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(54) **Radiator cap**

(57) A radiator cap (10), highly capable of reliable operation, comprises a cover (12), an internal cap (14) snap-fastened inside said cover (12), said internal cap (14) having an opening (16) shut off by a valve body (18) which is closed under stress and constitutes a pressure-relief valve sealed by means of a seat (22)

provided with a gasket (24), said valve body (18) being shaped like an inverted cup provided with an inflow opening (26) shut off by a shutter (28) which is closed under stress by elastic means (30) in a single piece with the shutter (28) and constitutes a low-pressure valve.

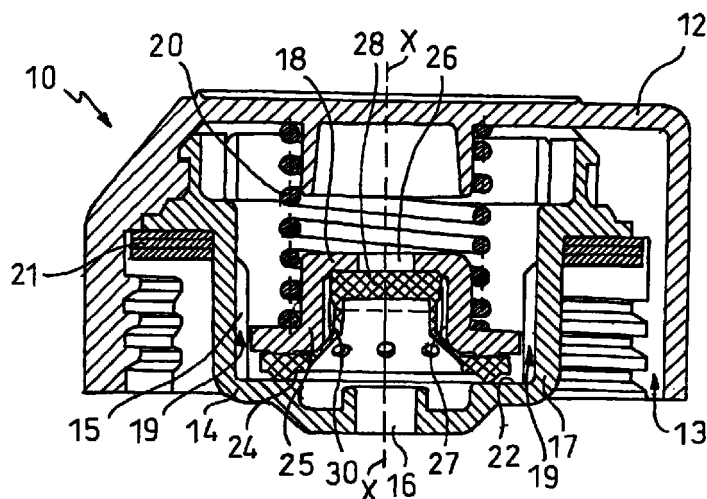


FIG.1

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Description

[0001] The present invention relates to a radiator cap, for example a cap for a vehicle radiator.

[0002] A known type of radiator cap essentially comprises a cover, and an internal cap snap-fastened inside said cover. Said internal cap has a first opening shut off by a valve body which is closed under stress and constitutes a pressure-relief valve sealed by means of a seat provided with a gasket. Said valve body is shaped like an inverted cup provided with a second, inflow opening shut off by a shutter which is closed under stress by elastic means and constitutes a low-pressure valve.

[0003] In the known radiator caps, said shutter comprises a small plate associated with a gasket. Said shutter is stressed so as to close the inflow opening by a small metal helical spring supported on the base of the internal cap and received partly in the valve body of the pressure-relief valve.

[0004] The construction of said known radiator cap is very complicated. Moreover, constantly accurate assembly of the shutter, the small spring and the gasket, which constitute the low-pressure valve, is particularly difficult in the known radiator cap. Indeed, it is known that incorrect assembly of the low-pressure valve causes unacceptable malfunctioning of the radiator cap in the event of low pressure occurring in the radiator to which the cap is connected to close an opening. In other words, incorrect assembly of the low-pressure valve allows an opening of the valve which does not correspond to the requirements for reliable operation and safe use of the radiator cap in a vehicle.

[0005] On account of these disadvantages, the current construction procedure of the known radiator cap is weighed down and complicated by the need to carry out pre-assembly of the spring, the shutter and the gasket to form the low-pressure valve. At present, it is only subsequently, and by means of special, complicated procedures, that said valve can be mounted inside the valve seat provided in the radiator cap. Notwithstanding the use of special assembly techniques, it is currently quite common to find, downstream of the assembly line, known radiator caps with the small spring of the low-pressure valve imperfectly aligned with one of its necessary bearing surfaces and/or with the shutter, which leads to unpredictable operation of the radiator cap and consequent rejection of the product.

[0006] The problem forming the basis of the present invention is that of devising a radiator cap of the type specified above, which has constructional and operational characteristics which make it possible to overcome the abovementioned disadvantages referred to in relation to the known art.

[0007] This problem is solved by means of a radiator cap comprising a cover, an internal cap fixed inside said cover, said internal cap having an opening shut off by a valve body which is closed under stress so as to

constitute a pressure-relief valve sealed by means of a seat provided with a gasket, said valve body being shaped like an inverted cup provided with an inflow opening shut off by a shutter which is closed under stress by elastic means so as to constitute a low-pressure valve, characterized in that the shutter and the elastic means are a single piece.

