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(54) **Gas safety valve with a damper for the movable armature**

(57) The safety valve (1) has an electromagnet actuator (2) supplied by a DC current pulse and whose core (11) attracts a movable armature (5) with the stem (4) and the valve (1) closure member (3), against the force of the helical return spring (9), effecting an accelerated stroke (S2) until coming up against the magnetic sticking surface (11a, 11b) of the core. A damping element (10) made of a flexible material is arranged around the stem (4) inside a helical spring (9). The damper (10) takes the form of a foldable tubular cup of a given length (Le), which folds, absorbing part of the energy (E) associated with the armature (5) and damping its acceleration. For this folding on itself, the tubular damping cup (10) is pressed by means of a thrust disc (12) associated with the stem (4) after effecting the prior starting of the armature (5), not exerting any folding resistance or force antagonistic to the electromagnetic attraction holding the armature (5) actuated in contact with said sticking magnetic surface (11a, 11b).

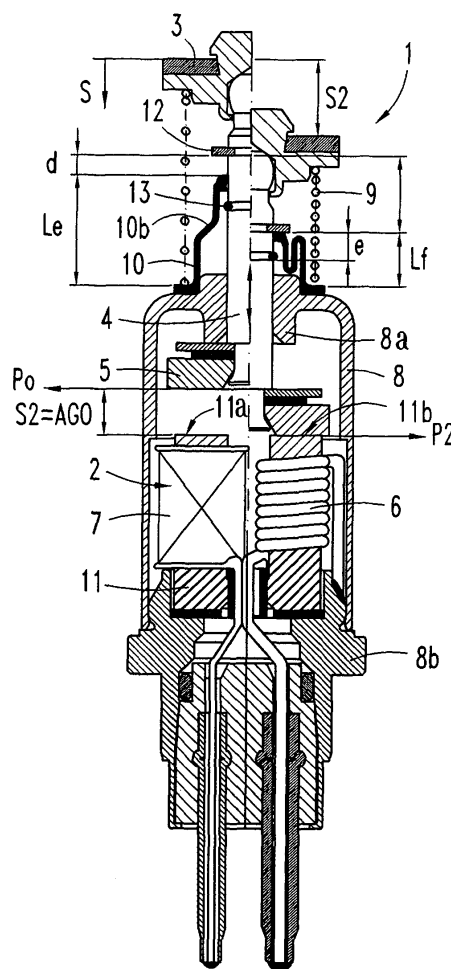


FIG. 1

Description

[0001] The present invention relates to a gas safety valve adapted to a household gas appliance of the type whose electromagnet is actuated by means of a DC voltage power supply and a movable armature associated with the valve closure member of the type that is lifted for the opening of a gas passageway.

PRIOR ART

[0002] Publication EP-1063474-A (ES-2154594-A) discloses a gas safety valve with an electromagnet actuator and a movable armature of the type described above. The electromagnet, built with a U-shaped core, is provided with an actuating bobbin made of thin wire for opening the valve, and it may also have a thick wire winding for the holding of the valve open by a flame thermocouple once the gap width between the armature and the magnetic poles of the core is closed.

[0003] The actuating bobbin is capable of strongly attracting the movable armature of the electromagnet with an accelerated movement. But the magnetic sticking face of the core receives an impact of the movable armature that deteriorates its contact surface. In the opposite direction, when the energising of the flame thermocouple or other electric maintenance current ceases, the valve is closed under the action of the return spring and the gap width returns to its home position measurement value. The electromagnet with its movable armature are housed in a cylindrical protective capsule provided with a sleeve traversed by a stem with a clearance for guiding its displacement, so it does not have a tight seal. The return spring encircles the stem between the valve closure member and the movable armature, and it rests up against a immobile surface of the cylindrical capsule.

