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(3.10/3.5x/3.0.1)

Description

The invention relates to a nozzle cap rotatably mounted at the end of the injection cylinder for a trigger type liquid dispenser. A conventional dispenser of this kind is shown in Fig. 11 of the accompanying drawings and will now be described by way of background to the invention. The trigger type liquid dispenser shown in Fig. 11 operates so as to actuate a piston 2 several times with a trigger 1 to suck liquid from a container, to pull the trigger 1 in this state to press the piston 2 into a pumping chamber to pressurize the interior in the pumping chamber, and to open an exhaust valve by the high pressure liquid to inject the liquid through an injection cylinder 4 and the nozzle port of a cap 5.

The nozzle cap 5 has, as known per se, a liquid guide engaged fixedly at the end of the injection cylinder 4, and a nozzle body rotatably engaged with the end of the liquid guide and opened with a nozzle port at the centre therof. The nozzle body can be selected to three types of states of "foam", "direct" and "closed", i.e., injecting the liquid contents in a foaming state, injecting the liquid contents in a water column state as it is or closing to stop injecting the liquid contents, according to the rotating position of the nozzle body.

Heretofore, foaming means have had a foaming cylinder arranged on the front face of the nozzle port of the nozzle body. The foaming cylinder is a mere cylinder which lacks variable reflection of injecting liquid and can not foam the liquid efficiently. Such a dispenser is shown in US-A-4 598 862 wherein a foamable liquid is passed through a swirl chamber and orifice to produce a vortex spray of finely - divided particles.

It is, therefore, a principle aim of the present invention to provide a nozzle cap having a foaming cylinder capable of efficiently foaming liquid.

In order to achieve the above aim and other aims, there is provided, according to the present invention a nozzle cap having the features set forth in the characterised portion of claim 1. Preferred features of the invention are set fourth in claims 2 to 12.

The foaming cylinder acts to reflect injected liquid onto the inner peripheral wall, to thus involve air in the liquid to foam the liquid. Thus, the inner peripheral uneven portion is formed on the inner peripheral wall of the foaming cylinder to reflect the injected liquid from the nozzle port by the inner peripheral uneven portion - as compared with a cylindrical foaming cylinder of merely smooth inner peripheral surface - to thus effeciently foam the liquid.

These and other aims and features will become more apparent from the following description of the preferred embodiments of the present invention when read in connection with Figs. 1 - 10 of the accompanying drawings, in which :

Figs. 1(A) and 1(B) are longitudinal sectional views of an embodiment of a nozzle cap according to the present invention;

Figs. 2 to 7 are longitudinal sectional views of the essential portions of different embodiments having various peripheral uneven portions;

Fig. 8 is a sectional view of the essential portion of the embodiment in which the inner peripheral uneven portion is formed shorter in an axial direction and the inner diameter of the portion not formed with the uneven portion of the foaming cylinder is larger than the maximum inner diameter of the uneven portion;

Fig. 9 is a sectional view of the essential portion of still another embodiment in which the inner diameter of the portion not formed with the uneven portion of the foaming cylinder is smaller than the minimum inner diameter of the uneven portion; and

Fig. 10 is a longitudinal sectional view of the other embodiment in which a foaming cylinder 7 and a nozzle body 5a are integrally formed.

Embodiments of the present invention will now be described in detail with reference to Figs 1 to 10 of the accompanying drawings. The first embodiment of a nozzle cap for a trigger type liquid dispenser according to the present invention will be described by referring to Figs. 1(A) and 1(B). A nozzle cap 5 comprises a nozzle body 5a and a liquid guide 5b. The liquid guide 5b is engaged fixedly with the end of a liquid injection cylinder 4. The nozzle body 5a has a substantially triangular shape in the front shape. A nozzle port 6 is perforated at the centre on the front face of the nozzle body 5a. The nozzle body 5a is rotatably engaged through a short cylindrical portion 5c with a plug 9 at the end of the liquid guide 5b.

Figs. 1(A) and 1(B) show the "foaming" position of the nozzle cap. Shallow grooves 10 are formed at a plurality of peripheral positions on the peripheral surface of the end of the plug 9 of the liquid guide 5b in a longitudinal direction from the front end face over a predetermined zone. Liquid passages 11 are formed at a plurality of peripheral positions on the inner periphery of an end cylindrical portion 5c in longitudinal line direction from the rear end face over a predetermined zone. A spin groove 12 is disposed at the rear side face of the nozzle port 6. At the "foaming" position, the shallow grooves 10, 10 communicate between the liquid passages 11, 11 and the spin groove 12 to thus inject high pressure liquid through the spin groove 12 and the nozzle port 6 in an atomized state to collide the atomized liquid to the inner peripheral wall of the foaming cylinder 7 to foam the liquid.

When the nozzle body 5a is rotated to the "direct" position, a deed groove of different direction - not shown in Fig. 1 - of the plug 9 communicates the liquid passages 11, 11 directly with the nozzle port 6 to thus inject the high pressure nozzle directly in a water column state without spin from the nozzle port 6. When the nozzle body 5a is rotated to the "closed" position, the portion not formed with the shallow grooves 10, 10 and the deep groove of the plug 9 is disposed to interrupt communication between the liquid passages 11, 11, the nozzle port 6 and the spin groove 12 and to shut off the communication thereamong.

