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(54) FOUNTAIN PEN

FÜLLFEDERHALTER

STYLO À PLUME

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Description

Technical Field

[0001] The present invention relates to a fountain pen.

[0002] A fountain pen typically comprises a hollow barrel that functions as the outer casing of the pen and houses a reservoir (consisting in a cavity, or a cartridge) containing ink; the barrel also provides the grippable portion of the pen that is held by a user when writing. Attached to one end of the hollow barrel is a nib, constituting the part of the pen through which the ink is delivered when writing, and connected for this purpose to the ink reservoir by an element known to persons skilled in the art as a feed.

[0003] The nib presents a writing tip and rests flush on the feed, which is furnished with one or more ducts conveying the ink from the reservoir to the tip by capillary action.

Background Art

[0004] By reason of their structure, fountain pens of conventional design are inevitably liable to leak appreciable amounts of ink when exposed to fluctuations in temperature or pressure.

[0005] In the main, ink leaks may be caused as a result of the pen barrel being warmed by the hand of the user when writing, and during air travel, as a consequence of pressure dropping in the aircraft cabin. In either case, a difference in pressure is created between the inside of the reservoir (or cartridge) and the outside, sufficient to overcome the resistance of the ducts in the nib and cause the ink to escape.

[0006] In effect, the force exerted on the ink is due to the pressure of the gas (typically air) locked in the cartridge being greater than that of the surrounding environment, and will tend to continue expelling the ink until such time as the pressure of this same gas and the pressure externally of the cartridge have equalized.

[0007] With regard in particular to a drop in ambient pressure, it has been found that the problem persists even when adopting a hermetic cap, since the moment the cap is removed, the ink will in any event escape and leave self-evidently unwelcome stains, often indelible. In this situation, consequently, the fountain pen becomes unusable at least temporarily, until the cause of the variation in temperature and/or pressure disappears.

[0008] According to US patent 2 340 359 (Ziegler) in a pen with an elastically compressibile sac structure as reservoir for the ink to avoid the expulsion of ink in case of changes in atmospheric pressure it suggested that the sac is equipped with a shrounding which is formed of one or more strands of filament wound closely about the sac, so to realize a net, such strand or filament being not extensible so to avoid any dilatation of the sac in case of changes in atmoapheric pressure.

[0009] It has been found that the said solution is difficult to be realized in practice considering what it is described in the specification at page 2.

[0010] According to WO 2009/141747 it is provided a fountain pen with a refillable ink reservoir deformable between a first limit position with maximum internal volume and a second position with reduced internal volume and subject to the actions of a mechanism to create a vacuum inside the ink reservoir by compressing and decompressing the ink reservoir in view to consent the refilling of ink inside the reservoir. The fountain pen is equipped with a cap for covering the nib of the pen, when the pen is not being used, and it is equipped also with valve means provided to close the channel of passage of the ink from the reservoir and the nib with the cap in a position to cover the nib, so to avoid the expulsion of ink in case of changes in atmospheric pressure.

[0011] It has been found that in case of changes in atmospheric pressure when the cup is later removed the risk that a minimum flow of ink is expelled from the nib cannot be avoided due the structure of the ink compressing reservoir.

Aim of the Invention

[0012] Accordingly, the object of the present invention is to provide a fountain pen such as will be unaffected by the drawbacks associated with the prior art mentioned above.

[0013] One object of the present invention, in particular, is to provide a fountain pen that will withstand fluctuations in temperature and/or pressure without ink leaking from the nib.

[0014] A further object of the invention is to provide a fountain pen that can be used at all times, and in particular, even during or immediately following the onset of conditions tending to cause the aforementioned fluctuations in temperature and/or pressure.

[0015] The stated objects of the invention are substantially realized in a fountain pen of which the characteristics are as recited in one or more of the appended claims.

Brief Description of the Drawings

[0016] The invention will now be described in detail, by way of example, with the aid of the accompanying drawings, in which:

- figure 1 shows a portion of a fountain pen seen in a part elevation and part sectional view taken on a longitudinal plane and illustrated in a first operating configuration;
- figure 2 shows the portion of the fountain pen in figure 1, seen in a part elevation and part sectional view taken on a longitudinal plane and illustrated in a second operating configuration;
- figure 3 is a side view of an ink cartridge according to the invention used in the fountain pen illustrated in figures 1 and 2;
- figure 3.1 is lateral view of the ink cartridge of figure 3;
- figure 4 shows the portion of the fountain pen in figure 1, seen in a sectional view taken on a longitudinal plane, illustrated in an embodiment according to the invention and in a first operating configuration;
- figure 5 shows the portion of the fountain pen in figure 4, seen in a sectional view taken on a longitudinal plane and illustrated in a second operating configuration;
- figure 6A shows a detail of the fountain pen in figure 5, seen in a sectional view taken on a longitudinal plane and illustrated in a first operating configuration;
- figures 6B and 6C show the detail of figure 6A in views from above and beneath, respectively, illustrated in the first operating configuration;
- figure 7 shows the detail of figure 6A in a view from beneath, illustrated in a second operating configuration.

Detailed Description of the Preferred Embodiments of the Invention

[0017] With reference to the accompanying drawings, numeral 1 denotes a fountain pen, in its entirety, according to the present invention.

[0018] The pen 1 comprises a hollow barrel 2 by which the pen is held when writing, and which provides an outer casing.

[0019] The barrel 2 has a predominating longitudinal axis denoted X and extends along this same axis X from a front end 2a, the writing end of the pen, and a rear end not visible in the accompanying drawings.

[0020] The inside of the barrel 2 presents a chamber 3 extending longitudinally along the axis X and designed to contain an ink reservoir S in form of a cartridge 8.

[0021] Attached stably to the hollow barrel 2 at the aforementioned front end 2a is a nib 4, presenting a writing tip 4a designed to release ink when offered to the writing surface, and accordingly, positioned outside the dimensional compass of the barrel 2, projecting from the front end.

[0022] At the end remote from the writing tip 4a, the nib 4 presents an ink feed element 5 directed toward the cartridge 8, embodied preferably in one piece with the tip 4a. The ink feed element 5 presents a plurality of ink-retaining chambers 6 delimited one from another by a sequence of partition walls 7 disposed mutually parallel and perpendicular to the longitudinal axis X such as can be filled by the ink when delivered from the cartridge 8 at a high flow rate. This situation will be illustrated in due course.

[0023] Thus, the ink-retaining chambers 6 take the form substantially of interstices delimited by adjacent partition walls 7.

[0024] The feed element 5, fashioned for example from plastic material by an injection process, presents an internal duct (not illustrated) aligned on the aforementioned longitudinal axis X and connecting said feed element 5 to the writing tip 4a; the duct is connected to the retaining chambers 6 in such a manner that when ink is delivered from the cartridge 8 at high flow rate, as aforementioned, the excess is released to the chambers 6.

[0025] In other words, the ink feed element 5 is located between the cartridge 8 and the writing tip 4a of the nib 4, serving thus to regulate the ink flow and prevent the nib from flooding.

[0026] For instance, an excessive ink flow would tend to occur when the difference in pressure levels on the inside and the outside of the cartridge 8 results in a significant force being generated from the inside of cartridge 8 outwards (due to a rise in internal pressure, induced for example by heat from the hand of the user when holding the pen), or when ink is drawn to excess from the cartridge 8 by an external force (such as negative external pressure, generated for example during air travel by a pressure drop in the aircraft cabin).

[0027] The fountain pen 1 according to the present invention comprises a cartridge 8 whose internal volume increases in order to accommodate a variation in pressure and thereby counteract the condition that otherwise would quickly cause an abnormally and undesirably copious release of ink from the cartridge 8.

[0028] The cartridge 8 is elastically deformable between a normally undeformed first configuration, and a deformed second configuration (illustrated in figure 3.1) in which its containment volume is greater than the containment volume afforded in the undeformed configuration.

[0029] The increase in volume is determined by the difference in pressure levels existing inside and outside the

cartridge 8, hence on either side of the cartridge 8 is walls. These unequal pressures induce a deformation that causes the cartridge 8 to expand, with the result that the containment volume is increased. Accordingly, the change in pressure is absorbed by the deformation of the cartridge 8 and by the consequent increase in its containment volume, thus attenuating the force exerted on the ink, which tends to remain within the cartridge 8.

