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(54) **Structure of solenoid valve attached to resin cover by insert-molding**

Struktur eines mittels Umspritzung an einer Harzabdeckung befestigten Magnetventils

Structure de vanne à solénoïde fixée à un couvercle en résine par un moulage d'insert

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Description

TECHNICAL FIELD

[0001] This disclosure relates to a structure of a solenoid valve attached to a resin cover by insert-molding. More particularly, this disclosure pertains to a structure of a solenoid valve attached to a resin cover by insert-molding provided in, for example, an internal combustion engine.

BACKGROUND DISCUSSION

[0002] In a known attachment structure of an oil control valve disclosed in JP2006-29166A (Reference 1), a metal sleeve (corresponding to a valve body and a sleeve of this disclosure) and a resin valve casing (corresponding to a cover of this disclosure) are integrally insert-molded and attached to each other. More particularly, a primer is applied on an outer peripheral surface of the metal sleeve before the insert-molding operation so that the metal sleeve is attached to a resin material that forms the valve casing.

[0003] However, in the attachment structure of the oil control valve (corresponding to a solenoid valve of this disclosure) disclosed in the Reference 1, no countermeasure is disclosed against heat deformation that may occur due to a difference in thermal expansion coefficients between different materials, for example, the materials of the metal sleeve and the resin valve casing. Thus, when the metal sleeve and the resin valve casing are integrally insert-molded, the resin cover may be thermally deformed or deteriorate due to heat of a fluid or heat conducted from an internal combustion engine, thereby causing a gap between the sleeve and the valve casing, which may result in unintentional fluid communication between two oil holes (corresponding to two fluid passages of this disclosure). Particularly, when the difference in the thermal expansion coefficient between the different materials exists, for example, the metal sleeve and the resin valve casing, the resin valve casing may come apart from the metal sleeve, and thus the unintentional fluid communication between the two oil holes may be established.

[0004] DE 20 2006 011 672 U1 relates to a cylinder head cover comprising means for preventing a resin cover and a valve body from coming apart from each other, which is provided only at one position of an end portion of the valve body.

[0005] AT 382 222 B relates to a connection device for tubes, in particular plastic tubes, wherein plural through holes are formed on a radially outward portion of a gasket ring.

[0006] DE 103 59 785 A1 concerns an add-on part for a vehicle consisting of a cast part suitable for a connection to the vehicle body of the vehicle, wherein a hole is formed on a plate and a portion, which includes the hole, of the plate 2 is inserted into a member so as to be insert-molded.

[0007] US 2007/0045968 A1 relates to a pipe gasket in which plural through holes are formed on a gasket, wherein a sealing member is insert-molded.

Summary

[0008] According to an aspect of this disclosure, a structure of a solenoid valve attached to a resin cover by insert-molding, the solenoid valve includes a sleeve having a cylindrical shape and at least two fluid passages, a spool housed in the sleeve and slidable therein in an axial direction relative to the sleeve, a solenoid for actuating the spool, wherein a valve body is provided on an outer peripheral surface of the sleeve and has a plurality of fluid passages that is in fluid communication with the fluid passages of the sleeve, a plurality of flanges is provided on an outer peripheral surface of the valve body, and at least one of the flanges has a through hole formed in the axial direction relative to the valve body.

[0009] Due to the above described structure, when the valve body is insert-molded, molten resin efficiently flows and fills in the through holes provided on the flanges so as to adhere to the flanges, thereby preventing the resin cover and the valve body from coming apart from each other.

[0010] Due to the above described structure, the sleeve constituting the solenoid valve and the valve body used as an insert upon molding the resin cover are provided separately. This allows, when the solenoid valve is damaged, an easy replacement of the solenoid valves by removing a portion of the solenoid valve including the sleeve from the valve body, and then attaching the new portion of the solenoid valve including the new sleeve. Thus, the resin cover and the valve body may be used as they are, that is, the resin cover and the valve body do not require alternation, which saves replacement parts and improves replacement workability.

[0011] According to a further aspect of this disclosure, a material of the sleeve and a material of the valve body have substantially same thermal expansion coefficients.

[0012] This prevents a gap between the valve body and the sleeve from being increased upon thermal expansion of the valve body or the sleeve due to heat of the fluid or heat conducted from outside, for example, an internal combustion engine. Consequently, unintentional fluid communication between the two fluid passages and fluid leakage to an outside of the solenoid valve are prevented.

[0013] According to a further aspect of this disclosure, the resin cover encloses and supports at least the flanges of the valve body.

[0014] According to a further aspect of this disclosure, an outer diameter of the at least one of the flanges is larger than an outer diameter of the other flanges.

[0015] Consequently, when the valve body is insert-molded, the molten resin flows and fills in the through holes with small likelihood of being blocked by the other

flanges. Consequently, improper adhesion of the resin material to the valve body and other inconvenience are prevented without increasing temperature of the molten resin which later hardens and forms the resin cover or increasing an injection pressure.

[0016] According to a further aspect of this disclosure, the plurality of the through holes is formed along a circumferential direction of the at least one of the flanges.

[0017] Consequently, the flanges and the valve body are securely fixed to each other at larger areas, thereby preventing the resin cover and the valve body from coming apart from each other.

[0018] According to a further aspect of this disclosure, the through hole is opened outwardly in a radial direction of the flange.

[0019] Consequently, the molten resin flows and fills in the through hole efficiently.

[0020] According to a further aspect of this disclosure, the through hole has an oval shape in cross section.

[0021] Consequently, greater amount of molten resin flows and fills in the through hole, and thus the flanges and the resin cover are even more securely fixed to each other. This prevents the resin cover and the valve body from coming apart from each other.

