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(54) **An electromagnetically operated fuel metering and atomising valve**

Elektromagnetisch betätigbares Kraftstoffdosier- und Zerstäubungsventil

Soupape à commande électromagnétique de dosage et de pulvérisation de carburant

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Description

The present invention relates to an electromagnetically actuated fuel metering and atomising valve, intended to be fitted to the fuel supply device of an internal combustion engine.

According to what is described in European Patent Application N° 0536774, actually the valves of the above type include a main body internally housing an annular electromagnet, a core and a movable valve shutter element. The electromagnet consists of a support former and an electrical winding.

A main disadvantage lies in the fact that the former and the main body are not directly fixed to each other, but are fixed indirectly by connection between the various fixed components of the valve. It is clear that clearances may exist between the former and the main body, which clearances could increase over time making the position of the electrical winding unstable relative to the axial air gap of the magnetic circuit defined in the valve. It is clear that this instability affects the axial component of the magnetic force controlling the stroke of the valve shutter element, meaning that for each similar command to the electromagnet the time taken for the valve shutter member to complete its stroke could be different. In addition, this clearance could compromise the fluid-tight seal of the valve as the seals would age prematurely as a result of the extra stress (vibration of the various elements) to which they were subjected.

The object of the present invention is to provide an electromagnetically operated fuel metering and atomising valve free from the above disadvantages, that is to say one provided with a system which prevents clearances from forming and at the same time provides a reliable fluid-tight seal.

Further objects and advantages of the present invention will become apparent from the description which follows.

An electromagnetically actuated fuel metering and atomising valve, intended to be fitted in a fuel supply system of an internal combustion engine, comprising:

a tubular casing housing the lower portion of the said valve;

an electromagnet defined by a tubular former and an electrical winding mounted in an annular seat formed inside the said former;

a tubular body with a lower portion made of ferromagnetic material forming the core of a magnetic circuit defined in the said valve;

a movable valve shutter member operable to control the flow of fuel through an injection orifice;

a movable tubular armature attracted by the said lower portion of the said body when the electromag-

net is excited and supporting the said valve shutter member;

a plate with the said injection orifice formed therein; and

a fuel inlet defined in the said body;

characterised in that it includes an axial interlock between the said casing and the said former, this interlock involving at least one tongue formed in the said casing and engaging a groove formed in the said former.

In order better to understand the present invention, a preferred embodiment will now be described purely by way of non-limitative example, with reference to the appended drawings, in which:

Figure 1 is a sectioned elevation of a valve according to the principles of the present invention;

Figure 2 is a section taken on the line II-II of Figure 1;

Figure 3 is an exploded section of some of the components of the valve of Figure 1; and

Figure 4 is a section of a component of the valve of Figure 1.

With reference to Figure 1, a magnetically actuated fuel metering and atomising valve, generally indicated 1, is intended to be fitted in the fuel supply device of an internal combustion engine.

The valve 1 comprises:

a main body 2 forming a tubular casing for the lower part of the valve;

an electromagnet 3 defined by a tubular former 4 and an electrical winding 5 mounted in an annular seat within the former 4;

a tubular body 6 a lower portion of which is made of ferromagnetic material so as to form the core of a magnetic circuit defined in the valve 1;

a movable valve shutter member 8 operable to control the passage of fuel through an injection orifice 11;

a movable tubular armature 12 attracted by the portion 7 when the electromagnet 3 is excited and supporting the valve shutter member 8;

a plate 13 with the injection orifice 11 formed therein;

a fuel inlet 14 formed in an upper portion 15 of the body 6; and

a filter 16 fitted in the inlet 14.

With reference to Figures 1 and 3, the former 4 is constituted by two tubular parts 4a and 4b, securely fixed one within the other and made of plastics material, defining within them the seat for the winding 5. A body 17 extends obliquely upwards from an upper area of the outermost section 4b and constitutes an electrical con-

nector as it houses blade-like pins 18 through which the winding 5 is supplied. A wall 19 extends upwardly from an upper area of the section 4b, in a position diametrically opposite the body 17. An annular recess 21 is formed in the inner surface of the upper end of the inner part 4a of the former 4 to house an annular seal 22 which is compressed radially by the portion 7 of the body 6. The seat for the seal 22 is closed at the top by an annular shoulder 23 formed in the body 6.