[0030] At all events, any release of ink that may occur will be minimal, and taken up by the retaining chambers 6 of the feed element 5, so that there is no leakage of ink from the pen 1.

[0031] The cartridge 8 is housed stably within the hollow barrel 2 (and preferably removable), aligned on the longitudinal axis X, and is positioned in the hollow barrel 2 in such a way as to create an annular air chamber 9, between the cartridge and the barrel, of width measuring between 0.5 to 3 millimetres and preferably between 1 to 3 millimetres.

[0032] The cartridge 8 is shaped preferably in such a way that the transition from the normally undeformed configuration to the deformed configuration occurs through lateral expansion, that is to say bulging in a transverse direction, away from the longitudinal axis X. The expansion is allowed by the aforementioned width values adopted for the annular air chamber 9 separating the cartridge 8 from the barrel 2.

[0033] The deformability of the cartridge 8 is elastic in nature. Accordingly, once the cartridge 8 has assumed the expanded (deformed) configuration, it will tend to return to the initial undeformed configuration spontaneously.

[0034] Figure 3 illustrates the cartridge 8 in detail. The cartridge 8 presents at least one first portion 10 fashioned from a first elastically deformable material, capable of deforming elastically between the normally undeformed configuration and the deformed configuration.

[0035] Surprisingly, the applicant has found that optimum results are achievable, in terms of preventing an undesirable release of ink, by adopting a silicone material as the first elastically deformable material.

[0036] For such optimum results to be achieved, moreover, the applicant has found that the silicone material must have a high percentage elongation at rupture. The optimum elongation in question is between 300% and 800%, preferably between 450% and 700%, and yet more preferably, 590%.

[0037] The applicant has also found that the optimum silicone material has an ultimate tensile strength of between 3.5 and 11 N/mm2, preferably between 5 and 7 N/mm2, and yet more preferably, 5.8 N/mm2.

[0038] Furthermore, the applicant has found that the optimum silicone material presents a Shore A hardness of between 10 and 40, preferably between 20 and 30, and yet more preferably, 25.

[0039] Table 1 below indicates the main mechanical parameters of certain silicone materials (silicone rubbers) that have proven capable of delivering optimum performance in terms of preventing an undesirable release of ink from the cartridge 8.

Table 1

	S1	S2	S3
Hardness (Shore A)	20	30	25
Density (g/cm3)	1.10	1.13	1.07
Ultimate tensile strength (N/mm2)	8.2	7.7	5.8
Elongation at rupture (%)	810	640	590

[0040] In order to minimize the difference in pressure levels inside and outside of the cartridge 8, it is preferable that the silicone material used for the cartridge 8 should be highly permeable to gases.

[0041] To advantage, as illustrated in figure 1, the cartridge 8 further comprises at least one second portion 11 (two portions 11 according to figure 1 defining the longitudinal end of the cartridge 8) fashioned from a second material less deformable than the first material.

[0042] The second material is preferably a rigid plastic, and yet more preferably, polycarbonate, or polyamide, or polybutylene terephthalate (PBT).

[0043] The second material, which is therefore substantially stiff when compared to the more readily deformable silicone material, serves to provide the cartridge 8 with a rigid frame, that is to say a strong and stable outer structure such as will give the cartridge 8 a substantially permanent outer shape.

[0044] In other words, the cartridge 8 comprises at least one substantially rigid portion 11, and at least one portion 10 that is elastically deformable relative to the rigid portion 11, in order to produce the aforementioned deformed configuration.

[0045] In a preferred embodiment of the invention, (figures 3 and 3.1) the cartridge 8 comprises a main frame fashioned from the aforementioned second plastic material and presents one or more windows F, provided with a covering made of the first silicone material.

[0046] With this arrangement, it is the aforementioned windows F that allow the cartridge 8 to expand and increase its containment volume.

[0047] Preferably, each window F extends parallel with a longitudinal axis Y of the cartridge 8 (coinciding with the longitudinal axis X of the barrel 2).

[0048] Also, the windows F are arranged in succession on a developable plane completely encircling the longitudinal axis Y.

[0049] In one possible embodiment of the invention, the cartridge 8 is furnished with one or more leaves (or membranes) of silicone material, each covering a respective window F.

[0050] In an alternative embodiment, the cartridge 8 is furnished with a single membrane of silicone material, attaching said silicone membrane to the frame fashioned from the second plastic material in such a manner that different parts of the membrane are positioned to cover respective windows F of the cartridge 8.

[0051] In figure 3, the first material is denoted M1 and the second material is denoted M2.

[0052] From a constructional standpoint, the applicant has found unexpectedly that the geometrical parameter having the greatest influence on the performance of the cartridge, in terms of preventing the release of ink, is the thickness of the first material.

[0053] In particular, optimum thickness values for the silicone material (the areas covering the windows F of the cartridge 8) are between 0.15 and 0.45 millimetres, and preferably between 0.2 and 0.3 millimetres. The best performance characteristics are obtained with a constant thickness of 0.25 millimetres.

[0054] The thickness of the silicone material can be constant or variable, but will fall preferably within the ranges of values indicated above.

[0055] Adopting a preferred method of manufacture, moreover, the cartridge 8 can be fashioned by co-moulding the silicone material of the first portion 10 together with the plastic material of the second portion 11.

[0056] In combination with the cartridge 8 presenting the features described above, the fountain pen 1 according to the invention also comprises valve means 12 designed to enable and to regulate the ink flow passing from the cartridge 8 to the nib 4 via the feed element 5 and that in case of variations of the atmospheric pressure interact with the cartridge 8 to avoid any undesired expulsion of ink.

[0057] More exactly, as illustrated in figures 4 and 5, the pen 1 comprises a connecting duct 13 interposed between the cartridge 8 and the nib 4, serving to place the cartridge 8 and the nib 4 in fluid communication by way of the feed element 5.

[0058] The valve means 12 are designed to operate on the connecting duct 13, alternating between an open configuration (figure 4) in which ink is able to flow through the connecting duct 13, and a closed configuration (figure 5) in which the flow of ink through the connecting duct 13 is cut off.

[0059] The valve means 12 in question comprise a connecting element 14 located between the cartridge 8 and the nib 4 and designed to incorporate the connecting duct 13 internally, as illustrated in figure 6A.

[0060] The connecting duct 13 presents a cross section of polygonal, preferably quadrangular, and yet more preferably, rectangular or square geometry (figures 6B and 6C).

[0061] The polygonal section presents a profile appearing as a succession of consecutive segments and serves to break the surface tension of the ink, which consequently will run more freely and encounter less flow resistance than would be the case, for example, with a duct of perfectly round section. The polygonal section thus prevents the creation of surface tension that would cause deposits to form on the connecting element 14 and impede the correct flow of the ink.

[0062] The connecting element 14 is fashioned from a deformable material, preferably silicone, and able to alternate between a normally undeformed configuration coinciding with an open configuration of the valve means 12, and a deformed configuration coinciding with a closed configuration of the valve means 12.

[0063] The deformability of the connecting element 14 is elastic in nature. Accordingly, once the connecting element 14 has assumed the deformed configuration, it will tend to return to the initial undeformed configuration spontaneously.

[0064] The polygonal geometry (hence also rectangular or square geometry) of the connecting duct 13 is established when the connecting element 14 presents the normally undeformed configuration 14.

[0065] The valve means 12 also comprise at least one presser element 15, associated slidably with the barrel 2 of the pen 1, capable of shifting toward and away from the connecting element 14 and causing said connecting element 14 to assume the aforementioned deformed and undeformed configurations.

[0066] The presser element 15 is fashioned preferably as a pin, or plunger, seated slidably in a hole afforded by the barrel 2 of the pen 1.

[0067] To advantage, the presser element 15 impinges on a vertex of the polygonal section presented by the connecting duct 13 in such a way as to direct this same vertex toward another (non-adjacent) vertex of the polygonal section.

[0068] Where the connecting duct 13 is of quadrangular section, the presser element 15 causes one vertex to draw close to or enter into contact with the opposite vertex.

[0069] Under the forcing action of the presser element 15, the quadrangular section is deformed to the point of assuming the shape of a much compressed rhomboid, or preferably collapsed to the point of appearing substantially as a segment (completely blocking the ink flow).

[0070] This complete closure would be difficult if not impossible to achieve, were the forcing action to be applied at

intermediate points on the segments making up the polygonal section.