[0022] According to a further aspect of this disclosure, the through hole has a circular shape in cross section.

[0023] According to a further aspect of this disclosure, the through hole has a polygon shape in cross section.

[0024] Consequently, the through hole is formed in a simple machining process.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] The foregoing and additional features and characteristics of this disclosure will become more apparent from the following detailed description considered with the reference to the accompanying drawings, wherein:

Fig. 1 is a cross-sectional view of a structure of a solenoid valve attached to a resin cover by insert-molding according to an example for explaining the invention;

Fig. 2 is a cross-sectional view of a valve body according to an example for explaining the invention;

Fig. 3 is a cross-sectional view of a structure of a solenoid valve attached to a resin cover by insert-molding according to an embodiment disclosed here;

Fig. 4 is a perspective view of a valve body according to the embodiment disclosed here;

Fig. 5 is a cross-sectional view of a variation of a through hole according to the embodiment disclosed here;

Fig. 6 is a cross-sectional view of another variation of the through hole according to the embodiment disclosed here;

Fig. 7 is a cross-sectional view of another variation of the through hole according to the embodiment disclosed here; and

Fig. 8 is a cross-sectional view of another variation of the through hole according to the embodiment disclosed here.

DETAILED DESCRIPTION

[0026] An example of a structure of a solenoid valve attached to a resin cover by insert-molding disclosed here will be explained with reference to Figs. 1 and 2.

[0027] A solenoid valve has a valve body 10 having a cylindrical shape, five fluid passages 10a, 10b, 10c, 10d, 10e, a spool 12 slidably housed in the valve body 10, and a solenoid portion 13 (serving as a solenoid) for axially moving the spool 12.

[0028] The valve body 10 is made of metal such as aluminum alloy and has the cylindrical shape. The five fluid passages 10a, 10b, 10c, 10d, 10e are provided on an outer peripheral surface of the valve body 10 to allow the fluid to flow between an inside and an outside of the valve body 10. Flanges 10f, 10g are provided on the outer peripheral surface of the valve body 10 so as to extend in a circumferential direction of the valve body 10 and to outwardly protrude in a radial direction of the valve body 10. The plural flanges 10f, 10g are arranged along an axial direction relative to the valve body 10.

[0029] A cylinder head cover 11 (serving as a resin cover) is made of a resin material and provided with an accommodating hole 11e for accommodating therein the valve body 10. The cylinder head cover 11 is also provided with fluid passages 11a, 11b, 11c, 11d arranged so as to correspond to locations of the fluid passages 10a, 10b, 10c, 10d provided on the valve body 10.

[0030] The spool 12 is provided inside the valve body 10. A sliding motion of the spool 12 in the axial direction relative to the valve body 10 establishes or disconnects the flow of the fluid between the fluid passages 10a, 10b, 10c, 10d, 10e. In Fig. 1, the flow of the fluid between the fluid passages 10b, 11b and the fluid passages 10c, 11c is established. Another flow of the fluid between the fluid passages 10a, 11a and the fluid passages 10b, 11b is disconnected. Another flow of the fluid between the fluid passages 10d, 11d and the fluid passage 10e is established. The spool 12 is connected to the solenoid portion 13, and the solenoid portion 13 actuates, or drives, the spool 12 to move, or to slide, in the axial direction relative to the valve body 10 when a control signal is sent from an ECU to the solenoid portion 13.

[0031] The solenoid portion 13 is fixedly mounted on one axial end of the valve body 10 with a fastener, for example, a bolt, or by means of caulking.

[0032] Next, the flanges 10f, 10g provided on the outer peripheral surface of the valve body 10 will be described.

[0033] As previously described, the flanges 10f, 10g are provided on the outer peripheral surface of the valve body 10 along the circumferential direction of the valve body 10. The plural flanges 10f, 10g are arranged along the axial direction relative to the valve body 10. The flange

10f outwardly protrudes in the radial direction of the valve body 10 further than the flange 10g outwardly protrudes in the radial direction of the valve body 10. The flanges 10f and 10g are alternately arranged in the axial direction relative to the valve body 10. The flange 10f is provided with a through hole 10h penetrating the flange 10f in the axial direction relative to the valve body 10 and having an oval shape when viewed from the axial direction of the valve body 10. In this embodiment, four through holes 10h, 10h, 10h, 10h are formed on the flange 10f along a circumferential direction of the flange 10f.

[0034] According to the above-described structure of the solenoid valve attached to the resin cover by insert-molding, when insert-molding the valve body 10 into the cylinder head cover 11, that is, when molding the cylinder head cover 11 by using the valve body 10 as an insert, that is, an object to be insert-molded, molten resin which later hardens and forms the cylinder head cover 11 flows and fills between the adjacent flanges 10f and 10g. Thus, both side surfaces of each of the flanges 10f, 10g in the axial direction relative to the valve body 10 are in close contact with (adhere to) the cylinder head cover 11. This prevents the cylinder head cover 11 and the valve body 10 from coming apart from each other even when the cylinder head cover 11 and the valve body 10 are made of different materials, and thus when thermal expansion coefficients are different between the two materials.

[0035] The flange 10f is provided with the through hole 10h penetrating the flange 10f in the axial direction relative to the valve body 10. Thus, the molten resin flows and fills in the through hole 10h when the cylinder head cover 11 is molded by using the valve body 10 as the insert. Consequently, the flange 10f and the cylinder head cover 11 are securely fixed to each other, that is, the cylinder head cover 11 encloses and supports the flange 10f. This prevents the cylinder head cover 11 and the valve body 10 from coming apart from each other even when the cylinder head cover 11 and the valve body 10 are made of the different materials, and thus when the thermal expansion coefficients are different between the two materials.

