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(54) **Improved gas-accumulation Buchholz relay**

Verbessertes Gasspeicherbuchholzrelais

Relais de Buchholz d'accumulation de gaz amélioré

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(56) References cited:
BE-A- 678 625 **FR-A- 1 012 247**
US-A- 5 426 271

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Description

[0001] The present invention relates to an improved gas-accumulation Buchholz relay.

[0002] It is well-known that in oil-immersed transformers it is necessary to install relays of this type so that they detect and signal both the presence and the generation of gas.

[0003] The presence of gas in a transformer is in fact always associated with a malfunction, because the gas either originates from the outside through circulation pumps or is produced by the decomposition of the liquid or solid insulators inside the transformer.

[0004] This decomposition of the insulators is caused by their overheating or by the onset of electric arcs.

[0005] The Buchholz relay must be installed in the transformer below the expansion vessel, commonly known as conservator, and is filled with oil during normal operation.

[0006] Constructively, this type of relay is constituted by a body which is obtained from aluminium alloy castings inside which a supporting frame for at least one movable device is arranged; the movable device comprises a float for actuating at least one magnetic switch of a per se known type enclosed in a bulb.

[0007] Actually, Buchholz relays are usually provided with an upper float which enables and disables an alarm circuit and with a lower float which is directly connected to a disconnection circuit.

[0008] If gas forms inside the transformer, it tends to escape upward, flowing toward the expansion vessel and thus gradually accumulating inside the relay.

[0009] This accumulation of gas inside the body of the relay causes a lowering of the level of the oil that is detected by the upper float, which accordingly actuates the magnetic switch with which it is associated and by means of which the alarm circuit is closed.

[0010] If the accumulation of gas continues, inside the relay the level of the oil undergoes a further drop which is detected by the lower float, which is directly connected to the circuit for disconnection of the transformer from the power supply line.

[0011] Moreover, Buchholz relays all have a further protection which is capable of detecting strong oil currents generated, for example, by short-circuits.

[0012] This protection is constituted by a suitably adjusted flap which is sensitive to the flow-rate of the oil current and is also connected to the circuit for disconnecting the transformer from the power supply.

[0013] This type of relay is also used to signal any leaks of oil from the tank of the transformer, because in this case also the general level of the oil lowers and accordingly the floats move downward.

[0014] This lowering of the floats determines the activation of the external alarm and/or disconnection circuits connected thereto.

[0015] A Buchholz relay of this type having all the features of the preamble of claim 1 is known for example

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[0016] Furthermore, it is extremely important that the relays be capable of operating correctly in the presence of vibrations caused by seismic activity.

5 [0017] For this reason, all Buchholz relays are subjected, before being marketed, to experimental tests during which they are arranged on a table shaker and, by means of a suitable tool, the test operator records the accelerations with which the alarm and disconnection circuits are closed; these accelerations are higher than the values set by standards and/or by the specifications of the users of the relays.

10 [0018] However, unfortunately during the starting of the transformer the relay is commonly affected by an impact due to handling operations and, due to the vibrations generated by this impact, the floats improperly close the alarm and/or disconnection circuit.

15 [0019] It is evident that this causes an enormous and useless waste of time for starting over with the maneuvers for starting the transformer.

20 [0020] The aim of the present invention is to provide a Buchholz relay which is sensitive to variations in the level of the oil and insensitive to the occurrence of vibrations due to seismic activities or maneuvers for starting the transformer, adequately acting on the alarm and/or disconnection circuits.

25 [0021] Within the scope of this aim, an important object of the present invention is to provide a Buchholz relay which ensures good characteristics in terms of assured intervention.

30 [0022] Another important object is to provide a Buchholz relay whose configuration is simpler than that of conventional types.

35 [0023] Another object of the present invention is to provide a Buchholz relay whose assembly and maintenance are simpler and quicker to perform with respect to conventional relays.

40 [0024] This aim, these objects and others which will become apparent hereinafter are achieved by a gas-accumulation Buchholz relay, which comprises, to be immersed in an oil bath, a supporting frame for magnetic switches for closing circuits and at least one movable device of the float type for actuating said switches, characterized in that said float is of the lever type with a rotation axis which is fixed to said frame and is operatively connected to a magnet holder which acts as a counterweight, said float being articulated in its rotation with respect to said magnet holder through a given angle.

45 [0025] Further characteristics and advantages of the present invention will become apparent from the following detailed description of a preferred embodiment, illustrated by way of non-limitative example in the accompanying drawings, wherein:

55 Figure 1 is a partially sectional view of a transformer provided with a Buchholz relay according to the present invention;

Figure 2 is a front view of a Buchholz relay according

to the invention;

Figure 3 is a perspective view of the internal mechanism of the relay of Figure 2;

Figure 4 is a perspective exploded view of the mechanism shown in Figure 3;

Figure 5 is a perspective view of the details of the mechanism of the relay of Figure 2;

Figure 6 is a perspective exploded view of the details shown in Figure 5.

