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(54) FLOW VENT ADJUSTABLE SYSTEM FOR BUCHHOLZ RELAY

(57) The present invention relates to a Buchholz relay (1) for the protection of oil insulated power electrical equipment, comprising:
- a support frame (2) suitable to be in contact with the oil;
- floating means (3) coupled with said support frame (2) and movable relative thereto;
- switching means (4) operatively connected with said floating means (3) and suitable to enable/disable an alarm circuit and/or a trip circuit of said electrical equipment;
- at least one flow vent device (5) coupled with said support frame (2) and operatively connected to said trip circuit, suitable to be affected by the oil flow and movable between a first position, in which the flow vent device (5) maintains said trip circuit disabled, and a second position, in which the flow vent device (5) enables said trip circuit;
- contrast means (6) suitable to exert on the flow vent device (5) a contrast force suitable to maintain the flow vent device (5) in the first position until the oil flow speed does not exceed a predetermined oil flow speed threshold value, and to release the flow vent device (5) such that it reaches the second position when the oil flow speed exceeds said predetermined oil flow speed threshold value,

The Buchholz relay (1) comprises a regulation device (19) suitable to act on the contrast means (6) and/or on the flow vent device (5) so to modify said contrast force.

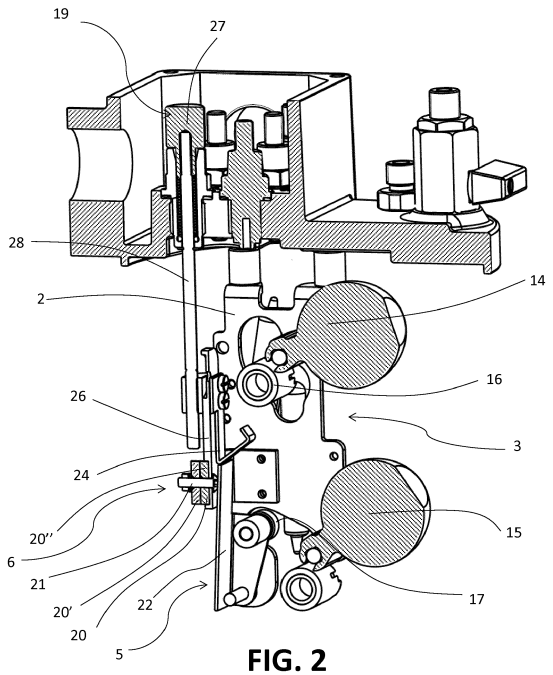

FIG. 2

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Description

BACKGROUND

Technical field

[0001] The present invention refers to a Buchholz relay for the protection of oil insulated power electrical equipment, particularly power transformers.

Description of the Related Art

[0002] An oil insulated power electrical equipment, particularly comprising an insulating oil bath transformer, usually includes a Buchholz relay, which is an electrical device operating when in the transformer there is an abnormal evolvement of gas, usually sign of a serious failure, or when there are relevant oil flows. The presence of gas and relevant oil currents inside an oil-insulated transformer may be an indication of a potentially dangerous malfunction in the transformer.

[0003] The Buchholz relay generally includes an outer casing, housing a frame for supporting an upper float and a lower float both suitable to operate respective magnetic switches. In particular, the upper float enables or disables, by means of the respective switch, an alarm circuit while the lower float drives, in an equivalent manner, a trip circuit of the functioning of the transformer.

[0004] Gas formed inside the transformer tends to flow upwardly and accumulates inside the Buchholz relay causing the lowering of the oil level therein. Such a lowering of the oil level firstly detected by the upper float, which in turn lowers and so drives the alarm circuit. If the accumulation of gas continues, the oil level further lowers together with the lower float, which drives the trip circuit of the transformer from the supply line.

[0005] In order to detect the presence of high oil currents, the Buchholz relay further comprises a flow vent device also connected to the trip circuit of the transformer from the supply.

[0006] The flow vent device comprises a shaped body, which, when it directly invested by relevant oil currents, with a value exceeding a predetermined threshold, rotates causing the intervention of the magnetic switch of the trip circuit. To reopen the contact, it is sufficient that the oil current falls below the predetermined threshold 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. It is stated precisely that the maximum sensitivity of intervention of the trip circuit corresponds to a minimum predetermined threshold of the sudden oil flow, whether volumetric or massive, which invests the flow vent device.