The foaming cylinder 7 is integrally formed as an outer periphery thereof with a large-diameter mounting cylinder 13. The mounting cylinder 13 is engaged fixedly within a peripheral wall 14 projected toward the front face side so that the foaming cylinder 7 is arranged at an air gap 13A of suitable distance on the front face of the nozzle port 6 of the nozzle body 5a. The foaming cylinder 7 and the mounting cylinder 13 are integrated by a front end plate. Air intake openings 15 are perforated peripherally at the end plate and communicate with the air gap 13A. The foaming cylinder 7 also has an engaging projecting circumferential strip 16 formed on the outer peripheral surface of the mounting cylinder 13 to be engaged with an engaging inner circumferential groove 17 formed on the inner peripheral surface of the peripheral wall 14.

The inner peripheral uneven portion 8 on the inner peripheral wall of the foaming cylinder 7 is formed substantially by half near the nozzle port 6 for colliding injecting liquid from the nozzle port 6 and the projecting strip is spirally projected on the inner wall to be formed in the uneven state.

The inner peripheral uneven portion 8 of the foaming cylinder 7 may be formed in an uneven state on the inner wall of the foaming cylinder 7, and is not limited to the embodiment in Fig. 1.

Fig. 2 to 7 show different examples of inner peripheral uneven portions 8 of the foaming cylinder 7. In the example of Fig. 2, grooves are spirally recessed on the inner peripheral wall of the foaming cylinder 7 to form an uneven state on the inner peripheral wall. In the example of Fig. 3, a plurality of ring-like projecting strips 8A are peripherally projected on the inner peripheral wall of the foaming cylinder 7 to form an uneven state on the inner peripheral wall. In the example of Fig. 4, a plurality of ring-like peripheral grooves 8B are peripherally recessed on the inner peripheral wall of the foaming cylinder 7 to form an uneven state in the inner peripheral wall. In the example of Fig. 5, a plurality of projections 8C are projected on the inner peripheral wall of the foaming cylinder 7 to form an uneven state on the inner peripheral wall. In the example of Fig. 6, a plurality of pores 8D are recessed on the inner peripheral wall of the foaming cylinder 7 to form an uneven portion on the inner peripheral wall. In the example of Fig. 7, small projections 8E of triangular projecting shape on a plane are formed at a predetermined circumferential interval on the inner peripheral wall of the foaming cylinder 7 to form an uneven state on the inner peripheral wall.

When the nozzle body 5a is set to the "foaming" position, an angle for diffusing liquid (atomized state) injected from the nozzle port 6 depends differently upon the viscosity of the liquid to be injected. Therefore, the formation of the uneven portion 8 is preferably devised on the basis of the viscosity of the liquid to be injected.

In case of low viscosity liquid, the liquid is injected to be dispersed in a wide angle from the nozzle port 6. Thus, the injected liquid (atomized state) is diffused at the position near the nozzle port 6 axially, as compared with the case of high viscosity liquid. Accordingly, when the foaming cylinders which have the uneven portions of the same shape are employed, a range that the low viscosity liquid is contacted with the uneven portion 8 becomes a peripheral surface near the nozzle port 6 on the inner peripheral wall of the foaming cylinder 7, as compared with that of the high viscosity liquid. Thus, in the case of low viscosity liquid, as shown in Fig. 8, it is desirable to form the uneven portion 8 shorter and nearer to the nozzle port 6 axially as compared with the case of high viscosity liquid. When the uneven portion 8 is formed too long in the axial direction in the foaming cylinder 7, the resistance of the uneven portion 8 against the liquid injected from the nozzle port 6 is increased, so that the injecting pressure of the liquid injected from an injection port 18 decreases. For example, as shown in Fig. 8, the uneven portion 8 is formed on the portion near the side of the nozzle port 6 from the centre of the inner peripheral wall of the foaming cylinder 7. When the foamablity is good and the viscosity of the liquid is low, foaming is performed efficiently even if the uneven portion 8 is formed shorter in the axial direction of the foaming cylinder 7.

On the other hand, in case of high viscosity liquid, the liquid is diffused and injected in a relatively narrow angle from the nozzle port 6 as compared with the case of low viscosity liquid. Thus, it is preferable to form the uneven portion 8 longer in the axial direction further from the nozzle port 6.

Further, in order to reduce the resistance of the foaming cylinder 7 against the injected liquid in case of low viscosity liquid, as shown in Fig. 8, the inner diameter of the portion 7a formed with no uneven portion 8 of the forming cylinder 7 may increased larger than the maximum inner diameter of the uneven portion 8. Thus, such configuration eliminates the increase in resistance of the inner wall portion 7a of the foaming cylinder 7 not formed with the uneven portion 8 so that the injecting pressure of the liquid from the injection port 18 increases. Also, the atomizing pattern can be varied.

In case of high viscosity liquid, as shown in Fig. 9, the inner diameter of the portion 7a not formed with the uneven portion 8 of the foaming cylinder 7 may be formed smaller than the minimum inner diameter of the uneven portion 8. However, when the inner diameter of the portion 7a is excessively reduced, the resistance increases excessively to cause the injecting pressure of the liquid to reduce, thereby permitting the liquid to leak and drop from the injection port.

The uneven portion 8 of the inner peripheral wall of the foaming cylinder 7 is formed mainly on the rear half portion near the nozzle port 6 on the inner peripheral wall of the foaming cylinder 7 and it is preferable not to form the uneven portion 8 on the entire inner peripheral wall of the foaming cylinder 7. If the uneven portion 8 is formed on the entire inner peripheral wall of the foaming cylinder 7, the resistance against the injected liquid by the uneven portion 8 is excessively increased to reduce the injection pressure of the liquid. The axial length of the uneven portion 8 on the inner peripheral surface depends upon the viscosity of the liquid.