[0008] In order to better understand the invention, a description follows below of a non-limiting exemplary embodiment thereof, which is illustrated in the appended drawings, in which:

Figure 1 illustrates a section of a radiator cap along a line indicated by I-I in Figure 2;

Figure 2 illustrates, in a view from above, the radiator cap in Figure 1;

Figure 3 illustrates, in a view from below, a component of the radiator cap in Figure 1;

Figure 4 illustrates, in lateral section, the component in Figure 3;

Figure 5 illustrates, in lateral section, the radiator cap in Figure 1 in another operating position;

Figure 6 illustrates, in lateral section, a radiator cap according to a second embodiment;

Figure 7 illustrates, in lateral section, a component of the radiator cap in Figure 6, and

Figure 8 illustrates a cross section of the component in Figure 7 along the line VIII-VIII.

[0009] With reference to the abovementioned figures, reference number 10 indicates a radiator cap as a whole.

[0010] Said radiator cap 10 comprises a cover 12 which has a body which is longitudinally of an essentially tubular cylindrical shape with an axis X-X. The cover 12 is provided internally with a thread which is suitable for connecting it to a threaded connection or mouth of a container, for example a vehicle radiator. Said cover is also provided with fluid inflow and outflow ducts 13 which are formed, for example, in enlarged portions of the body of the cover, which do not have the internal thread for connection to the radiator. Provided inside the tubular body of the cover 12 is an annular protuberance which extends internally, or towards the X-X axis, to form a bearing surface and an undercut coupling recess.

[0011] An internal cap 14 is received inside the cover. Said internal cap has an essentially cup-shaped body provided with a lateral wall, a bottom and, close to one of its openings, an annular protuberance which extends externally, or away from the axis X-X, to form a surface which mates with the bearing surface of the cover. Extending longitudinally from said annular protuberance of the internal cap is a plurality of thin plates provided with hooked portions suitable for snap-fastening the internal cap inside said cover 12, for example by being anchored in said undercut coupling recess of the cover. A gasket 21 for sealing the cover 12 on the radia-

tor is mounted externally on said internal cap. Said internal cap 14 is provided with a plurality of longitudinal projections which extend from the lateral wall 17 towards the inside of said internal cap to form guides 15. Said guides 15 form fluid outflow ducts 19. Said internal cap 14 has a first opening 16 in its bottom. According to one embodiment, the bottom has a longitudinally extending annular projection around said opening 16. According to another embodiment, the portion of the bottom close to said opening 16 forms a duct inside the radiator cap, which duct is delimited on one of its sides by said annular projection.

[0012] Said opening 16 is shut off by a valve body 18 which is received in said internal cap 14 and guided by said guides 15. The valve body 18 is stressed by a spring 20 so as to close the opening 16. The valve body 18 constitutes, together with the spring 20, a pressure-relief valve or, in other words, a valve which is capable of discharging any excess pressure present in the radiator closed by the radiator cap. Said pressure-relief valve is sealed against a seat 22 by means of a gasket 24. According to one embodiment, said gasket 24 is an annular body of essentially rectangular section and bears against the seat 22 by means of an annular extension having a section which decreases towards said seat 22 or, in other words, a compliance which increases from the gasket body to the seat 22, by means of, for example, a V-shaped cross section of the annular extension. Said valve body 18 is shaped like an inverted cup with a lateral wall and a bottom provided with a second, or inflow, opening 26. Close to its opening, the body shaped like an inverted cup has a radial extension which extends externally, or away from the axis X-X, to form a support surface for the gasket 24 and an opposite bearing surface for the spring 20. The lateral wall 25 of said valve body has longitudinal projections on the inside, which are shaped like guides 27 and form inflow ducts 29 for the fluid.

[0013] The inflow opening 26 is shut off by a shutter 28 which is, for example, disc-shaped, is received in said valve body 18 shaped like an inverted cup, and can slide on said guides 27 (Figure 1). Said shutter 28 is closed under stress by elastic means 30 of predetermined compliance.

[0014] Advantageously, said elastic means 30 are produced in a single piece with the shutter 28 to constitute a low-pressure valve.

[0015] In one embodiment of the invention, said elastic means 30 have a portion with a tubular cylindrical body close to the shutter. Said tubular portion is, at the end opposite the shutter, connected to an annular portion of frustoconical skirt like a cup spring 32. Said cup spring 32 has a predetermined wall 34 thickness which, together with its geometry, defines a predetermined compliance of the elastic means 30. Said wall has a plurality of through-holes 36 suitable for the inflow of fluid.