The part 4a of the former 4 has an annular base wall from which an annular pressure foot 24 extends downwardly. Diametrically opposite, two small part-annular grooves 25 are formed in the outer surface of the part 4b. In particular, one groove 25 is formed just beneath the lower end of the wall 19 and the other groove 25 is formed just beneath the lower end of the body 17.

With reference to Figure 1, the portion 7 of the body 6 is installed within the former 4 and contains an annular pin 26 the function of which is to engage against a coil spring 27 arranged fitted between the pin 26 and the valve shutter member 8 which is defined by a small plate.

With reference to Figures 1, 3 and 4, the body 2 comprises:

- a lower portion 28 housing the plate 13;
- a central portion 31 having a smaller internal diameter than the portion 28 and within which the armature 12 and the valve shutter member 8 are slidable; and
- an upper portion 32 having a larger internal diameter than the portion 31 so as to define an annular wall 33 between the two.

The former 4 is housed in the portion 32, and the annular base wall of the part 4a of the former 4 and the wall 33 define between them an annular seat in which is fitted an annular seal 29 which is compressed axially by the part 4a. The seat for the seal 29 is closed on the inside by the annular foot 24.

With reference to Figures 3 and 4, two diametrically opposite notches 34 having longitudinal axes parallel to a longitudinal axis X of the body 2 are formed in the portion 32 of this body. Under the bottom wall of each notch 34, a through-slot is formed in the portion 32 which defines a tongue 36 with the bottom wall of the notch 34. It must be pointed out that in Figures 3 and 4 the body 2 is illustrated prior to the assembly of the valve 1.

In use, the seal 29 is first placed on the wall 33 then the former 4 is fitted into the portion 32 of the body 2, taking care to orientate the former 4 in such a way that the wall 19 and the body 17 are in correspondence with a respective notch 34. The former 4 is then pressed against the wall 33 so as to compress the seal 29 in such a way that the tongues 36 are moved into correspondence with respective grooves 25.

Next a tool is used to deform the tongues 36 towards the axis X so that they tightly engage the respective grooves 25 as shown in Figures 1 and 2. The seal

29, having been preloaded, acts as a spring, urging the former 4 upwards which former is held fixedly by the engagement of the tongues 36 in the grooves 25.

The advantages inherent in the implementation of the present invention are clear from the above description.

In particular, the invention provides a valve which is simple to manufacture and easy to assemble; it can be assembled with the use of automated machinery. The main advantage of the valve according to the present invention lies in having provided axial interlock between the valve casing and the electromagnet. This interlock enables the position of the electrical winding to be kept stable relative to the wall 33 and thus relative to the airgap of the magnetic circuit, this airgap being defined between the portion 7 of the body 6 and the armature 2.

It is clear that the stable position of the electrical winding tends to improve the performance of the magnetic circuit. In addition, it must be emphasised that in addition to its role in providing an axial, and therefore particularly effective, fluid-tight seal, the seal 29 also acts as an axial spring, maintaining constant the pressure of the bottom of the grooves 25 against the lower edge of the tongues 36. The locking system between the casing and the electromagnet enables the size of the valve 1 to be kept compact.

In particular, the interlocking system between the casing and the electromagnet may also be applied to valves which provide for the fuel to enter a central area. In addition, this locking system may be made differently from the way described above. In particular, there may be a different number of tongues and these may have different geometric shapes from those described.

Claims

1. An electromagnetically actuated fuel metering and atomising valve, intended to be fitted in a fuel supply system of an internal combustion engine, comprising:

- a tubular casing (2) housing the lower portion of the said valve;
- an electromagnet (3) defined by a tubular former (4) and an electrical winding (5) mounted in an annular seat formed inside the said former (4);
- a tubular body (6) with a lower portion (7) made of ferromagnetic material forming the core of a magnetic circuit defined in the said valve;
- a movable valve shutter member (8) operable to control the flow of fuel through an injection orifice (11);
- a movable tubular armature (12) attracted by the said lower portion (7) of the said body (6) when the electromagnet (3) is excited and supporting the said valve shutter member (8);

a plate (13) with the said injection orifice (11) formed therein; and
a fuel inlet (14) defined in the said body (6);

characterised in that it includes an axial interlock between the said casing (2) and the said former (4), this interlock involving at least one tongue (36) formed in the said casing (2) and engaging a groove (25) formed in the said former (4).

