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(54) **Electroinjector for feeding fuel to an internal combustion engine, and process for manufacturing it.**

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EP-A- 0 172 591
DE-A- 2 123 145
FR-A- 2 241 008
FR-A- 2 409 818
FR-A- 2 532 005
US-A- 4 311 280
US-A- 4 423 841

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Description

The present invention relates to an electroinjector for feeding fuel to an internal combustion engine, and to a process for the manufacturing thereof.

More particularly, the invention relates to an electroinjector of the type comprising an encasing body, inside of which a cylindrical core is positioned of ferromagnetic material, at least partly surrounded by an actuator coil, a movable armature of ferromagnetic material, having a substantially hollow cylindrical shape and bearing at one of its ends a closure element suitable to interrupt, in one position of said armature, the passage of fuel through an injection nozzle under the action of a return spring, and an annular shoulder element of impact-resistant and at least partly amagnetic material, rigid with the core and projecting from an end surface thereof such as to act as a stop shoulder for an opposite end of said armature in another position of said armature in which the closure element leaves open the fuel passage through the injection nozzle, the armature being guided by a small tube rigidly inserted in a hollow cylindrical portion of the core and protruding therefrom and the annular shoulder element being driven on the end portion of the cylindrical portion of the core with diametrical interference, the outer diameter of said end portion being smaller than the outer diameter of the cylindrical portion of said core and the outer diameter of the annular shoulder element being greater than the outer diameter of said cylindrical portion of said core.

Such an electroinjector is known from EP-A 0 172 591, which is prior art according to Art. 54(3) EPC.

In the injector of this document, the annular shoulder element, which instead of being mounted on the outer cylindrical wall of the end portion of the core may also be mounted on an inner cylindrical wall thereof, may be partly split in a longitudinal direction to allow elastic forcing of the annular element on the core into its final position, or it may be assembled against a shoulder provided on the end portion of the core, so arranged to cause the annular element to axially project from the end surface of the core by the desired amount.

The end surface of the annular shoulder element, which may be hardened by a coating of a hard material, preferably titanium nitride, may be rounded or inclined through a certain angle instead of being flat and perpendicular to the axis of the element, so as to limit the contact area between the armature and the annular shoulder element in operation.

Owing to axial protrusion of the annular shoulder element from the end of the core in its position axially fixed by diametrical interference, in the position of end lift of the armature, when this latter rests against the annular element, a small clearance remains between the armature and the core. This clearance, together with the nature of the material of the annular element, avoids the occurrence of phenomena of magnetic sticking between the armature and the core, phenomena which on the contrary occur in case of direct contact, due to the progressive leveling of the contact surfaces, and hence of the increase of actual contact area, which over time generates considerable adhesion forces.

The same annular element, thanks to its reduced wall thickness, minimises the possibility of hydraulic sticking in the step of resting against the shoulder.

In an electroinjector of this kind, there are hence particularly fast and constant armature closure and opening transients.

It is however important, to the purpose of a precise electromagnetic arrangement of the electroinjector, and to keep constant the functional characteristics found on the various electroinjectors from a mass-production, that the dimension of the said clearance be kept as constant as possible within very narrow tolerance limits, also considering the value of off-plane location of the front surface of the shoulder annular element relatively to the front surface of the end of core.

If one desires to keep the tolerance limits within the maximum value of, e.g., 10 μ, it is necessary to impose, for the concerned dimensions of the two components and for the off-normality location of the surfaces, tolerance limits lower than 2 μ for each dimension, which involves a hardly bearable increase in electroinjector production costs. On the other hand, also an assembly by dimensional sorting of the components, as provided, e.g., by US-A 4 423 841, does not solve the problem, in that it does not eliminate the need for small tolerances in errors of normality and parallelism between the surfaces determining the dimensional value of the clearance, and is hence burdensome for a mass-production.

From DE-A 2 123 145 there is known an electric commutator for pneumatic signals which comprises, like an electroinjector, a cylindrical core of ferromagnetic material surrounded by a coil, and a movable armature the axial position of which relative to the core is influenced by the energisation of the coil. An annular shoulder element of amagnetic material is fixed on the core and projects therefrom to act as a stop for the armature.

The tolerance problems pointed out above are also present in the above commutator.

Furthermore, an electroinjector of the type having a cylindrical core of ferromagnetic material and an armature movable relative thereto in an axial direction upon energisation of a coil surrounding the core is known from FR-A 2 532 005. In this known electroinjector the armature is slidingly guided by a guide tube secured inside the cylindrical core and projecting therefrom.

A washer housed inside the armature near its lower end defines the stroke of the armature by abutting against the lower end of the guide tube.

This construction has even more critical problems of tolerances because the clearance between the armature and the core depends not only from the exact fixing position of the guide tube with respect to the end of the core in axial direction, but also from the exact fixing position of the washer with respect to the upper end of the armature in axial direction.

The purpose of the present invention is to provide an electroinjector of the type mentioned in the introduction, which can be obtained in a mass-pro-

duction at competitive costs, while guaranteeing the observance of particularly precise dimensions, but without requiring the observance of severe tolerances for the dimensions of the individual components, but allowing on the contrary medium-precision processes to be adopted for components machining.

Within the scope of the invention, also providing a particular electroinjector manufacturing process offering advantages in precision with limited production costs is desired.

According to one aspect of the invention, the above mentioned purpose is achieved in that in an electroinjector of the type mentioned in the introduction, the core has an approximately conically shaped transient zone between the smaller diameter core portion on which the annular shoulder element is driven, and the greater-diameter core portion, said transient zone being plastically deformed by the end of the annular shoulder element which penetrates in a generally axial direction of the core into said transient zone.

The plastic deformation is accomplished in the step of assembling the annular shoulder element on the core, by applying an impulsive action in an axial direction onto the annular shoulder element driven on the core, the action being such as to cause a plastic deformation of the transient zone of the core in a generally axial direction.

According to another aspect of the invention, a deformable washer element is interposed in axial direction between the annular shoulder element and a stop shoulder of the core, the washer element having an outer diameter greater than the outer diameter of the cylindrical portion of said core and being pressed onto the stop shoulder thereby having a plastically deformed end portion overlapping the periphery of said stop shoulder.