[0026] With reference to the above figures, an oil-filled transformer is generally designated by the reference numeral 10 and has a tank with radiators 11 above which an expansion vessel 12 of a per se known type is connected.

[0027] The transformer 10 is conventional and Figure 1 illustrates high-voltage insulators 13, an oil drain 14 and a thermometer 15 for detecting the temperature of the oil.

[0028] The transformer 10 is provided with a Buchholz relay, according to the invention, which is generally designated by the reference numeral 16 and is integrated between the transformer and the expansion vessel 12.

[0029] The relay 16 is constituted by a body 17 which is preferably hermetic and made of cast aluminum alloy and in which inspection ports 18 are defined, preferably made of tempered glass or very sturdy plastics, provided with graduated scales 19.

[0030] In the upper part, the relay 16 is provided with a cover 20 from which a cock 21 for discharging the gas and a pneumatic test valve 22 protrude.

[0031] The frame 23 is arranged inside the relay 16, is made of plastics, and is provided, in an upward region, with through holes 24 for engagement with the cover 20 by way of fixing screws which are not shown in the above figures for the sake of simplicity.

[0032] The frame 23 has, in this configuration, a mainly longitudinal structure which includes two uprights 25 in which there are seats 26 for accommodating magnetic switches 27.

[0033] Each one of said switches 27 is conventional and has, inside a bulb, a magnet and electric contacts, not shown in the figures, which are directly connected to an alarm circuit and/or to a disconnection circuit.

[0034] An upper movable device 28 and an equivalent lower movable device 29 are fixed to the frame 23.

[0035] Each one of the movable devices 28 and 29 comprises a float 30 of the lever type, which has a substantially ovoid structure in which there are flat regions 31 and from which an arm 32 protrudes starting from a longitudinal band of the float 30.

[0036] First and second elastic curved wings 34a and 34b protrude from said arm 32 and define, as a whole, a semitubular profile 33.

[0037] In particular, the first wing 34a is shorter than the second wing 34b, so as to form, together with the second wing and at each end, a seat 35 which covers a reduced angle in cross-section.

[0038] A pivot 36 is inserted in the semitubular profile 33 and is appropriately shaped complementarily to the wings 34a and 34b.

[0039] A radial extension 36a protrudes at each end from said pivot 36, which constitutes the rotation axis for the float 30; a magnet holder 37 is associated with the radial extension, parallel to the pivot 36, has a substantially tubular configuration and is provided, at its two ends, with elastic teeth 38.

[0040] Pivot 36 is adapted to be inserted in the semitubular profile 33 between the wings 34a and 34b, so that each extension 36a is arranged at the seat 35.

[0041] A counterweight 39 can be inserted in the magnet holder 37 and has a cylindrical structure; said counterweight is to be arranged in a central position and in contact, at its two ends, with a first magnet and a second magnet which are respectively designated by the reference numerals 40 and 41 and preferably have a tablet-like structure.

[0042] The counterweight 39 is preferably made of brass.

[0043] The first and second magnets 40 and 41 and said counterweight 39 are retained in the magnet holder 37 by way of the snap-on retention provided by the teeth 38 and optionally by way of the presence of a suitable adhesive.

[0044] First and second guides 42 and 43 are provided in the uprights 25 of the frame 23, respectively in the upper and median parts of the frame 23; the complementarily shaped ends of the pivot 36 of each one of the upper and lower movable devices 28 and 29 can slide along said guides.

[0045] Each one of the guides 42 and 43 has, in the innermost end portion of its extension, a seat 44 adapted to accommodate the end of the pivot 36 of each one of the movable devices 28 and 29.

[0046] The movable devices are therefore assembled to the frame 23 by snap action after moving along the guides 42 or 43 with the ends of the pivot 36 for insertion and consequent locking in the seats 44.

[0047] The Buchholz relay 16 is also provided with a rod-like element 45 which is associated with one of the uprights 25 of the frame 23 and whose upper end is accessible to a user by way of an adapted spring-loaded push-button, which is not shown in the above-cited figures for the sake of simplicity.

[0048] An upper lever 46 and a lower lever 47 are associated with the rod-like element 45; each lever is L-shaped and has, at its engagement end, a tab 48 which is monolithic with a ring 49 inside which said rod-like element 45 is inserted substantially without play.

[0049] Each lever 46 and 47 can slide along the rod-like element 45 along the path determined respectively by an upper guide 50 and by a lower guide 51, both of which are formed in the upright 25; the tabs 48 of the levers 46 and 47 move along the guides.

[0050] The levers are required by the relay 16 respectively to mechanically test the alarm circuit, which is as-

sociated with the upper movable device 28, and the disconnection circuit, which is associated with the lower movable device 29.

[0051] By actuating the rod-like element 45, with which said two levers 46 and 47 are associated, it is in fact possible to push down the floats 30 in order to mechanically check the closure of the alarm and disconnection circuits.