[0036] Because the flange 10f outwardly protrudes in the radial direction of the valve body 10 further than the flange 10g outwardly protrudes in the radial direction of the valve body 10, when the valve body 10 is insert-molded, the molten resin flows and fills in the through hole 10h provided on the flange 10f with no need to increase temperature of the molten resin or to increase an injection pressure, and at the same time, improper adhesion of the resin material to the valve body 10 and other inconvenience are prevented.

[0037] According to the structure of the solenoid valve attached to the resin cover by insert-molding of the first embodiment, the valve body 10 has a function of a sleeve constituting the solenoid valve. This achieves a simple structure that requires no seal material including an o-ring between the cylinder head cover 11 and the valve body 10.

[0038] An embodiment of the structure of the solenoid valve attached to the resin cover by insert-molding disclosed here will be explained with reference to Figs. 3 and 4. In the embodiment, same reference numerals as in the above example designate the same or corresponding components.

[0039] The solenoid valve of the second embodiment has a valve body 100 having a cylindrical shape and four fluid passages 100a, 100b, 100c, 100d, a sleeve 110 having five fluid passages 110a, 110b, 110c, 110d, 110e, a spool 12 slidably housed in the sleeve 110, and a solenoid portion 13 for axially moving the spool 12.

[0040] The valve body 100 is made of metal such as aluminum alloy and has the cylindrical shape. The four fluid passages 100a, 100b, 100c, 100d are provided on an outer peripheral surface of the valve body 100 to allow the fluid to flow between an inside and an outside of the valve body 100. Flanges 100f, 100g are provided on the outer peripheral surface of the valve body 100 so as to extend in a circumferential direction of the valve body 100 and to outwardly protrude in a radial direction of the valve body 100. The plural flanges 100f, 100g are arranged along an axial direction relative to the valve body 100.

[0041] The sleeve 110 is made of metal such as the aluminum alloy and has the cylindrical shape. The five fluid passages 110a, 110b, 110c, 110d, 110e are provided on an outer peripheral surface of the sleeve 110 to allow the fluid to flow between an inside and an outside of the sleeve 110. The fluid passages 110a, 110b, 110c, 110d of the sleeve 110 are arranged so as to correspond to locations of the previously-described fluid passages 100a, 100b, 100c, 100d of the valve body 100, thereby establishing fluid communication between the corresponding fluid passages. An outer diameter of the sleeve 110 is set to be equal to an inner diameter of the valve body 100 so that an outer peripheral surface of the sleeve 110 and an inner peripheral surface of the valve body 100 contact with each other.

[0042] An o-ring 111 is attached to the outer peripheral surface of the sleeve 110, on an opening side of the accommodating hole 11e. The o-ring 111 is provided for preventing the fluid from leaking from the inside of the solenoid valve to the outside thereof via a minute gap between the valve body 100 and the sleeve 110.

[0043] The valve body 100 and the sleeve 110 may be made of the materials having the substantially equal thermal expansion coefficients. This prevents the gap between the valve body 100 and the sleeve 110 from being increased upon thermal expansion of the valve body 100 or the sleeve 110 due to heat of the fluid or heat conducted from outside, for example, an internal combustion engine. Even when the valve body 100 and the sleeve 110 are made of different materials, it is desirable that the materials have the equal thermal expansion coefficients or substantially equal thermal expansion coefficients (thermal expansion coefficients close to each other). In this case, a range of difference in the thermal expansion

coefficients needs to be narrow enough at least to prevent the fluid from leaking outside the solenoid valve via the gap between the valve body 100 and the sleeve 110, through the o-ring 111.

[0044] A cylinder head cover 11 is made of a resin material and provided with an accommodating hole 11e for accommodating therein the valve body 100 and the sleeve 110. The cylinder head cover 11 is also provided with fluid passages 11a, 11b, 11c, 11d arranged so as to correspond to locations of the fluid passages 100a, 100b, 100c, 100d provided on the valve body 10.

[0045] The spool 12 is provided inside the sleeve 110. A sliding motion of the spool 12 in an axial direction relative to the sleeve 110 establishes or disconnects the flow of the fluids between the fluid passages 100a, 100b, 100c, 100d, 100e. In Fig. 3, the flow of the fluid between the fluid passages 100b, 110b, 11b and the fluid passages 100c, 110c, 11c is established. Another flow of the fluid between the fluid passages 100a, 110a, 11a and the fluid passages 100b, 110b, 11b is disconnected. Another flow of the fluid between the fluid passages 100d, 110d, 11d and the fluid passage 110e is established. The spool 12 is connected to the solenoid portion 13, and the solenoid portion 13 actuates the spool 12 to move, or slide, in the axial direction relative to the sleeve 110 when a control signal is sent from an ECU to the solenoid portion 13.

[0046] The solenoid portion 13 is fixedly mounted on one axial end of the sleeve 110 with a fastener, for example, a bolt or a rivet.

[0047] Next, the flanges 100f, 100g provided on the outer peripheral surface of the valve body 100 will be described.

[0048] As previously described, the flanges 100f, 100g are provided on the outer peripheral surface of the valve body 100 so as to extend in the circumferential direction of the valve body 100. The plural flanges 100f, 100g are arranged along the axial direction relative to the valve body 100. The flange 100f outwardly protrudes in the radial direction of the valve body 100 further than the flange 100g outwardly protrudes in the radial direction of the valve body 100. The flange 100f and 100g are alternately arranged in the axial direction relative to the valve body 100. The flange 100f is provided with a through hole 100h penetrating the flange 100f in the axial direction relative to the valve body 100 and having an oval shape when viewed from the axial direction of the valve body 100. In this embodiment, the four through holes 100h, 100h, 100h, 100h are formed on the flange 100f.