In the embodiments described above, the foaming cylinder 7 is formed independently from the nozzle body 5a. However, the foaming cylinder 7 may be formed integrally with the nozzle body 5a. Fig. 10 shows the example of this case. A foaming cylinder 7 projects integrally from the front wall of the outer periphery of the nozzle port. When the foaming cylinder 7 is integrally formed with the nozzle body 5a and an air intake port 15 is formed on the front face of the nozzle cap, it cannot be removed from a mould after moulding it in a casting mould. Therefore, in the embodiment of Fig. 10, an air intake port 15 is formed on the side of the nozzle cap.

The respective portions are moulded of synthetic resin material.

According to the present invention as described above, the uneven portion 8 is formed on the inner peripheral wall of the foaming cylinder 7 so that the injecting liquid from the nozzle port 6 is complicatedly reflected by the uneven portion 8. Therefore, the nozzle cap having high foaming efficiency can be provided.

Claims

1. A nozzle cap comprising a nozzle body (5a) having a nozzle port (6) and a foaming cylinder (7) with a roughened inner surface attached to the nozzle body so as to be axially aligned with and forward of the nozzle port (6), characterised in that the nozzle port (6) is of divergent form and that the foaming cylinder (7) comprises an inner peripheral uneven portion (8) formed on an inner peripheral wall of the foaming cylinder having a substantially uniform cross-sectional opening and an inner peripheral even portion defined by the inner peripheral wall of the foaming cylinder having a substantially uniform cross-sectional opening, the inner peripheral uneven portion (8) of the foaming cylinder being adjacent to the divergent nozzle port (6) so that liquid injected from the divergent nozzle port is dispersed outwardly and directly impinges on the adjacent uneven portion (8) of the foaming cylinder (7).

2. A nozzle cap according to claim 1, characterised in that the uneven portion (8) of the foaming cylinder (7) is formed by spirally projecting a projecting strip on the inner peripheral wall of the foaming cylinder (7).

3. A nozzle cap according to claim 1, characterised in that the uneven portion (8) is formed by spirally recessing a groove on the inner peripheral wall of the foaming cylinder (7).

4. A nozzle cap according to claim 1, characterised in that the uneven portion (8) is formed by peripherally projecting a plurality of ring-like projecting strips (8A) on the inner peripheral wall of the foaming cylinder (7).

5. A nozzle cap according to claim 1, characterised in that the uneven portion (8) is formed by peripherally recessing a plurality of ring-like grooves (8B) on the inner peripheral wall of the foaming cylinder (7).

6. A nozzle cap according to claim 1, characterised in that the uneven portion (8) is formed by projecting a plurality of projections (8C) on the inner peripheral wall of the foaming cylinder (7).

7. A nozzle cap according to claim 1, characterised in that the uneven portion (8) is formed by recessing a plurality of recesses (8D) on the inner peripheral wall of the foaming cylinder (7).

8. A nozzle cap according to claim 1, characterised in that the uneven portion (8) is formed by forming small projections (8E) of a triangular projecting shape at predetermined peripheral intervals on a circumferential plane of the inner peripheral wall of the foaming cylinder (7).

9. A nozzle cap according to claim 1, characterised in that, when a low viscosity liquid is injected, the uneven portion (8) is formed on the inner wall nearest the divergent nozzle port (7) in an axial direction of the foaming cylinder (7) and the length of the uneven portion (8) is less than half the length of the foaming cylinder (7).

10. A nozzle cap according to claim 1, characterised in that, when a low viscosity liquid is the material to be foamed, the inner cross-sectional opening of the even portion of the foaming cylinder (7) is larger than the maximum inner cross-sectional opening of the uneven portion (8).

11. A nozzle cap according to claim 1, characterised in that, when high viscosity liquid is injected, the uneven portion (8) is formed over a substantial portion of the length of the foaming cylinder (7) in the axial direction of the foaming cylinder.

12. A nozzle cap according to any preceding claim, characterised in that the nozzle body and the foaming cylinder (7) are formed as one integrated part.

13. A nozzle cap according to claim 1, characterised in that, when a high viscosity liquid is the material to be foamed, the inner cross-sectional opening of the even portion of the foaming cylinder (7) is smaller than the minimum inner cross-sectional opening of the uneven portion (8).

Patentansprüche

1. Düsenkappe mit einem Düsenkörper (5a), der eine Düsenöffnung (6) und einen schaumerzeugenden Zylinder (7) mit aufgerauhter innerer Oberfläche aufweist, der an den Düsenkörper angeschlossen ist, so daß er axial mit und vor der Düsenöffnung (6) in einer Flucht liegt,
dadurch **gekennzeichnet,** daß die Düsenöffnung (6) eine allmählich sich aufweitende Form besitzt und der schaumerzeugende Zylinder (7) einen inneren, peripheren, unebenen Abschnitt (8) aufweist, der auf einer inneren peripheren Wand des schaumerzeugenden Zylinders gebildet ist, welcher eine im wesentlichen gleichförmige Querschnittsöffnung und einen inneren, peripheren, glatten Abschnitt besitzt, der durch die innere periphere Wand des schaumerzeugenden Zylinders mit im wesentlichen gleichförmiger Querschnittsöffnung definiert ist, wobei sich der innere, periphere, unebene Abschnitt (8) des schaumerzeugenden Zylinders in der Nähe der allmählich sich aufweitenden Düsenöffnung (6) befindet, so daß sich die aus der allmählich sich aufweitenden Düsenöffnung austretende Flüssigkeit außen ausbreitet und direkt auf den benachbarten unebenen Abschnitt (8) des schaumerzeugenden Zylinders (7) auftrifft.