[0052] Relay 16 also has a flap 52, of a per se known type, which is associated with the frame 23 below the lower movable device 29 and is adapted to detect any presence of strong oil currents inside the relay 16.

[0053] The operation of the Buchholz relay 16 described with the present invention is extremely simple, since the lever-type floats 30 of the upper and lower movable devices 28 and 29 follow the level of the oil, moving down and up as a function of said level.

[0054] In particular, each float 30, in following the level variations of the oil, rotates with respect to the pivot 36, but by way of the coupling of the two extensions 36a in the seats 35 formed in the semitubular profile 33 by the wings 34a and 34b it is partially articulated with respect to the magnet holder 37, i.e., it has a certain play.

[0055] Said play is determined by the breadth of the angle that the float 30 can move through without transmitting its motion to the two extensions 36a and accordingly to the magnet holder 37.

[0056] When contact is established between the float 30 of a movable device 28 and 29 and the corresponding magnet holder 37, the magnet holder, by rigidly following the float 30 in its rotation, in fact moves with respect to the frame 23 and so do the first and second magnets 40 and 41 with it.

[0057] The movement of the first and second magnets 40 and 41 determines an interaction with the magnets contained in the bulb of the switches 27, causing, due to consequent movements between the electric contacts enclosed in the bulb, the closure of the alarm or disconnection circuit connected thereto.

[0058] In this manner, the maximum extent of the play that can occur between the lever-type float 30 and the corresponding magnet holder 37 determines the degree of sensitivity of the relay 16 to vibrations.

[0059] It is evident that the adjustment of this angle must be studied carefully in order to make the relay 16 conveniently immune to vibrations caused by the operations for starring the transformer 10 and to the vibrations generated by seismic activity or by other phenomena.

[0060] In practice it has been observed that the present invention widely achieves the intended aim and all the objects.

[0061] An important advantage has in fact been achieved with the present invention in that a Buchholz-type gas accumulation relay has been devised which is capable of ensuring different sensitivity depending on the speed of the oil flow whereto it is subjected, thus ensuring higher operating reliability.

[0062] Another advantage is achieved by the present

invention in that a Buchholz relay has been provided which has a simple structural configuration.

[0063] Another important advantage is achieved considering that the present invention provides a relay whose assembly can be easily achieved more simply and quickly than in conventional types.

[0064] The materials employed, so long as they are compatible with the contingent use, may also be any according to requirements.

[0065] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A gas-accumulation Buchholz relay (16), which comprises, to be immersed in an oil bath, magnetic switches (27) for closing circuits and at least one movable device (28,29) of the float type (30) for actuating said switches (27), **characterized in that** the relay (16) is provided with a supporting frame (23) immersed in said oil bath for said magnetic switches (27) and at least said one movable device (28,29), said float (30) is of the lever type with a rotation axis (36) which is fixed to said frame (23) and is operatively connected to a magnet holder (37) which acts as a counterweight (39), said float (30) being articulated in its rotation with respect to said magnet holder (37) through a given angle.
2. The relay (16) according to claim 1 **characterized in that** an arm (32) protrudes from said float (30) and is provided with a semitubular profile (33) in which a pivot (36) can be coupled, said pivot (36) being fixed to said frame (23) by way of its ends and being rigidly associated with said magnet holder (37).
3. The relay (16) according to claim 2, **characterized in that** said semitubular profile (33) is constituted by two arc-like wings (34a,34b) which form a seat which is shaped complementarily to said pivot (36), one of said wings (34a,34b) being shorter than the other so as to form at least one seat (35) whose angle in cross-section is reduced with respect to the remaining part of the semitubular profile (33), at least one extension (36a) protruding radially from said pivot (36) in order to associate said pivot (36) and said magnet holder (37), said pivot (36) being inserted in said semitubular profile (33) to that said extension (36a) is located at said seat (35).
4. The relay (16) according to claim 3, **characterized**

in that said float (30) is articulated with respect to said magnet holder (37) by an angle which is determined by the difference between the angle covered by said seat (35) formed in the semitubular profile (33) and the width of said extension (36a).

5. The relay (16) according to claim 1, **characterized in that** said magnet holder (37) has a tubular extension which internally contains a counterweight (39) and, at least at one end, a magnet (40,41) for actuating a corresponding one of said switches (27).
6. The relay (16) according to claim 2, **characterized in that** mutually opposite guides (42,43) are provided on said frame (23) for the sliding of the ends of said pivot (36) each guide (42,43) ending with a seat (44) for the snap insertion of the end of said pivot (36).