In this case, manufacturing of the electroinjector is accomplished by interposing the washer shoulder element and the stop shoulder of the core and then applying an impulsive action onto the annular shoulder element in an axial direction thereof such as to cause a plastic deformation of the washer element in a generally axial direction thereof.

With such a plastic deformation of the core or the washer element, the component elements (the core and the annular element) manufactured with medium-precision processes, which would allow a dimensional variability of the clearance of, e.g., 150 μ, are made assume, in the assembly step, mutual positions securing the observance of the dimensions required for the correct operating of the electroinjector.

For the driving of the annular element in its end position, the use of a particular tool is proposed, as it is claimed in claims 7 and 8.

It has been found indeed that the end positioning of the annular element on the core by restriking of the components under a driving impulsive action guarantees the dimensional constancy and the circumferential uniformity of the clearance by causing different local yieldings of the core body, of material essentially less hard than that of the annular element, up to compensate for the widest dimension and shape tolerances applied to the cycle of production of the two components.

The low ratio existing between the fitting length and the diameter of the annular element secures, in the driving step, also the parallelism and the normality of the two elements being assembled.

Further details of the invention shall appear more evident from the following disclosure of preferred and not limitative embodiments of an electroinjector according to the invention, illustrated in the attached drawings, wherein:

Fig. 1 is an axial sectional view of an electroinjector according to the invention;

Fig. 2 is a partial sectional view of the body defining the cylindrical core in a first embodiment;

Figs. 3 and 4 are partial sectional views on enlarged scale in correspondence of the area of assembly of the annular element on the core of figs. 1 and 2, respectively before and after the end driving;

Figs. 5 and 6 are partial sectional views on enlarged scale, always in correspondence of the point of assembly of the annular element on the core, in a second embodiment, respectively before and after the end driving;

Fig. 7 is a partially sectional view of a tool for the assembly of the annular element on the core;

Fig. 8 is a detail, on enlarged scale, of fig. 7 in the step immediately prior to the end driving.

Referring first to Fig. 1, an electroinjector of the type being the object of the present invention comprises a cylindrical core 10 of ferromagnetic material, housed inside an encasing body 11, it too of ferromagnetic material, and extending to the outside of the body 11 to form a fitting 10a to connect the injector to a fuel feed.

To the core 10 a movable armature 12 of ferromagnetic material is coaxially associated, which, together with the core 10 and the body 11, forms a magnetic circuit.

The core 10 is at least partly surrounded by a coil 13, wound around a bobbin 14, which is electrically fed, with intermittent drive, by means of conductors 15 partly embedded in a cap of plastics 16.

The movable armature 12, of substantially hollow cylindrical shape, bears a closure element 17 with the interposition of a washer 18, and is guided by a tube 19 rigidly inserted in a hollow cylindrical portion of the core 10, but protruding out of it. A spring 20 keeps the closure element 17 normally pressed against the shoulder of an injection nozzle 21, provided with a calibrated bore for the outlet of the fuel. The spring 20 reacts against a sleeve 22 inserted with interference inside the core 10 and centrally open to allow the flow of the fuel.

Between the nozzle 21 and the body 11 an annular spacer 23 is placed, substantially defining the stroke of the armature 12, which on its side facing towards the core 10 comes to stop against an annular shoulder element 24, of impact-resistant material, and at least partly amagnetic, mounted on the end portion of the cylindrical portion of the core 10 so as to axially protrude from the end of core 10. As visi-

ble in the drawings, the outer diameter of said end portion in smaller than the outer diameter of the cylindrical portion of the core 10 and the outer diameter of the annular shoulder element 24 is greater than the outer diameter of the cylindrical portion of the core 10. Owing to axial protrusion of element 24, a small clearance T, fig. 2, is left between the armature 12 and the core 10 in the armature lift end position, in which the closure element 17 leaves open the passage through the nozzle 21. The annular shoulder element 24 guarantees that phenomena of magnetic and/or hydraulic sticking, detrimental to the purpose of a quick closure of the injector, do not occur.

The hydraulic tightness is secured by seal rings 25, 26 and 36. The fuel, fed through the sleeve 22, arrives to bores 27 of the core 10 and then to bores 28 of the armature 12, from which the fuel flows to the outside of the nozzle 21.

It shall be understood that when the coil 13 is deenergized, the armature 12 is in its lowermost position wherein the closure element 17 interrupts the fuel flow through the nozzle 21, whilst, when the coil 13 is energized, the armature 12 is in its uppermost position resting against the annular shoulder element 24 and the closure element 17 leaves open the fuel passage through the injection nozzle 21.

To secure the highest precision in the positioning of the annular element 24 and the maintainment of a clearance T of desired dimension for all the injectors of a mass-production, without the need for respecting too restricted tolerances in the machining of the core 10 and of the annular element 24, and hence without having excessive, unbearable costs, accomplishing the dimensional precision is proposed, according to the invention, when assembling the two components, rather than in the machining step.

The annular element 24, manufactured with medium precision, is driven on the end portion of the cylindrical portion of the core 10, it too manufactured with medium precision, by diametrical interference up to a certain axial position, and is then fixed in position by plastic deformation of a portion of the core 10 in an essentially axial direction, or by plastic deformation of an element interposed in axial direction between the annular element 24 and the core 10.

To that purpose, according to a first practical embodiment illustrated in figs. from 2 to 4, the core 10 is provided, its end portion on which the annular element 24 is to be driven, with an annular groove 29 between a smaller-diameter core portion 30 and a greater-diameter core portion 31, this latter being radiused to the main cylindrical portion of the core 10. An approximately conically shaped transient zone is provided between the groove 29 and the portion 31 and represents in this embodiment the portion which on the end assemblage of the annular element 24 undergoes the plastic deformation, as it can be observed by comparing figs. 3 and 4, from which it can be noted that the transient zone is plastically deformed by the end of the annular shoulder element 24 which penetrates in a generally axial direction of the core 10 into said transient zone.

The affixing in the end position is carried out by means of an impulsive action on the annular element 24 with the interposition of a pusher 32, having a stem which is driven inside the core 10, and a head which rests against the front end of the annular element 24.