2. Düsenkappe nach Anspruch 1,
dadurch **gekennzeichnet,** daß der unebene Abschnitt (8) des schaumerzeugenden Zylinders (7) durch spiraliges Vorspringenlassen eines abstehenden Steges auf der inneren peripheren Wand des schaumerzeugenden Zylinders (7) gebildet ist.

3. Düsenkappe nach Anspruch 1,
dadurch **gekennzeichnet,** daß der unebene Abschnitt (8) durch spiraliges Eintiefen einer Nut in die innere periphere Wand des schaumerzeugenden Zylinders (7) gebildet ist.

4. Düsenkappe nach Anspruch 1,
dadurch **gekennzeichnet,** daß der unebene Abschnitt (8) durch peripheres Vorspringenlassen einer Vielzahl von ringartig abstehenden Stegen (8A) auf der inneren peripheren Wand des schaumerzeugenden Zylinders (7) gebildet ist.

5. Düsenkappe nach Anspruch 1,
dadurch **gekennzeichnet,** daß der unebene Abschnitt (8) durch peripheres Eintiefen einer Vielzahl von ringförmigen Nuten (8B) in die innere periphere Wand des schaumerzeugenden Zylinders (7) gebildet ist.

6. Düsenkappe nach Anspruch 1,
dadurch **gekennzeichnet,** daß der unebene Abschnitt (8) durch Vorstehenlassen einer Vielzahl von Vorsprüngen (8C) auf der inneren peripheren Wand des schaumerzeugenden Zylinders (7) gebildet ist.

7. Düsenkappe nach Anspruch 1,
dadurch **gekennzeichnet,** daß der unebene Abschnitt (8) durch Eintiefen einer Vielzahl von Vertiefungen (8D) in der inneren peripheren Wand des schaumerzeugenden Zylinders (7)

gebildet ist.

8. Düsenkappe nach Anspruch 1,
dadurch **gekennzeichnet,** daß der unebene Abschnitt (8) durch Ausbilden einer Vielzahl von Vorsprüngen (8E) dreieckiger Ansatzform in vorbestimmten peripheren Abständen entlang einer Umfangsebene der inneren peripheren Wand des schaumerzeugenden Zylinders (7) gebildet ist.

9. Düsenkappe nach Anspruch 1,
dadurch **gekennzeichnet,** daß beim Spritzen mit einer Flüssigkeit geringer Viskosität der unebene Abschnitt (8) auf der inneren Wand axial in nächster Nähe zur sich allmählich aufweitenden Düsenöffnung (6) des schaumerzeugenden Zylinders (7) angeordnet ist und die Länge des unebenen Abschnittes (8) kleiner als die Hälfte der Länge des schaumerzeugenden Zylinders (7) ist.

10. Düsenkappe nach Anspruch 1,
dadurch **gekennzeichnet,** daß wenn eine Flüssigkeit geringer Viskosität das in Schaum zu verwandelnde Material bildet, die innere Querschnittsöffnung des glatten Abschnittes des schaumerzeugenden Zylinders (7) größer als die maximale innere Querschnittsöffnung des unebenen Abschnittes (8) ist.

11. Düsenkappe nach Anspruch 1,
dadurch **gekennzeichnet,** daß beim Spritzen mit Flüssigkeit hoher Viskosität der unebene Abschnitt (8) in axialer Richtung des schaumerzeugenden Zylinders über einen beträchtlichen Abschnitt der Länge des schaumerzeugenden Zylinders (7) hinweg ausgebildet ist.

12. Düsenkappe nach einem beliebigen vorhergehenden Anspruch,
dadurch **gekennzeichnet,** daß der Düsenkörper und der schaumerzeugende Zylinder (7) einstückig ausgebildet sind.

13. Düsenkappe nach Anspruch 1,
dadurch **gekennzeichnet,** daß wenn eine Flüssigkeit hoher Viskosität das in Schaum zu verwandelnde Material bildet, die innere Durchschnittsöffnung des glatten Abschnittes des schaumerzeugenden Zylinders (7) kleiner als die kleinste Querschnittsöffnung des unebenen Abschnittes (8) ist.

Revendications

1. Coiffe de buse comportant un corps (5a) de buse ayant un orifice (6) de buse et un cylindre générateur de mousse (7) présentant une surface intérieure rendue rugueuse, reliée au corps de buse de façon à être alignée axialement avec l'orifice (6) de buse et en avant de celui-ci, caractérisée en ce que l'orifice (6) de buse est d'une forme divergente et en ce que le cylindre générateur de mousse (7) comprend une partie périphérique intérieure inégale (8) formée sur une paroi périphérique intérieure de ce cylindre générateur de mousse ayant une ouverture de section transversale sensiblement uniforme et une partie périphérique intérieure égale définie par la paroi périphérique intérieure du cylindre générateur de mousse, ayant une ouverture de section transversale sensiblement uniforme, la partie périphérique intérieure inégale (8) du cylindre générateur de mousse étant adjacente à l'orifice divergent (6) de la buse afin qu'un liquide injecté depuis l'orifice divergent de la buse soit dispersé vers l'extérieur et atteigne directement la partie inégale adjacente (8) du cylindre générateur de mousse (7).