[0071] Adopting the preferred embodiment of figures 4 and 5, the valve means 12 comprise two mutually opposed presser elements 15 acting on two opposite (or at least non-adjacent) vertices of the polygonal section, such as will deform the connecting element 14 to the point of bringing these same two vertices into close proximity or direct contact one with another, blocking the ink flow completely (figure 7).

[0072] Where the connecting duct 13 is of quadrangular section, the two presser elements 15 impinge on mutually opposed vertices of the polygonal section.

[0073] In figures 6C and 7, the arrows indicate the direction of the pushing force exerted by the presser elements 15 on the connecting element 14.

[0074] The valve means 12 are subject to the action of the removable cap 16 of the pen fitted to the barrel 2 in such a way as to cover the nib, preferably ensuring a hermetic closure.

[0075] The valve means 12 are activated directly by the cap 16 in such a way as to disallow the passage of ink from the cartridge 8 to the nib when the cap 16 is fitted to the barrel 2.

[0076] In particular, the presser elements 15 are operated directly by the cap 16 when fitted over the nib 4. More exactly, the presser elements 15 will be engaged by the cap 16 and forced toward one another, ultimately deforming the connecting element 14 and cutting off the fluid communication between the cartridge 8 and the nib 4.

[0077] When the cap 16 is removed subsequently, the presser elements 15 are released and tend to move away from one another, forced apart by the connecting element 14 as it returns elastically to its initial shape, and fluid communication between the cartridge 8 and the nib 4 is restored.

[0078] To avoid to modify the flow condition of the ink from the cartridge 8 to the nib 4 and to avoid any modification of the pressure condition of said flow, the connecting element 14 presents a preferably axial-symmetric, and more preferably a circular outer structure, aligned concentrically on a respective axis Z coinciding with the longitudinal axis X of the barrel 2.

[0079] Preferably, as illustrated in figure 6A, the connecting element 14 presents a lateral profile substantially of "T" shape, or rather, comprising a lower portion 14a of smaller section and a longitudinally adjoining portion 14b of larger section, which combine to give the connecting element 14 the aforementioned "T" profile.

[0080] The portion 14b of larger section presented by the connecting element might also incorporate a part of the connecting duct 13 that is widened, relative to the part of the connecting duct 13 presented by the portion 14a of smaller section.

[0081] To advantage, as illustrated in figure 6B, the connecting element 14 might present a plurality of ribs 17 internally of the connecting duct 13, providing the wall of said connecting duct 13 with an irregular surface that serves to break the surface tension of the ink flowing through the duct and consequently facilitate its passage.

[0082] The ribs 17 extend parallel to the longitudinal axis Z of the connecting element 14, projecting radially into the connecting duct 13 (directed away from the wall of the connecting duct 13 and toward the longitudinal axis Z of the connecting element 14), and are distributed angularly around said longitudinal axis Z.

[0083] The ribs 17 will be located preferably in the part of the connecting duct 13 that occupies the portion 14b of larger section presented by the connecting element 14.

[0084] Moreover, the ribs 17 are located at the end of the connecting element 14 directed toward the cartridge 8.

[0085] In addition, the part of the connecting duct 13 furnished with the aforementioned ribs 17 will preferably be wider in section than the part of the connecting duct 13 engaged by the presser elements 15.

[0086] The drawbacks associated with the prior art are overcome by the present invention, and the stated objects duly realized.

[0087] The use of a deformable and dilatable cartridge according to the invention, as described above, enables the ink reservoir of a fountain pen to absorb possible pressure jumps (caused by fluctuations in pressure and/or temperature) without any leakage of ink occurring. In the eventuality of such a pressure jump, more exactly, the cartridge is readily deformable and will expand, its containment volume increasing to accommodate the sudden change in pressure and limit the tendency for the ink to be forced from the cartridge.

[0088] In combination with the action of the ink feed element, this expansion has the effect of negating the risk of leaks from the nib, since any minimal leakages of ink from the cartridge will be taken up and held by the retaining chambers of the feed element.

Claims

1. A fountain pen, comprising:

- a hollow barrel (2) such as can be held by a user;
- a nib (4) stably attached to one end (2a) of the hollow barrel (2);

- an ink reservoir (S) in form of a cartridge (8) having a given containment volume, housed internally of the hollow barrel (2) and connected to the nib (4) by way of a feed element (5) in such a way that ink can be supplied through said feed element to the nib (4);
- a removable cap (16) serving to cover the nib (4);
- valve means (12) located between the cartridge (8) and the nib (4) such as selectively cutting off the ink flow from the cartridge (8) to the nib (4), and a connecting duct (13) being interposed between the cartridge (8) and the nib (4) and serving to place the cartridge (8) and the nib (4) in fluid communication; wherein the valve means (12) operate on the connecting duct (13) in such a manner as to allow and regulate the passage of ink through said connecting duct (13) and are activated by the cap (16) in such a way that the ink flow from the cartridge (8) to the nib (4) will be cut off when the cap (16) is fitted over the nib (4);

characterized in that:

- the cartridge (8) is elastically deformable between a normally undeformed first configuration, and a deformed second configuration in which the containment volume of the cartridge (8) is greater than the containment volume in the undeformed configuration;
- the feed element (5) presenting a plurality of retaining chambers (6) designed to be filled with ink released from the cartridge (8) in the event of excessive ink flow delivered to the nib (4);
- The connecting duct (13) being of polygonal section,
- the valve means (12) comprise a deformable connecting element (14) that incorporates internally the connecting duct (13) of polygonal section and is deformable between a normally undeformed configuration, coinciding with an open configuration of the valve means (12), and a deformed configuration coinciding with a closed configuration of the valve means (12).

2. A pen as in claim 1, wherein the cap (16) can be associated removably with the barrel (2) to cover the nib (4), and wherein the valve means (12) operate on the connecting duct (13), assuming at least an open configuration, in which the passage of ink through the connecting duct (13) is allowed, and a closed configuration in which the passage of ink through the connecting duct (13) is disallowed; the valve means (12) being activated by the cap (16) in such a way as to disallow the passage of ink from the cartridge (8) to the nib (4) when the cap (16) is fitted over the nib (4).

3. A pen as in claim 1 or 2, wherein the valve means (12) comprise at least one presser element (15), associated slidably with the barrel (2) in such a way as to shift toward and away from the connecting element (14) and cause said connecting element (14) to alternate between the deformed and undeformed configurations, the presser element (15) impinging on a vertex of the polygonal section presented by the connecting duct (13) and operated by the cap (16) in such a way as will cause the connecting element (14) to assume the deformed configuration when the cap (16) is fitted over the nib (4).

4. A pen as in claim 1 or 2, wherein the valve means (12) comprise a pair of presser elements (15), associated slidably with the barrel (2) in such a way as to shift toward and away from the connecting element (14) and cause said connecting element (14) to alternate between the deformed and undeformed configurations, the presser elements (15) impinging on respective non-adjacent vertices of the polygonal section presented by the connecting duct (13) and operated by the cap (16) in such a way as will cause the connecting element (14) to assume the deformed configuration when the cap (16) is fitted over the nib (4).

5. A pen as in any one of claims 1 to 4, wherein the connecting duct (13), in the undeformed configuration, presents a cross section appearing quadrangular, preferably rectangular and yet more preferably square.

6. A pen as in claims 4 and 5 wherein the presser elements (15) impinge on opposite vertices of the quadrangular section presented by the connecting duct (13).

7. A pen as in claim 1 to 4, wherein the connecting element (14) presents a plurality of ribs (17) internally of the connecting duct (13), extending parallel to a longitudinal axis (Z) of the connecting element (14) and distributed angularly around said longitudinal axis (Z) of the element (14), which serve to provide the wall of said connecting duct (13) with an irregular surface.

8. A pen as in claim 1, wherein the cartridge (8) is centred on a longitudinal axis (Y), and the transition from the undeformed configuration to the deformed configuration occurs as a result of the cartridge (8) expanding in a direction away from the longitudinal axis (Y) and is accommodated internally of the hollow barrel (2) in such a way as to

create an annular air chamber (9) between the cartridge (8) and the barrel (2), of width measuring between 0.5 and 3 millimetres, and preferably between 1 and 3 millimetres, thereby allowing the cartridge (8) to deform by expansion.