As it can be observed from figs. 3 and 5, the head of the pusher 32 is advantageously provided, on its face facing the stem, with an annular step portion 44 of height H and of outer diameter slightly less than the inner diameter of the annular element 24, which step portion 44, by coming to rest against the front end surface of the core 10, determines the end of the axial stroke of pusher 32 and, consequently, the value of the end protrusion, or clearance T of fig. 2, of the annular element 24 from the front end surface of said core.

Due to the elastic recovery of the core 10 and of the annular element 24, the dimension H of the step portion 44 is slightly different from the dimension T of desired clearance. Even in the complete absence of the step portion 44, a clearance T shall hence be formed, even if of the order of a few hundredths of millimeter only.

A tool which can be advantageously used for manufacturing the injector by providing said impulsive action is illustrated in figs. 7 and 8. It comprises a stationary support 33, on the upper part of which a mass 35 is hinged on a hinge 34, through a supporting rod 37. To the lower portion of the support 33, the core 10 is fixed in a correspondingly shaped seat 38, in such a way that the front end of the core 10, on which the annular element 24 has to be mounted, protrudes from the side facing towards the mass 35 on the trajectory of the same mass 35. The core 10 is fixed by means of a ring nut 39 screwed down in a sleeve 40 fastened on the support 33.

To the mass 35 a pin 41 is centrally fastened, suitable to act axially on the pusher 32 inserted in the core 10. The arrangement is in fact such that the axis of the core 10 and of the annular element 24 coincides with the tangent to the trajectory of the centre of the pin 41 in the lowermost point of the same trajectory.

It shall be understood that by letting the mass 35, suitably dimensioned as a function of the dimensions and of the nature of the elements to be fastened to each other, fall down from a pre-established height, on the pusher 32 and hence on the annular element 24, an impulsive action is exerted, which causes the end driving of the annular element 24 on the core 10 with the above said plastic deformation in the transient zone adjacent to the groove 29.

To exemplifying purposes, the annular element 24 can be driven on the core 10 by means of static predriving by press with a force of 90–110 kg, and the dynamic end driving can be obtained with a work of 0.07 kgm.

According to another embodiment, illustrated in figs. 5 and 6, the plastic deformation is envisaged to occur on a deformable washer element 42, e.g., a copper washer, axially interposed between the annular shoulder element 24 and a flat stop shoulder 43 provided on the core 10, extending crosswise rel-

atively to the axis of core 10. The washer element 42 has an outer diameter greater than the outer diameter of the cylindrical portion of the core 10 and is pressed onto the stop shoulder 43 thereby having a plastically deformed end portion overlapping the periphery of the stop shoulder 43. The end driving can be carried out in this case in a way analog to that described for the foregoing embodiment.

It has been found that an impulsive action as described guarantees not only a constancy of end dimension and a circumferential evenness of the clearance due to different local yieldings of core 10, but also a compensation for the greater tolerances of dimensions and shape adopted in the machining of the core 10 and of the annular element 24.

Of course, numerous changes and variants are possible. So, e.g., the end-driving impulsive action could be achieved by means of a mass made fall down on the annular element 24 kept with its axis in vertical position.

Claims

1. Electroinjector for feeding fuel to an internal combustion engine, comprising an encasing body (11) inside of which a cylindrical core (10) is positioned of ferromagnetic material, at least partly surrounded by an actuator coil (13), a movable armature (12) of ferromagnetic material having a substantially hollow cylindrical shape and bearing at one of its ends a closure element (17) suitable to interrupt, in one position of said armature (12), the passage of fuel through an injection nozzle (21), under the action of a return spring (20), and an annular shoulder element (24) of impact-resistant and at least partly amagnetic material rigid with the core (10) and projecting from an end surface thereof such as to act as a stop shoulder for an opposite end of said armature (12) in another position of said armature (12) in which the closure element (17) leaves open the fuel passage through the injection nozzle (21), the armature (12) being guided by a guide tube (19) rigidly inserted in a hollow cylindrical portion of the core (10) and protruding therefrom and the annular shoulder element (24) being driven on the end portion of the cylindrical portion of the core (10) with diametrical interference, the outer diameter of said end portion being smaller than the outer diameter of the cylindrical portion of said core (10) and the outer diameter of the annular shoulder element (24) being greater than the outer diameter of said cylindrical portion of said core (10), whereby the core (10) has an approximately conically shaped transient zone between the smaller-diameter core portion (30) on which the annular shoulder element (24) is driven, and the greater-diameter core portion (31), said transient zone being plastically deformed by the end of the annular shoulder element (24) which penetrates in a generally axial direction of the core (10) into said transient zone.

2. Electroinjector according to claim 1, characterized in that an annular groove (29) is provided between said smaller-diameter portion (30) and said transient portion of the core (10).

3. Electroinjector for feeding fuel to an internal combustion engine, comprising an encasing body (11) inside of which a central core (10) is positioned of ferromagnetic material, at least partly surrounded by an actuator coil (13), a movable armature (12) of ferromagnetic material having a substantially hollow cylindrical shape and bearing at one of its ends a closure element (17) suitable to interrupt, in one position of said armature (12), the passage of fuel through an injection nozzle (21), under the action of a return spring (20), and an annular shoulder element (24) of impact-resistant and at least partly amagnetic material rigid with the core (10) and projecting from an end surface thereof such as to act as a stop shoulder for an opposite end of said armature (12) in another position of said armature (12) in which the closure element (17) leaves open the fuel passage through the injection nozzle (21), the armature (12) being guided by a guide tube (19) rigidly inserted in a hollow cylindrical portion of the core (10) and protruding therefrom and the annular shoulder element (24) being driven on the end portion of the cylindrical portion of the core (10) with diametrical interference, the outer diameter of said end portion being smaller than the outer diameter of the cylindrical portion of said core (10) and the outer diameter of the annular shoulder element (24) being greater than the outer diameter of said cylindrical portion of said core (10), whereby a deformable washer element (42) is interposed in axial direction between the annular shoulder element (24) and a stop shoulder (43) of the core (10), said washer element (42) having an outer diameter greater than the outer diameter of the cylindrical portion of said core (10) and being pressed onto the stop shoulder (43) thereby having a plastically deformed end portion overlapping the periphery of said stop shoulder (43).

