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(54) **FLOW ADJUSTMENT ARRANGEMENT FOR A BUCHHOLZ RELAY**

DURCHFLUSSEINSTELLUNGSANLAGE FÜR EIN BUCHHOLZ RELAIS

AGENCEMENT D'AJUSTEMENT D'ÉCOULEMENT POUR UN RELAIS DE BUCHHOLZ

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Description

[0001] The present invention refers to a Buchholz relay for the protection of oil insulated power electrical equipments, such as power transformers. Well-known, an oil insulated power electrical equipment, such as an insulating oil bath transformer, includes a Buchholz relay, an electrical device which operates when in the transformer there is an abnormal evolution of gas, usually sign of a serious failure, or when there are relevant oil currents.

[0002] The presence of gas and/or relevant oil currents inside an oil insulated transformer is always synonymous of a malfunction.

[0003] In some cases, the gas comes from the outside and is put in the transformer through the circulation pumps; in other cases, the gas is produced by the decomposition of the insulators, liquid or solid, caused by overheating or by the appearance of electrical arcs.

[0004] Similarly, the presence of high oil currents is certainly caused by serious failures, to which excessive production of gas is accompanied, or, in other cases, by the presence of short circuits or leaks in the external envelope of the transformer. The Buchholz relay is applied at the highest part of the transformer and below the container or expansion tank, commonly called "conservator".

[0005] In some cases it is convenient tilting appropriately the connection pipe between the transformer and the conservator so that the Buchholz relay takes the highest position on the transformer itself.

[0006] In condition of normal operation, in addition, the Buchholz relay is filled with oil.

[0007] The Buchholz relay generally includes an outer casing, obtained by aluminium alloy casting, in which there is a frame for supporting a mobile device which comprises an upper float upper and a lower float both suitable to operate appropriate magnetic switches.

[0008] In particular, the upper float enables or disables, by means of the respective switch, an alarm circuit alarm while the lower float drives, in an equivalent manner, a shutdown circuit of the functioning of the transformer.

[0009] The gas which is formed at the inside of the transformer tends to flow upwardly and accumulates inside the Buchholz relay causing a lowering of the level of the oil present therein.

[0010] Such a lowering of the level of the oil is firstly detected by the upper float, which so drives the alarm circuit, and subsequently, if the accumulation of gas continues becoming relevant, by the lower float directly connected to the shutdown circuit of the transformer from the supply line.

[0011] In order to detect the presence of high oil currents, the Buchholz relay makes use, instead, of a regulation valve properly calibrated, oil discharge sensor and also connected to the shutdown circuit of the transformer from the supply.

[0012] The regulation valve consists of a shaped body which, when it is directly invested by relevant oil currents, with a value exceeding a prearranged threshold, rotates

with respect to its own axis causing the intervention of the magnetic switch of the shutdown circuit.

[0013] To reopen the contact, it is sufficient that the oil current falls below the preset value of intervention. The aforesaid prearranged threshold is set by specific rules on the matter but very often is fixed by the same user, so that the manufacturer of the relay under consideration must necessarily diversify its production according to the calibration needs of the valve.

[0014] It is stated precisely that the maximum sensitivity of intervention of the shutdown circuit corresponds to a minimum prearranged threshold of the oil discharge, whether volumetric or massive, which invests the regulation valve.

[0015] Some known types of Buchholz relay provide to modify the calibration of the regulation valve by adding or removing proper counterweights applied to the bottom. In other cases of known type, the calibration of the regulation valve occurs by moving the same along appropriate guides or, more, by using fastening screws in order to choke the surface of the valve which is affected by oil flow.

[0016] There are currently on the market Buchholz relay of more recent conceiving which provide to vary the sensitivity of intervention of the shutdown circuit of the transformer, that is the prearranged threshold of the oil discharge to which the valve rotates, through the provision on a flat laminar fin of the shaped body of the valve of one or more sections which can be broken, definitively removable by the user depending on the set operative needs of the transformer.