[0004] DE-A-19837908 discloses an electromagnetic valve of the type whose closure member is raised by means of a movable armature attracted by the electromagnet until the gap width of the core is closed. The electromagnet is accommodated in a housing, and the valve stem is enclosed by a flexible sealing bellows which closes the housing, thus stopping the access of gas to the electromagnet to prevent corrosion of the surface of the magnetic core. The sealing bellows extends all along the valve stem, between the closure member and the electromagnet housing, inside the helical return spring. As the function of this rubber bellows is only to provide a tight seal for the electromagnet, its thickness is thin and its profile has a number of zig-zag folds for uniform deformation purposes, so it does not offer resistance to the displacement of the valve stem.

DISCLOSURE OF THE INVENTION

[0005] The object of the present invention is a gas safety valve adapted to a gas tap for a household electrical appliance whose electromagnet actuator has an actuat-

ing bobbin which attracts an armature in accelerated movement against the magnetic core for opening the valve, and which is provided with a means for the damping of the impact of the armature on the magnetic sticking face of the core to prevent its deterioration.

[0006] The safety valve according the invention comprises a damping element, which, according to a preferred embodiment, has the form of a cup made of a flexible material such as rubber surrounding the stem between the movable armature and the valve member, and which is folded during the stroke of the armature towards the magnetic poles. The damping element absorbs the energy inherent in the accelerated movement so as to cushion the shock between the surfaces. The electrical energy for actuation needed for the starting of the electromagnet does not increase substantially due to the damping element, since it does not offer resistance in the initial stroke portion for run up, while for its folding in the final stroke portion it absorbs considerable energy, which brakes the displacement of the armature.

[0007] For holding the armature attracted and the valve open, the valve electromagnet with the damping element incorporated does not require an electric current higher than that needed to overcome the force of the compressed return spring, as, once folded, the middle portion of the damping cup does not generate any electrical force additional to that of said spring.

DESCRIPTION OF THE DRAWINGS

[0008]

FIG. 1 is a longitudinal sectional view of a gas safety valve provided with a damping element, in two halves corresponding to the two positions, initial and actuated, of the valve closure member.

FIG. 2 is a partial sectional view of the safety valve in FIG. 1, with the valve closure member in a midway position during its valve actuating stroke.

FIG. 3 is a sectional view of the damping element in FIG. 1.

FIG. 4 is a diagram of the energy of the moment developed in the movable armature of the valve in FIG. 2, in accordance with the actual armature gap width.

DETAILED DESCRIPTION OF THE INVENTION

[0009] In reference to figures 1 to 3, a preferred embodiment of safety valve 1 comprises a valve closure member 3, a stem 4 of a given length between the closure member 3 and the movable armature 5, an electromagnet 2 with an actuating bobbin 7 and a winding 6 for a flame thermocouple or other holding electric current, each mounted on an arm of a U-shaped core 11 forming two magnetic poles 11a, 11b. The movable armature 5 of the electromagnet linked to the valve member 3 by means of the stem 4, is attracted instantly when the bob-

bin 7 is supplied by a high current peak, so that the gas passageway to a main tap or valve, not shown in the drawings, is opened up. The electromagnet 2 is housed in a rigid plastic cylindrical capsule 8, provided with a rigid sleeve 8a guiding the displacement "S" of the stem 4. When energising of the electromagnet 2 ceases, a helical return spring 9 pushes the valve member 3 for shutting-off the valve, and the gap width AG opens again to its initial measurement value "AG0".

[0010] As a specimen embodiment, the diameter of the capsule 8 is 14 mm, the diameter of the stem is 3 mm and the diameter of the armature 5 is 11 mm. The rigid guide sleeve 8a and the stem 4 have a clearance between them of 0.1 mm so as to facilitate displacement without offering resistance. The core 11 formed by the two semi-cylindrical section arms 11a, 1b is locked up against a metal seat 5b, with the opposing flat faces with a separating gap of as little as 1.5 mm. The armature 5 in the rest position "P0" maintains a gap width AG0, whose value, for instance of 1.2 mm, is the same as the total stroke "S2" effected by the valve member 3 when the electromagnet 2 is actuated.