9. A pen as in claim 8, wherein the cartridge (8) presents at least one first portion (10) (M1) fashioned from a first elastically deformable material, thereby enabling elastic deformation between the undeformed configuration and the deformed configuration; the first material being a silicone material, and further comprises at least one second portion (11) (M2) fashioned from a second material less deformable than the first material, providing a frame for the cartridge (8) and consisting preferably in a plastic material, yet more preferably polycarbonate, or polyamide, or polybutylene terephthalate (PBT).

10. A pen as in claim 9, wherein the silicone material has a percentage elongation at rupture of between 500% and 800%, preferably between 550% and 700%, and yet more preferably 590% and presents a hardness of between 10 and 40 Shore A, preferably between 20 and 30 Shore A, and yet more preferably 25 Shore A.

11. A pen as in any one of claims 9 and 10, wherein the silicone material has an ultimate tensile strength of between 3.5 and 10 N/mm2, preferably between 5 and 7 N/mm2, and yet more preferably 5.8 N/mm2.

12. A pen as in any one of claims 9 to 11, wherein the thickness of the first portion (10) is between 0.15 and 0.45 millimetres, preferably between 0.2 and 0.3 millimetres, and yet more preferably, constant at 0.25 millimetres.

13. A pen as in claim 9, wherein the second portion (M2) presents at least one aperture (F), and the first portion (M1) comprises at least one deformable covering membrane fashioned from the first material and positioned to close the aperture (F).

14. A pen as in claim 9 or 13, wherein the second portion (M2) presents a plurality of apertures (F), and the at least one first portion (M1) comprises a plurality of deformable covering membranes fashioned from the first material, each positioned to close a respective aperture (F).

15. A pen as in claim 9 or 14, wherein the second portion (M2) presents a plurality of apertures (F), and the at least one first portion (M1) comprises a single deformable covering membrane fashioned from the first material and applied to the second portion (M2) in such a way as to close all of the apertures (F).

Patentansprüche

1. Füllfederhalter, umfassend:

- einen hohlen Stab (2), sodass dieser von einem Nutzer gehalten werden kann;
- eine Schreibfeder (4), die fest an einem Ende (2a) des hohlen Stabs (2) angebracht ist;
- einen Tintenbehälter (S) in Form einer Patrone (8), aufweisend einen bestimmten Behälterinhalt, untergebracht im hohlen Stab (2) und verbunden mit der Schreibfeder (4) mittels eines Zuführungselements (5), sodass die Tinte durch das Zuführungselement zur Schreibfeder (4) geführt werden kann;
- eine abnehmbare Kappe (16), die zur Abdeckung der Schreibfeder (4) dient;
- Ventilmittel (12), befindlich zwischen der Patrone (8) und der Schreibfeder (4), um den Tintenfluss von der Patrone (8) zur Schreibfeder (4) selektiv zu unterbrechen, sowie eine Verbindungsleitung (13), die zwischen der Patrone (8) und der Schreibfeder (4) angeordnet ist und dazu dient, die Fluidkommunikation zwischen der Patrone (8) und der Schreibfeder (4) herzustellen; wobei die Ventilmittel (12) auf der Verbindungsleitung (13) arbeiten, sodass der Tintendurchfluss durch diese Verbindungsleitung (13) ermöglicht und reguliert wird, und die durch die Kappe (16) so aktiviert werden, dass der Tintenfluss von der Patrone (8) zur Schreibfeder (4) unterbrochen wird, wenn die Kappe (16) auf die Schreibfeder (4) gesetzt wird;

dadurch gekennzeichnet, dass:

- die Patrone (8) elastisch zwischen einer normalerweise nicht deformierten ersten Konfiguration und einer deformierten zweiten Konfiguration deformierbar ist, in der der Behälterinhalt der Patrone (8) größer ist als der Behälterinhalt in der nicht deformierten Konfiguration;
- das Zuführungselement (5) eine Vielzahl an Behälterkammern (6) aufweist, die dazu ausgelegt sind, mit Tinte gefüllt zu werden, die von der Patrone (8) abgegeben wird, wenn der übermäßige Tintenfluss zur Schreibfeder

(4) geliefert wird;
- die Verbindungsleitung (13) einen vieleckigen Querschnitt aufweist;
- die Ventilmittel (12) ein deformierbares Verbindungselement (14) umfassen, das intern die Verbindungsleitung (13) eines vieleckigen Querschnitts enthält und zwischen einer normalerweise nicht deformierten Konfiguration, die mit einer offenen Konfiguration der Ventilmittel (12) übereinstimmt, und einer deformierten Konfiguration deformierbar ist, die mit einer geschlossenen Konfiguration der Ventilmittel (12) übereinstimmt.

2. Füllfederhalter nach Anspruch 1, wobei die Kappe (16) abnehmbar mit dem Stab (2) verbunden werden kann, um die Schreibfeder (4) abzudecken, und wobei die Ventilmittel (12) auf der Verbindungsleitung (13) arbeiten und mindestens eine offene Konfiguration einnehmen, in der der Tintendurchfluss durch die Verbindungsleitung (13) gestattet ist, und eine geschlossene Konfiguration, in der der Tintendurchfluss durch die Verbindungsleitung (13) nicht gestattet ist; wobei die Ventilmittel (12) von der Kappe (16) so aktiviert werden, dass der Tintendurchfluss von der Patrone (8) zur Schreibfeder (4) nicht gestattet wird, wenn die Kappe (16) auf die Schreibfeder (4) gesetzt wird.

3. Füllfederhalter nach Anspruch 1 oder 2, wobei die Ventilmittel (12) mindestens ein Presselement (15) umfassen, das verschiebbar mit dem Stab (2) verbunden ist, sodass es sich zum Verbindungselement (14) hinführend und von diesem wegführend verschiebt und bewirkt, dass das Verbindungselement (14) abwechselnd deformierte und nicht deformierte Konfigurationen einnimmt, wobei das Presselement (15) auf einen Scheitel des vieleckigen Querschnitts, dargestellt durch die Verbindungsleitung (13) und betätigt von der Kappe (16), aufprallt, sodass bewirkt wird, dass das Verbindungselement (14) die deformierte Konfiguration einnimmt, wenn die Kappe (16) auf die Schreibfeder (4) gesetzt ist.

4. Füllfederhalter nach Anspruch 1 oder 2, wobei die Ventilmittel (12) ein Paar Presselemente (15) umfassen, verschiebbar verbunden mit dem Stab (2), sodass sie sich zum Verbindungselement (14) hinführend und von diesem wegführend verschieben und bewirken, dass das Verbindungselement (14) abwechselnd deformierte und nicht deformierte Konfigurationen einnimmt, wobei die Presselemente (15) auf jeweils nicht aneinandergrenzende Scheitel des vieleckigen Querschnitts, dargestellt durch die Verbindungsleitung (13) und betätigt von der Kappe (16), aufprallen, sodass bewirkt wird, dass das Verbindungselement (14) die deformierte Konfiguration einnimmt, wenn die Kappe (16) auf die Schreibfeder (4) gesetzt ist.

5. Füllfederhalter nach Anspruch 1 bis 4, wobei die Verbindungsleitung (13) in der nicht deformierten Konfiguration einen Querschnitt aufweist, der viereckig, vorzugsweise rechteckig und noch besser quadratisch erscheint.

6. Füllfederhalter nach Anspruch 4 und 5, wobei die Presselemente (15) auf gegenständig angeordnete Scheitel des viereckigen Querschnitts aufprallen, dargestellt durch die Verbindungsleitung (13).

7. Füllfederhalter nach Anspruch 1 bis 4, wobei das Verbindungselement (14) eine Vielzahl an Rippen (17) in der Verbindungsleitung (13) aufweist, die sich parallel zu einer Längsachse (Z) des Verbindungselements (14) erstrecken und im Winkel rund um die Längsachse (Z) des Elements (14) angeordnet sind, die dazu dienen, die Wand der Verbindungsleitung (13) mit einer unregelmäßigen Oberfläche bereitzustellen.

8. Füllfederhalter nach Anspruch 1, wobei die Patrone (8) auf einer Längsachse (Y) zentriert ist und der Wechsel von der nicht deformierten Konfiguration zur deformierten Konfiguration infolge der Ausdehnung der Patrone (8) in eine von der Längsachse (Y) wegführende Richtung stattfindet und im hohlen Stab (2) so untergebracht ist, dass eine ringförmige Luftkammer (9) zwischen der Patrone (8) und dem Stab (2) gebildet wird, deren Breite zwischen 0,5 und 3 Millimetern beträgt, vorzugsweise zwischen 1 und 3 Millimetern, wodurch die Patrone (8) sich durch Ausdehnung deformieren kann.