[0007] Normally, the flow vent device threshold of intervention is fixed and cannot be adjusted. However, recently, the need to adjust the flow vent device threshold of intervention has increased. This allows the manufacturer to standardize its production of the Buchholz relay leaving to the end user the possibility of choice on the threshold of intervention of the trip circuit in case of oil flow of high value.

[0008] A known Buchholz relay is disclosed in document WO 2009/019732 A1. With the technical solution described therein, the user can adjust the oil flow speed level by disassembling the Buchholz relay and substituting parts thereof, therefore with a sort of "trial and error" approach.

BRIEF SUMMARY OF THE INVENTION

[0009] The object of the present invention is to provide a Buchholz relay for the protection of oil insulated power electrical equipment, which allows the regulation of the oil flow speed level threshold without disassembling the Buchholz relay, such that the user is free to choose the predetermined threshold of intervention of the trip circuit without a "trial and error" approach.

[0010] This and other objects achieved by a Buchholz relay for the protection of oil insulated power electrical equipment in accordance with claim 1.

[0011] Dependent claims define possible advantageous embodiments of the invention.

[0012] According to the claimed invention, the user can adjust the flow vent without opening the device by acting on a regulation device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] Further characteristics and advantages of the Buchholz relay according to the invention will be more apparent from the following description of a preferred embodiment and of its alternatives given as a way of an example with reference to the enclosed drawings in which:

Figure 1 shows a section view of a Buchholz relay according to a possible embodiment of the invention;

Figure 2 shows a section view of a portion of the Buchholz relay in Figure 1;

Figure 3 shows a particular of the portion of the Buchholz relay in Figure 2;

Figure 4 shows another particular of the portion of the Buchholz relay in Figure 2 in a first condition;

Figure 5 shows the particular of the portion of the Buchholz relay in Figure 4 in a second condition.

DETAILED DESCRIPTION

[0014] A Buchholz relay for the protection of oil insulated power electrical equipment, particularly transform-

ers, is illustrated in figure 1, where it is generally indicated with 1.

[0015] The Buchholz relay 1 according to the invention can be integrated between a transformer, not shown, and an expansion tank, or conservator, also not represented. The Buchholz relay 1 comprises a support frame 2 which, in use, is in direct contact with the oil; floating means, as a whole indicated 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 floating means 3, intended to enable or disable an alarm circuit and/or a trip circuit of the electrical equipment, not shown.

[0016] According to a possible embodiment, an outer casing 7 of the Buchholz relay 1 comprises a lid 8 from which preferably a discharge cock 10 for the exhaust of the gas departs. A pneumatic test valve 11 and/or a member for mechanical test 9 can be further provided. Moreover, the outer casing 7 can be provided with a plug 35 for the discharge of oil. The support frame 2 can be for example housed in a cavity 36 formed inside the outer casing 7, which is filled by oil in operation. Moreover, the outer casing 7 preferably comprises a first flange 12 for the connection of the relay to a transformer tank pipe (not shown) and a second flange 13 for the connection of the relay to an oil conservator pipe (not shown).

[0017] As far as the floating means 3 are concerned, they preferably comprise a top mobile float 14 and a bottom mobile float 15. The switching means 4, can comprise for example magnetic switches connected to the alarm circuit and the trip circuit of the transformer, respectively. The top mobile float 14 and the bottom mobile float 15 act through corresponding magnetic switches on the alarm circuit and the trip circuit of the transformer. In particular, 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 14 lowers and activates a first magnetic switch 16 which in turn operates the alarm circuit. 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 15 which consequently lowers and causes the immediate closure of the trip circuit activating a second magnetic switch 17.

[0018] The Buchholz relay 1 comprises a flow vent device 5 coupled to the support frame 2, in general suitable to be immersed in oil and to be invested by the oil flow in case of a fault, as discussed above. Anomalous oil discharges 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 should be immediately blocked or severely limited. To this purpose, the flow vent device 5 is movable between a first position and a second position and is configured to interact with the switching means 4, particularly with the second magnetic switch 17, which operates the trip circuit. To this purpose, the flow vent device 5 can be provided with a switch, for example a magnetic switch 18, suitable to interact with the second magnetic switch 17 associated to the trip circuit. Particularly, the flow vent device 5 configured such that in the second position, it interacts with the trip circuit so to maintain the latter in an enabled condition, and in the first position, it interacts with the trip circuit so to maintain the latter in a disabled condition. Hence, in case of fault causing a relevant oil flow, the flow vent device 5 goes to the second position so to enable the trip circuit.