[0049] According to the above-described structure of the solenoid valve attached to the resin cover by insert-molding of this embodiment, the molten resin which later hardens and forms the cylinder head cover 11 flows and fills between the adjacent flanges 100f and 100g upon molding the cylinder head cover 11 by using the valve body 10 as an insert. Thus, both side surfaces of each of the flanges 100f, 100g in the axial direction relative to the valve body 100 are in close contact with (adhere to) the cylinder head cover 11. This prevents the cylinder head cover 11 and the valve body 100 from coming apart from each other even when the cylinder head cover 11 and the valve body 100 are made of different materials, and thus when the thermal expansion coefficients are different between the two materials.

[0050] The flange 100f is provided with the through hole 100h passing through the flange 100f in the axial direction relative to the valve body 100. Thus, the molten resin which later hardens and forms the cylinder head cover 11 flows and fills in the through hole 100h when the valve body 100 is insert-molded. Consequently, the flange 100f and the cylinder head cover 11 are securely fixed to each other, that is, the cylinder head cover 11 encloses and supports the flange 100f. This prevents the cylinder head cover 11 and the valve body 100 from coming apart from each other even when the cylinder head cover 11 and the valve body 100 are made of the different materials, and thus when the thermal expansion coefficients are different between the two materials.

[0051] Because the flange 100f outwardly protrudes in the radial direction of the valve body 100 further than the flange 100g outwardly protrudes in the radial direction of the valve body 100, when the valve body 100 is insert-molded, the molten resin flows and fills in the through hole 100h provided on the flange 100f with no need to increase temperature of the molten resin or to increase an injection pressure, at the same time, improper adhesion of the resin material to the valve body 100 and other inconvenience are prevented.

[0052] In the example and the embodiment, the flanges 10f, 10g, 100f, 100g are formed to have an axial cross section of a three-sided rectangular shape, however, this disclosure is not limited to the three-sided rectangular shape, and other shapes including a semicircular shape or a V-shape may be employed.

[0053] The variations of the through holes 10h (100h), which will be described below with reference to Figs. 5 to 8, apply both to the example and the embodiments.

[0054] As shown in Fig. 5, the flange 10f (100f) of the valve body 10 (100) is provided with a through hole 10i (100i) where a portion of a perimeter of the through hole 10i (100i) is interrupted so that the through hole 10i (100i) is opened outwardly in the radial direction of the flange 10f (100f). That is, a cross section of the through hole 10i (100i) has a shape that is opened outwardly in the radial direction of the flange 10f (100f). In other words, the cross section of the through hole 10i (100i) is no longer the perfect oval shape. This allows the molten resin to efficiently flow and fill in the through hole 10i (100i) when the valve body 10 (100) is insert-molded. Consequently, this reliably prevents the cylinder head cover 11 and the valve body 10 (100) from coming apart from each other.

[0055] As shown in Fig. 6, the flange 10f (100f) of the valve body 10 (100) is provided with a through hole 10j (100j) having a circular shape in cross section. In addition, a portion of a perimeter of the through hole 10j (100j)

is interrupted so that the through hole 10j (100j) is opened outwardly in the radial direction of the flange 10f (100f). That is, a cross section of the through hole 10j (100j) has a shape that is opened outwardly in the radial direction of the flange 10f (100f). In other words, the cross section of the through hole 10j (100j) is no longer the perfect circular shape. This allows the through hole 10j (100j) to be formed in a simple machining process, and the molten resin to flow and fill in the through hole 10j (100j) efficiently when the valve body 10 (100) is insert-molded. Consequently, this reliably prevents the cylinder head cover 11 and the valve body 10 (100) from coming apart from each other.

[0056] As shown in Fig. 7, a through hole 10k (100k) has a circular shape in cross section. Thus, the through hole 10k (100k) is formed in the simple machining process.

[0057] As shown in Fig. 8, a through hole 10l (100l) has a polygon shape, for example a quadrangle shape, in section. Thus, the through hole 10k (100k) is formed in the simple machining process.

Claims

1. A solenoid valve attached to a resin cover by insert-molding, the solenoid valve comprising:

   a sleeve (110) having a cylindrical shape and at least two fluid passages (110a, 110b, 110c, 110d, 110e);
   a spool (12) housed in the sleeve (110) and slidable therein in an axial direction relative to the sleeve (110); and
   a solenoid (13) for actuating the spool (12); wherein
   a valve body (100) is provided on an outer peripheral surface of the sleeve (110) and has a plurality of fluid passages (100a, 100b, 100c, 100d) that is in fluid communication with the fluid passages (110a, 110b, 110c, 110d, 110e) of the sleeve (110), a plurality of flanges (100f, 100g) is provided on an outer peripheral surface of the valve body (100) and arranged along an axial direction relative to the valve body (100), and at least one of the flanges (100f) has a through hole (100h, 100i, 100j, 100k, 100l) formed in the axial direction relative to the valve body (100), wherein the at least one flange (100f) on which the through hole (100h) is provided protrudes outwardly in a radial direction of the valve body (100) further than the flange (100g) not provided with the through hole (100h) outwardly protrudes in the radial direction of the valve body (100), wherein flanges (100f) provided with the through hole (100h, 100i, 100j, 100k, 100l) and flanges (100g) not provided with the through hole (100h) of the plurality of flanges (100f, 100g) are alternately arranged in the axial direction of the valve body (100).

2. The solenoid valve attached to the resin cover by insert-molding according to Claim 1, wherein a material of the sleeve (110) and a material of the valve body (100) have substantially same thermal expansion coefficients.