[0011] The valve stem 4 has a flexible tubular element 10 (FIG. 3) made of a material such as rubber so as to cushion the shock of the impact between the surfaces of the poles 11a, 11b. The damper element 10 encircles the stem 4 in a portion of its length between the movable armature 5 and the valve member 3, supported by means of a flat rim edge 15 on the rigid protective capsule 8. Being of an initial rest length "Le" (FIG. 1), the damping element 10 is deformed under the pressure of the valve member 3 during the stroke "S" of the armature towards the magnetic poles 11a, 11b. When the armature 5 is close to the complete closure of the gap width AG, a folding central portion 10b of the damper element 10 provides a deformation resistance opposed to the force "F" exerted by the stem 4 (FIG. 2), absorbing the energy "E" associated with the displacement of the armature 5. After the stem 4 effects its total stroke "S2", the armature 5 maintains its gap width AG position P2 at a value equal to zero and the damping element has a contracted length "Lf" (FIG. 1).

[0012] In a preferred embodiment the gap width AG0 is equal to 1.2 mm and the damping element 10 is designed in the form of a cup (FIG. 1 and FIG. 3) of a length "Le" of 7.8 mm for instance, incorporated around the stem 4, inside the helical return spring 9. The flexible damping cup 10 comprises three differentiated longitudinal portions 10a, 10b, 10c: an initial cylindrical portion 10a of smaller diameter "D1" next to the valve member 3, a second intermediate transition portion 10b between the two other portions with an inclined wall in relation to the stem 4, which forms the folding portion in order to achieve the damping effect, and a third cylindrical portion 10c of larger diameter "D2", provided with a bearing base flange 15, which is connected to the spring end 9 within a guiding recess on the rigid capsule 8 of the valve body.

[0013] The first portion 10a of the damping cup has a

rigid ring 14, with a hole 16 traversed by the stem, whose outer surface is flat and it is pushed by a thrust washer or disc 12 fixed to the stem 4, when the latter is displaced for the valve opening. The thrust disc 12 is situated near the closure member 3, and the rigid ring 4 closes with clearance up against the stem 4 so that the latter slides smoothly through the hole 16 without compressing the damping cup 10. If for instance the diameter of the stem 4 will be 3 mm, the diameter of the hole 16 is 3.2 mm. Once the thrust washer 12 reaches the rigid ring 14 of damping cup 10, said intermediate portion 10b of the damping cup is deformed by forming an undulating fold in the intermediate tubular portion 10c of larger diameter "D2". Due to a sufficiently strong wall thickness 17, the latter portion 10c is not deformed because it is subjected to an axial compression component only. The folding resistance of the intermediate portion 10b damps the energy "E" associated with the accelerated movement of the armature, and as a result the axial length of the flexible cup 10 is reduced to the final contracted value "Lf".

[0014] By way of example, the damping cup 10 has a diameter D1 = 4.2 mm, a diameter D2 = 6.6 mm, and the thickness 17 of the wall of the undeformable portion 10c is 0.3 mm. Preferably, the wall thickness 17 of the three longitudinal portions 10a, 10b, 10c of the damping cup 10 is uniform along their whole length Le.

[0015] According to this configuration of the folding cup 10, the cushioning of the shock of the armature 5 does not affect the energy of the electromagnet 2 needed for starting in the valve opening operation, called herein armature latching 5. The valve member 3 will effect the initial stroke portion for run up without opposition of the flexible damping element 10, as far as a position P1 of the armature shown in FIG. 2. The length "Le" of the damping cup 10 is designed somewhat shorter than the portion of stem 4 comprised between said fixed support recess in the valve capsule 8 and the thrust disc 12, i.e. the thrust disc 12 remains spaced apart a distance "d" from the damping cup rigid ring 14. Thus, in the initial rest position P0 of the electromagnet 2, a portion of stem 4 of length "d" remains uncovered by the damping cup 10, and it effects this initial stroke portion "S1" for run up, with no opposition to displacement except that of the return spring 9. For the return of the valve member 3 to gas passageway closure, the return spring 9 pushes the stem 4 separating the armature 5 from the core 11, and the flexible element 10 returns to its extended length "Le". The rigid support ring 14 is now pushed in the opposite return direction from its inside face, by means of a drive washer 13 fixed to the stem 4, which is situated inside the flexible cup 10 and spaced apart from the cup rigid ring 14 by gap "e".