[0017] Therefore, if the user wishes to obtain the maximum sensitivity of intervention of the regulation valve, he keeps it in the original state, as provided by the manufacturer, while, if she wants to reduce the sensitivity of intervention of the valve itself, increasing the allowable oil discharge, he removes a convenient number of sections which can be broken.

[0018] This allows the manufacturer to standardize its production of the Buchholz relay leaving to the end user the possibility of choice on the prearrange threshold of intervention of the shutdown circuit in case of oil flow of high value.

[0019] However, the Buchholz relay as so far conceived do not to allow to exceed a certain limit for the aforementioned prearranged threshold to which the regulation valve operates and, consequently, the shutdown circuit of the transformer.

[0020] Such a limit for the oil discharge allowed by the Buchholz relay of the known type corresponds to a value of the oil speed of approximately 2 m/s.

[0021] This factor constitutes a drawback in this field at issue if it is considered that customers increasingly requires to raise the threshold of intervention of the shutdown circuit of the transformer, bringing it to values corresponding to speed fluid of 2,5-3 m/s, reducing, conversely, the sensitivity of intervention of the regulation valve.

[0022] The present invention aims to overcome the drawback of the known technique, as described in EP 09 44150 and WO 93/01606, just mentioned.

[0023] In particular, the main aim of the invention is to provide a Buchholz relay for the protection of oil insulated power electrical equipments which allows to increase the threshold of intervention of the regulation and, hence, of the shutdown circuit of the transformer in case of significant oil flow.

[0024] It is a second aim of the present invention to make a Buchholz relay which still keeps a simple construction.

[0025] The aforesaid aims are achieved by a Buchholz relay for the protection of oil insulated power electrical equipments in accordance with the attached claim 1, to which they refer for the sake of brevity.

[0026] Other technical features of detail of the Buchholz relay of the invention are highlighted in the corresponding dependent claims.

[0027] Advantageously, the Buchholz relay according to the invention allows to reduce with respect to the prior art the sensitivity of intervention of the regulation valve when invested by oil flows of a certain consistency for the circle at issue.

[0028] Still advantageously, the Buchholz relay is attractive to the customers since it is capable of meeting a higher number of operating conditions compared to equivalent relays of the known type. Further specificities and peculiarities of the invention will be more evident from the description that follows, relative to a preferred embodiment, given by illustrative but not limiting way of example with reference to the attached drawings where:

- figure 1 is a perspective view of the Buchholz relay according to the invention;
- figure 2 is an enlarged perspective view of a particular of figure 1.

[0029] The Buchholz relay for the protection of oil insulated power electrical equipments, such as transformers, is illustrated in figure where it is generally indicated with 1.

[0030] In particular, the Buchholz relay 1 according to the invention is integrated between the transformer, not shown, and an expansion tank, or conservator, also not represented.

[0031] As it can be noted, the Buchholz relay 1 includes:

- a support frame 2, by way of preference made of plastic material, which is in direct contact with the oil;
- drive means, as a whole reported with 3, coupled to the support frame 2 relative to which they are mobile;
- switching means, as a whole marked with 4, operatively connected to the drive means 3, intended to enable/disable an alarm circuit and/or a shutdown circuit of the electrical equipment, not shown;
- a regulation valve of the oil flow F, overall numbered

with 5, coupled to the support frame 2, suitable to be affected by the oil flow F in order to define a first position in which it disables the shutdown circuit of the electrical equipment and a second position in which, if the oil discharge exceeds a certain threshold, it enables

the shutdown circuit of said electrical equipment. In accordance with the invention, the Buchholz relay includes contrast means, as a whole numbered with 6, associated both to the support frame 2 and to the regulation valve 5 to keep it in the aforesaid first position when affected by the oil flow F until the oil discharge does not exceed the certain threshold. The Buchholz relay 1 also comprises an outer casing 7, which defines an internal chamber 23 which contains oil and the support frame 2, fixed to the outer casing 7, as custom in the equivalent relays of the known type.