4. A process for manufacturing an electroinjector according to claim 1, in which the annular shoulder element (24) is driven on the core (10) of the injector, characterized in that it comprises the step of applying an impulsive action in an axial direction onto said annular shoulder element (24) driven on the core (10), said action being such as to cause a plastic deformation of the transient zone of the core (10) in a generally axial direction.

5. A process for manufacturing an electroinjector according to claim 3, in which the annular shoulder element (24) is driven on the core (10) of the injector, characterized in that it comprises the steps of interposing a washer element (42) in axial direction between the annular shoulder element (24) and the stop shoulder of the core (10), and of applying an impulsive action onto the annular shoulder element (24) in an axial direction thereof such as to cause a plastic deformation of the washer element (42) in a generally axial direction thereof.

6. A process according to claim 4 or 5, characterized in that the impulsive action is accomplished by causing a prefixed mass (35) to fall down from a prefixed height for acting axially onto said annular shoulder element (24) driven onto the core (10).

7. Use of a tool for implementing the process of any one of claims 4 to 6, wherein the tool comprises a pusher (32) having a stem insertable into the core

(10) of the injector and a head having an annular step portion (44) on its face facing toward the stem, the step portion (44) having an axial height substantially equal to the axial dimension of a prefixed clearance between the end surface of the core (10) and the end surface of the annular shoulder element (24) projecting therefrom and an outer diameter slightly less than the inner diameter of the annular shoulder element (24), and wherein the pusher (32) with the stem inserted in the core (10) is subjected to an impulsive action such as to bring said step portion (44) to rest against the end surface of the core (10).

8. Use of a tool according to claim 7, further comprising a mass (35) movable relative to a stationary support holding the core (10), wherein the mass (35) is caused to fall by gravity from a prefixed height onto the pusher (32) having the stem inserted in the core (10).

Patentansprüche

1. Elektromagnetisches Brennstoffeinspritzventil für Verbrennungsmotoren, mit einem Gehäusekörper (11), in dem ein zylindrischer Kern (10) aus ferromagnetischem Material angeordnet ist, welcher zumindest teilweise von einer Erregerspule (13) umgeben ist, mit einem bewegbaren Anker (12) aus ferromagnetischem Material, welcher im wesentlichen hohlzylindrische Form aufweist und an einem seiner Enden ein Verschlußelement (17) trägt, welches in einer Stellung des Ankers (12) den Durchtritt von Kraftstoff durch eine Einspritzdüse (21) unter Einwirkung einer Rückholfeder (20) zu unterbrechen geeignet ist, und mit einem ringförmigen Schulterelement (24) aus stoßbeständigem und zumindest teilweise amagnetischem Material, welches Element fest mit dem Kern (10) ausgebildet ist und von einer Endfläche desselben vorragt, um als Anschlagschulter für ein gegenüberliegendes Ende des Ankers (12) in der anderen Position des Ankers (12) zu wirken, in welcher das Verschlußelement (17) die Kraftstoff-Durchtrittsöffnung durch die Einspritzdüse (21) offen hält, wobei der Anker (12) durch ein fest in den hohlzylindrischen Bereich des Kernes (10) eingesetztes und aus diesem hervorragendes Führungsrohr (19) geführt wird und das ringförmige Schulterelement (24) auf den Endbereich des zylindrischen Bereiches des Kernes (10) mit einer Durchmesser-Abstimmung aufgetrieben wird, wobei der Außendurchmesser des zylindrischen Bereiches des Kernes (10) und der Außendurchmesser des ringförmigen Schulterelementes (24) größer ist als der Außendurchmesser des zylindrischen Bereiches des Kernes (10), wobei der Kern (10) eine ungefähr konisch ausgebildete Übergangszone zwischen dem Kernbereich (30) mit geringerem Durchmesser, auf welchen das Schulterelement (24) aufgetrieben wird, und dem Kernbereich (31) mit größerem Durchmesser aufweist, wobei die Übergangszone durch das Ende des ringförmigen Schulterelementes (24) plastisch verformt wird, welches in im wesentlichen axialer Richtung des Kerns (10) in die Übergangszone eindringt.

2. Elektromagnetisches Brennstoffeinspritzventil nach Anspruch 1, dadurch gekennzeichnet, daß eine ringförmige Nut (29) zwischen dem Bereich (30) mit geringerem Durchmesser und dem Übergangsbereich des Kernes (10) vorgesehen ist.

3. Elektromagnetisches Brennstoffeinspritzventil für Verbrennungsmotoren, mit einem Gehäusekörper (11), in dem ein zylindrischer Kern (10) aus ferromagnetischem Material angeordnet ist, welcher zumindest teilweise von einer Erregerspule (13) umgeben ist, mit einem bewegbaren Anker (12) aus ferromagnetischem Material, welcher im wesentlichen hohlzylindrische Form aufweist und an einem seiner Enden ein Verschlußelement (17) trägt, welches in einer Stellung des Ankers (12) den Durchtritt von Kraftstoff durch eine Einspritzdüse (21) unter Einwirkung einer Rückholfeder (20) zu unterbrechen geeignet ist, und mit einem ringförmigen Schulterelement (24) aus stoßbeständigem und zumindest teilweise amagnetischem Material, welches Element fest mit dem Kern (10) ausgebildet ist und von einer Endfläche desselben vorragt, um als Anschlagschulter für ein gegenüberliegendes Ende des Ankers (12) in der anderen Position des Ankers (12) zu wirken, in welcher das Verschlußelement (17) die Kraftstoff-Durchtrittsöffnung durch die Einspritzdüse (21) offen hält, wobei der Anker (12) durch ein starr in den hohlzylindrischen Bereich des Kernes (10) eingesetztes und aus diesem hervorragendes Führungsrohr (19) geführt wird und das ringförmige Schulterelement (24) auf den Endbereich des zylindrischen Bereiches des Kernes (10) mit einer Durchmesser-Abstimmung aufgetrieben wird, wobei der Außendurchmesser des Endbereiches kleiner ist als der Außendurchmesser des zylindrischen Bereiches des Kernes (10) und der Außendurchmesser des ringförmigen Schulterelementes (24) größer ist als der Außendurchmesser des zylindrischen Bereiches des Kernes (10), wobei ein deformierbares Beilagscheibenelement (42) in axialer Richtung zwischen dem ringförmigen Schulterelement (24) und einer Anschlagschulter (43) des Kerns (10) angeordnet ist, wobei das Beilagscheibenelement (42) einen größeren Außendurchmesser als den Außendurchmesser des zylindrischen Bereiches des Kerns (10) aufweist und die Anschlagschulter (43) aufgepreßt wird, so daß ein plastisch deformierter Endbereich den Umfang der Anschlagschulter (43) überlappt.