Patentansprüche

1. Gasansammlungs-Buchholzrelais (16), das zum Eintauchen in ein Ölbad Magnetschalter (27) zum Schließen von Schaltkreisen und zumindest eine bewegliche Einrichtung (28, 29) von dem Schwimmtyp (30) zum Betätigen der Schalter (27) umfasst, **dadurch gekennzeichnet, dass** das Relais (16) mit einem Trägerrahmen (23), der in das Ölbad eingetaucht ist, für die Magnetschalter und zumindest die eine bewegliche Einrichtung (28, 29) versehen ist, wobei der Schwimmer (30) von dem Hebeltyp mit einer Drehachse (36) ist, die an dem Rahmen (23) befestigt ist, und funktional mit einem Magnethalter (37) verbunden ist, der als ein Gegengewicht (39) wirkt, wobei der Schwimmer (30) in seiner Drehung in Bezug auf den Magnethalter (37) über einen gegebenen Winkel angelenkt ist.
2. Relais (16) nach Anspruch 1, **dadurch gekennzeichnet, dass** ein Arm (32) von dem Schwimmer (30) vorsteht und mit einem Halbrohrprofil (33) versehen ist, in welchem ein Drehzapfen (36) gekoppelt sein kann, wobei der Drehzapfen (36) an dem Rahmen (23) mittels seiner Enden befestigt und dem Magnethalter (37) starr zugeordnet ist.
3. Relais (16) nach Anspruch 2, **dadurch gekennzeichnet, dass** das Halbrohrprofil (33) durch zwei bogenartige Schenkel (34a, 34b) gebildet ist, die einen Sitz bilden, der komplementär zu dem Drehzapfen (36) geformt ist, wobei einer der Schenkel (34a, 34b) kürzer ist als der andere, um zumindest einen Sitz (35) zu bilden, dessen Winkel im Querschnitt in Bezug auf den verbleibenden Teil des Halbrohrrohrprofils (33) reduziert ist, wobei zumindest ein Vorsprung (36a) radial von dem Drehzapfen (36) vorsteht, um den

Drehzapfen (36) und den Magnethalter (37) zuzuordnen, wobei der Drehzapfen (36) in das Halbrohrprofil (33) derart eingesetzt ist, dass die Verlängerung (36a) an dem Sitz (35) angeordnet ist.

4. Relais (16) nach Anspruch 3, **dadurch gekennzeichnet, dass** der Schwimmer (30) in Bezug auf den Magnethalter (37) über einen Winkel angelenkt ist, der durch die Differenz zwischen dem Winkel, der durch den in dem Halbrohrprofil (33) gebildeten Sitz (35) abgedeckt ist, und der Breite der Verlängerung (36a) bestimmt ist.
5. Relais (16) nach Anspruch 1, **dadurch gekennzeichnet, dass** der Magnethalter (37) eine rohrförmige Verlängerung aufweist, die innen ein Gegengewicht (39) und zumindest an einem Ende einen Magneten (40, 41) zum Betätigen eines entsprechenden der Schalter (27) enthält.
6. Relais (16) nach Anspruch 2, **dadurch gekennzeichnet, dass** einander gegenüberliegende Führungen (42, 43) an dem Rahmen (23) zum Verschieben der Enden des Drehzapfens (36) vorgesehen sind, wobei jede Führung (42, 43) mit einem Sitz (44) für das Einsetzen des Endes des Drehzapfens (36) mittels einer Schnappverbindung endet.

Revendications

1. Relais Buchholz (16) à accumulation de gaz comprimant, à immerger dans un bain d'huile, des interrupteurs magnétiques (27) pour fermer des circuits et au moins un élément mobile (28, 29) du type flotteur (30) pour actionner lesdits interrupteurs (27), **caractérisé en ce que** le relais est doté d'un châssis de support (23), immergé dans ledit bain d'huile pour lesdits interrupteurs magnétiques (27) et au moins ledit un élément mobile (28, 29), ledit flotteur (30) est du type à levier avec un axe de rotation (36) qui est fixé sur ledit châssis (23) et est raccordé de manière opérationnelle à un support d'aimant (37) qui sert de contre-poids (39), ledit flotteur (30) étant articulé dans sa rotation par rapport audit support d'aimant (37) selon un angle donné.
2. Relais (16) selon la revendication 1, **caractérisé en ce qu'un** bras (32) fait saillie dudit flotteur (30) et est doté d'un profil semi-tubulaire (33) dans lequel un pivot (36) peut être couplé, ledit pivot (36) étant fixé sur ledit châssis (23) au moyen de ses extrémités et étant rigidement associé audit support d'aimant (37).
3. Relais (16) selon la revendication 2, **caractérisé en**

ce que ledit profil semi-tubulaire (33) est composé de deux ailes en forme d'arc (34a, 34b) qui forment un siège conformé de manière complémentaire par rapport audit pivot (36), l'une desdites ailes (34a, 34b) étant plus courte que l'autre afin de former au moins un siège (35) dont l'angle en coupe est réduit par rapport à la partie restante du profil semi-tubulaire (33), au moins une extension (36a) faisant saillie radialement dudit pivot (36) afin d'associer ledit pivot (36) et ledit support d'aimant (37), ledit pivot (36) étant inséré dans ledit profil semi-tubulaire (33) de sorte que ladite extension (36a) est positionnée au niveau dudit siège (35).