9. Füllfederhalter nach Anspruch 8, wobei die Patrone (8) mindestens einen ersten Abschnitt (10) (M1) aufweist, der aus einem elastisch deformierbaren Material ausgebildet ist, was die elastische Verformung zwischen der nicht deformierten Konfiguration und der deformierten Konfiguration ermöglicht, wobei es sich beim ersten Material um ein Silikonmaterial handelt, und aufweisend mindestens einen zweiten Abschnitt (11) (M2), ausgebildet aus einem zweiten Material, das weniger deformierbar ist als das erste Material, das einen Rahmen für die Patrone (8) zur Verfügung stellt und vorzugsweise aus einem Kunststoffmaterial, noch besser aus Polycarbonat oder Polyamid oder Polybutylenterephtalat (PBT) besteht.

10. Füllfederhalter nach Anspruch 9, wobei das Silikonmaterial einen Kennwert für die Bruchdehnung von 500 bis 800 %, vorzugsweise 550 bis 700 % und noch besser von 590 % besitzt und eine Härte von 10 bis 40 Shore A, vor-

zugsweise von 20 bis 30 Shore A und noch besser von 25 Shore A aufweist.

11. Füllfederhalter nach einem der Ansprüche 9 und 10, wobei das Silikonmaterial eine Zugfestigkeit von 3,5 bis 10 N/mm2, vorzugsweise von 5 bis 7 N/mm2 und noch besser von 5,8 N/mm2 aufweist.

12. Füllfederhalter nach einem der Ansprüche 9 bis 11, wobei die Dicke des ersten Abschnitts (10) zwischen 0,15 und 0,45 Millimetern, vorzugsweise 0,2 bis 0,3 Millimeter und noch besser konstant 0,25 Millimeter beträgt.

13. Füllfederhalter nach Anspruch 9, wobei der zweite Abschnitt (M2) mindestens eine Öffnung (F) aufweist und der erste Abschnitt (M1) mindestens eine deformierbare Abdeckmembran umfasst, die aus dem ersten Material ausgebildet ist und positioniert ist, um die Öffnung (F) zu verschließen.

14. Füllfederhalter nach Anspruch 9 bis 13, wobei der zweite Abschnitt (M2) eine Vielzahl an Öffnungen (F) aufweist und der mindestens erste Abschnitt (M1) eine Vielzahl an deformierbaren Abdeckmembranen umfasst, die aus dem ersten Material ausgebildet sind und jeweils positioniert sind, um eine jeweilige Öffnung (F) zu verschließen.

15. Füllfederhalter nach Anspruch 9 oder 14, wobei der zweite Abschnitt (M2) eine Vielzahl an Öffnungen (F) aufweist und der mindestens erste Abschnitt (M1) eine einzelne deformierbare Abdeckmembran umfasst, die aus dem ersten Material ausgebildet ist und am zweiten Abschnitt (M2) so angebracht wird, dass alle Öffnungen (F) verschlossen werden.

Revendications

1. Stylo-plume, comprenant :

- un corps creux (2) pouvant être tenu par un utilisateur ;
- une plume (4) solidement attachée à une extrémité (2a) du corps creux (2) ;
- un réservoir à encre (S) ayant la forme d'une cartouche (8) ayant un volume de contenance donné, logé à l'intérieur du corps creux (2) et relié à la plume (4) par un organe d'alimentation (5) de manière à ce que l'encre puisse être amenée à travers ledit organe d'alimentation jusqu'à la plume (4) ;
- un capuchon amovible (16) servant à couvrir la plume (4) ;
- des moyens de valve (12) situés entre la cartouche (8) et la plume (4) de manière à interrompre de façon sélective l'écoulement de l'encre de la cartouche (8) à la plume (4), et un conduit de raccordement (13) étant interposé entre la cartouche (8) et la plume (4) et servant à placer la cartouche (8) et la plume (4) en communication fluidique ; dans lequel les moyens de valve (12) agissent sur le conduit de raccordement (13), de manière à permettre et à régler le passage de l'encre à travers ledit conduit de raccordement (13), et sont activés par le capuchon (16) de manière à interrompre l'écoulement de l'encre de la cartouche (8) à la plume (4) lorsque le capuchon (16) est replacé sur la plume (4) ;

caractérisé en ce que :

- la cartouche (8) est élastiquement déformable entre une première configuration normalement non déformée, et une seconde configuration déformée dans laquelle le volume de contenance de la cartouche (8) est supérieur au volume de contenance dans la configuration non déformée ;
- l'organe d'alimentation (5) présentant une pluralité de chambres de retenue (6) conçues pour être remplies par l'encre libérée de la cartouche (8) si un écoulement excessif d'encre parvenait à la plume (4) ;
- le conduit de raccordement (13) ayant une section polygonale ;
- les moyens de valve (12) comprennent un élément de raccordement déformable (14) qui incorpore à l'intérieur le conduit de raccordement (13) à section polygonale et est déformable entre une configuration normalement non déformée, coïncidant avec une configuration d'ouverture des moyens de valve (12), et une configuration déformée coïncidant avec une configuration de fermeture des moyens de valve (12).

2. Stylo selon la revendication 1, dans lequel le capuchon (16) peut être associé de façon amovible au corps (2) pour couvrir la plume (4), et dans lequel les moyens de valve (12) agissent sur le conduit de raccordement (13), adoptant au moins une configuration d'ouverture, dans laquelle le passage de l'encre à travers le conduit de raccordement (13) est permis, et une configuration de fermeture dans laquelle le passage de l'encre à travers le conduit de raccordement (13) n'est pas permis ; les moyens de valve (12) étant activés par le capuchon (16) de manière à ne

pas permettre le passage de l'encre de la cartouche (8) à la plume (4) lorsque le capuchon (16) est replacé sur la plume (4).

3. Stylo selon les revendications 1 ou 2, dans lequel les moyens de valve (12) comprennent au moins un élément presseur (15), associé de façon coulissante au corps (2) de manière à se déplacer en se rapprochant et en s'éloignant de l'élément de raccordement (14) et à faire alterner ledit élément de raccordement (14) entre les configurations déformée et non déformée, l'élément presseur (15) contrariant un sommet de la section polygonale présenté par le conduit de raccordement (13) et actionné par le capuchon (16) de manière à faire en sorte que l'élément de raccordement (14) adopte la configuration déformée lorsque le capuchon (16) est replacé sur la plume (4).

4. Stylo selon les revendications 1 ou 2, dans lequel les moyens de valve (12) comprennent une paire d'éléments presseurs (15), associés de façon coulissante au corps (2) de manière à se déplacer en se rapprochant et en s'éloignant de l'élément de raccordement (14) et à faire alterner ledit élément de raccordement (14) entre les configurations déformée et non déformée, les éléments presseurs (15) contrariant des sommets non-adjacents respectifs de la section polygonale présentés par le conduit de raccordement (13) et actionnés par le capuchon (16) de manière à faire en sorte que l'élément de raccordement (14) adopte la configuration déformée lorsque le capuchon (16) est replacé sur la plume (4).

5. Stylo selon l'une quelconque des revendications de 1 à 4, dans lequel le conduit de raccordement (13), dans la configuration non déformée, présente une section transversale quadrangulaire, de préférence rectangulaire ou mieux encore carrée.

6. Stylo selon les revendications 4 et 5, dans lequel les éléments presseurs (15) contrarient des sommets opposés de la section quadrangulaire présentés par le conduit de raccordement (13).

7. Stylo selon les revendications 1 à 4, dans lequel l'élément de raccordement (14) présente une pluralité de nervures (17) situées à l'intérieur du conduit de raccordement (13), se développant parallèlement à un axe longitudinal (Z) de l'élément de raccordement (14) et réparties angulairement autour dudit axe longitudinal (Z) de l'élément (14) servant à donner à la paroi dudit conduit de raccordement (13) une surface irrégulière.

8. Stylo selon la revendication 1, dans lequel la cartouche (8) est centrée sur un axe longitudinal (Y), et la transition de la configuration non déformée à la configuration déformée survient lorsque la cartouche (8) enfle en s'éloignant de l'axe longitudinal (Y) et se trouve logée à l'intérieur du corps creux (2) de manière à créer une chambre à air annulaire (9) entre la cartouche (8) et le corps (2) d'une largeur comprise entre 0,5 et 3 millimètres, et de préférence entre 1 et 3 millimètres, permettant ainsi à la cartouche (8) de se déformer en enflant.