4. Verfahren zur Herstellung eines elektromagnetischen Brennstoffeinspritzventiles nach Anspruch 1, wobei das ringförmige Schulterelement (24) auf den Kern (10) des Einspritzventiles aufgetrieben wird, dadurch gekennzeichnet, daß es einen Schritt einer Anwendung einer Stoßbeanspruchung in axialer Richtung auf das auf den Kern (10) aufzutreibende ringförmige Schulterelement (24) umfaßt, wobei die Beanspruchung derart ist, um eine plastische Deformation der Übergangszone des Kernes (10) in im wesentlichen axialer Richtung zu bewirken.

5. Verfahren zur Herstellung eines elektromagnetischen Brennstoffeinspritzventiles nach Anspruch 3, wobei das ringförmige Schulterelement (24) auf den Kern (10) des Einspritzventiles aufgetrieben wird, dadurch gekennzeichnet, daß es die

Schritte einer Anordnung eines Beilagscheibenelementes (42) in axialer Richtung zwischen dem ringförmigen Schulterelement (24) und der Anschlagschulter des Kernes (10) und der Anwendung einer Stoßbeanspruchung auf das ringförmige Schulterelement (24) in axialer Richtung desselben umfaßt, um eine plastische Deformation des Beilagscheibenelementes (42) in im wesentlichen axialer Richtung desselben zu bewirken.

6. Verfahren nach Anspruch 4 oder 5, dadurch gekennzeichnet, daß die Stoßbeanspruchung dadurch vorgenommen wird, daß eine vorbestimmte Masse (35) aus einer vorbestimmten Höhe für eine axiale Einwirkung auf das auf den Kern (10) aufzutreibende ringförmige Schulterelement (24) fallengelassen wird.

7. Verwendung eines Werkzeuges zur Durchführung des Verfahrens nach einem der Ansprüche 4 bis 6, wobei das Werkzeug eine Stoßeinrichtung (32) mit einem in den Kern (10) des Einspritzventiles einführbaren Schaft und einen Kopf mit einem ringförmigen, abgestuften Bereich (44) auf der dem Schaft zugewandten Fläche aufweist, wobei der abgestufte Bereich (44) eine axiale Höhe, welche im wesentlichen gleich der axialen Abmessung eines vorbestimmten Abstandes zwischen der Endfläche des Kernes (10) und der Endfläche des von diesem vorragenden ringförmigen Schulterelementes (24) ist, sowie einen Außendurchmesser aufweist, welcher geringfügig kleiner als der Innendurchmesser des ringförmigen Schulterelementes (24) ist, und wobei die Druckeinrichtung (32) mit dem in den Kern (10) eingeführten Schaft einer Stoßbeanspruchung unterworfen wird, um den abgestuften Bereich (44) in Anlage an die Endfläche des Kernes (10) zu bringen.

8. Verwendung eines Werkzeuges nach Anspruch 7, welches weiter eine relativ zu einem stationären, den Kern (10) tragenden Support bewegbare Masse (35) umfaßt, wobei die Masse (35) zu einem Fall unter Einwirkung der Schwerkraft aus einer vorbestimmten Höhe auf die Druckeinrichtung (32), deren Schaft in den Kern (10) eingeführt ist, veranlaßt wird.

Revendications

1. Injecteur électromagnétique d'alimentation d'un moteur à combustion interne en carburant, comprenant un boîtier-enveloppe (11), à l'intérieur duquel est disposé un noyau cylindrique (10) en matière ferromagnétique et entouré au moins partiellement par une bobine de commande (13), une armature mobile (12) en matière ferromagnétique, ayant une forme sensiblement cylindrique creuse et portant à l'une de ses extrémités un élément obturateur (17) apte à interrompre, dans une première position de cette armature (12) et sous l'action d'un ressort de rappel (20), le passage du carburant dans une buse d'injection (21), et un élément annulaire formant épaulement (24), en une matière résistante aux chocs et au moins partiellement amagnétique, qui est solidaire du noyau (10) d'une manière rigide et fait saillie par rapport à une surface extrême de celui-ci de façon à servir d'épaulement de butée pour une extrémité, lui faisant face, de l'armature (12), dans une autre position de cette dernière dans laquelle l'élément d'obturation (17) laisse ouvert le passage du carburant dans la buse d'injection (21), l'armature (12) étant guidée par un tube de guidage (19), qui est emboîté de manière rigide dans une partie cylindrique creuse du noyau (10) et fait saillie par rapport à cette dernière, et l'élément annulaire formant épaulement (24) étant emboîté à force sur la partie extrême de la partie cylindrique du noyau (10) avec un ajustement serré dans le sens radial, le diamètre extérieur de cette partie extrême étant plus petit que le diamètre extérieur de la partie cylindrique du noyau (10) et le diamètre extérieur de l'élément annulaire formant épaulement (24) étant supérieur au diamètre extérieur de cette partie cylindrique du noyau (10) caractérisé en ce que ce noyau (10) comporte une zone de transition, de forme approximativement conique, entre la partie de plus petit diamètre (30) du noyau, sur laquelle l'élément annulaire formant épaulement (24) est emboîté à force, et la partie de plus grand diamètre (31) du noyau, cette zone de transition étant l'objet d'une déformation plastique de la part de l'extrémité de l'élément annulaire formant épaulement (24) qui pénètre dans cette zone de transition sensiblement suivant la direction axiale du noyau (10).

2. Injecteur électromagnétique suivant la revendication 1, caractérisé en ce qu'il est prévu une gorge annulaire (29) entre la partie de plus petit diamètre (30) et la partie de transition du noyau (10).