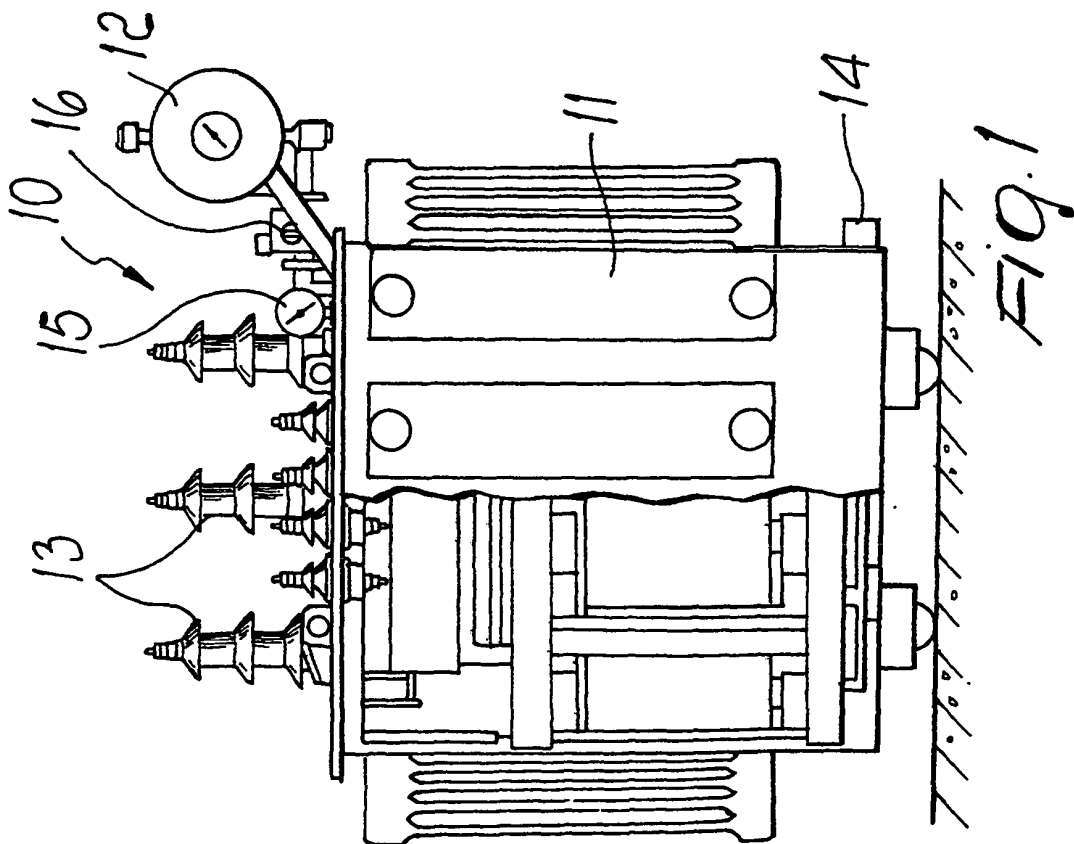
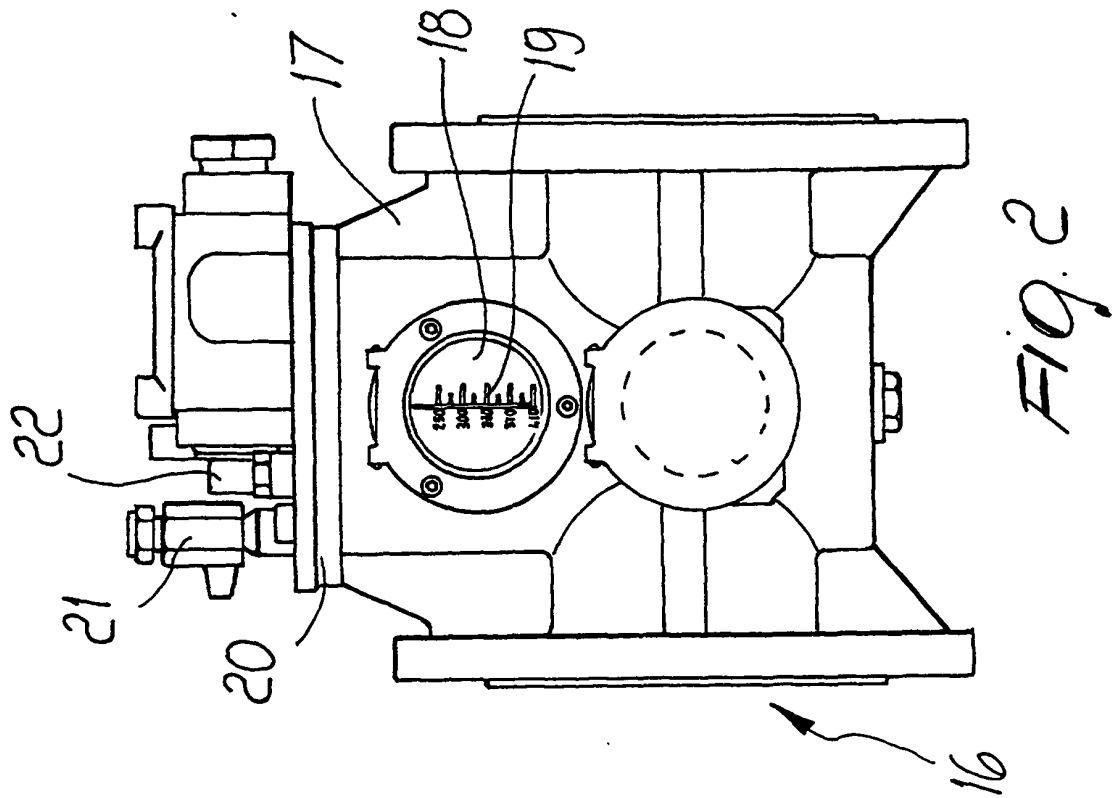
4. Relais (16) selon la revendication 3, **caractérisé en ce que** ledit flotteur (30) est articulé par rapport audit support d'aimant (37) selon un angle qui est déterminé par la différence entre l'angle couvert par ledit siège (35) formé dans le profil semi-tubulaire (33) et la largeur de ladite extension (36a).
5. Relais (16) selon la revendication 1, **caractérisé en ce que** ledit support d'aimant (37) a une extension tubulaire qui contient à l'intérieur un contrepoids (39) et, au moins à l'une de ses extrémités, un aimant (40, 41) pour actionner un interrupteur correspondant desdits interrupteurs (27).
6. Relais (16) selon la revendication 2, **caractérisé en ce que** sont prévus des guides (42, 43) mutuellement opposés sur ledit châssis (23) pour le coulissement des extrémités dudit pivot (36), chaque guide (42, 43) se terminant par un siège (44) pour l'insertion par emboîtement de l'extrémité dudit pivot (36).