3. The solenoid valve attached to the resin cover by insert-molding according to Claim 1 or 2, wherein the resin cover encloses and supports at least the flanges (100f, 100g) of the valve body (100).

4. The solenoid valve attached to the resin cover by insert-molding according to any one of Claims 1 to 3, wherein an outer diameter of the at least one of the flanges (100f, 100g) is larger than an outer diameter of the other flanges (100f, 100g).

5. The solenoid valve attached to the resin cover by insert-molding according to any one of Claims 1 to 4, wherein the plurality of the through holes (100h, 100i, 100j, 100k, 100l) is formed along a circumferential direction of the at least one of the flanges (100f, 100g).

6. The solenoid valve attached to the resin cover by insert-molding according to any of claims 1 to 5, wherein the through hole (100i, 100j) is opened outwardly in a radial direction of the flange (100f, 100g).

7. The solenoid valve attached to the resin cover by insert-molding according to any one of Claims 1 to 6, wherein the through hole (100h) has an oval shape in cross section.

8. The solenoid valve attached to the resin cover by insert-molding according to any one of Claims 1 to 7, wherein the through hole (100k) has a circular shape in cross section.

9. The solenoid valve attached to the resin cover by insert-molding according to any one of Claims 1 to 8, wherein the through hole (100l) has a polygon shape in cross section.

Patentansprüche

1. Solenoidventil, das an einer Harzabdeckung durch Inserttechnik angebracht ist, wobei das Solenoidventil aufweist:

   eine Hülse (110) mit einer zylindrischen Form und mindestens zwei Fluidpassagen (110a, 110b, 110c, 110d, 110e);
   eine Spule (12), die in der Hülse (110) unterge-

bracht und darin in einer axialen Richtung relativ zu der Hülse (110) gleitend ist; und
ein Solenoid (13) zur Aktivierung der Spule (12); wobei
ein Ventilkörper (100) auf einer äußeren Umfangsfläche der Hülse (110) vorgesehen ist und eine Mehrzahl von Fluidpassagen (100a, 100b, 100c, 100d) aufweist, die in Fluidverbindung mit den Fluidpassagen (110a, 110b, 110c, 110d, 110e) der Hülse (110) sind, eine Mehrzahl von Flanschen (100f, 100g) auf einer äußeren Umfangsfläche des Ventilkörpers (100) vorgesehen und entlang einer axialen Richtung relativ zu dem Ventilkörper (100) angeordnet sind, und mindestens einer der Flansche (100f) ein Durchgangsloch (100h, 100i, 100j, 100k, 100l) aufweist, das in der axialen Richtung relativ zu dem Ventilkörper (100) ausgebildet ist, wobei der mindestens eine Flansch (100f), auf dem das Durchgangsloch (100h) vorgesehen ist, nach außen in einer radialen Richtung des Ventilkörpers (100) vorsteht, weiter als der Flansch (100g), der nicht mit dem Durchgangsloch (100h) versehen ist, nach außen in der radialen Richtung des Ventilkörpers (100) vorsteht, wobei die Flansche (100f), die mit dem Durchgangsloch (100h, 100i, 100j, 100k, 100l) versehen sind, und die Flansche (100g) von der Mehrzahl von Flanschen (100f, 100g), die nicht mit dem Durchgangsloch (100h) versehen sind, abwechselnd in der axialen Richtung des Ventilkörpers (100) angeordnet sind.

2. Solenoidventil, das an der Harzabdeckung durch Inserttechnik angebracht ist, nach Anspruch 1, bei dem ein Material der Hülse (110) und ein Material des Ventilkörpers (100) im Wesentlichen die gleichen thermischen Expansionskoeffizienten aufweisen.

3. Solenoidventil, das an der Harzabdeckung durch Inserttechnik angebracht ist, nach Anspruch 1 oder 2, bei dem die Harzabdeckung mindestens die Flansche (100f, 100g) des Ventilkörpers (100) umschließt und abstützt.

4. Solenoidventil, das an der Harzabdeckung durch Inserttechnik angebracht ist, nach einem der Ansprüche 1 bis 3, bei dem ein Außendurchmesser von mindestens einem der Flansche (100f, 100g) größer als ein Außendurchmesser der anderen Flansche (100f, 100g) ist.

5. Solenoidventil, das an der Harzabdeckung durch Inserttechnik angebracht ist, nach einem der Ansprüche 1 bis 4, bei dem die Mehrzahl der Durchgangslöcher (100h, 100i, 100j, 100k, 100l) entlang einer Umfangsrichtung von mindestens einem der Flansche (100f, 100g) ausgebildet ist.

6. Solenoidventil, das an der Harzabdeckung durch Inserttechnik angebracht ist, nach einem der Ansprüche 1 bis 5, bei dem das Durchgangsloch (100i, 100j) in einer radialen Richtung des Flansches (100f, 100g) nach außen offen ist.

7. Solenoidventil, das an der Harzabdeckung durch Insert-Technik angebracht ist, nach einem der Ansprüche 1 bis 6, bei dem das Durchgangsloch (100h) im Querschnitt eine ovale Form aufweist.

8. Solenoidventil, das an der Harzabdeckung durch Inserttechnik angebracht ist, nach einem der Ansprüche 1 bis 7, bei dem das Durchgangsloch (100k) im Querschnitt eine Kreisform aufweist.

9. Solenoidventil, das an der Harzabdeckung durch Inserttechnik angebracht ist, nach einem der Ansprüche 1 bis 8, bei dem das Durchgangsloch (100l) im Querschnitt eine Polygonform aufweist.