2. A valve according to Claim 1, characterised in that engagement of the said tongue (36) in the said groove (25) is defined by a deformation of the tongue (36).

3. A valve according to Claim 2, characterised in that the said casing (2) includes:

a lower portion (28) housing the said plate (13);
a central portion (31) having a smaller inner diameter than that of the said lower portion (28) within which the said armature (12) and the said valve shutter member (8) are slidable; and
an upper portion (32) having a greater inner diameter than that of the said central portion (31) so as to define an annular wall (33) between these two; the former (4) being housed within the said upper portion (32).

4. A valve according to Claim 3, characterised in that an annular seat is defined between an annular base wall of the said former and the annular wall (33) of the said casing (2), housing an annular seal (29) which is axially compressed by the said former (4).

5. A valve according to Claim 4, characterised in that two small part-annular grooves (25) are formed in the said former (4) in diametrically opposite positions, and in that two diametrically opposite notches (34) are formed in the said upper portion (32) of the said casing (2), with their longitudinal axes parallel to a longitudinal axis (X) of the said casing (2), and in that in the bottom of each notch (34) a slot is formed through the said upper portion (32) which defines the said tongue (36) with the bottom of a respective notch (34).

Patentansprüche

1. Elektromagnetisch betätigtes Kraftstoff-Dosierungs- und -Zerstäubungsventil, das dazu bestimmt ist, in ein Kraftstoffzufuhrsystem einer Brennkraftmaschine eingebaut zu werden, umfassend:

ein röhrenförmiges Gehäuse (2), das den unteren Abschnitt des Ventils aufnimmt;
einen Elektromagneten (3), der durch eine röh-

renförmige Wickelschablone (4) und eine elektrische Wicklung (5) gebildet ist, die in einem ringförmigen Sitz angebracht ist, der innerhalb der Wickelschablone (4) ausgebildet ist;

einen röhrenförmigen Körper (6) mit einem unteren Abschnitt (7), der aus ferromagnetischem Material hergestellt ist, der den Kern eines Magnetkreises bildet, der innerhalb des Ventils definiert ist,

ein bewegliches Ventil-Verschußteil (8), das betätigbar ist, um den Kraftstofffluß durch eine Einspritzöffnung (11) zu steuern;

einen beweglichen röhrenförmigen Magnetanker (12), der von dem unteren Abschnitt (7) des Körpers (6) angezogen wird, wenn der Elektromagnet (3) erregt ist, und der das Ventil-Verschußteil (8) trägt;

eine Platte (13) mit der darin eingeförmten Einspritzöffnung (11); und einen Kraftstoffeinlaß (14), der in dem Körper (6) gebildet ist;

dadurch gekennzeichnet, daß es eine axiale Blockierung zwischen dem Gehäuse (2) und der Wickelschablone (4) aufweist, wobei die Blockierung zumindest eine Zunge (36) umfaßt, die in das Gehäuse (2) eingeförm ist und in eine Nut (25) eingreift, die in die Wickelschablone (4) eingeförm ist.

2. Ventil nach Anspruch 1, **dadurch gekennzeichnet, daß** der Eingriff der Zunge (36) in die Ausnehmung (25) durch eine Deformation der Zunge (36) gebildet ist.

3. Ventil nach Anspruch 2, **dadurch gekennzeichnet, daß** das Gehäuse (2) umfaßt:

einen unteren Abschnitt (28), der die Platte (13) aufnimmt;

einen zentralen Abschnitt (31), der einen kleineren Innendurchmesser als der des unteren Abschnittes (28) aufweist, innerhalb dessen der Magnetanker (12) und das Ventil-Verschußteil (8) gleitgelagert sind; und

einen oberen Abschnitt (32), der einen größeren Innendurchmesser als der des zentralen Abschnittes (31) aufweist, um so eine ringförmige Wand (33) zwischen diesen beiden zu bilden, wobei die Wickelschablone (4) innerhalb des oberen Abschnittes (32) aufgenommen ist.

