a sealing abutment between the resilient sealing portion (38) and the rigid pipe portion (40).

3. The teatcup (2) according to any one of the preceding claims, wherein the rigid pipe portion (40) comprises a first end portion (48), the first end portion (48) of the rigid pipe

portion (40) being arranged within the shell (10), and wherein the first end portion (48) of the rigid pipe portion (40) has an outer diameter (d1) that is larger than a diameter (D) of the through hole (32).

4. The teatcup (2) according to claim 3, wherein the rigid pipe portion (40) comprises a second end portion (50) opposite to its first end portion (48), seen along the longitudinal centre axis (15), and wherein the second end portion (50) has an outer diameter (d2) that is smaller than the diameter (D) of the through hole (32) of the shell (10).

5. The teatcup (2) according to claim 4, wherein the second end portion (50) of the rigid pipe portion (40) is arranged outside the shell (10), and wherein the rigid pipe portion (40) at its second end portion (50) is provided with a circumferentially extending external bead (52) configured for engagement with the flexible milk tube.

6. The teatcup (2) according to any one of the preceding claims, wherein the inner surface portion (44) and/or the axial end surface portion (46) of the resilient sealing portion (38), that seals against the exchangeable cartridge (12) at its milk outlet opening (20), includes a first funnel shaped portion (54).

7. The teatcup (2) according to claim 6 and any one of claims 3 - 5, wherein the rigid pipe portion (40), at its first end portion (48) is provided with a conical portion (56), and wherein the conical portion (56) is arranged in sealing abutment with a second funnel-shaped portion (58) at an inner surface portion of the resilient sealing portion (38).

8. The teatcup (2) according to claim 7, wherein the rigid pipe portion (40) is provided with a radially outer annular shoulder (60), and wherein the resilient sealing portion (38) abuts in an axial direction against the radially outer annular shoulder (60).

9. The teatcup (2) according to any one of the preceding claims, wherein an outer surface (62) of the exchangeable cartridge (12), at its milk outlet opening (20), has a tapering shape towards the outlet member (14).

10. The teatcup (2) according to claim 9 and any one of claims 6 - 8, wherein the outer surface (62) of the exchangeable cartridge (12) having the tapering shape, seals against the first funnel-shaped portion (54) of the resilient sealing portion (38).

11. The teatcup (2) according to any one of the preceding claims, wherein the resilient sealing portion (38) is made from one or more of silicone, thermoplastic elastomer, natural rubber, synthetic rubber.

12. The teatcup (2) according to any one of the preceding claims, wherein the resilient sealing portion (38) is sleeve-shaped and provided with a circumferentially extending groove (64), and wherein the shell (10) is provided with an annular rim portion (66), which extends around the shell (10) at the through hole (32) and into the circumferentially extending groove (64).

13. The teatcup (2) according to any one of the preceding claims, wherein seen along the longitudinal centre axis (15), a diameter of an inner surface (68) of the shell (10) at its second end portion is tapering towards the through hole (32), in such a way that the diameter is smaller towards the through hole (32) than towards the first end portion of the shell (10).

14. The teatcup (2) according to claim 4 or 5, wherein the outlet member (14) is manually detachable from the shell (10) by pushing the outlet member (14) in a direction towards the first end portion (30) of the shell (10).

15. The teatcup (2) according to any one of the preceding claims, wherein the shell (10) comprises an injection moulded plastic portion (11) and an outer metal sleeve (13) extending at least partially along the injection moulded plastic portion (11).

16. The teatcup (2) according to any one of the preceding claims, comprising a resilient band (70) arranged circumferentially around an exterior of the shell (10) at its first end portion (30), wherein the resilient band (70) is separate from the exchangeable cartridge (12), and wherein the resilient band (70) forms an impact absorbing member.