Revendications

1. Vanne à solénoïde attachée à un couvercle en résine par un moulage d'insert, la vanne à solénoïde comprenant:

un manchon (110) présentant une forme cylindrique et au moins deux passages de fluide (110a, 110b, 110c, 110d, 110e);
une bobine (12) logée dans le manchon (110) et pouvant coulisser dans celui-ci dans une direction axiale par rapport au manchon (110); et un solénoïde (13) pour actionner la bobine (12), dans laquelle un corps de vanne (100) est prévu sur une surface périphérique extérieure du manchon (110) et comprend une pluralité de passages de fluide (100a, 100b, 100c, 100d) qui sont en communication fluidique avec les passages de fluide (110a, 110b, 110c, 110d, 110e) du manchon (110), une pluralité de brides (100f, 100g) sont prévues sur une surface périphérique extérieure du corps de vanne (100) et sont agencées le long d'une direction axiale par rapport au corps de vanne (100) et au moins l'une des brides (100f) comporte un trou traversant (100h, 100i, 100j, 100k, 100l) formé dans la direction axiale par rapport au corps de vanne (100), dans laquelle ladite au moins une bride (100f) dans laquelle le trou traversant (100h) est prévu fait saillie vers l'extérieur dans une direction radiale du corps de vanne (100) plus loin que la bride (100g) dépourvue du trou traversant (100h) ne fait saillie vers l'extérieur dans la direction radiale du corps de vanne (100), dans

laquelle des brides (100f) comportant des trous traversants (100h, 100i, 100j, 100k, 100l) et des brides (100g) dépourvues du trou traversant (100h) de la pluralité de brides (100f, 100g) sont agencées de façon alternée dans la direction axiale du corps de vanne (100).

2. Vanne à solénoïde attachée à un couvercle en résine par un moulage d'insert selon la revendication 1, dans laquelle un matériau du manchon (110) et un matériau du corps de vanne (100) présentent des coefficients de dilatation thermique sensiblement identiques.

3. Vanne à solénoïde attachée à un couvercle en résine par un moulage d'insert selon la revendication 1 ou 2, dans laquelle le couvercle en résine renferme et supporte au moins les brides (100f, 100g) du corps de vanne (100).

4. Vanne à solénoïde attachée à un couvercle en résine par un moulage d'insert selon l'une quelconque des revendications 1 à 3, dans laquelle un diamètre extérieur de ladite au moins une des brides (100f, 100g) est plus grand qu'un diamètre extérieur des autres brides (100f, 100g).

5. Vanne à solénoïde attachée à un couvercle en résine par un moulage d'insert selon l'une quelconque des revendications 1 à 4, dans laquelle la pluralité de trous traversants (100h, 100i, 100j, 100k, 100l) sont formés le long d'une direction circonférentielle de ladite au moins une des brides (100f, 100g).

6. Vanne à solénoïde attachée à un couvercle en résine par un moulage d'insert selon l'une quelconque des revendications 1 à 5, dans laquelle le trou traversant (100i, 100j) est ouvert vers l'extérieur dans une direction radiale de la bride (100f, 100g).

7. Vanne à solénoïde attachée à un couvercle en résine par un moulage d'insert selon l'une quelconque des revendications 1 à 6, dans laquelle le trou traversant (100h) présente une section transversale de forme ovale.

8. Vanne à solénoïde attachée à un couvercle en résine par un moulage d'insert selon l'une quelconque des revendications 1 à 7, dans laquelle le trou traversant (100k) présente une section transversale de forme circulaire.

9. Vanne à solénoïde attachée à un couvercle en résine par un moulage d'insert selon l'une quelconque des revendications 1 à 8, dans laquelle le trou traversant (100l) présente une section transversale de forme polygonale.