[0032] The outer casing 7 is of the type in itself known and is preferably obtained by means of aluminium alloy casting at tightness test.

[0033] In addition, the outer casing 7 of the Buchholz relay 1 is provided with the traditional lid 8 from which a cock for the exhaust of the gas departs and pneumatic test valve, both not indicated by a reference number, as well as a member for mechanical test 9.

[0034] Moreover, the outer casing 7 has a plug, not shown, for the discharge of oil.

[0035] Figure 2 shows that, preferably, the contrast means 6 include a first ferromagnetic element 10, applied to the regulation valve 5, and a second ferromagnetic element 11, facing the first ferromagnetic element 10, associated with the support frame 2 through a reference sheet 12.

[0036] The reference sheet 12 is connected through fastening means, as a whole marked with 13, to the free end 2a of the support frame 2.

[0037] In this case, the reference sheet 12 presents in plan view a substantially C-shaped profile, while in cross section a rectangular profile.

[0038] The reference sheet 12 is also made of metallic material, preferably but not necessarily brass. According to the preferred embodiment here described of the invention, the first ferromagnetic element 10 is permanently inserted into a shaped housing 14 obtained in the side surface 15a of a laminar fin 15 belonging to the regulation valve 5 and has a stretch of one of its lateral sides faces visible outside. More in detail, the first ferromagnetic element 10 is in this case snap inserted into the shaped housing 14, while remaining understood that in other constructive solutions of the invention it can be coupled by generic junction means, for example adhesives substances.

[0039] The side surface 15a of the laminar fin 15 is frontally oriented towards the feed direction of the oil flow F, as highlighted in figure 1.

[0040] The second ferromagnetic element 11 is firmly coupled to the outer wall 16a of the a main portion 16 of

the reference sheet 12, from which protrudes for two sections placed next to the aforesaid stretch of the first ferromagnetic element 10.

[0041] At preferential but non binding title, the regulation valve 5 presents a hollow shape being defined by the laminar fin 15 and two shaped flanks 17, 18 one spaced apart and parallel to the other which depart from the side edges 15b, 15c of the laminar fin 15.

[0042] Each of the shaped flanks 17, 18 of the regulation valve 5 defines a plane orthogonal to the plan defined by the laminar fin 15.

[0043] Advantageously, the regulation valve 5 is provided with a cylindrical counterweight 19 inserted into a circular hole, not visible, made in the shaped flank 18 of the regulation valve 5.

[0044] In the specific case, the shaped flanks 17, 18 are made in a single body with the laminar fin 15: both the shaped flanks 17, 18 and the laminar fin 15 are made of plastic material.

[0045] As far as the drive means 3 are concerned, they are of the type in itself known in this kind of devices, including a top mobile float 20 and a bottom mobile float 21.

[0046] The switching means 4 are also of the type in itself known to the person skilled in the art and include magnetic switches, as that one indicated with 22 in figure 2, connected to the alarm circuit and the shutdown circuit of the transformer.

[0047] In practice, therefore, the top mobile float 20 and the bottom mobile float 21 act through the corresponding magnetic switches on the alarm circuit and the shutdown circuit of the transformer.

[0048] Other embodiments of the invention, not accompanied by drawings, may provide that the Buchholz relay includes one or more additional ferromagnetic elements, arranged in series, that is overlapped, with the first ferromagnetic element, with the purpose of increasing the resistance of the regulation valve to place itself in the second position and, thus, further decreasing the sensitivity of intervention of the regulation valve. In operating conditions, the Buchholz relay 1 provides that, in the presence of a sinking of the oil level for example due to the formation of gas which flows inside the outer casing 7, the top mobile float activates the magnetic switch 22 which in turn operates on the alarm circuit.

[0049] Any further sinking of the oil level due to an increase of the formation of gas in the transformer is detected by the bottom mobile float 21 which consequently causes the immediate closure of the shutdown circuit.