3. Injecteur électromagnétique d'alimentation d'un moteur à combustion interne en carburant, comprenant un boîtier-enveloppe (11), à l'intérieur duquel est disposé un noyau central (10) en matière ferromagnétique et entouré au moins partiellement par une bobine de commande (13), une armature mobile (12) en matière ferromagnétique, ayant une forme sensiblement cylindrique creuse et portant à l'une de ses extrémités un élément obturateur (17) apte à interrompre, dans une première position de cette armature (12) et sous l'action d'un ressort de rappel (20), le passage du carburant dans une buse d'injection (21), et un élément annulaire formant épaulement (24), en une matière résistante aux chocs et au moins partiellement amagnétique, qui est solidaire du noyau (10) d'une manière rigide et fait saillie par rapport à une surface extrême de celui-ci de façon à servir d'épaulement de butée pour une extrémité, lui faisant face, de l'armature (12), dans une autre position de cette dernière dans laquelle l'élément d'obturation (17) laisse ouvert le passage du carburant dans la buse d'injection (21), l'armature (12) étant guidée par un tube de guidage (19), qui est emboîté de manière rigide dans une partie cylindrique creuse du noyau (10) et fait saillie par rapport à cette dernière, et l'élément annulaire formant épaulement (24) étant emboîté à force sur la partie extrême de la partie cylindrique du noyau (10) avec un ajustement serré dans le sens radial, le diamètre extérieur de cette partie extrême étant plus petit que le diamètre extérieur de la partie cylindrique du noyau (10) et le diamètre extérieur de l'élément annulaire formant épaulement (24) étant supérieur au diamètre extérieur de cette partie cylindrique du noyau (10), caractérisé en ce qu'un élément déformable en forme

de bague (42) est interposé, suivant la direction axiale, entre l'élément annulaire formant épaulement (24) et un épaulement de butée (43) du noyau (10), cet élément en forme de bague (42) ayant un diamètre extérieur de la partie cylindrique du noyau (10) et étant appliqué sous pression sur l'épaulement de butée (43), en présentant ainsi une partie extrême qui est l'objet d'une déformation plastique et qui chevauche le contour périphérique de cet épaulement de butée (43).

4. Procédé de réalisation d'un injecteur électromagnétique suivant la revendication 1, dans lequel on emboîte à force l'élément annulaire formant épaulement (24) sur le noyau (10) de l'injecteur, caractérisé en ce qu'il comporte l'opération consistant à appliquer, suivant une direction axiale, une action fournissant une quantité de mouvement sur l'élément annulaire formant épaulement (24) emboîté à force sur le noyau (10), cette action étant telle qu'elle provoque une déformation plastique de la zone de transition du noyau (10) suivant une direction sensiblement axiale.

5. Procédé de réalisation d'un injecteur électromagnétique suivant la revendication 3, dans lequel on emboîte à force l'élément annulaire formant épaulement (24) sur le noyau (10) de l'injecteur, caractérisé en ce qu'il comporte les opérations consistant à interposer, suivant la direction axiale, un élément en forme de bague (42) entre l'élément annulaire formant épaulement (24) et l'épaulement de butée du noyau (10) et à appliquer une action fournissant une quantité de mouvement sur l'élément annulaire formant épaulement (24) suivant une direction axiale par rapport à celui-ci, de façon à provoquer une déformation plastique de l'élément en forme de bague (42) suivant une direction sensiblement axiale par rapport à celui-ci.

6. Procédé suivant l'une des revendications 4 ou 5, caractérisé en ce qu'on réalise l'action fournissant une quantité de mouvement en faisant tomber une masse fixée à l'avance (35) d'une hauteur fixée à l'avance, de façon qu'elle agisse axialement sur l'élément annulaire formant épaulement (24) emboîté à force sur le noyau (10).

7. Utilisation d'un outillage pour mettre en œuvre le procédé suivant l'une quelconque des revendications 4 à 6, selon laquelle l'outillage comprend un poussoir (32) comportant une tige, pouvant être introduite dans le noyau (10) de l'injecteur, et une tête comportant une partie annulaire en surépaisseur (44) sur sa face tournée vers la tige, cette partie en surépaisseur (44) ayant, d'une part, une hauteur axiale sensiblement égale à la dimension axiale d'un jeu fixé à l'avance qui est prévu entre la surface extrême du noyau (10) et la surface extrême de l'élément annulaire formant épaulement (24) faisant saillie par rapport à la première et, d'autre part, un diamètre extérieur légèrement inférieur au diamètre intérieur de l'élément formant épaulement (24), ce poussoir (32) étant soumis, avec sa tige introduite dans le noyau (10), à une action fournissant une quantité de mouvement de manière à amener la partie en surépaisseur (44) en appui sur la surface extrême du noyau (10).

8. Utilisation d'un outillage suivant la revendication 7, selon laquelle cet outillage comprend en outre une masse (35) mobile par rapport à un support fixe maintenant le noyau (10), cette utilisation consistant à faire tomber la masse (35), sous l'effet de la pesanteur et à partir d'une hauteur fixée à l'avance, sur le poussoir (32) comportant sa tige introduite dans le noyau (10).