[0016] FIG. 3 shows a representation of the safety valve 1 at the moment of the actuation of the electromagnet, when the valve member has effected said initial stroke portion "S1" during run up as far as a position P1 of the armature 5 whose gap width is AG1. As a result of this accelerated movement the armature 5 has move-

ment energy "E" associated, for example 0.4 mJ (milli-joules) approximately (FIG. 4). In this intermediate position P1 of the armature 5, the thrust disc 12 fixed to the stem 4 has made contact with the flexible damping element 10. The actual length of the damping cup has barely decreased in relation to the rest length "Le". Returning to FIG. 1, after effecting the complete gap width closing stroke "S2", the inclined portion 10b of the flexible cup has been folded in the third cylindrical portion 10c, whose wall 17 is parallel to the direction of displacement and bears a compression force only. The final length "Lf" of the flexible cup 10 when the electromagnet is held in the actuated position is 4.6 mm approximately, i.e. the damping flexible cup 10 has decreased 40% in length, from Le to Lf.

[0017] In reference to the diagram in FIG. 4, it shows a representation of the energy "E" associated with the displacement of the armature 5 in accordance with the stroke "S" effected by the closure member 3 and the stem 4. The value "S2" = 1.2 mm of the total stroke is the same as the gap width AG0 at rest in FIG. 1. The total stroke "S2" is effected from a starting position P0 of the electromagnet as far as the "zero" measurement of the final position P2, when the armature 5 comes up against the surface of the poles 11a and 1b. The energy curve referenced as "Epa" corresponds to the prior art valve in the absence of a damping element, wherein the only resistance to displacement of the stem 4 is generated by the return spring 9, which is uniform over the whole stroke S2. Owing to the acceleration of the armature 5, the energy "Epa" associated finally reaches a value of 2.5 mJ for instance during the shock of impact. The energy curve "Ed" referring to valve 1 provided with the flexible damping cup 10 described here only reaches a value of 1.5 mJ when the impact takes place, the energy difference (Epa-Ed) being absorbed by the folding of the inclined portion 10b of the flexible cup. In the intermediate position P1 represented in FIG. 3, when the armature has effected a stroke "S1" from a gap width AG0 = 1.2 mm to a gap width AG1 = 0.75 mm, the flexible cup 10 whose length is now shorter than "Le", has not yet absorbed any energy.

[0018] The damping effect of the flexible cup 10 does not however produce a substantial increase in the actuating power needed for starting the electromagnet 2, since the flexible cup 10 is folded without offering resistance during the first stroke portion "S1", while the necessary force for the intermediate portion 10b to be folded during the final stroke portion S2-S1 between armature positions P2-P1 absorbs said part Ed-Epa of the energy associated, reducing the acceleration of the armature 5. The damping cup 10 does not affect the electrical current of the electromagnet 2 necessary for holding the valve open either after contact of the armature 5 with the core 11, as the folded intermediate part 10b does not exert any antagonistic force to the electromagnetic attraction of the armature 5 additional to that of the spring 9.