[0050] The Buchholz relay 1 is sensitive also to oil discharge higher than a prearranged threshold, fixed at will, even in reasonable limits, by the end user. Such anomalous oil discharges which start between the transformer and the conservator are often the result of a serious fault inside the transformer, such as a discharge between the windings, and their adverse effects must therefore be immediately blocked or severely limited.

[0051] If the oil flow exceeds the prearranged threshold

imposed with the calibration, the regulation valve 5 rotates with respect to the support frame 2 to directly operate the shutdown circuit of the transformer.

[0052] In any case, the regulation valve 5 of the Buchholz relay according to the invention, thanks to special contrast media 6 of which is provided with, provides greater resistance to the intervention of the shutdown circuit of the transformer.

[0053] The regulation valve 5, indeed, is able to stand oil currents whose speed is also 2,5-3 m/s, higher than those to which the Buchholz relays of the known type are calibrated, without rotating, thus not activating such shutdown circuit.

[0054] Consequently, through the relay of the invention it is possible to manage more efficiently temporary or irrelevant functioning anomalies of the transformer, avoiding the detachment of the latter from the supply line, as it happens, instead, in equivalent known technique.

[0055] In the view of the above, it is understood, therefore, that the Buchholz relay for the protection of oil insulated power electrical equipments reaches the aims and realizes the advantages mentioned above. In execution, changes can be made to the Buchholz relay for the protection of oil insulated power electrical equipments consisting, for example, in a support frame of different constructive conceiving.

[0056] In addition, other embodiments may exist in which the contrast means associated with the regulation valve and the support frame are of other type compared to that described above, which does not affect the advantage brought by this patent.

[0057] It is clear, finally, that many other variations can be made to the Buchholz relay in question, without for this reason going out of the novelty principles inherent of the idea inventive, as it is clear that, in the practical implementation of the invention, materials, shapes and sizes of the details could be any, depending on the needs, and could be replaced with others technically equivalent.

Claims

1. Buchholz relay (1) for the protection of oil insulated power electrical equipments including:

- a support frame (2) in contact with the oil;
- an outer casing (7) which defines an internal chamber (23) which contains said oil, said support frame (2) being fixed to said outer casing (7);
- drive means (3) coupled with said support frame (2) in respect of which they are mobile;
- switching means (4), operatively connected with said drive means (3) and suitable to enable/disable an alarm circuit and/or a shutdown circuit of said electrical equipment;
- at least one regulation valve (5) of the oil flow (F), coupled with said support frame (2), suitable to be affected by the oil flow (F) to define a first

position in which disables said shutdown circuit of said electrical equipment and a second position in which, if the oil flow exceeds a certain threshold, it enables said shutdown circuit of said electrical equipment,

wherein said Buchholz relay (1) includes contrast means (6) associated with said support frame (2) and with said valve (5) to keep the latter in said first position, said contrast means (6) including a first ferromagnetic element (10), applied to said regulation valve (5), and a second ferromagnetic element (11), facing said first ferromagnetic element (10), associated with said support frame (2) through a reference sheet (12), **characterized in that** said first ferromagnetic element (10) is firmly inserted into a shaped housing (14) made in the side surface (15a) of a laminar fin (15) belonging to said regulation valve (5) and presents at least one stretch of one of its side faces visible outside and **in that** said second ferromagnetic element (11) is firmly coupled to the outer wall (16a) of a main portion (16) of said reference sheet (12), from which protrudes for at least a section next to said stretch of said first ferromagnetic element (10).