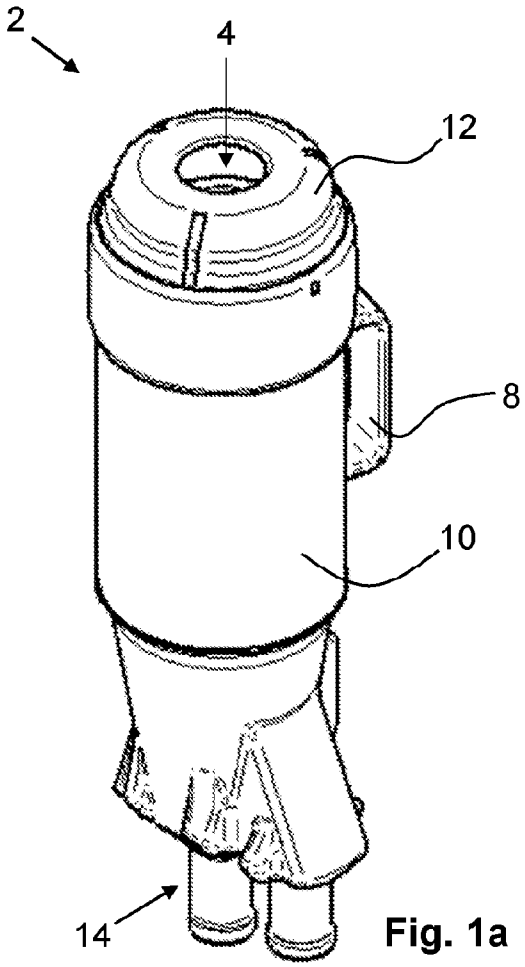

Fig. 1a

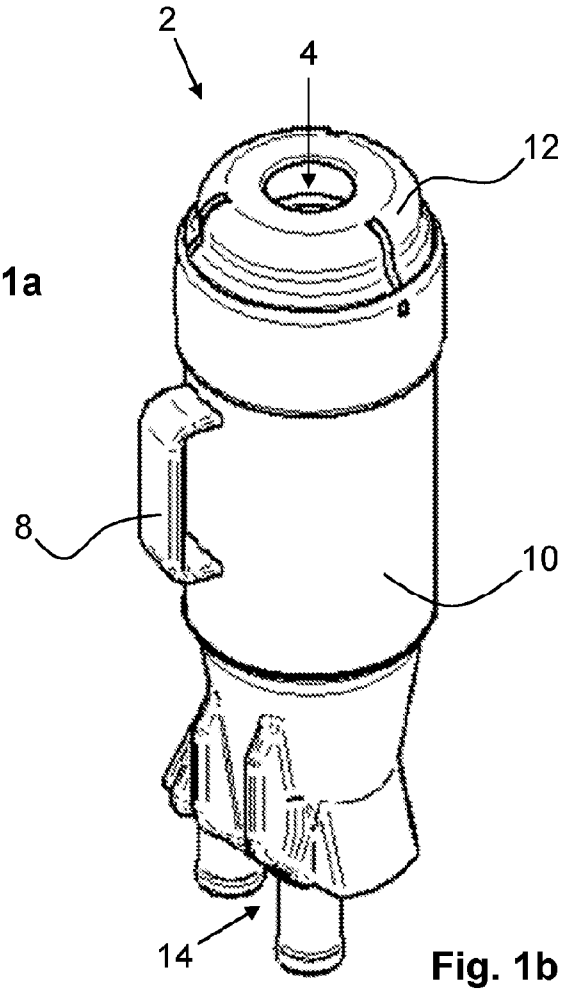

Fig. 1b

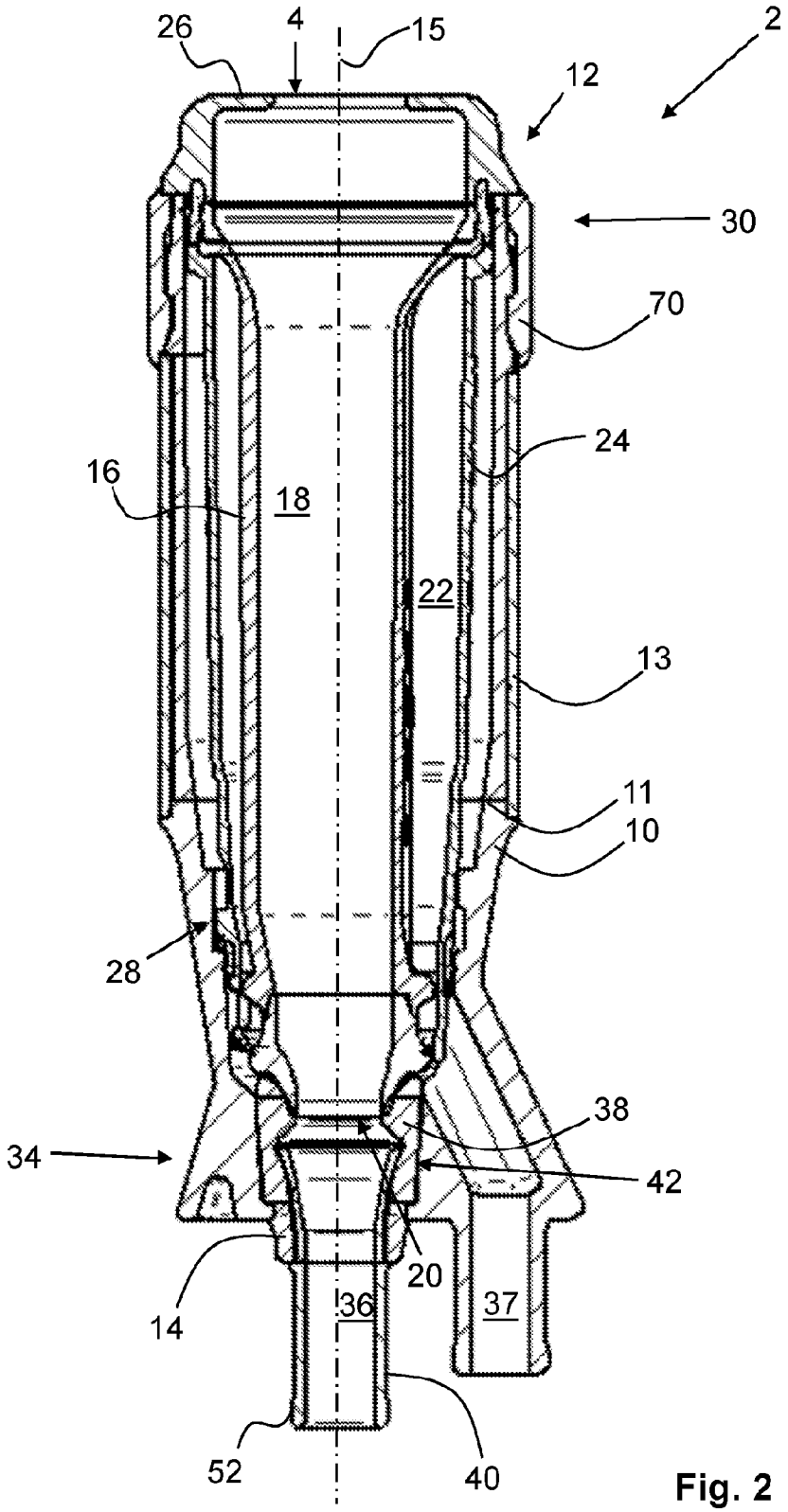

Fig. 2

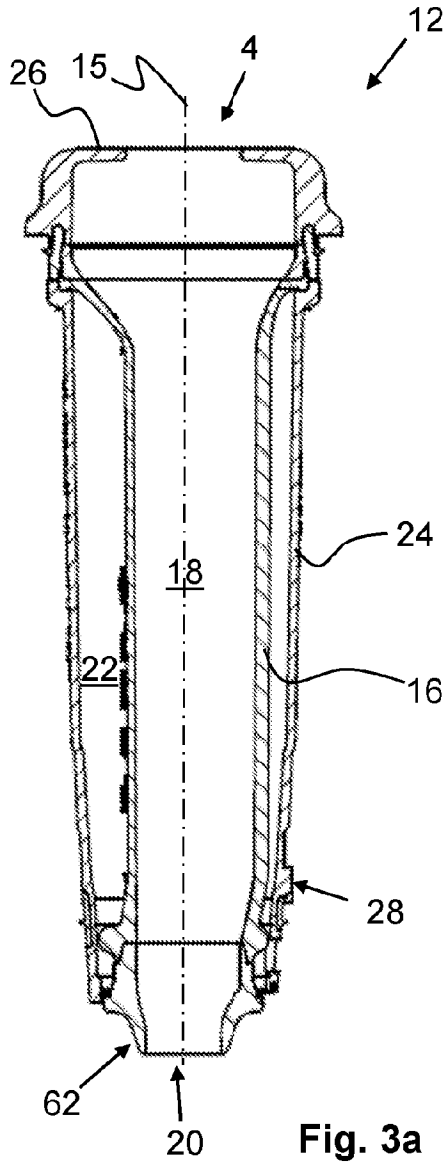

Fig. 3a

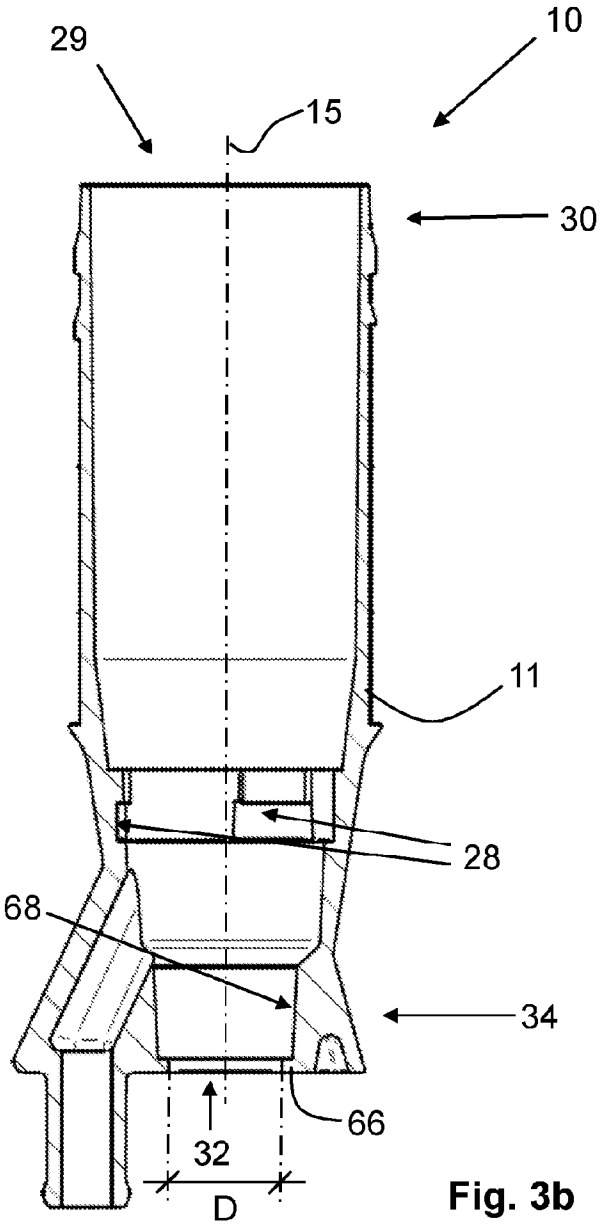

Fig. 3b

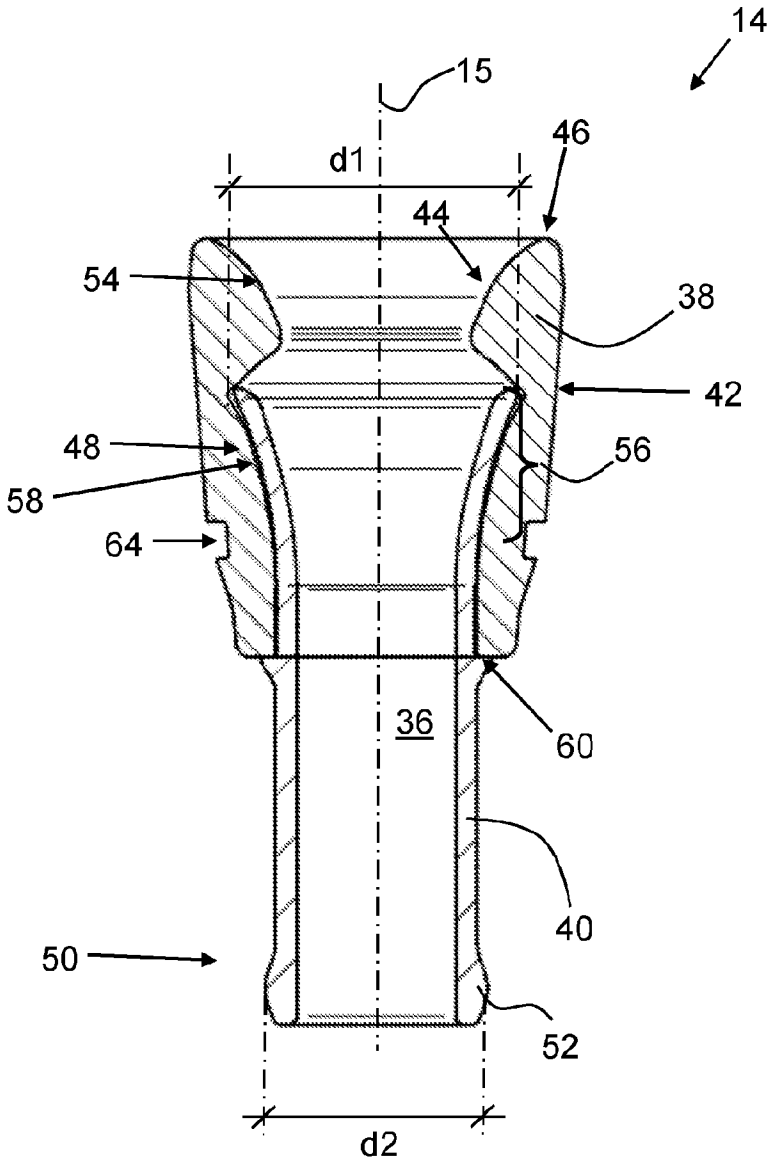

Fig. 3c

INTERNATIONAL SEARCH REPORT

International application No
PCT/SE2024/051060

A. CLASSIFICATION OF SUBJECT MATTER

INV. A01J5/08
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A01J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2020/267926 A1 (ANDERSSON ANNA [SE]) 27 August 2020 (2020-08-27) pages 3,5; figures 1-3,6,7	1-16
Y	US 6 202 593 B1 (MAIER JAKOB [DE] ET AL) 20 March 2001 (2001-03-20) figures 1,3	1-16
Y	US 10 548 291 B2 (DELAVAL HOLDING AB [SE]) 4 February 2020 (2020-02-04) figure 2	5

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance;; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance;; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
11 February 2025	28/02/2025

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Authorized officer

Nédélec, Morgan

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/SE2024/051060

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