Claims

1. Gas safety valve adapted for controlling combustion on a household appliance, of the magnetic core (11) electromagnet actuator (2) type with a magnetic sticking face at the poles (11a,11b), which attracts a movable armature (5) coupled to a stem (4) and a valve (1) closure member (3) for opening a gas passageway, overcoming the opposing force of a helical return spring (9) extended between the valve member (3) and a rigid support surface (8a) in the valve body, wherein the electromagnet (2) is actuated by means of a coil (7) supplied by an external DC current pulse, attracting the armature (5) during an accelerated stroke (S2) for closing the gap width (AG) and impacting against said magnetic surface (11a,11b) of the core, **characterised in that** the valve stem (4) comprises a portion of stem (4) encircled by said helical spring (9) and it is provided with a flexible damping element (10) surrounding a portion of stem (4) of a given length (Le) between the valve closure member (3) and said rigid support surface (8a) in the valve body, the damping element (19) being folded during said accelerated stroke (S2), absorbing part of the energy (E) associated with the displacement of the armature (5) to damp its acceleration and prevent the impact, as far as a contracted length measurement value (Lf) in the final position (P2) of the attracted armature (5), which is maintained during the operation of the electromagnet.
2. Gas safety valve according to claim 1, wherein said damping element (10) is configured in coaxial tubular form folding on itself, of a given length (Le) in the rest position (P0) of the electromagnet (2), and it is folded under the force (F) exerted by a thrust means (12) associated with the stem (4) once the electromagnet (2) actuation starting has been carried out, after the stem (4) and the armature (5) have completed an initial stroke portion run up (S1) with the sole opposition of the helical spring (9).
3. Gas safety valve according to claim 1, wherein said damping element (10) is configured as a substantially cylindrical and coaxial folding cup of smaller diameter (D1,D2) than said helical spring (9), and of a given length (Le) in the rest position (P0) of the electromagnet (2), comprising an intermediate longitudinal portion (10b) made of at least one flexible wall (17) inclined in relation to the stem (4), which is folded during a final portion (S2-S1) of said armature (5) acceleration stroke and the length (Lf) of the flexible cup (10) is reduced before said impact takes place against the core (1), and after the contact of the armature (5) said intermediate folded portion (10b) does not exert any antagonistic force to the electromagnetic attraction holding the armature (5) in contact with the core sticking surface (11a,11b).

4. Gas safety valve according to claim 1, wherein said damping element (10) is configured as a substantially cylindrical and coaxial flexible cup of smaller diameter (D1, D2) than said helical spring (9) and of a given length (Le) in the rest position (P0) of the electromagnet (2), comprising three successive longitudinal portions, of which an intermediate portion (10b) is folding under the pressure of the stem (4) when the electromagnet is actuated, and a third portion (10b) resting on an immobile surface (0) of the valve (2) is undeformable when subjected by the stem (4) to a compression force only. 5 10
5. Gas safety valve according to claim 1, wherein said damping element (10) is configured in tubular form coaxial with the valve stem (4) of smaller diameter (D1,D2) than said return spring (9), and when the electromagnet (2) is actuated, the damping tubular element (19) is folded on itself for damping purposes, pressed by the axial force (F) exerted by a disc (12) fixed to the stem (4) near to the valve closure member (3), from its length dimension (Le) in the rest state (P0) to a contracted length (Lf) with the electromagnet energised, and said spring (9) pushes the folded tubular portion (10a) of the damping element in the opposite direction, along with the valve closure member (3) and the stem (4) when energising of the electromagnet has ceased, and the damping element (19) thereby recovers its initial rest length (Le), driven by a return washer (13) attached to the stem (4) and located inside the tubular damping element (10). 15 20 25 30