[0016] According to another embodiment of the

invention, said shutter 28 and said elastic means 30, in a single piece with the shutter 28, form a single body with the sealing gasket 24 of the valve body 18. In particular, the wall 34 of the cup spring 32, which is shaped like a skirt of a frustoconical body or, in other words, shaped like a suction cup diaphragm, or a suction cup, extends from the inner edge of the sealing gasket 24 towards the shutter 28. Higher up, said wall 34 joins a tubular piece 38 extending below the disc-shaped shutter 28. Said through-holes 36 are preferably made in the thin suction-cup-like piece of wall 34 (Figures 3 and 4).

[0017] The low-pressure valve is advantageously made of a natural or synthetic elastic material which is capable of withstanding high temperatures in addition to having a predetermined compliance. The low-pressure valve is preferably made of silicone, for example of LSR 3485 with 4% oil, having a Shore hardness of between 45 and 65.

[0018] The operation of the radiator cap is described below with reference to Figures 1 and 5.

[0019] The radiator cap will be arranged so as to close in a sealed manner a mouth of a radiator, for example a vehicle radiator.

[0020] In the event of low pressure occurring inside the radiator or, in other words, the pressure prevailing inside the radiator being lower than the pressure outside the radiator, the shutter 28 is stressed by the external pressure exerted by the air which enters the cover 12 from the inflow and outflow ducts 13. Once the opposing action of the cup spring 32 has been overcome, the shutter slides inside the valve body 18 guided by the guides 27, freeing the inflow opening 26 or, in other words, opening the low-pressure valve. The air enters the valve body 18, which is sealed against the seat 22 of the pressure-relief valve, and flows over the shutter 28 and the wall 34 of the cup spring 32, passing through the inflow ducts 29. By virtue of the through-holes 36 provided in the wall 34, the air enters the low-pressure valve and passes into the radiator through the opening 16 of the internal cap 14.

[0021] On the other hand, if a fluid under excess pressure, for example steam, is present in the radiator, a thrust is exerted on the shutter, which closes the low-pressure valve, stressing the valve body against the action of the spring 20. Once the action of the spring 20 has been overcome, the valve body slides on the guides 15, raising the gasket 24 from the seat 22 and bringing about the opening of the pressure-relief valve. The fluid under pressure passing through the opening in the internal cap 14 enters the ducts 19 formed between the guides 15, reaching the inflow and outflow ducts 13 and then the outside of the radiator cap 10.

[0022] From the above, it can be appreciated how the radiator cap to which the invention relates, which comprises a low-pressure valve made of synthetic material, for example silicone rubber, performs the function of shutting the inflow opening and the function of closing the valve under elastic stress by means of a

component in a single piece, thereby making it possible to limit assembly times and to increase operational reliability, reducing the number of rejects in production.

[0023] In particular, it can be appreciated how the operation of the radiator cap to which the invention relates is accurate and affords very high operational reliability. The inclusion of a low-pressure valve provided with a shutter and elastic means in a single piece ensures that the opening of the low-pressure valve always takes place at the desired, predetermined value of low pressure in the radiator. This is because this low-pressure value depends on the constructional characteristics of the cup spring, in particular its dimensional shape or construction and the predetermined properties of the material from which it is made.

[0024] With the radiator cap to which the invention relates, the correct, predetermined action of the elastic means on the shutter is always guaranteed. The shutter in a single piece with the elastic means guarantees perfect alignment between the two and a precise value of the force necessary to open the low-pressure valve irrespective of accuracy of assembly and without stages for pre-assembly of the low-pressure valve. In this way, it is possible to produce a large run of radiator caps having a constant value of the elastic action which opposes the opening of the low-pressure valve, reducing the number of pieces rejected.

[0025] A further advantage of the invention is the fact that the radiator cap is simplified in terms of the number of components in relation to the radiator cap of the prior art and, as it is therefore also of simple construction, it furthermore allows simple management of parts stores. This is reflected in greater speed of assembly and consequent further reliability in terms of correct operation of the low-pressure valve.

[0026] It is also an advantage that the assembly operations are simplified, the stages of pre-assembly of the low-pressure valve being eliminated.

[0027] It is clear that variations and/or additions can be made to the embodiments described and illustrated above.