4. Ventil nach Anspruch 3, **dadurch gekennzeichnet, daß** ein ringförmiger Sitz zwischen einer ringförmigen Basiswand an der Wickelschablone und der ringförmigen Wand (33) des Gehäuses gebildet ist, der eine ringförmige Dichtung (29) aufnimmt, die in axialer Richtung durch die Wickelschablone (4) komprimiert ist.

5. Ventil nach Anspruch 4, **dadurch gekennzeichnet, daß** zwei kleine teilringförmige Nuten (25) in der Wickelschablone (4) an diametral gegenüberliegenden Positionen ausgebildet sind, und daß zwei diametral gegenüberliegende Kerben (34) in dem oberen Abschnitt (32) des Gehäuses (2) mit ihren Längsachsen parallel zu einer Längsachse (X) des Gehäuses (2) ausgebildet sind, und daß im Boden jeder Kerbe (34) ein Schlitz durch den oberen Abschnitt (32) ausgebildet ist, der die Zunge (36) mit dem Boden einer jeweiligen Kerbe (34) umgrenzt.

Revendications

1. Soupape à commande électromagnétique de dosage et d'atomisation de carburant, destinée à être montée dans un système d'alimentation en carburant d'un moteur à combustion interne, comprenant :

un boîtier tubulaire (2) logeant la partie inférieure de ladite soupape;

un électroaimant (3) défini par un support tubulaire (4) et un bobinage électrique (5) disposé dans un siège annulaire formé à l'intérieur dudit support (4);

un corps tubulaire (6) pourvu d'une partie inférieure (7) formée d'un matériau ferromagnétique constituant le noyau d'un circuit magnétique défini dans ladite soupape;

un élément mobile formant obturateur (8) de la soupape, pouvant être actionné pour commander l'écoulement du carburant dans un orifice d'injection (11);

une armature tubulaire mobile (12) attirée par ladite partie inférieure (7) dudit corps (6) lorsque l'électroaimant (3) est excité et supportant ledit élément formant obturateur (8) de la soupape;

une plaque (13) dans laquelle est formé ledit orifice d'injection (11); et

une entrée (14) pour le carburant, définie dans ledit corps (6);

caractérisée en ce qu'elle comprend un système de verrouillage axial entre ledit boîtier (2) et ledit support (4), ce système de verrouillage comportant au moins une languette (36) formée sur ledit boîtier (2) et s'engageant dans une rainure (25) formée dans ledit support (4).

2. Soupape selon la revendication 1, caractérisée en ce que l'engagement de ladite languette (36) dans ladite rainure (25) est défini par une déformation de la languette (36).

3. Soupape selon la revendication 2, caractérisée en

ce que ledit boîtier (2) comprend :

une partie inférieure (28) logeant ladite plaque (13);

une partie centrale (31) possédant un diamètre intérieur inférieur à celui de ladite partie inférieure (28), dans laquelle ladite armature (12) et ledit élément obturateur (8) de la soupape peuvent glisser; et

une partie supérieure (32) possédant un diamètre intérieur supérieur à celui de ladite partie centrale (31) de manière à définir une paroi annulaire (33) entre ces deux éléments; le support (4) étant logé dans ladite partie supérieure (32).

4. Soupape selon la revendication 3, caractérisée en ce qu'un siège annulaire est défini entre une paroi de base annulaire dudit support et la paroi annulaire (33) dudit boîtier (2), et loge un joint d'étanchéité annulaire (29), qui est comprimé axialement par ledit support (4).

5. Soupape selon la revendication 4, caractérisée en ce que deux rainures partiellement annulaires (25) sont formées dans ledit support (4) dans des positions diamétralement opposées et que deux encoches diamétralement opposées (34) sont formées dans ladite partie supérieure (32) dudit boîtier (2), avec leurs axes longitudinaux parallèles à un axe longitudinal (X) dudit boîtier (2), et que dans le fond de chaque encoche (34) une fente est formée à travers ladite partie supérieure (32) qui définit, avec le fond d'une encoche respective (34), ladite languette (36).