9. Stylo selon la revendication 8, dans lequel la cartouche (8) présente au moins une première partie (10) (M1) réalisée dans un premier matériau déformable élastiquement, permettant ainsi la déformation élastique entre la configuration non déformée et la configuration déformée, le premier matériau étant un matériau en silicone, et comprend de plus au moins une seconde partie (11) (M2) réalisée dans un second matériau se déformant moins que le premier matériau, servant de châssis à la cartouche (8) et consistant de préférence en un matériau en plastique, ou mieux encore en polycarbonate, ou polyamide, ou poly théréphtalate de butylène (PBT).

10. Stylo selon la revendication 9, dans lequel le matériau en silicone possède un pourcentage d'allongement à la rupture compris entre 500 % et 800 %, de préférence entre 550 % et 700 %, ou mieux encore de 590 % et présente une dureté en Shore A comprise entre 10 et 40, de préférence entre 20 et 30, et mieux encore une dureté en Shore A de 25.

11. Stylo selon l'une des revendications 9 et 10, dans lequel le matériau en silicone possède une résistance ultime à la traction comprise entre 3,5 et 10 N/mm2, de préférence entre 5 et 7 N/mm2, et mieux encore de 5,8 N/mm2.

12. Stylo selon l'une quelconque des revendications de 9 à 11, dans lequel l'épaisseur de la première partie (10) est comprise entre 0,15 et 0,45 millimètres, de préférence entre 0,2 et 0,3 millimètres, et mieux encore constante à 0,25 millimètres.

13. Stylo selon la revendication 9, dans lequel la seconde partie (M2) présente au moins une ouverture (F), et la première partie (M1) comprend au moins une membrane de couverture déformable réalisée dans le premier matériau et positionnée pour fermer l'ouverture (F).

14. Stylo selon les revendications 9 ou 13, dans lequel la seconde partie (M2) présente une pluralité d'ouvertures (F), et l'au moins une première partie (M1) comprend une pluralité de membranes de couverture déformables réalisées dans le premier matériau, chacune étant positionnée pour fermer une ouverture respective (F).

15. Stylo selon les revendications 9 ou 14, dans lequel la seconde partie (M2) présente une pluralité d'ouvertures (F), et l'au moins une première partie (M1) comprend une unique membrane de couverture déformable réalisée dans le premier matériau et appliquée à la seconde partie (M2) de manière à fermer toutes les ouvertures (F).