FIG. 1

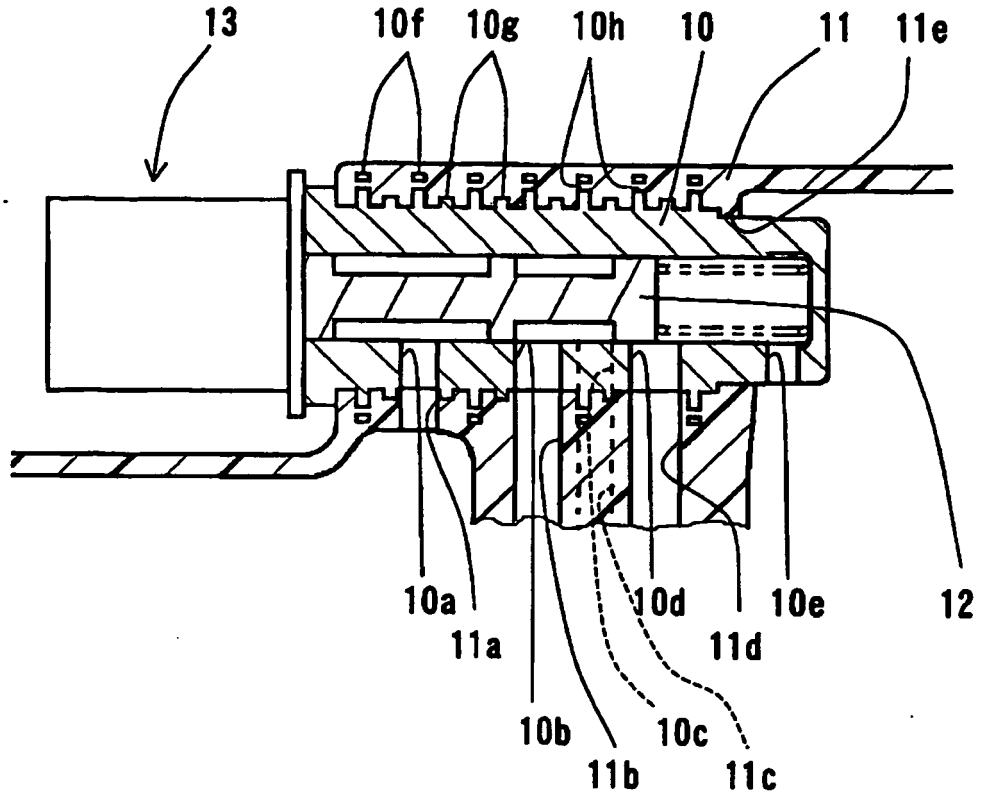

13
10f
10g
10h
10
11
11e
10a
11a
10b
11b
10c
11c
10d
11d
10e
12

FIG. 2

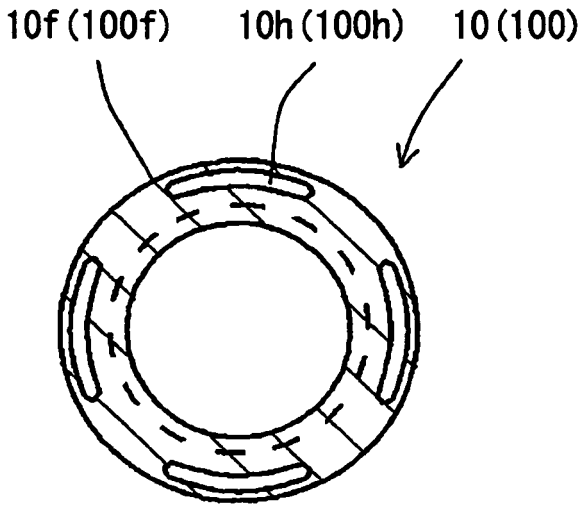

10f (100f)
10h (100h)
10 (100)

FIG. 3

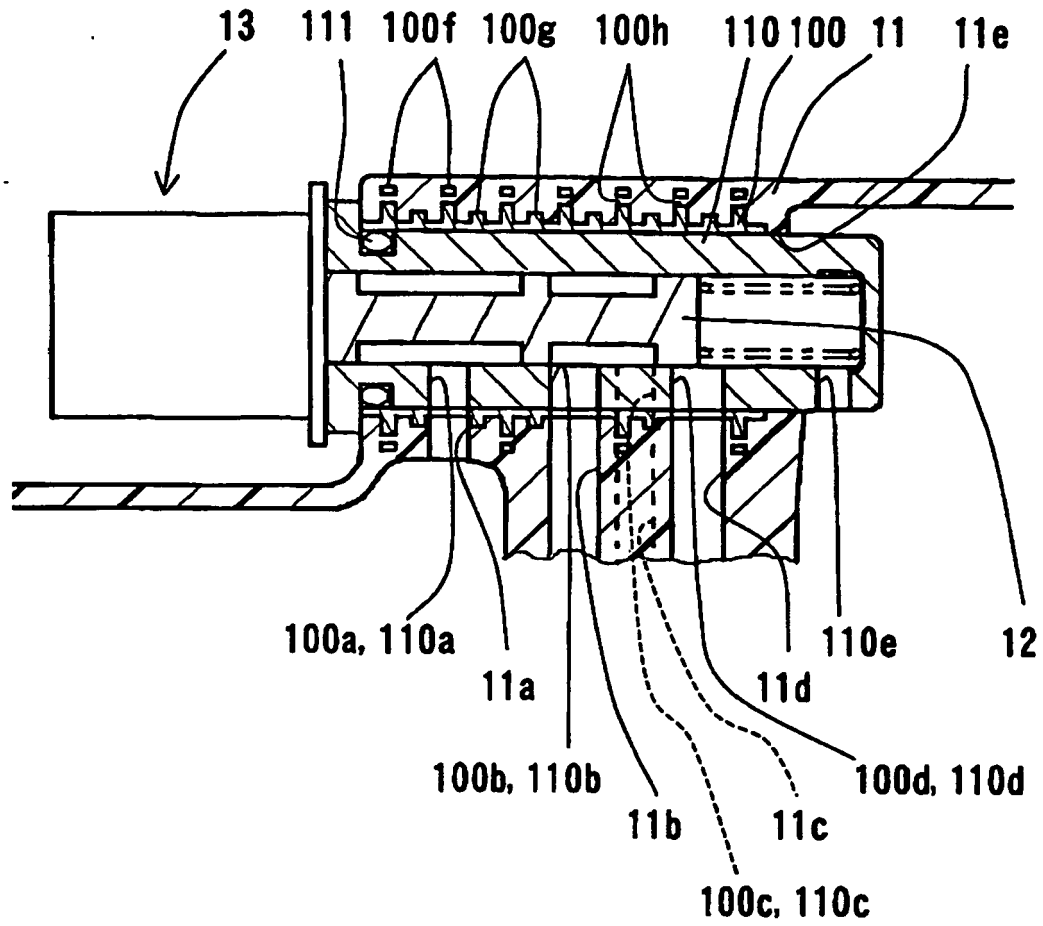

13
111
100f
100g
100h
110
100
11
11e
100a, 110a
11a
100b, 110b
11b
100c, 110c
11c
11d
100d, 110d
110e
12