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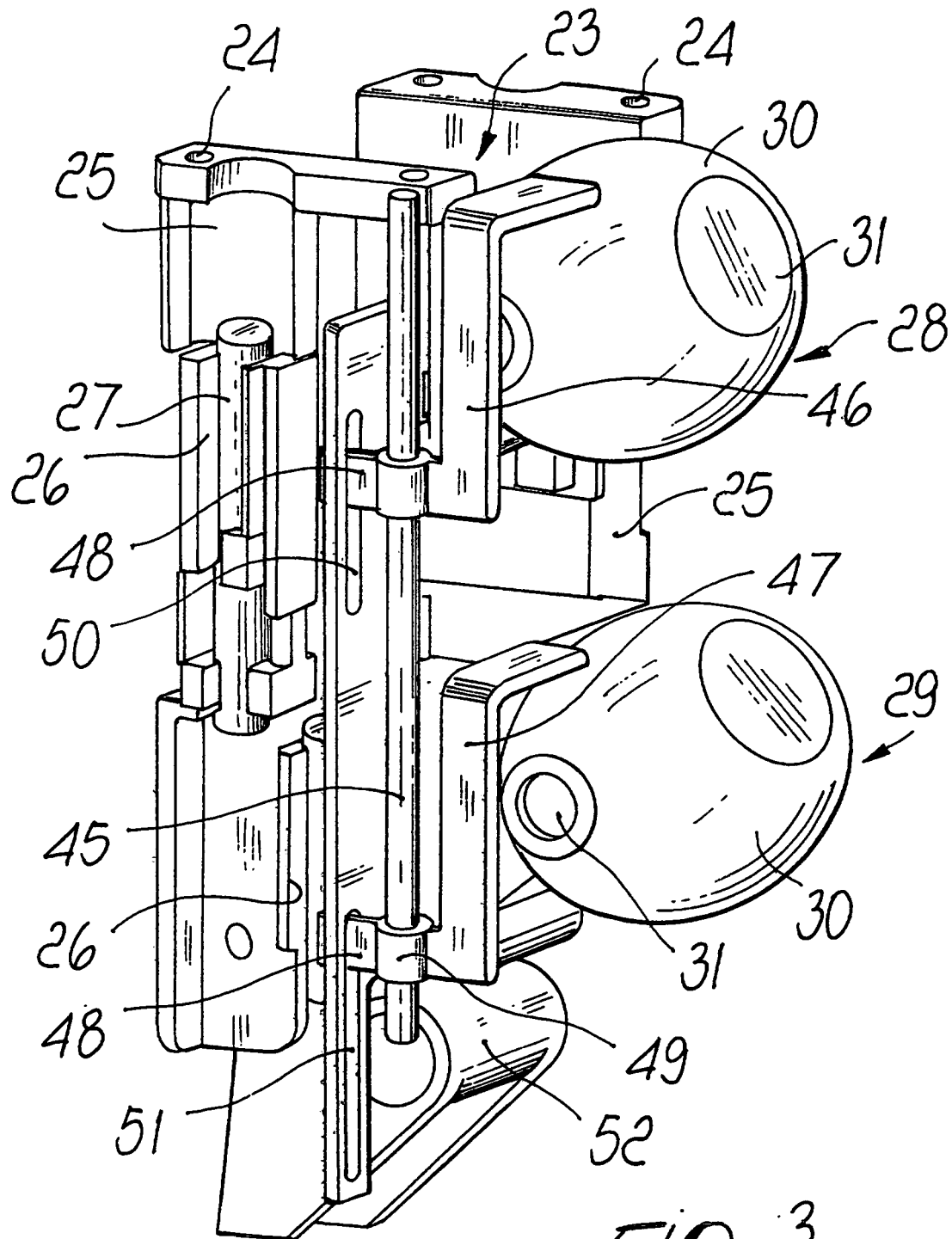