2. Coiffe de buse selon la revendication 1, caractérisée en ce que la partie inégale (8) du cylindre générateur de mousse (7) est formée par la réalisation en saillie hélicoïdale d'une bande en saillie sur la paroi périphérique intérieure du cylindre générateur de mousse (7).

3. Coiffe de buse selon la revendication 1, caractérisée en ce que la partie inégale (8) est formée par creusement hélicoïdal d'une gorge dans la paroi périphérique intérieure du cylindre générateur de mousse (7).

4. Coiffe de buse selon la revendication 1, caractérisée en ce que la partie inégale (8) est formée par la réalisation en saillie périphérique de plusieurs bandes (8A) en saillie analogues à des anneaux sur la paroi périphérique intérieure du cylindre générateur de mousse (7).

5. Coiffe de buse selon la revendication 1, caractérisée en ce que la partie inégale (8) est formée par creusement périphérique de plusieurs gorges (8B) analogues à des anneaux dans la paroi périphérique intérieure du cylindre générateur de mousse (7).

6. Coiffe de buse selon la revendication 1, caractérisée en ce que la partie inégale (8) est formée par la réalisation en saillie de plusieurs saillies (8C) sur la paroi périphérique intérieure du cylindre générateur de mousse (7).

7. Coiffe de buse selon la revendication 1, caractérisée en ce que la partie inégale (8) est formée par creusement de plusieurs évidements (8D) dans la paroi périphérique intérieure du cylindre générateur de mousse (7).

8. Coiffe de buse selon la revendication 1, caractérisée en ce que la partie inégale (8) est formée par la formation de petites saillies (8E) en forme de saillies triangulaires à intervalles périphériques prédéterminés sur un plan circonférentiel de la paroi périphérique intérieure du cylindre générateur de mousse (7).

9. Coiffe de buse selon la revendication 1, caractérisée en ce que, lorsqu'un liquide à faible viscosité est injecté, la partie inégale (8) est formée sur la paroi intérieure au plus prêt de l'orifice divergent (7) de buse dans une direction axiale du cylindre générateur de mousse (7) et la longueur de la partie inégale (8) est inférieure à la moitié de la longueur du cylindre générateur de mousse (7).

10. Coiffe de buse selon la revendication 1, caractérisée en ce que, lorsqu'un liquide à faible viscosité est la matière devant être amenée à l'état de mousse, l'ouverture de la section transversale intérieure de la partie égale du cylindre générateur de mousse (7) est plus grande que l'ouverture maximale de la section transversale intérieure de la partie inégale (8).

11. Coiffe de buse selon la revendication 1, caractérisée en ce que, lorsqu'un liquide à haute viscosité est injecté, la partie inégale (8) est formée sur une partie importante de la longueur du cylindre générateur de mousse (7) dans la direction axiale du cylindre générateur de mousse.

12. Coiffe de buse selon l'une quelconque des revendications précédentes, caractérisée en ce que le corps de buse et le cylindre générateur de mousse (7) sont formés d'une seule pièce.

13. Coiffe de buse selon la revendication 1, caractérisée en ce que, lorsqu'un liquide à haute viscosité est la matière devant être amenée à l'état de mousse, l'ouverture de la section transversale intérieure de la partie égale du cylindre générateur de mousse (7) est plus petite que l'ouverture minimale de la section transversale intérieure de la partie inégale (8).