[0028] The elastic means 30 can, for example, take the form of bellows 40. According to one embodiment, said bellows is formed from a plurality of interconnected portions with a frustoconical tubular body. Said bellows 40 is fixed to an annular base 42 from which small support columns 44 extend to the bottom of the internal cap so as to maintain the body of the elastic means 30 raised from the opening 16 of the internal cap 14.

[0029] According to another embodiment, the annular projection provided around the opening 16 is provided with inflow and outflow slots or grooves arranged between the small columns 44 for supporting the elastic means (Figures 6, 7 and 8).

[0030] For the purpose of satisfying contingent and specific requirements, an expert in the field will of course be able to apply numerous modifications and variations to the radiator cap described above, all of

which are, moreover, contained within the scope of protection of the invention as defined by the claims below.

Claims

1. Radiator cap (10) comprising a cover (12), an internal cap (14) fixed inside said cover (12), said internal cap (14) having an opening (16) shut off by a valve body (18) which is closed under stress and constitutes a pressure-relief valve sealed by means of a seat (22) provided with a gasket (24), said valve body (18) being shaped like an inverted cup provided with an inflow opening (26) shut off by a shutter (28) which is closed under stress by elastic means (30) and constitutes a low-pressure valve, characterized in that the shutter (28) and the elastic means (30) are a single piece.
2. Radiator cap (10) according to Claim 1, characterized in that the elastic means (30) have a predetermined compliance.
3. Radiator cap (10) according to Claim 1, characterized in that said shutter (28) and elastic means (30) in a single piece form a single body with the sealing gasket (24) of the valve body (18).
4. Radiator cap (10) according to Claim 3, characterized in that said elastic means (30) are a cup spring (32).
5. Radiator cap (10) according to Claim 4, characterized in that said cup spring (32) has a predetermined wall (34) thickness.
6. Radiator cap (10) according to Claim 4, characterized in that said cup spring (32) has, in the wall (34), a plurality of through-holes (36) for the inflow of fluid.
7. Radiator cap (10) according to Claim 3, characterized in that said elastic means (30) are a bellows (40).
8. Radiator cap (10) according to Claim 7, characterized in that said bellows (40) is fixed to an annular base (42) from which small support columns (44) extend so as to keep the body of the elastic means (30) raised for the passage of the fluid.
9. Radiator cap (10) according to any one of the preceding claims, characterized in that the low-pressure valve is made of synthetic material.
10. Radiator cap (10) according to Claim 9, characterized in that the low-pressure valve is made of silicone.