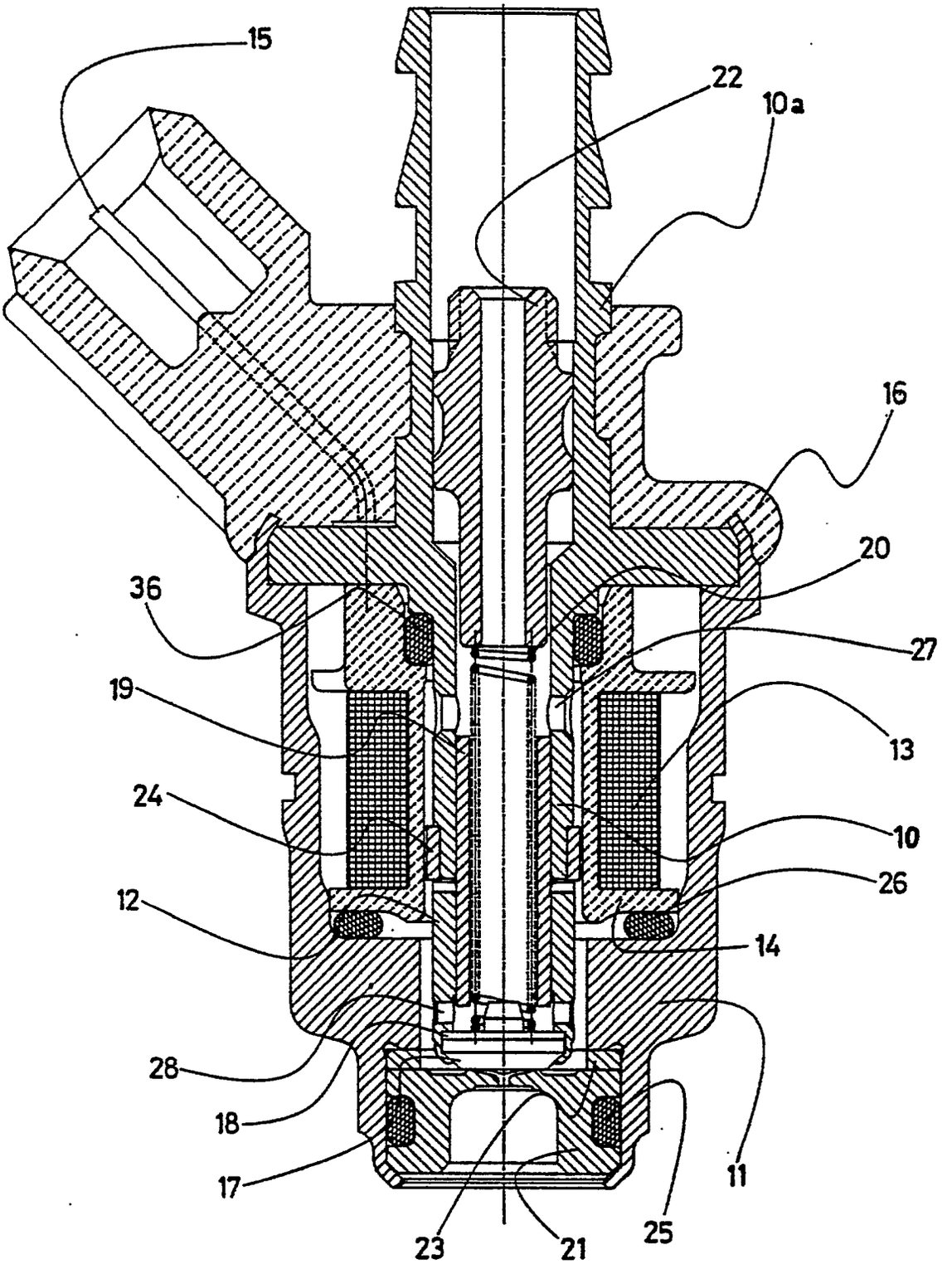

FIG. 1

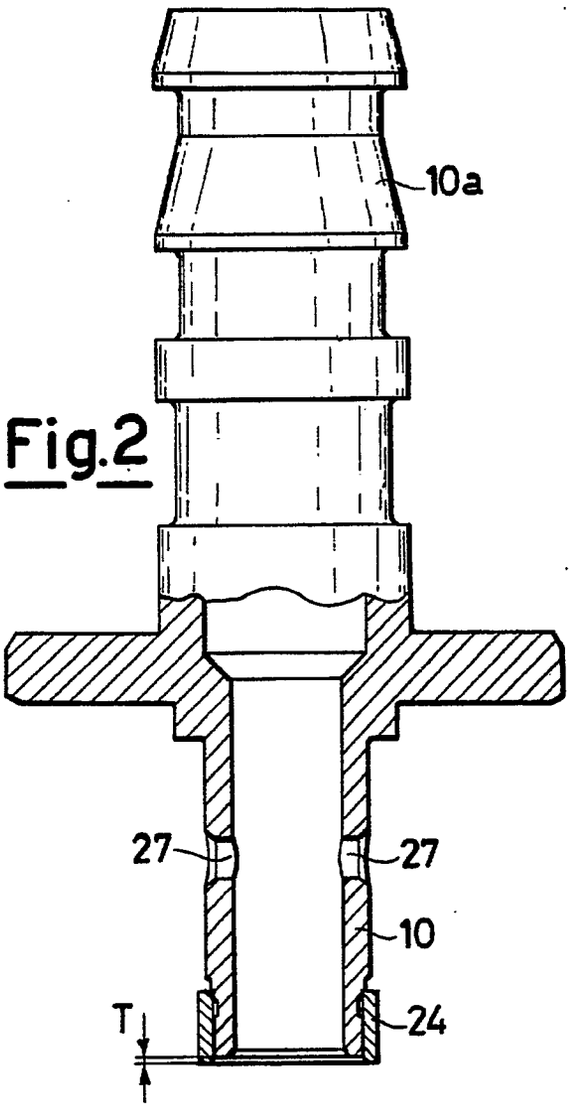

Fig.2

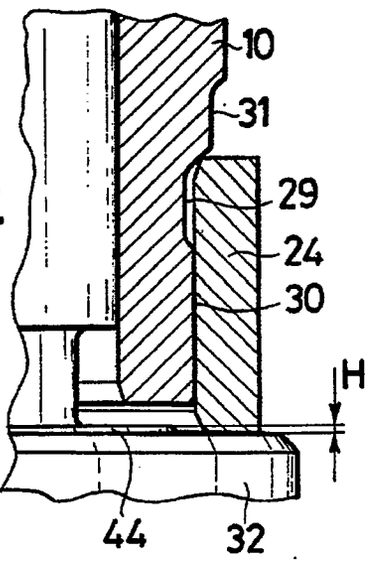

Fig.3

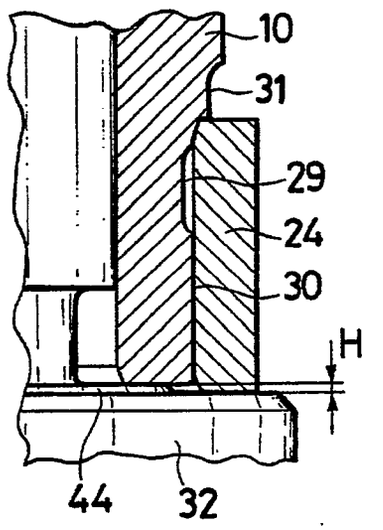

Fig.4