Fig.2

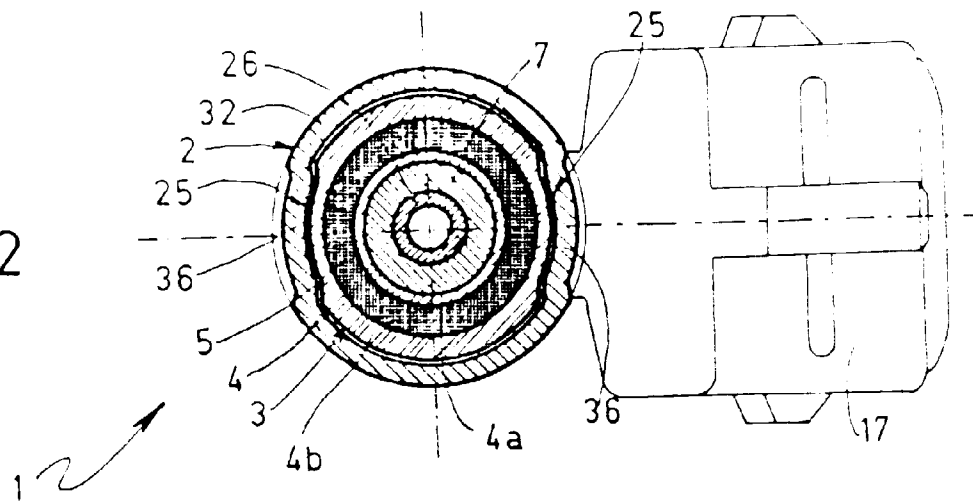
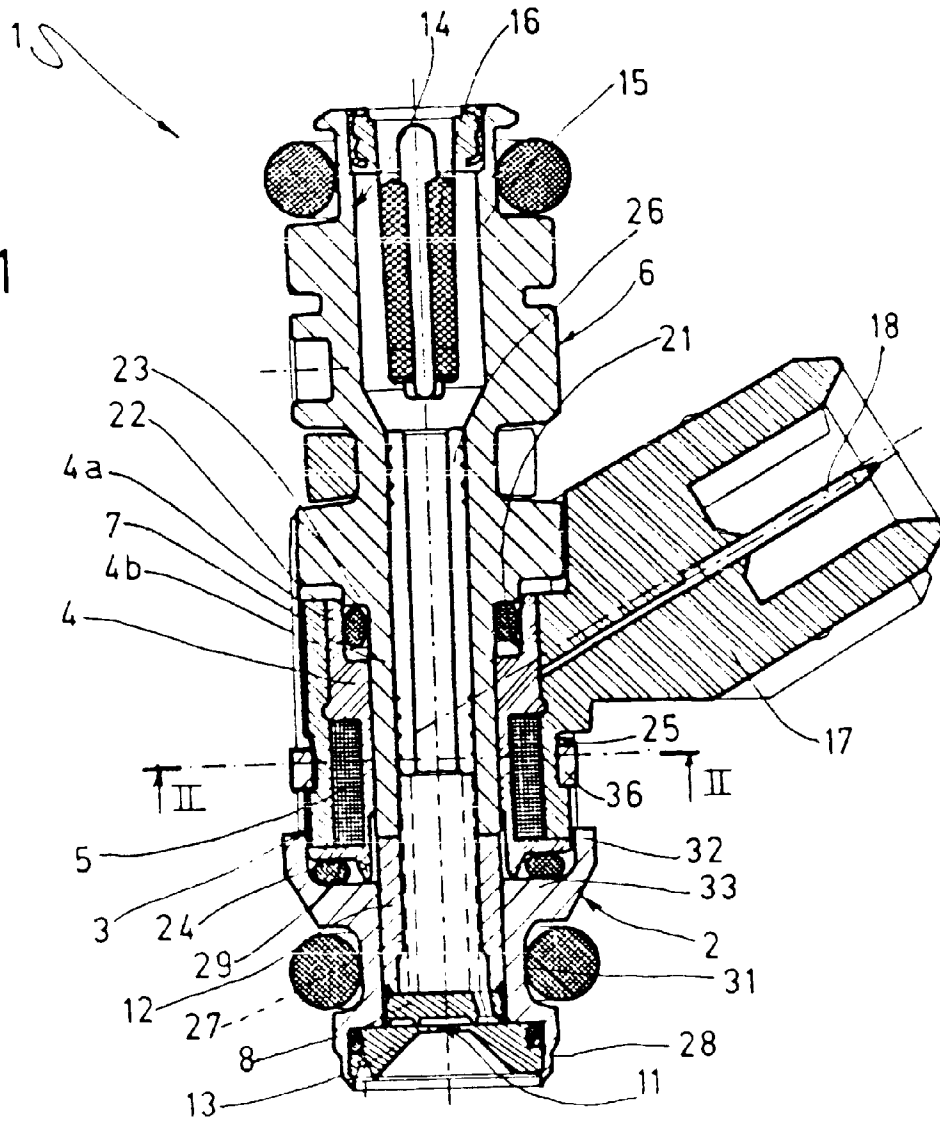