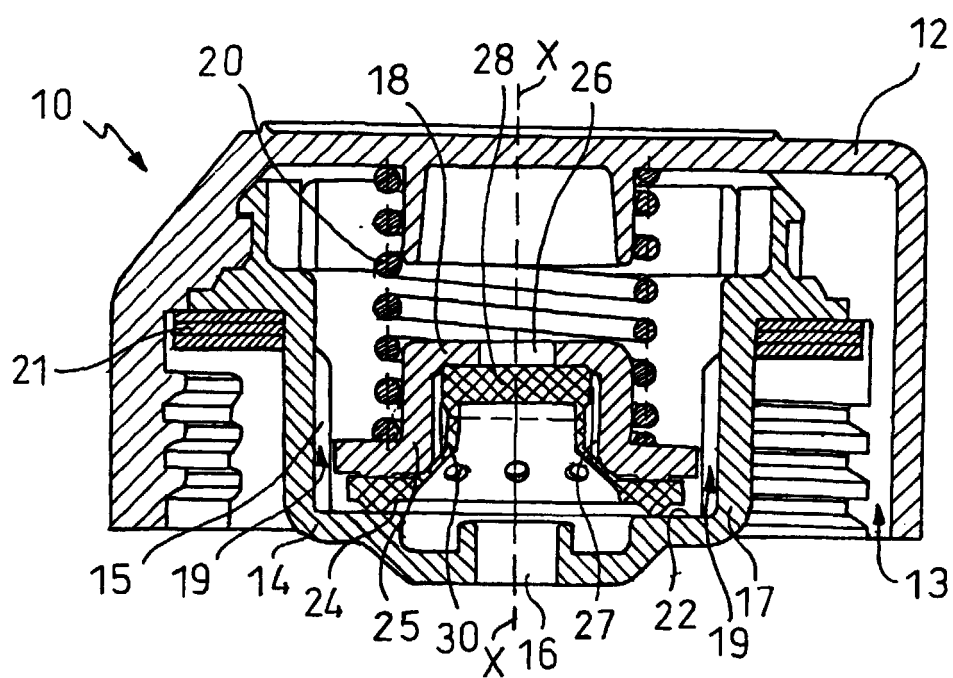


FIG. 1

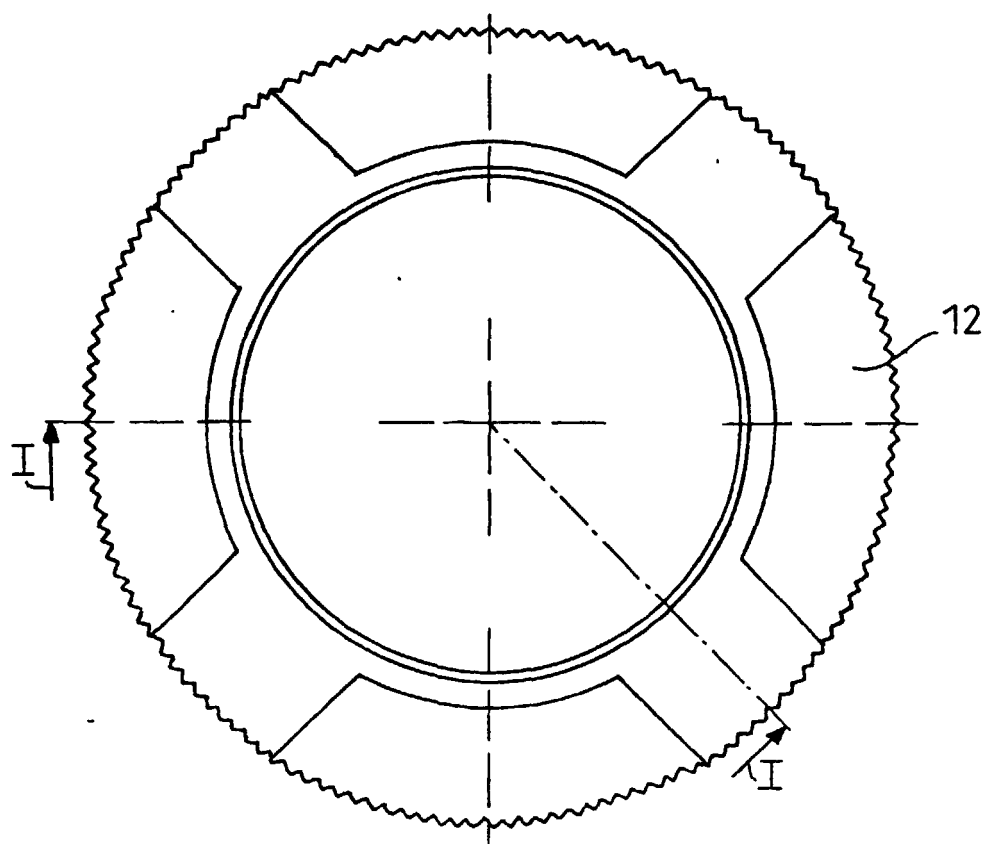


FIG. 2