2. Relay (1) as claimed in claim 1 **characterized in that** said reference sheet (12) is connected through fastening means (13) to the free end (12a) of said support frame (2).
3. Relay (1) as claimed in claim 1 **characterized in that** said reference sheet (12) presents a substantially C-shaped profile in top view and a rectangular profile in cross section.
4. Relay (1) as claimed in claim 1 **characterized in that** the reference sheet (12) is made of metallic material.
5. Relay (1) as claimed in claim 1 **characterized in that** said side surface (15a) of said laminar fin (15) is frontally oriented to the feed direction of said oil flow (F).
6. Relay (1) as claimed in claim 1 **characterized in that** said regulation valve (5) presents a hollow shape being defined by said laminar fin (14) and two shaped flanks (17, 18) spaced apart and parallel one each other which depart from the sides edges (15b, 15c) of said laminar fin (15).
7. Relay (1) as claimed in claim 6 **characterized in that** each of said shaped flanks (17, 18) of said regulation valve (5) defines a plane orthogonal to the plane defined by said laminar fin (15).
8. Relay (1) as claimed in claim 6 **characterized in**

that said regulation valve (5) is provided with a cylindrical counterweight (19) inserted into at least a circular hole made in at least one of said shaped flanks (17, 18) of said regulation valve (5).

9. Relay (1) as claimed in claim 6 **characterized in that** said shaped flanks (17, 18) are made in a single body with said laminar fin (15), said shaped flanks (17, 18) and said laminar fin (15) being formed of plastic material.
10. Relay (1) as claimed in claim 1 **characterized in that** it includes one or more additional ferromagnetic elements, arranged in series to said first ferromagnetic element (10), suitable to increase the strength of said regulation valve (5) to position itself in said second position.

20 Patentansprüche

1. Buchholz-Relais (1) zum Schutz von ölisolierten Leistungselektrikanlagen umfassend:
 - einen Tragrahmen (2), welcher in Kontakt mit dem Öl ist;
 - ein äußeres Gehäuse (7), welches einen inneren Raum (23) definiert, der das Öl enthält, wobei der Tragrahmen (2) an dem äußeren Gehäuse (7) befestigt ist;
 - Antriebsmittel (3), die mit dem Tragrahmen (2) verbunden sind, wobei diese hinsichtlich diesem beweglich sind,
 - Schaltmittel (4), die mit der Antriebseinrichtung (3) wirkmäßig verbunden sind und geeignet sind zum Aktivieren/Deaktivieren einer Alarmschaltung und/oder eines Abschaltstromkreises der elektrischen Anlage,
 - wenigstens ein Regelventil (5) für den Ölstrom (F), der mit dem Tragrahmen (2) verbunden ist, geeignet um durch den Ölstrom (F) beeinflusst zu werden um eine erste Position festzulegen, in welche der Abschaltstromkreis der elektrischen Anlage deaktiviert ist und um eine zweite Position festzulegen, in welche, wenn der Ölstrom eine bestimmte Schwelle überschreitet, es den Abschaltstromkreis der elektrischen Anlage aktiviert,

wobei das Buchholz-Relais (1) Gegenmittel (6) umfasst, die mit dem Tragrahmen (2) und mit dem Ventil (5) verbunden sind, um das letztere in der ersten Stellung zu halten, wobei die Gegenmittel (6) ein erstes ferromagnetisches Element (10) umfasst, dass auf das Regelventil (5) anwendbar ist, und ein zweites ferromagnetisches Element (11), welches dem ersten ferromagnetischen Element (10) gegenüber angeordnet ist, mit dem Tragrahmen (2) durch ein

Referenz-Blatt (12) anwendbar ist,

dadurch gekennzeichnet, dass

das erste ferromagnetische Element (10) fest in einem geformten Gehäuse (14) eingefügt ist, das in der Seitenfläche (15a) einer laminaren Rippe (15) hergestellt ist, die zum Regelventil (5) gehört, und dadurch dass das zweite ferromagnetische Element (11) fest mit der äußeren Wand (16a) des Hauptabschnitts (16) des Referenzblattes (12) verbunden ist, von dem zumindest ein Abschnitt neben der Ausdehnung des ersten ferromagnetischen Elements (10) herausragt.