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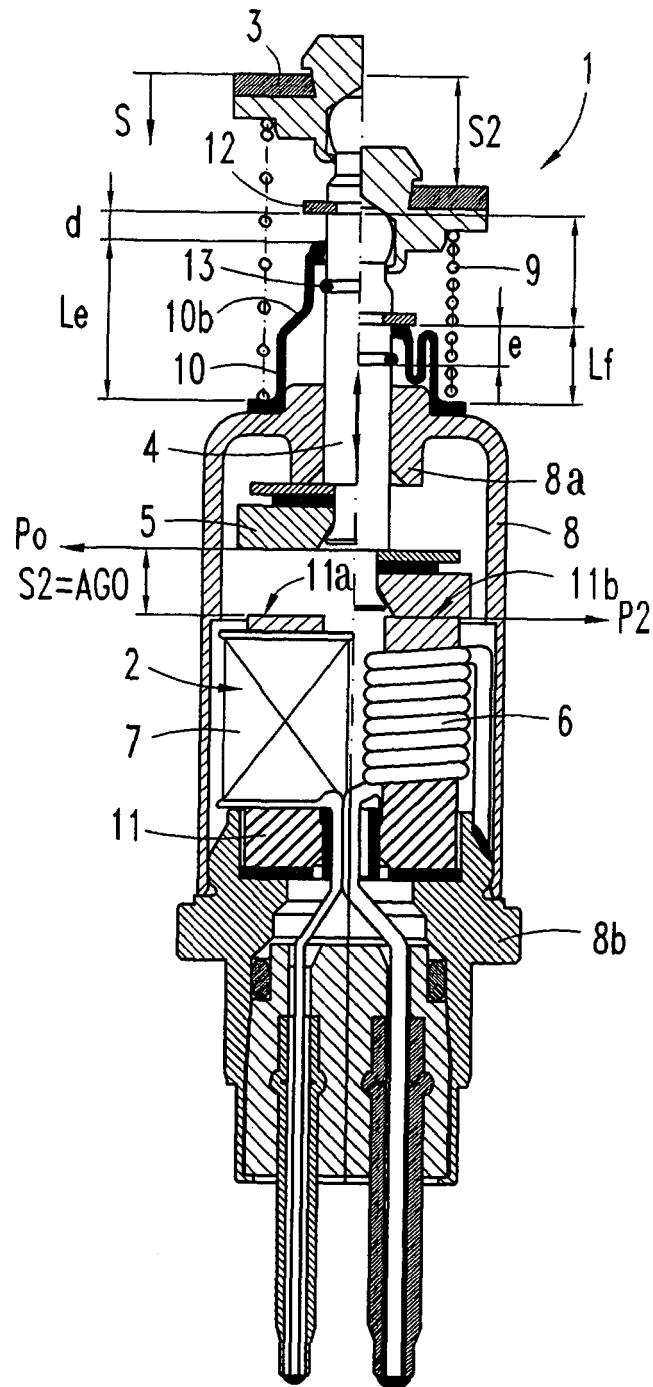