Fig.1

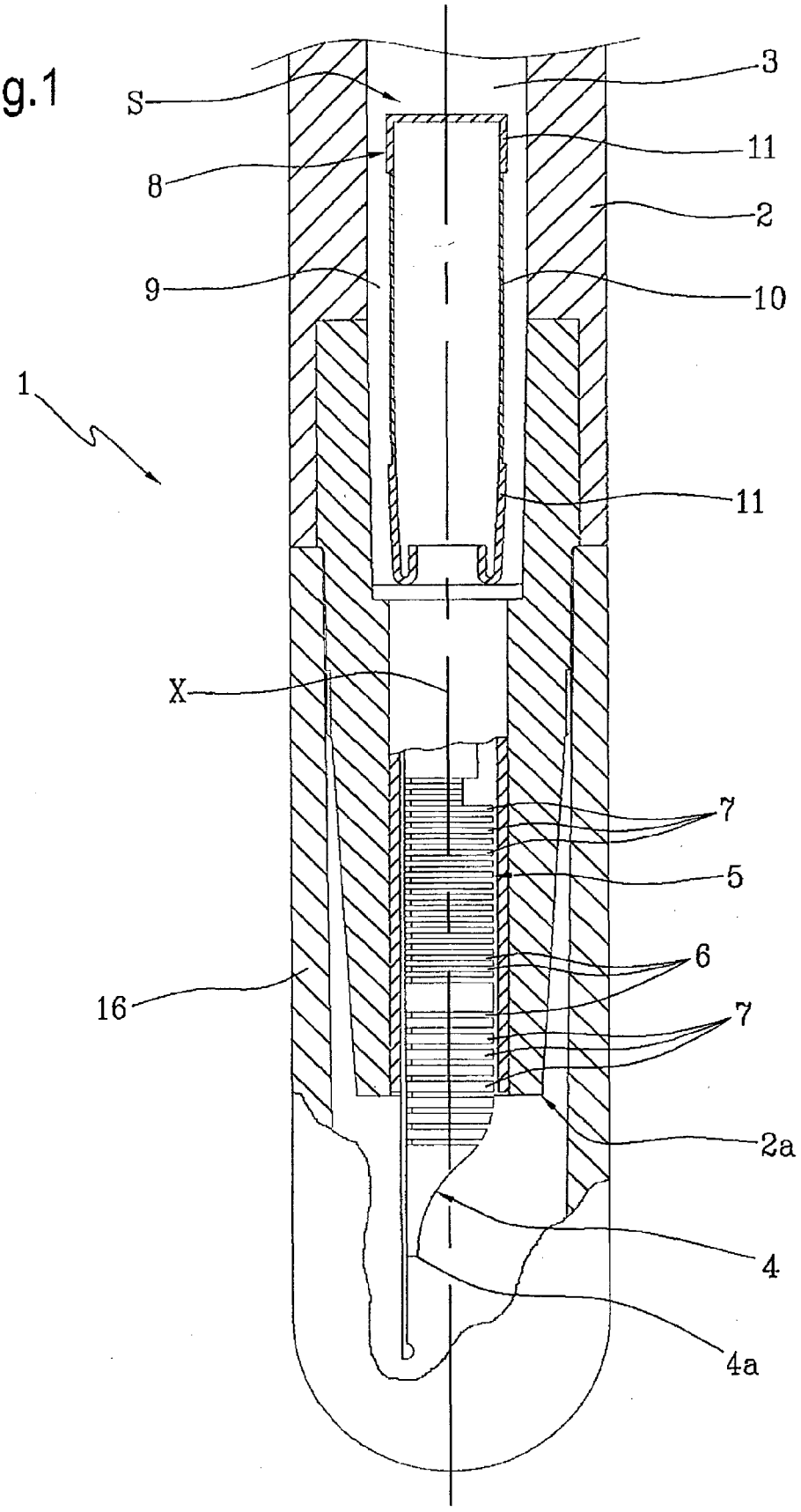


Fig.2

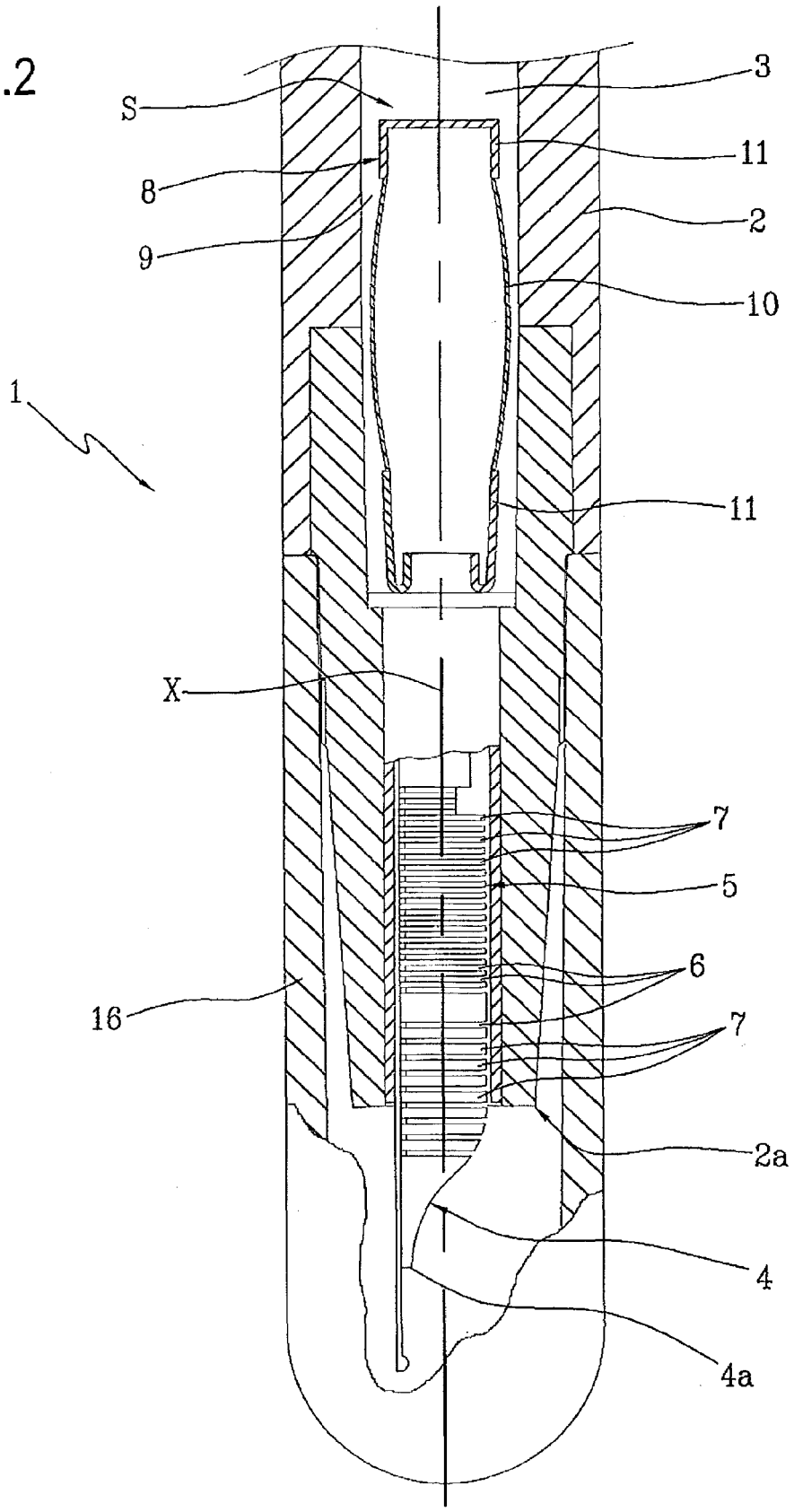


Fig.3

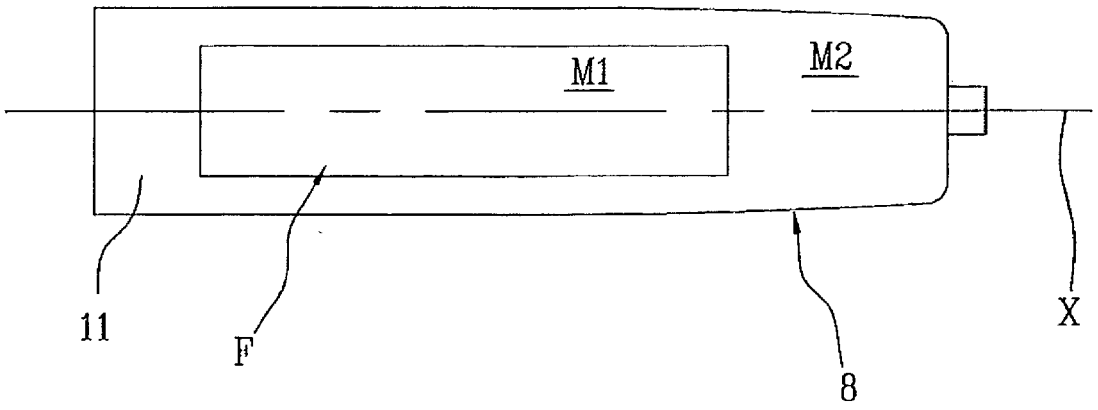


Fig.3.1

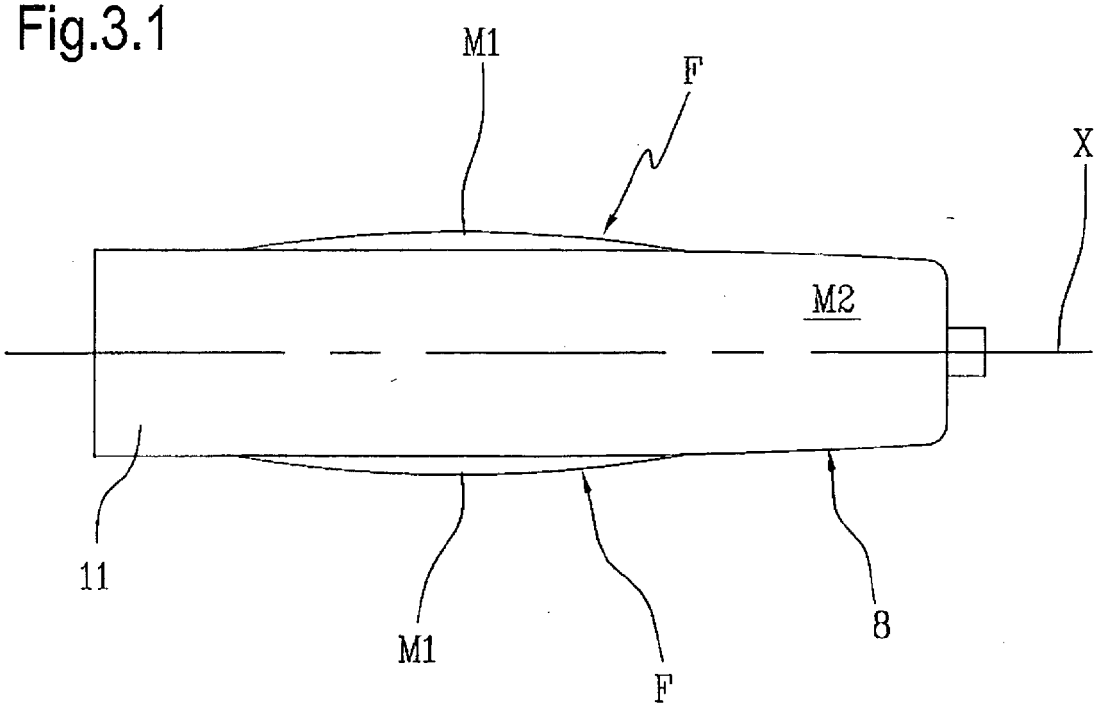


Fig.4

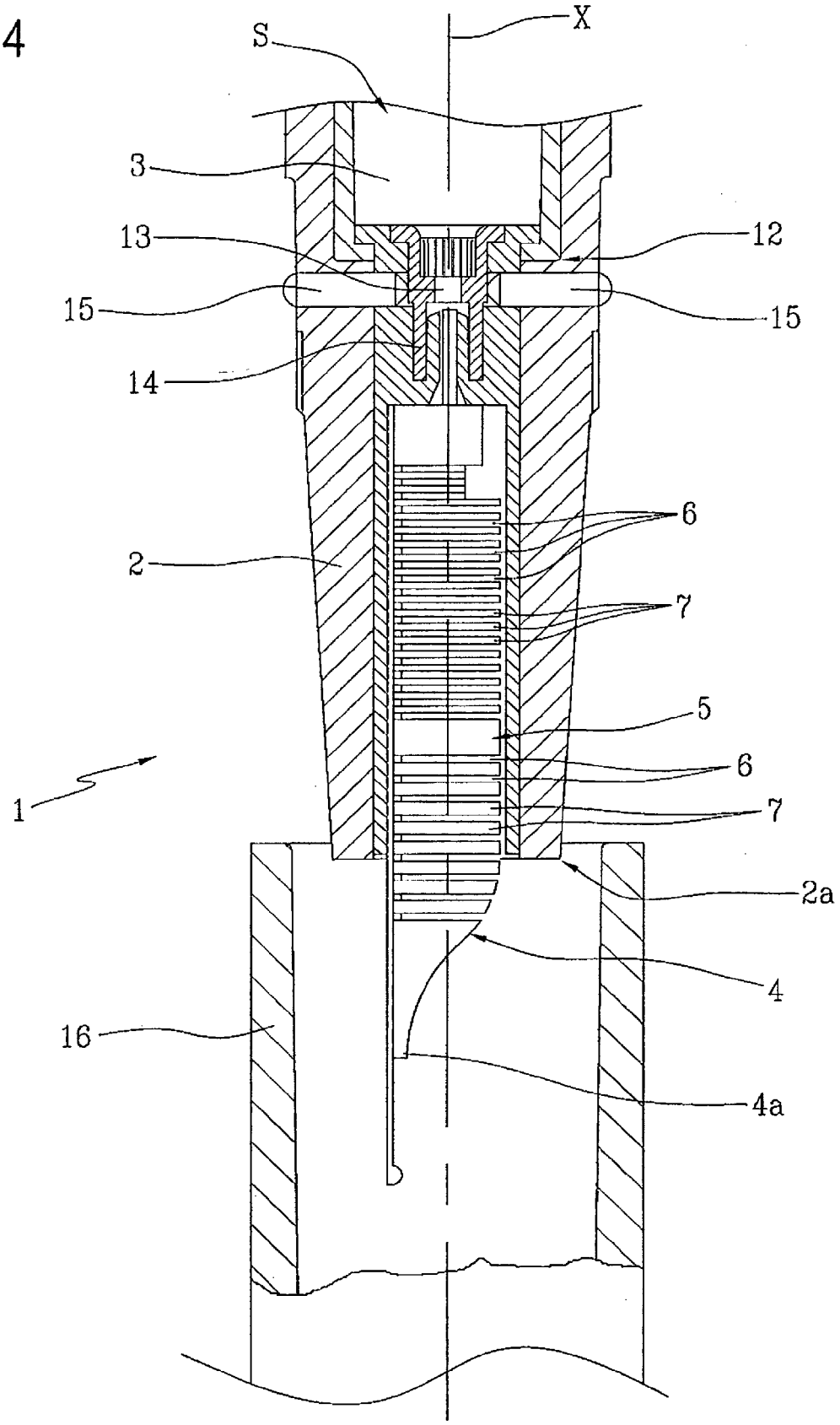


Fig.5

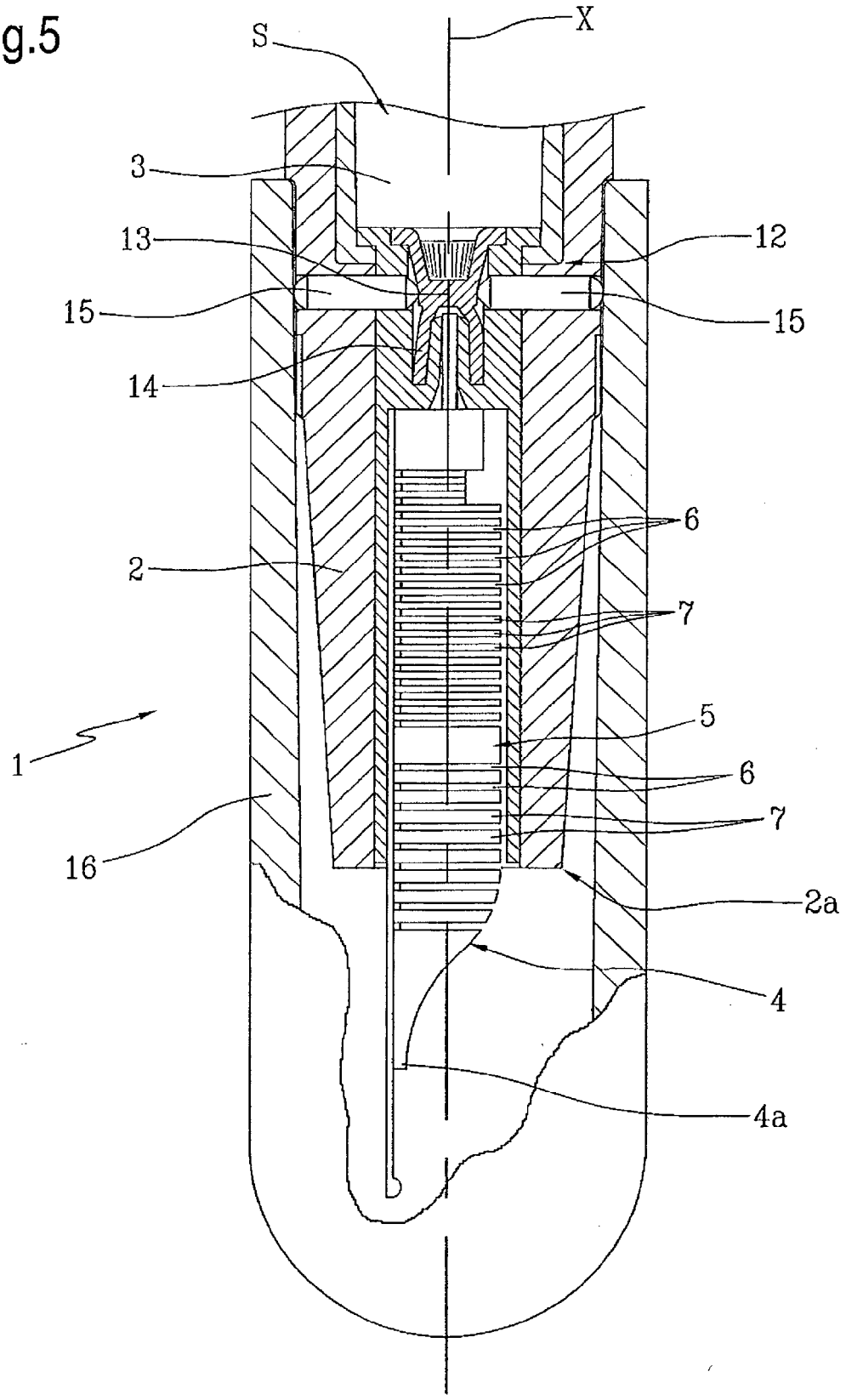