2. Relais (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** das Referenzblatt (12) durch Befestigungsmittel (13) mit dem freien Ende (12a) des Tragrahmens (2) verbunden ist.
3. Relais (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** das Referenzblatt (12) ein im Wesentliches C-förmiges Profil in der Draufsicht und ein rechteckiges Profil im Querschnitt aufweist.
4. Relais (1) nach ein Anspruch 1, **dadurch gekennzeichnet, dass** das Referenzblatt (12) aus metallischem Material hergestellt ist.
5. Relais (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** die Seitenfläche (15a) der laminaren Rippe (15) frontal zur Vorschubrichtung des Ölstroms (F) ausgerichtet ist.
6. Relais (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** das Regelventil (5) eine hohle Form aufweist, die festgelegt ist durch die laminare Rippe (14) und zwei geformten Seitenflächen (17, 18), die voneinander und parallel zueinander beabstandet sind von den Seitenränder (15b, 15c) der laminaren Rippe (15).
7. Relais (1) nach Anspruch 6, **dadurch gekennzeichnet, dass** jede der geformten Seitenflächen (17, 18) des Regelventils (5) eine Ebene festlegt, die senkrecht zu der von der laminaren Rippe (15) festgelegten Ebene ist.
8. Relais (1) nach Anspruch 6, **dadurch gekennzeichnet, dass** das Regelventil (5) mit einem zylindrischen Gegengewicht (19) ausgestattet ist, das in wenigstens einem kreisförmigen Loch einfügbar ist, welches in mindestens einer der geformten Seitenflächen (17, 18) des Regelventils (5) eingeführt ist.
9. Relais (1) nach Anspruch 6), **dadurch gekennzeichnet dass** die geformten Seitenflächen (17, 18) in einem einzigen Körper mit der laminaren Rippe (15) hergestellt sind, wobei die geformten Seitenflächen (17, 18) und die laminare Rippe (15) aus Kunst-

stoff geformt sind.

10. Relais nach einem der Anspruch 1, **dadurch gekennzeichnet, dass** es eine oder mehrere zusätzliche ferromagnetische Elemente umfasst, die in Reihe zu dem ersten ferromagnetischen Element angeordnet sind, wobei dieses geeignet ist um die Stärke des Regelventils (5) zu erhöhen um sich selbst in der zweiten Position zu positionieren.

Revendications

1. Relais de Buchholz (1) pour la protection d'équipements électriques de puissance isolés par huile, comprenant :

- un cadre support (2) en contact avec l'huile;
- un carter extérieur (7) qui définit une chambre interne (23) contenant ladite huile, ledit cadre support (2) étant fixé audit carter extérieur (7);
- des moyens d'entraînement (3) couplés audit cadre support (2) et mobiles par rapport à celui-ci;
- des moyens de commutation (4) reliés de manière fonctionnelle auxdits moyens d'entraînement (3) et aptes à activer/désactiver un circuit d'alarme et/ou un circuit d'arrêt dudit équipement électrique;
- au moins une vanne de régulation (5) de l'écoulement d'huile (F), couplée audit cadre support (2), apte à être affectée par l'écoulement d'huile (F) pour définir une première position dans laquelle elle désactive ledit circuit d'arrêt dudit équipement électrique et une seconde position dans laquelle, si l'écoulement d'huile dépasse un certain seuil, elle active ledit circuit d'arrêt dudit équipement électrique,

ledit relais Buchholz (1) comprenant des moyens de contraste (6) associés audit cadre support (2) et à ladite vanne (5) pour maintenir cette dernière dans ladite première position, lesdits moyens de contraste (6) comprenant un premier élément ferromagnétique (10), appliqué à ladite vanne de régulation (5), et un second élément ferromagnétique (11), situé en regard dudit premier élément ferromagnétique (10), associé audit cadre support (2) par l'intermédiaire d'une tôle de référence (12), **caractérisé en ce que** ledit premier élément ferromagnétique (10) est solidement inséré dans un logement profilé (14) réalisé dans la surface latérale (15a) d'une ailette laminaire (15) appartenant à ladite vanne de régulation (5), et présente au moins une étendue de l'une de ses faces latérales visible à l'extérieur, et **en ce que** ledit second élément ferromagnétique (11) est solidement couplé à la paroi extérieure (16a) d'une partie principale (16) de ladite tôle de référence (12), de la-

quelle il fait saillie pour au moins une section située à proximité de ladite étendue dudit premier élément ferromagnétique (10).