FIG. 1

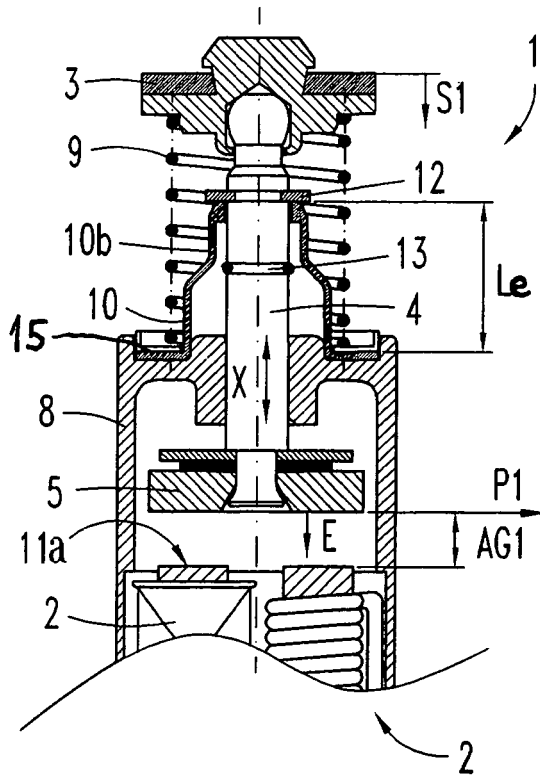


FIG. 2

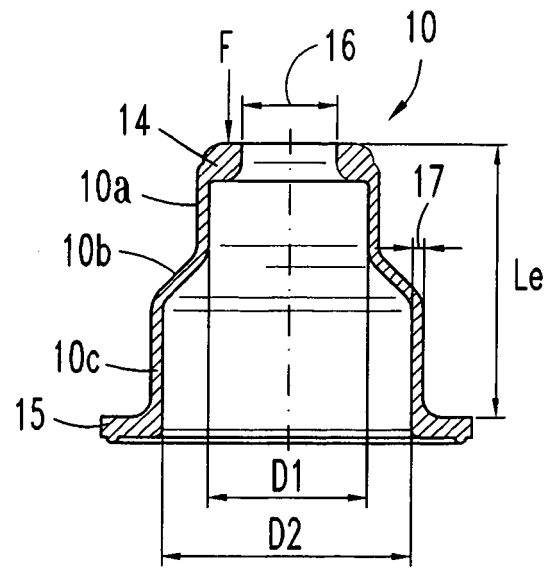


FIG. 3

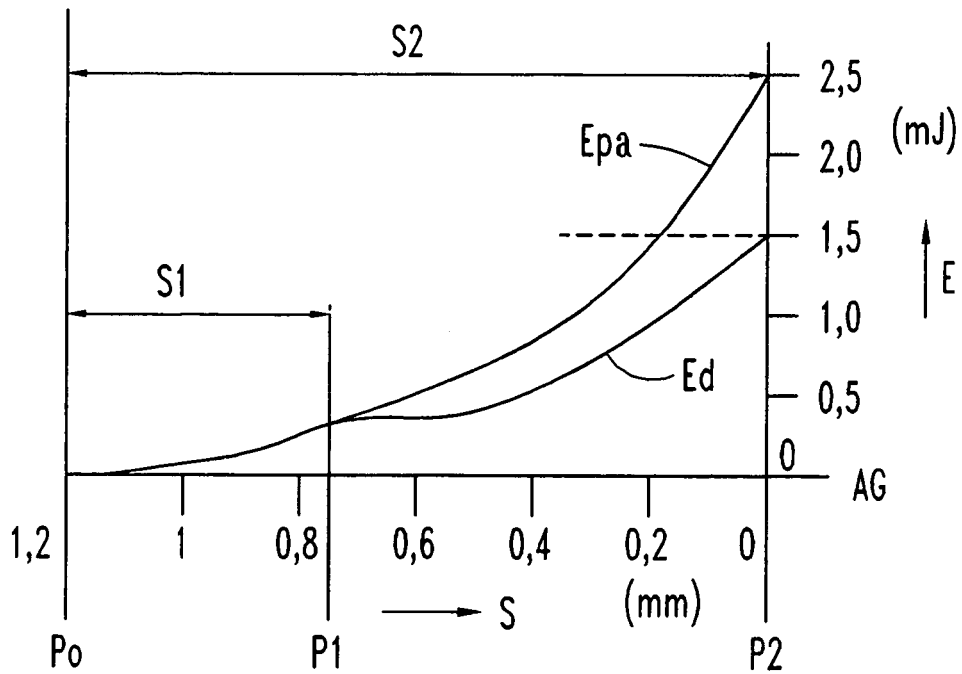


FIG. 4



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 05 38 0247

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	DE 198 37 908 A1 (MIKUNI ADEC CORP., TAKIZAWA, JP) 4 March 1999 (1999-03-04) * the whole document *	1	F23N5/10 F23N1/00
A,D	EP 1 063 474 A (ORKLI S. COOP) 27 December 2000 (2000-12-27) * the whole document *	1	
A	GB 2 267 335 A (* SIT LA PRECISA S.R.L) 1 December 1993 (1993-12-01) * the whole document *	1	
			TECHNICAL FIELDS SEARCHED (IPC)
			F23N
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 21 February 2006	Examiner Theis, G
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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 05 38 0247

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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21-02-2006

Patent document cited in search report		Publication date		Patent family member(s)	Publication date
DE 19837908	A1	04-03-1999	CN	1210951 A	17-03-1999
			JP	11082802 A	26-03-1999

EP 1063474	A	27-12-2000	DE	60002632 D1	18-06-2003
			DE	60002632 T2	08-04-2004
			ES	2154594 A1	01-04-2001
			PT	1063474 T	29-08-2003

GB 2267335	A	01-12-1993	DE	9307895 U1	22-07-1993
			FR	2691787 A1	03-12-1993
			IT	1255275 B	25-10-1995
			NL	9300869 A	16-12-1993