Fig.6A

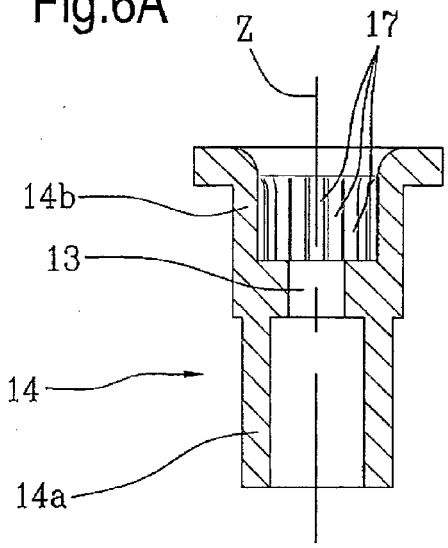


Fig.6B

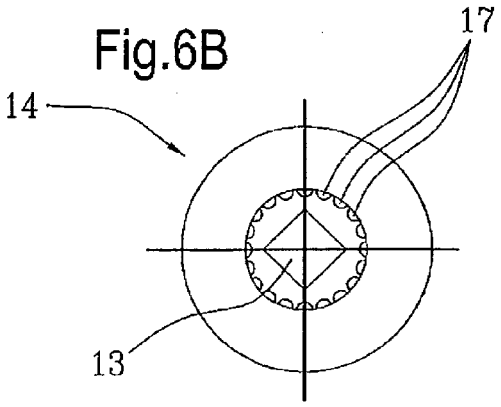


Fig.6C

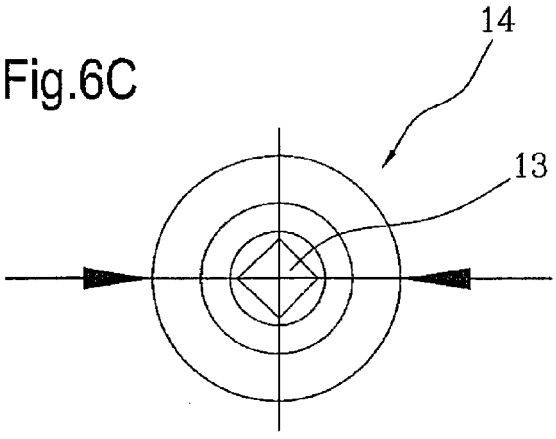
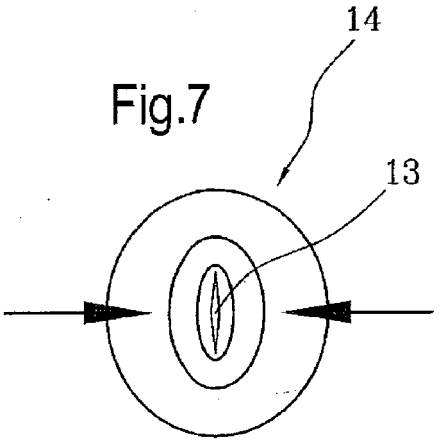


Fig.7



REFERENCES CITED IN THE DESCRIPTION

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