Fig. 3

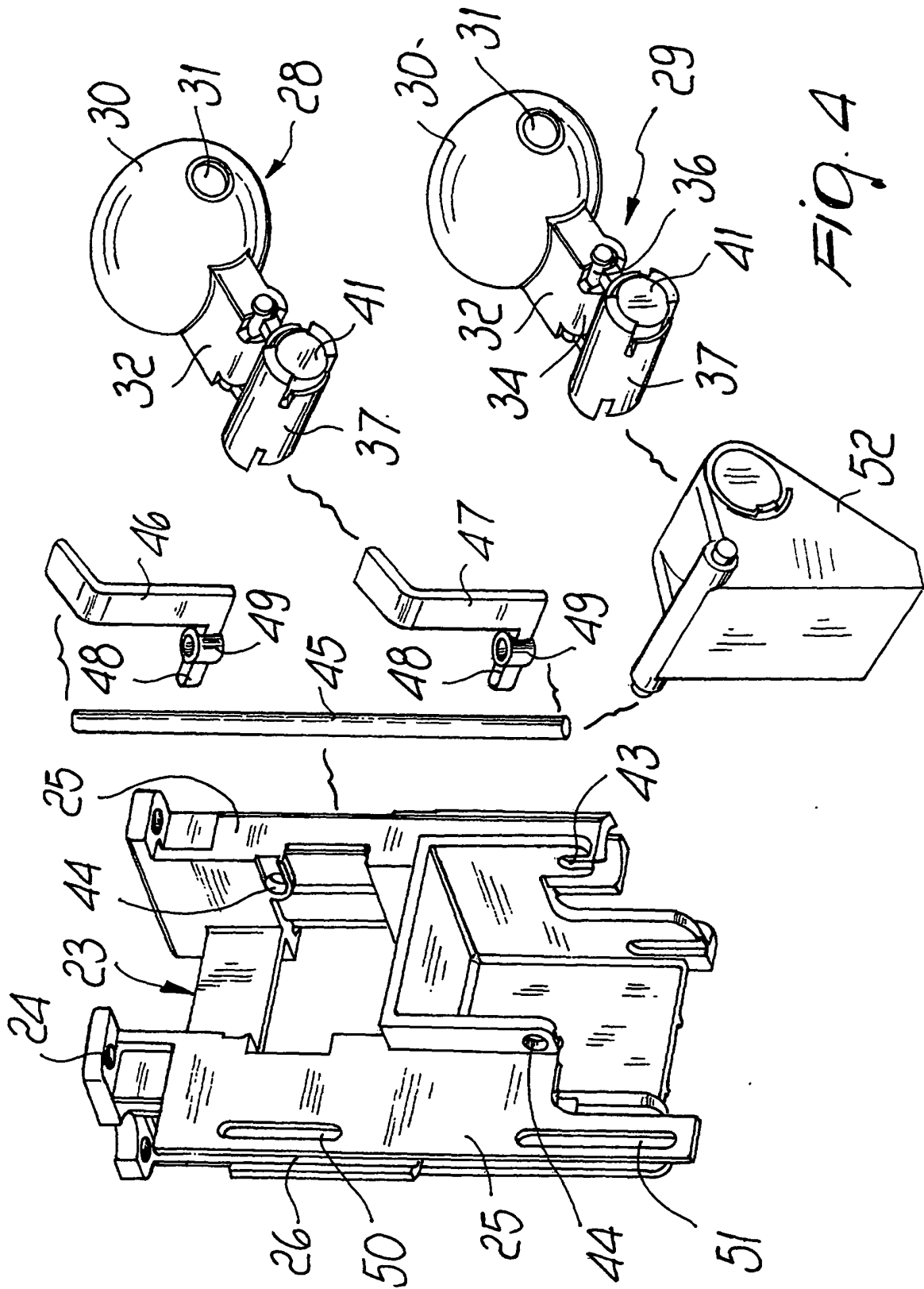
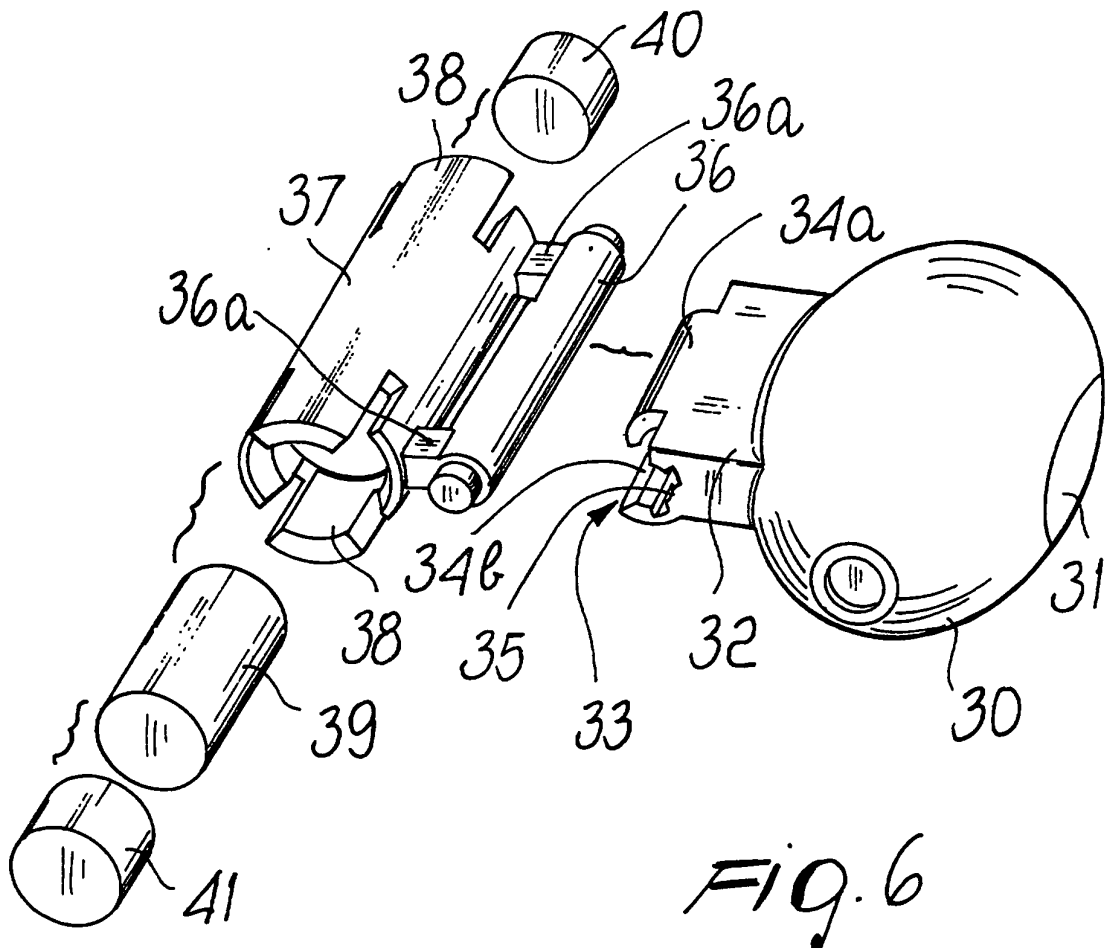