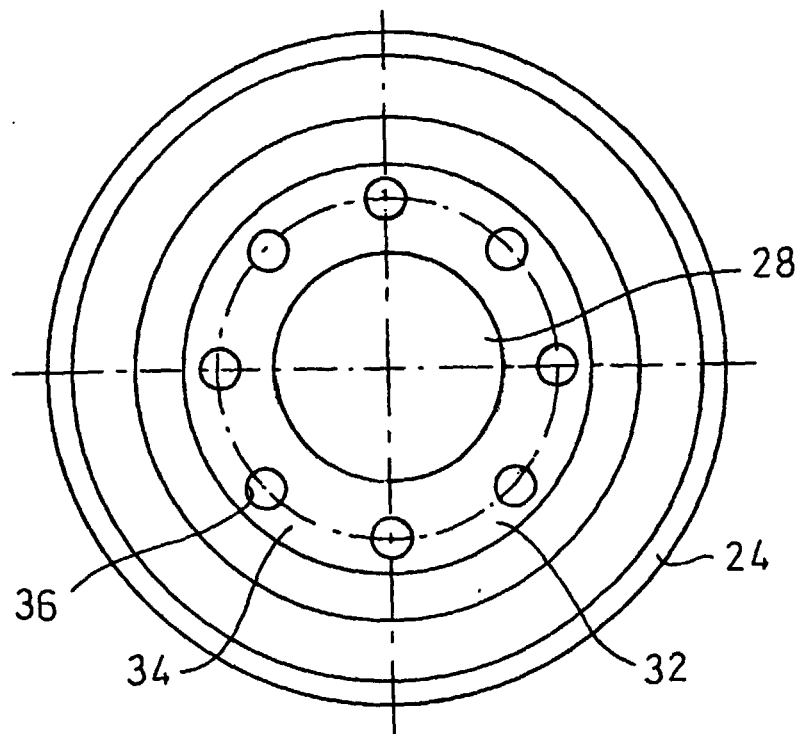


FIG. 3

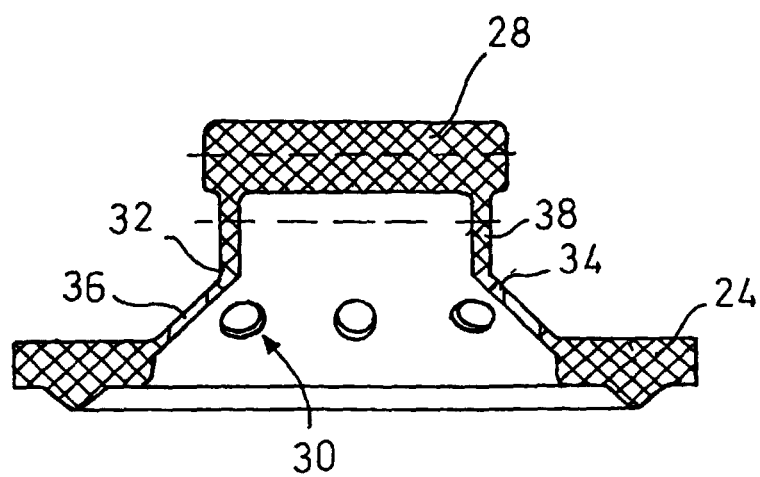


FIG. 4