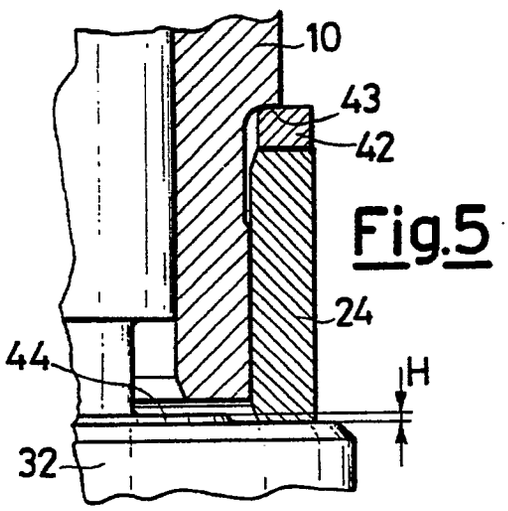

Fig.5

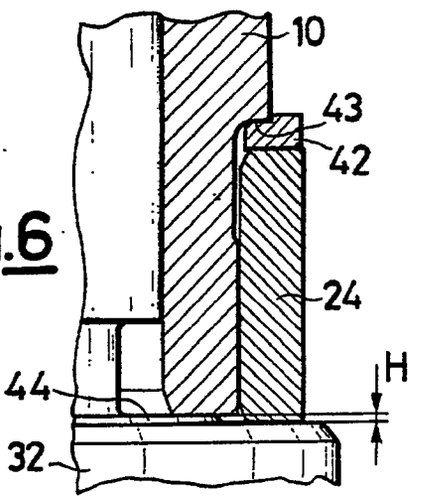

Fig.6

Fig.8

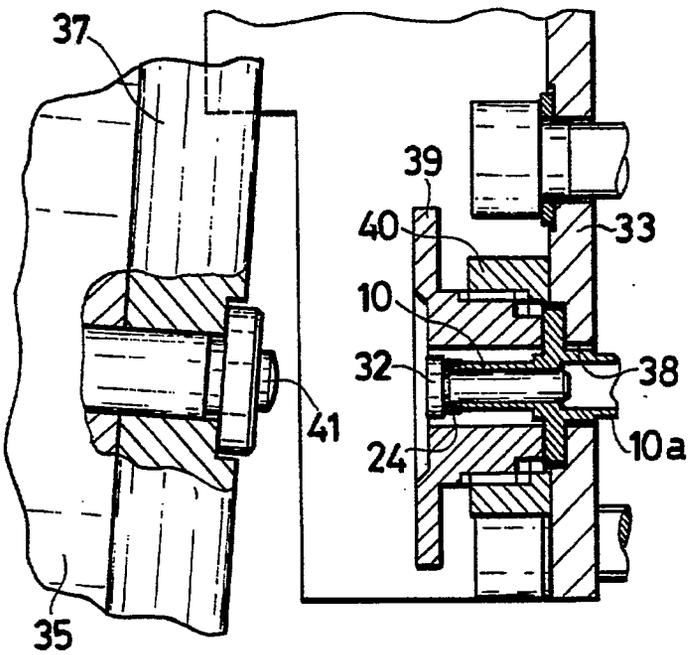
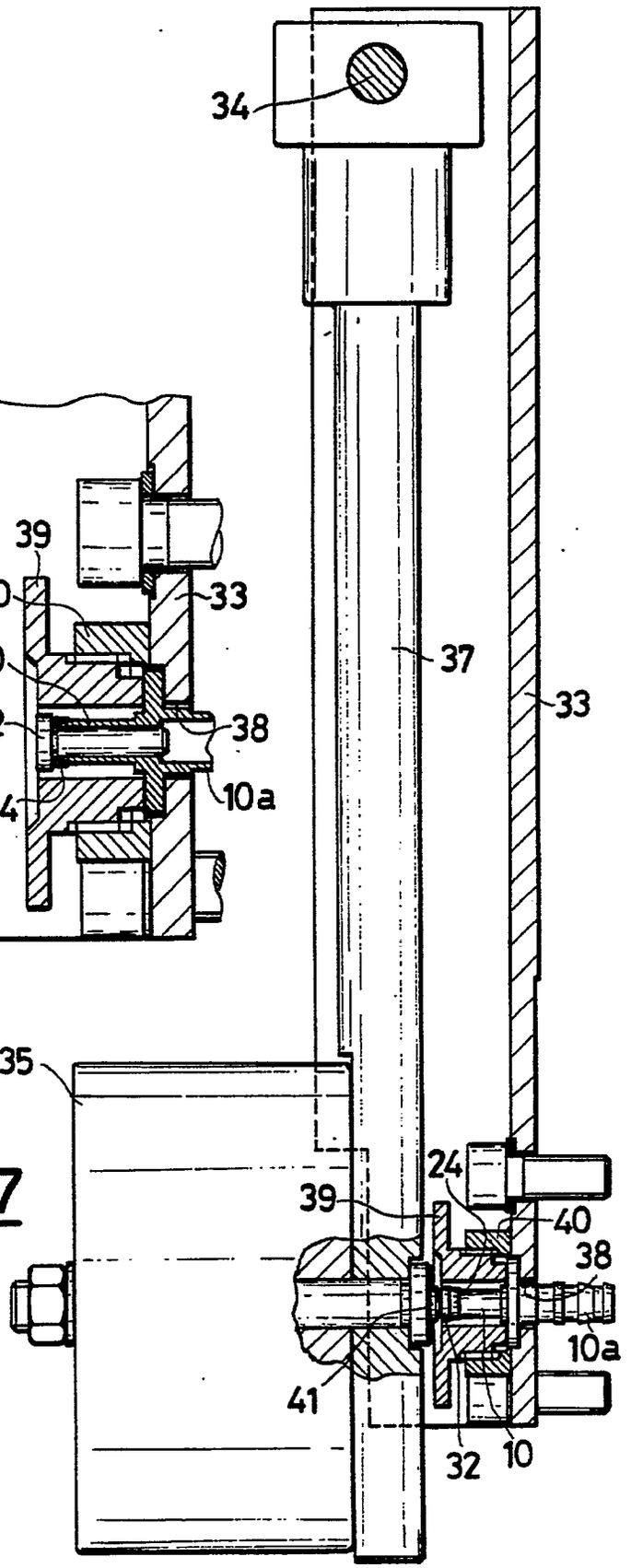
Fig.7