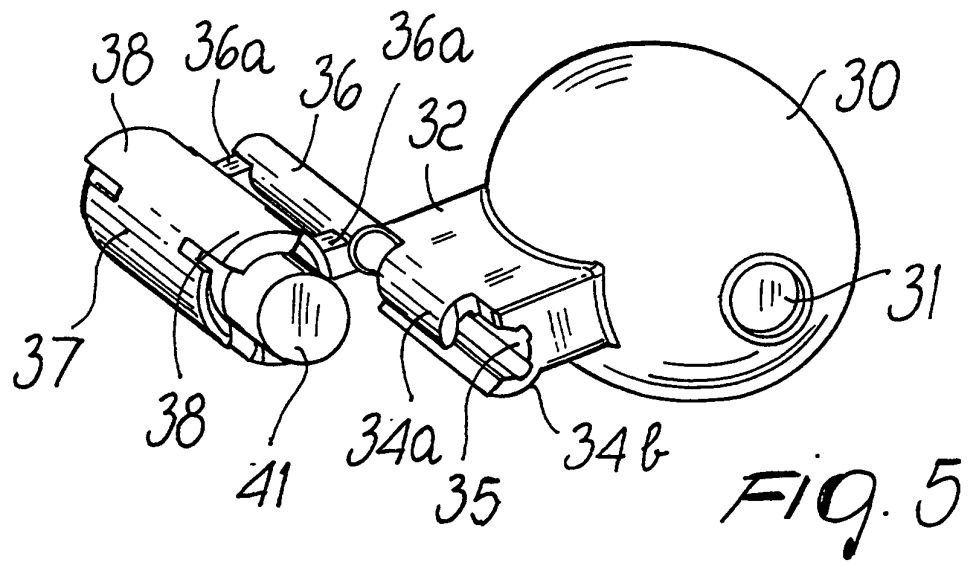


Fig. 4



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- BE 678625 A [0015]