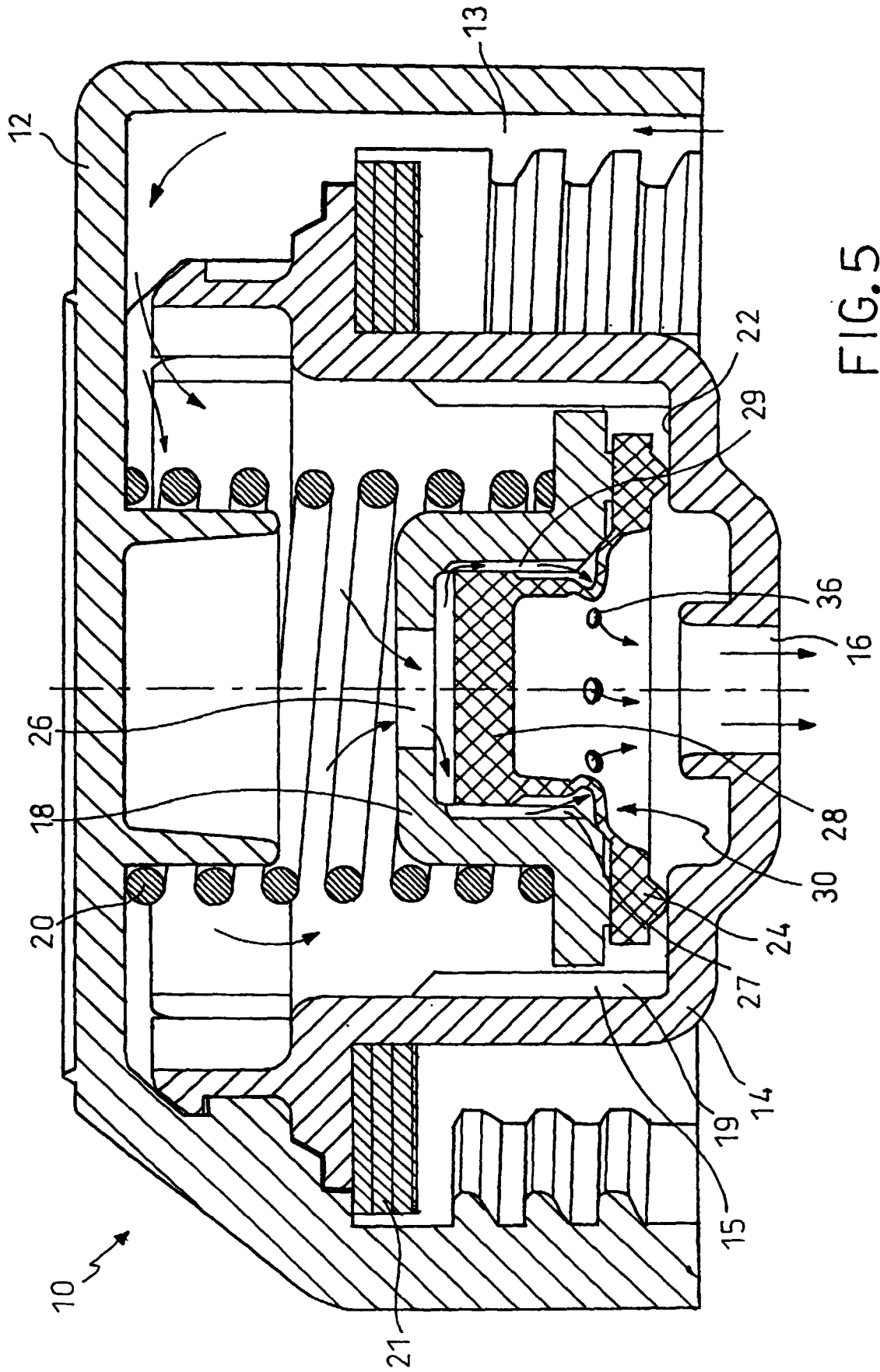


FIG. 5

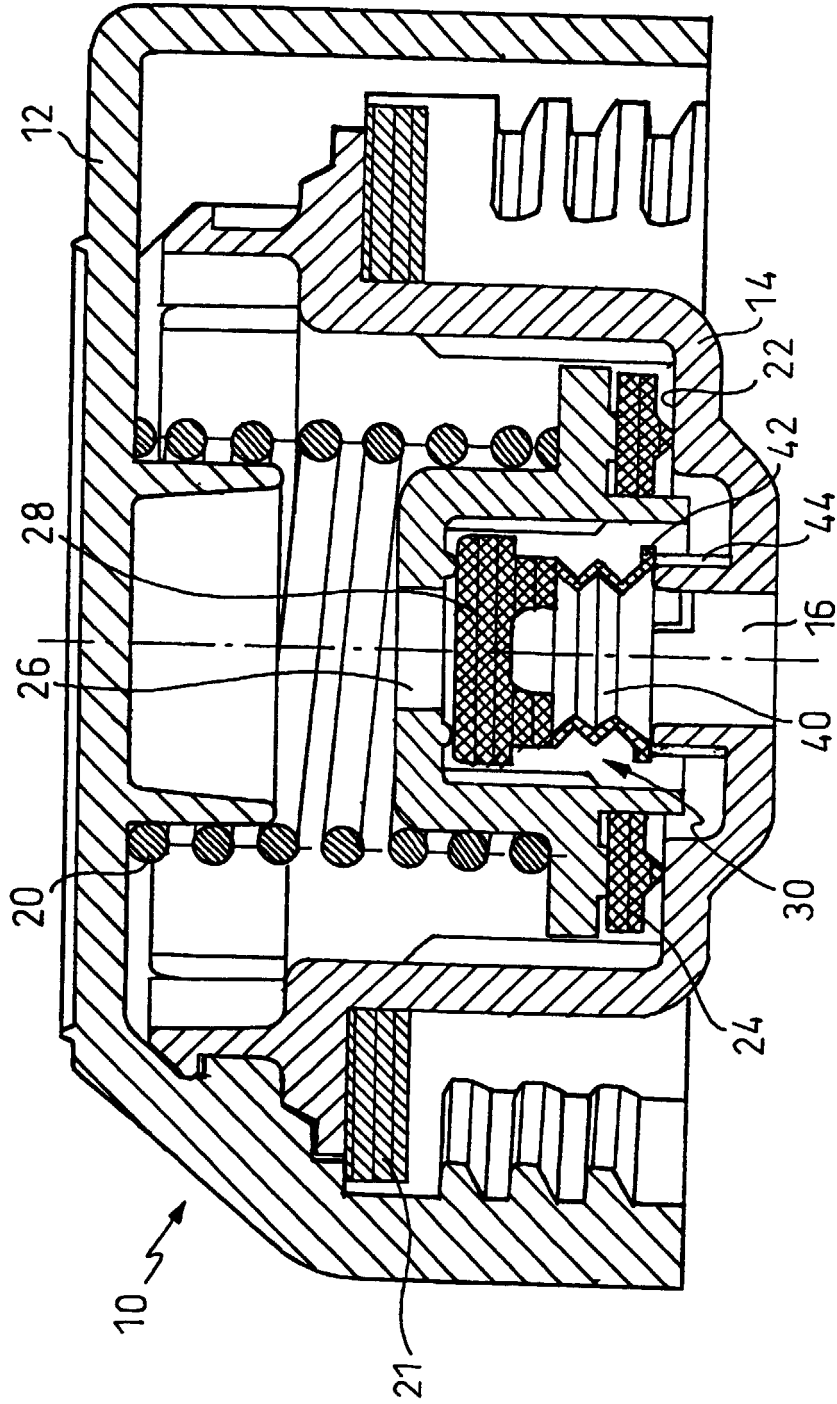


FIG. 6