2. Relais (1) selon la revendication 1), **caractérisé en ce que** ladite tôle de référence (12) est reliée, par l'intermédiaire de moyens de fixation (13), à l'extrémité libre (12a) dudit cadre support (2). 5
3. Relais (1) selon la revendication 1), **caractérisé en ce que** ladite tôle de référence (12) présente, vue de dessus, un profil sensiblement en forme de C et, en coupe transversale, un profil rectangulaire. 10
4. Relais (1) selon la revendication 1), **caractérisé en ce que** la tôle de référence (12) est réalisée en matériau métallique. 15
5. Relais (1) selon la revendication 1), **caractérisé en ce que** ladite surface latérale (15a) de ladite ailette laminaire (15) est frontalement orientée dans la direction d'alimentation dudit écoulement d'huile (F). 20
6. Relais (1) selon la revendication 1), **caractérisé en ce que** ladite vanne régulation (5) présente une forme creuse définie par ladite ailette laminaire (14) et deux flancs profilés (17, 18) espacés l'un de l'autre et parallèles entre eux, qui partent des bords latéraux (15b, 15c) de ladite ailette laminaire (15). 25
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7. Relais (1) selon la revendication 6), **caractérisé en ce que** chacun desdits flancs profilés (17, 18) de ladite vanne de régulation (5) définit un plan orthogonal au plan défini par ladite ailette laminaire (15). 35
8. Relais (1) selon la revendication 6), **caractérisé en ce que** ladite vanne de régulation (5) est pourvue d'un contrepoids cylindrique (19) inséré dans au moins un trou circulaire réalisé dans au moins l'un desdits flancs profilés (17, 18) de ladite vanne de régulation (5). 40
9. Relais (1) selon la revendication 6), **caractérisé en ce que** lesdits flancs profilés (17, 18) sont réalisés d'une seule pièce avec ladite ailette laminaire (15), lesdits flancs profilés (17, 18) et ladite ailette laminaire (15) étant en matière plastique. 45
10. Relais (1) selon la revendication 1), **caractérisé en ce qu'il** inclut un ou plusieurs éléments ferromagnétiques additionnels, disposés en série avec ledit élément ferromagnétique (10), qui sont aptes à augmenter la résistance de ladite vanne de régulation (5) pour son positionnement dans ladite seconde position. 50
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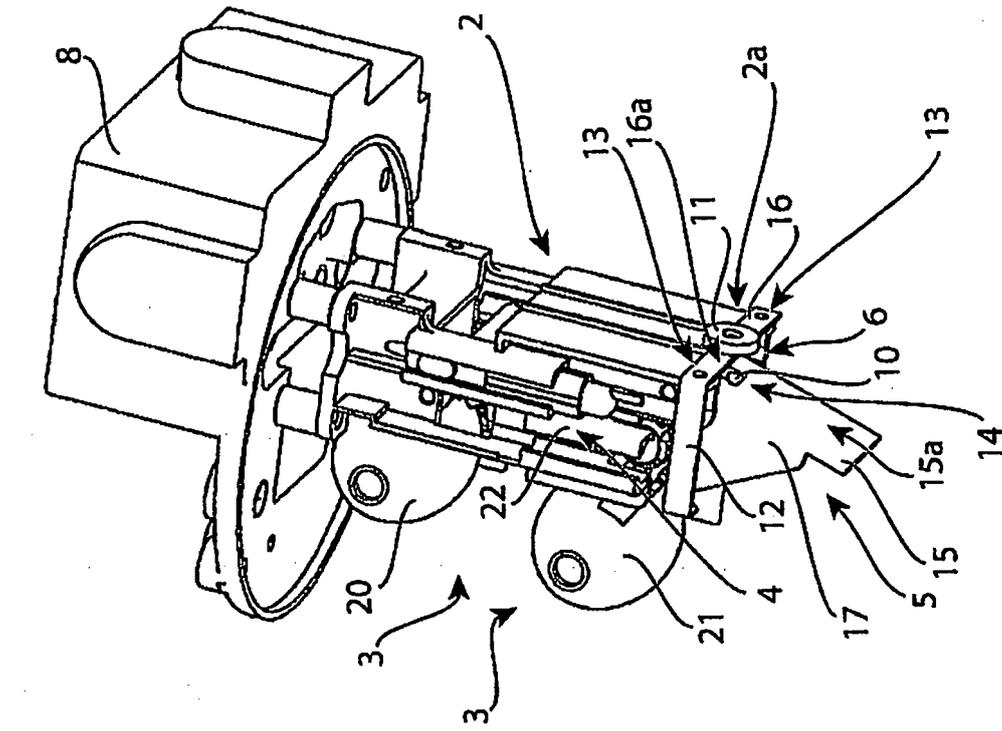