FIG. 4

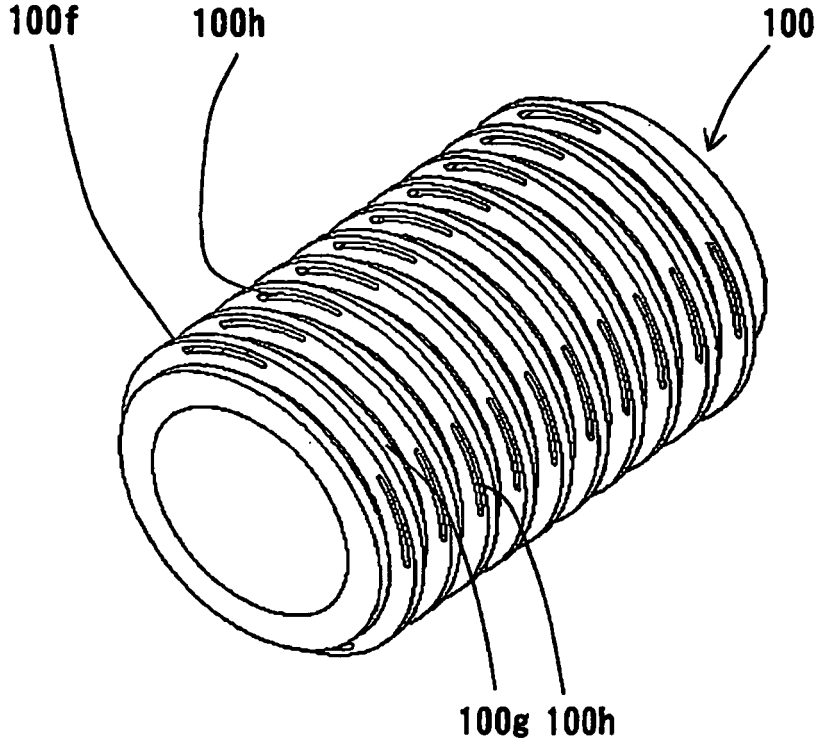


FIG. 5

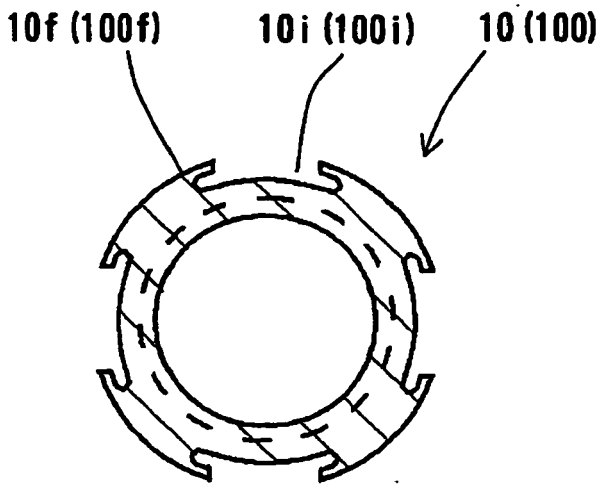


FIG. 6

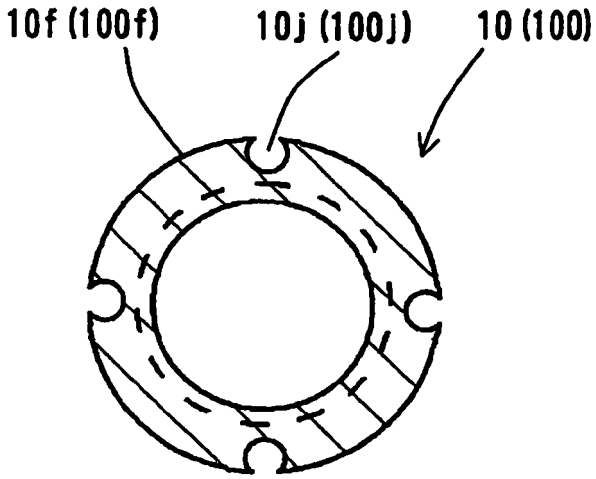


FIG. 7

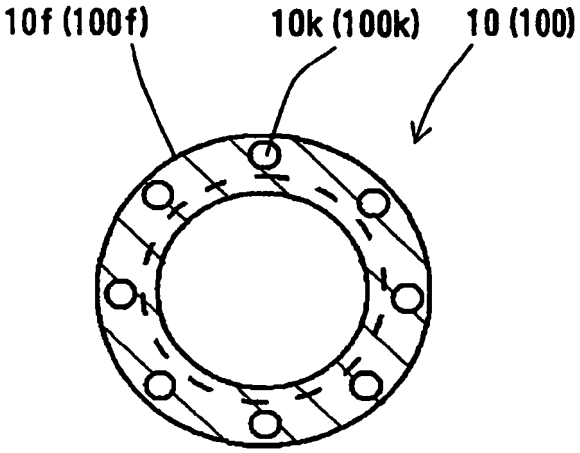
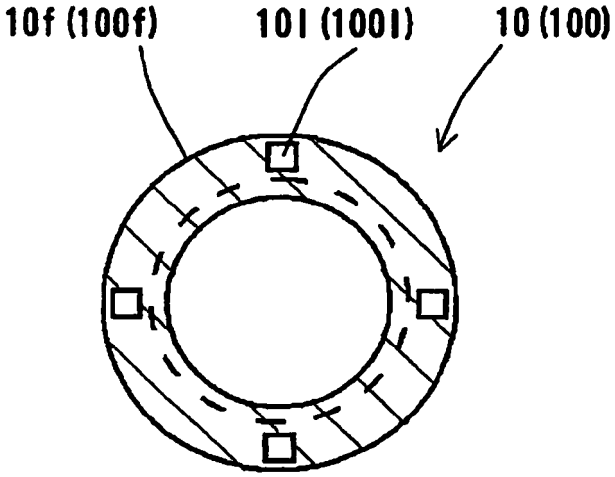


FIG. 8



REFERENCES CITED IN THE DESCRIPTION

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