Fig.1



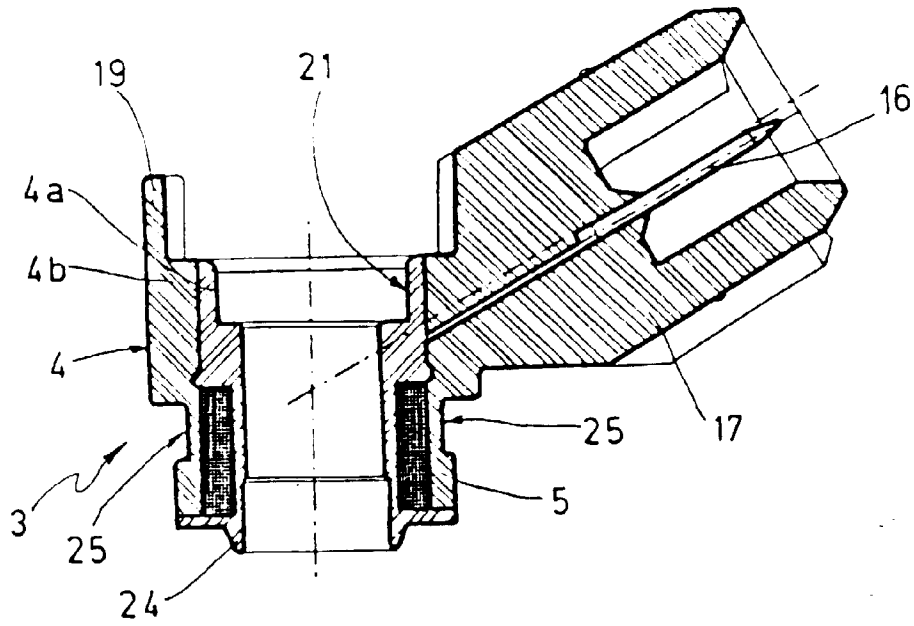


Fig.3

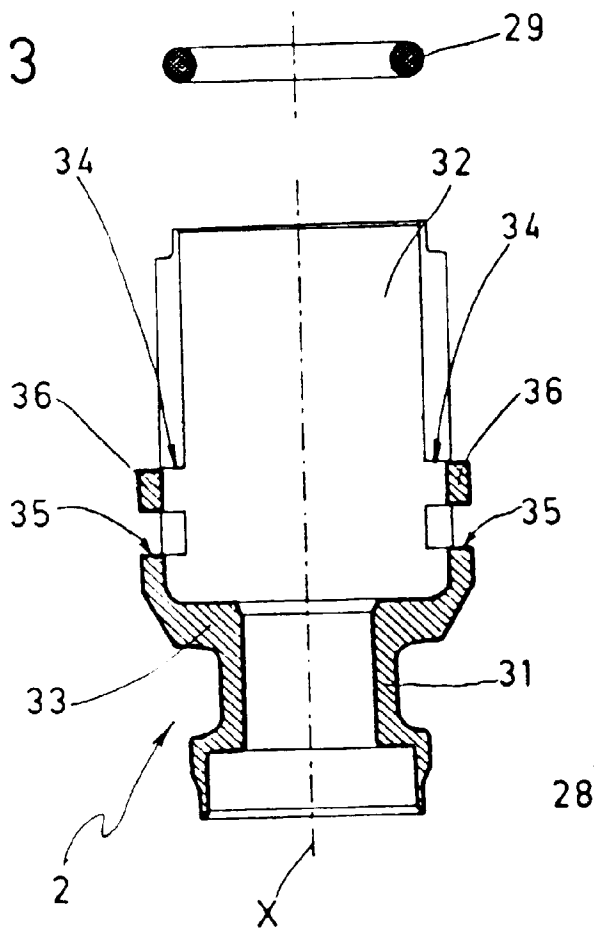


Fig.4