Fig. 1

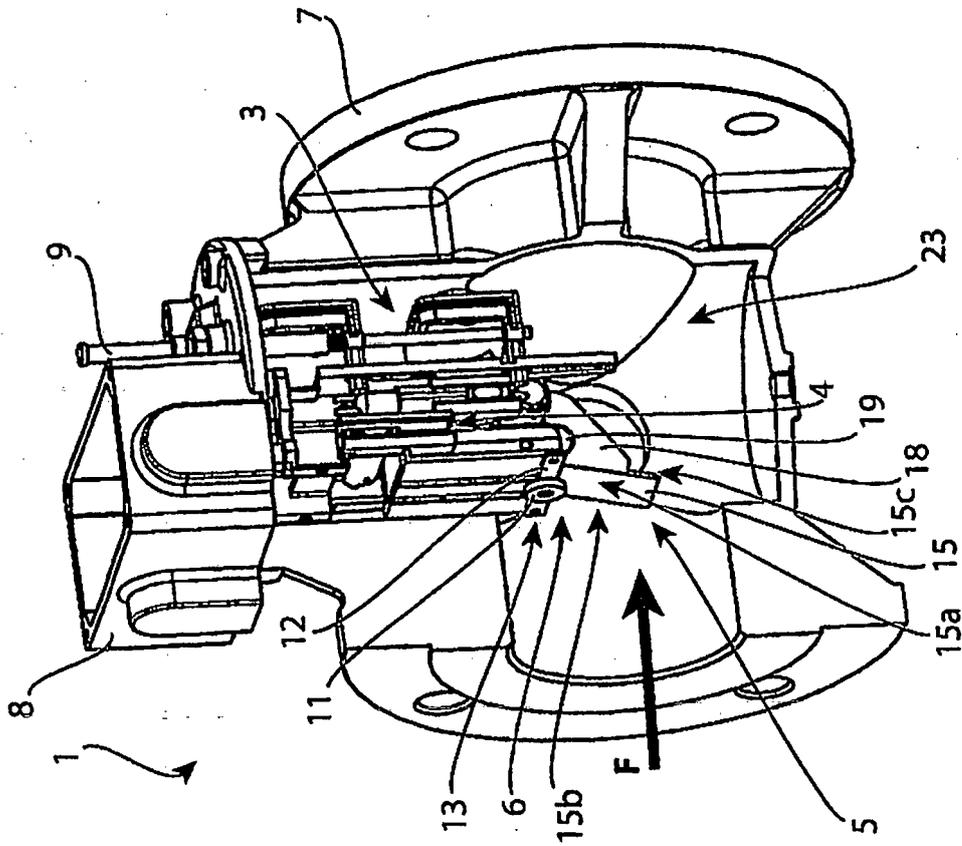


Fig. 2

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 0944150 A [0022]
- WO 9301606 A [0022]