FIG. 1A

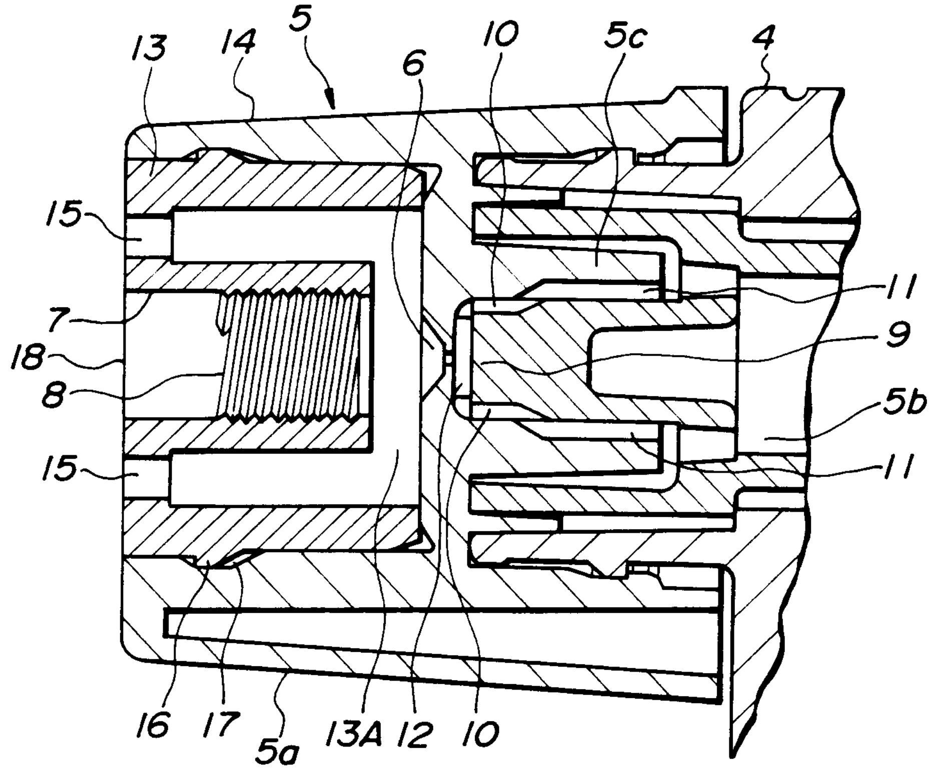

FIG. 1B

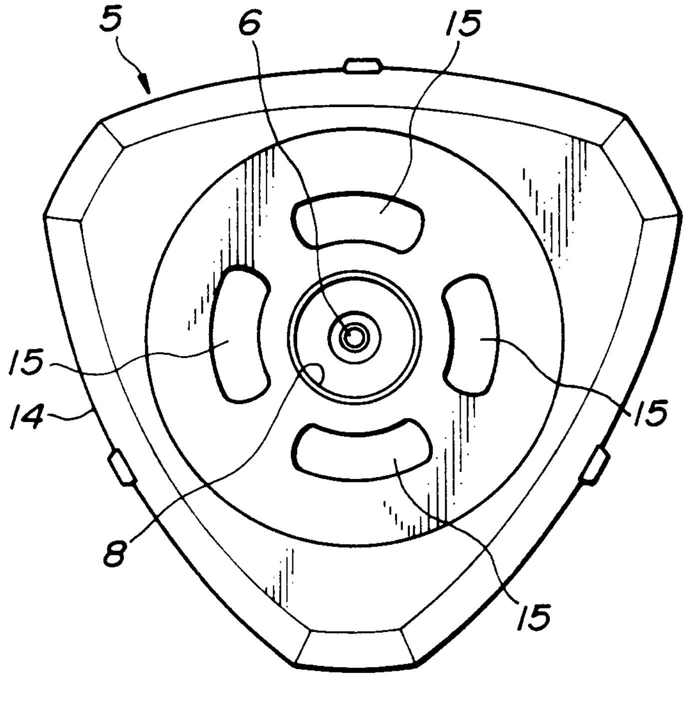

FIG. 2

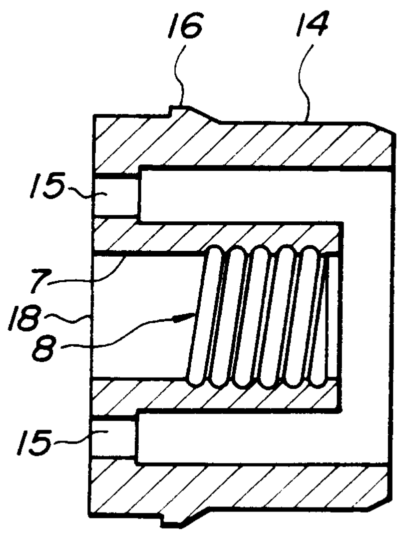

FIG. 3

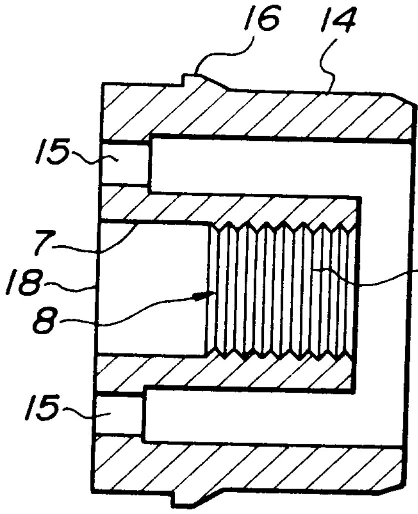