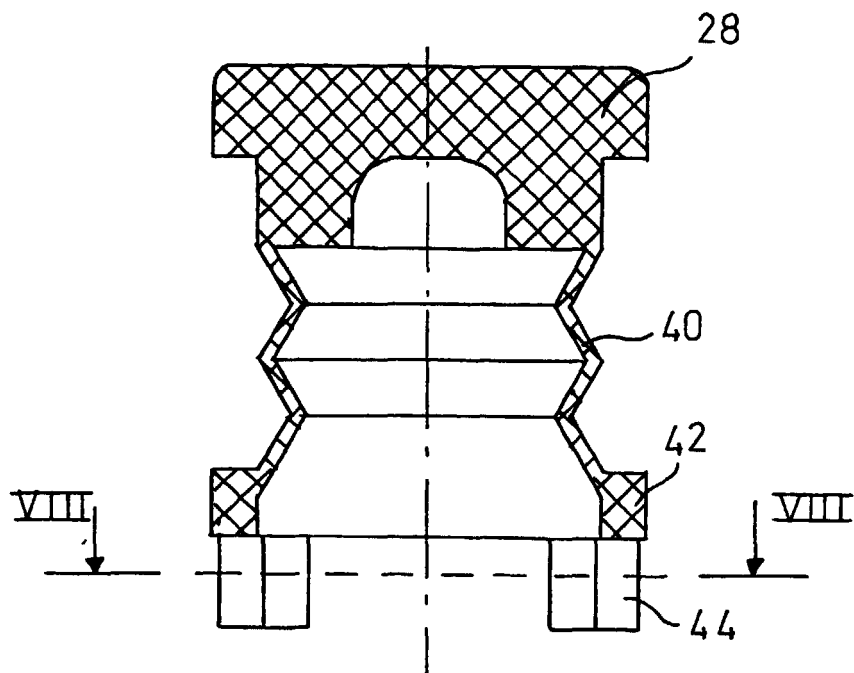


FIG.7

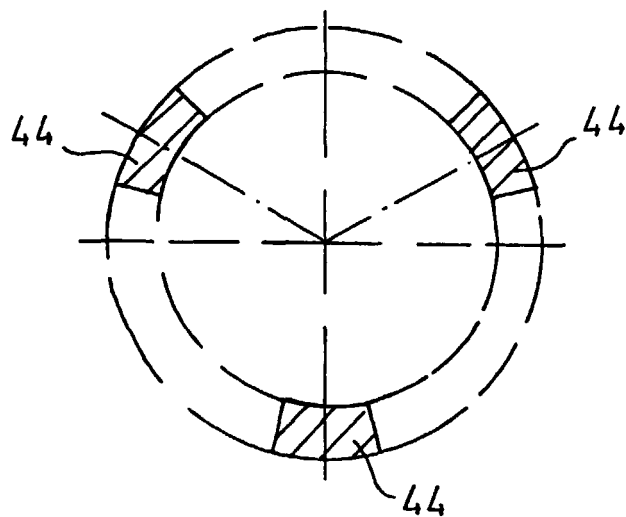


FIG.8