FIG. 4

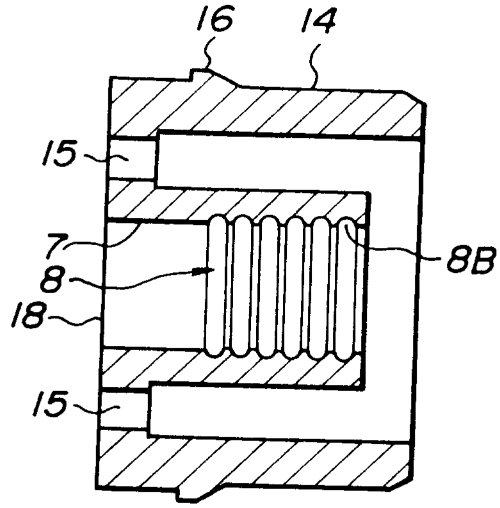

FIG. 5

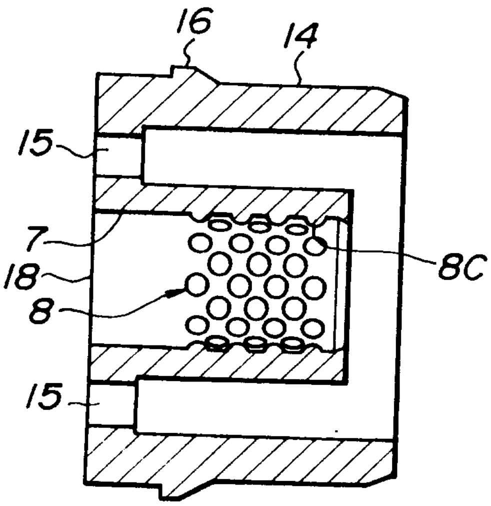

FIG. 6

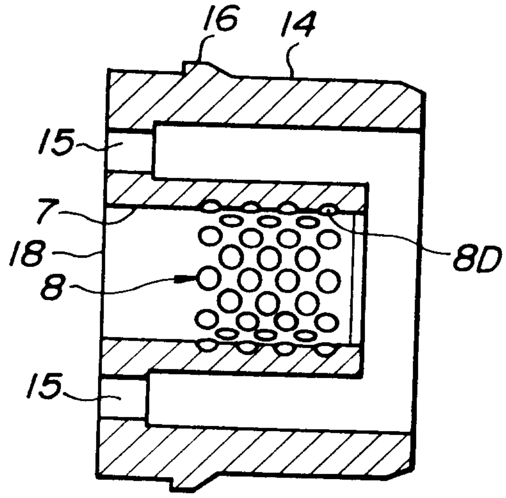

FIG. 7

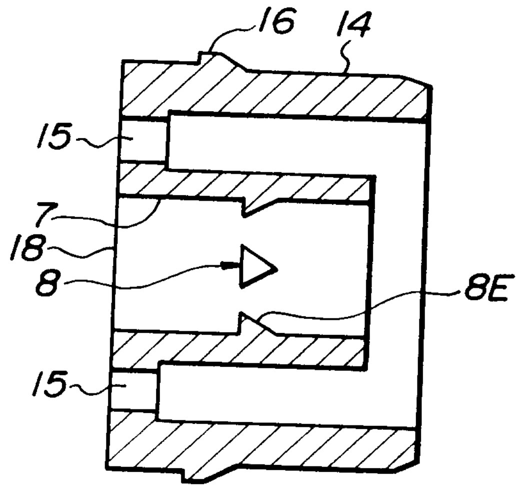

FIG. 8

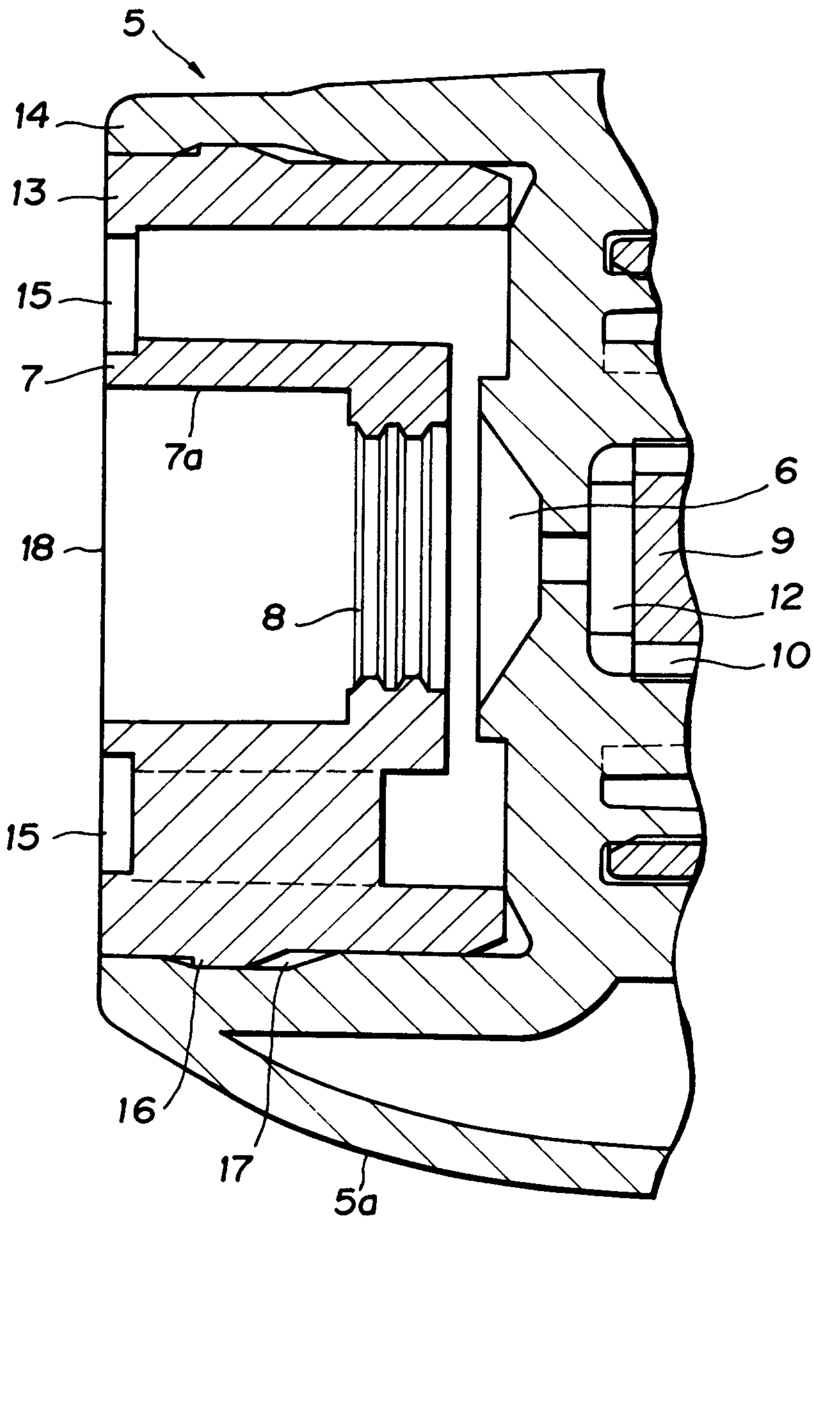

FIG. 9

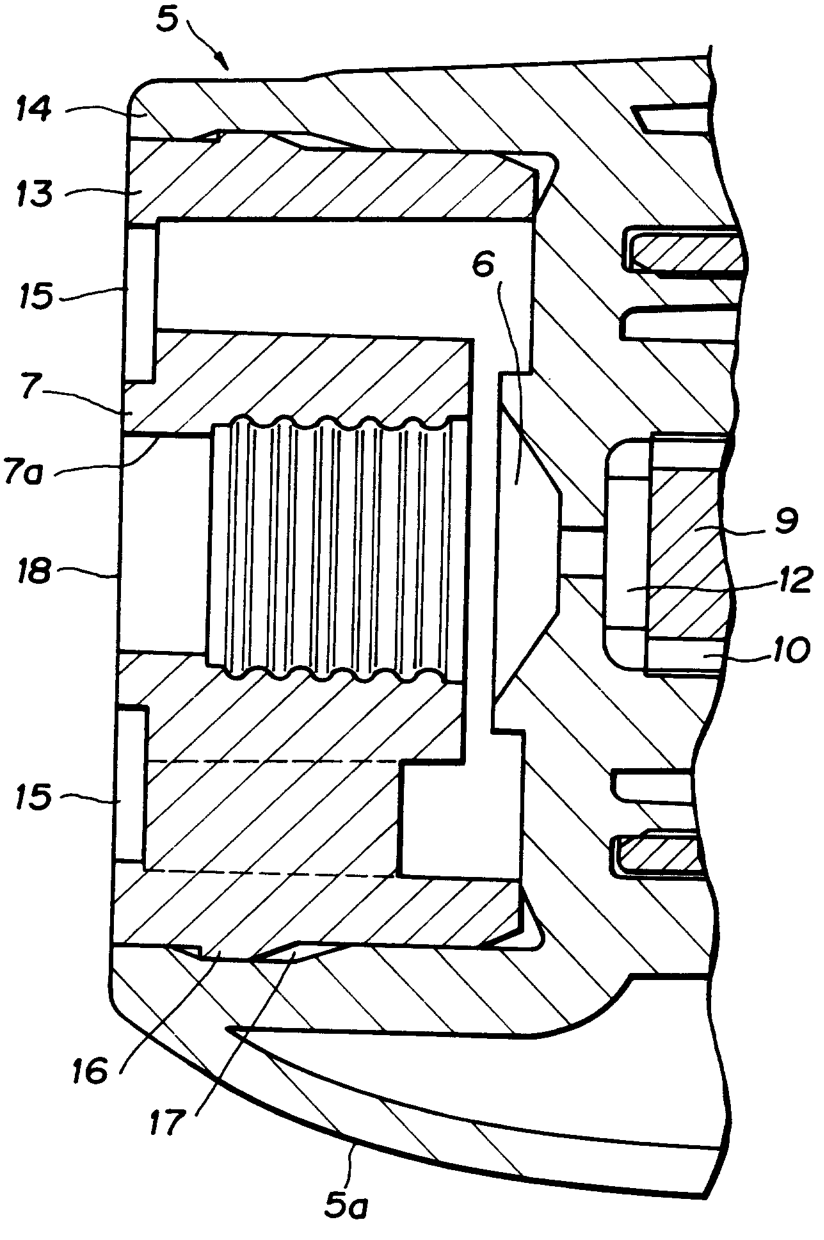

FIG. 10

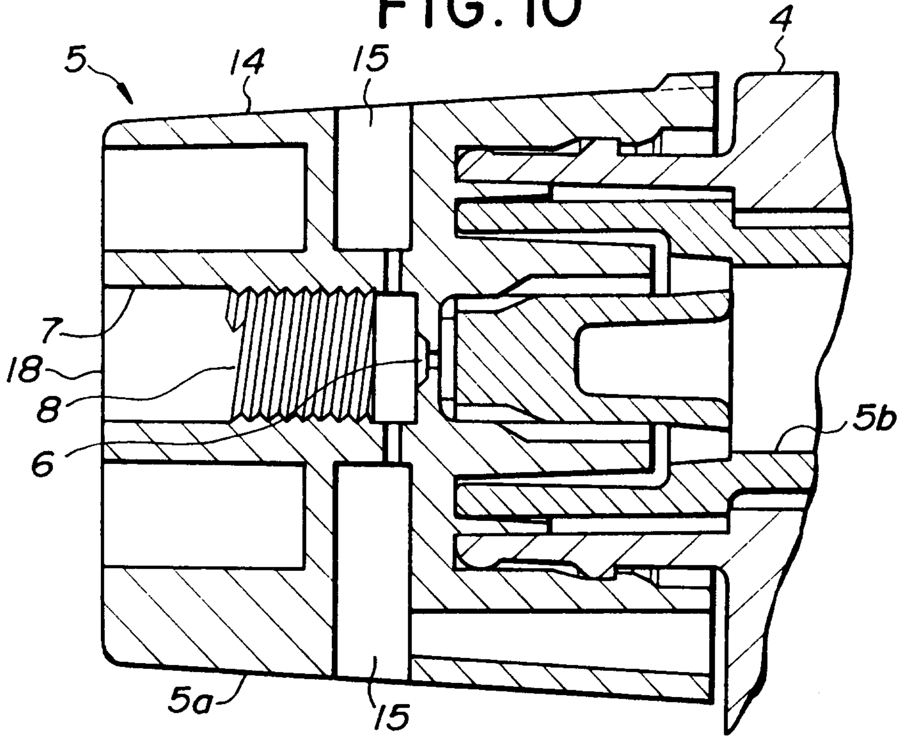

FIG. 11