[0019] In order to maintain in normal conditions (i.e. in absence of faults causing oil currents) the flow vent device 5 in the first position, the Buchholz relay comprises contrast means 6 suitable to exert on the flow vent device 5 a contrast force. The contrast force is such that the flow vent device 5 is maintained by the contrast force in the first position until the oil flow does not exceed a predetermined oil flow speed threshold value. In the case the oil flow does exceed such a predetermined oil flow speed threshold value, the contrast force is not sufficient to oppose the force acting on the flow vent device due to the oil flow. Therefore, when the oil flow exceeds said predetermined oil flow speed threshold value, the flow vent device 5 leaves the first position and moves towards its second position, thereby enabling the trip circuit, as discussed above.

[0020] It is to be noted that, when the oil flow ceases due to the removal of the faults, the flow vent device 5 should be repositioned in the first position. This can be done for example manually by using the member for mechanical test 9, which forces the flow vent device 5 towards its first position.

[0021] The Buchholz relay 1 further comprises a regulation device 19 suitable to act on the contrast means 6 and/or on the flow vent device 5 in such a manner so to modify the contrast force which maintains the flow vent device 5 in the first position until oil flow speed does not exceed the oil flow speed threshold value. By modifying the contrast force, the oil flow speed threshold value is modified, too. Hence, the user can adjust the oil flow speed threshold value causing the enabling of the transformer trip by simply acting on the regulation device 19.

[0022] With reference to the figures, possible embodiments of the regulation device and of the contrast means, as well as of the flow vent device 5 will be hereunder described.

[0023] According to a possible embodiment, the contrast means 6 are configured such that the contrast force which maintains the flow vent device 5 in the first position depends on the position of the flow vent device 5 itself relative to the contrast means 6. Particularly, the contrast means 6 can comprise magnetic means suitable to exert a magnetic force on the flow vent device 5. Depending on the arrangement, the magnetic contrast force can be either an attraction force or a repulsive force. In the embodiment shown in the figures, the contrast means 6 are configured so to exert an attraction magnetic force on the flow vent device 5.

[0024] As will be clear to those skilled in the art, under

this exemplary configuration, by modifying the relative position of the flow vent device 5 and of the magnetic contrast means 6, particularly their distance, it is possible to modify the magnetic contrast force and consequently the oil flow speed threshold value. Advantageously, the regulation device 19 is configured to move the contrast means 6 relative to the flow vent device 5. Alternatively, according to further possible embodiments not shown in the figures, the regulation device 19 can act on the flow vent device 5 or both on the flow vent device 5 and on the magnetic contrast means 6 in order to modify the relative position thereof.

[0025] It is however to be noted that the contrast force can be exerted in a different manner other than the magnetic one. For example, the contrast means 6 can alternatively comprise elastic means, for example one or more springs, acting on the flow vent device 5 and preloaded so to exert the aforementioned contrast force. In this case, the regulation device 19 can act on the springs so to modify their pre-loads.

[0026] Turning now back to the case of magnetic configuration of the contrast means 6, in order to exert the magnetic force, the contrast means 6 can comprise one or more magnets 20 associated to the support frame 2, preferably in a fixed manner. According to the embodiment shown in figures 2-5, a first 20' and a second 20" magnets are provided on a rear wall 26 of the support frame 2 and fixed thereon by means of a screw 21. Of course, depending on the circumstances, a different number of magnets (one or more) can be alternatively provided. The maximum magnetic contrast force can be varied by modifying the number of magnets.

[0027] Preferably, the flow vent device 5 comprises a fin 22, still more preferably an at least partially plate-shaped fin. Advantageously, the fin 22 envelopes according to a plane which in operation is transversal to the oil flow. Moreover, the fin 22 is pivotably coupled to the support frame 2, so to be able to rotate relative to the latter around a rotation axis A which is transversal, preferably orthogonal to the average oil flow direction. The fin 22 can be coupled to the support frame 2 for example in correspondence to its lateral portion 23, preferably also plate-shaped, and still more preferably parallel to the average oil flow direction in operation conditions. A pin 37 can couple the lateral portion 23 of the fin 22 to side walls 33 of the support frame 2. The flow vent device 5 magnetic switch 18 can be for example associated to the lateral portion 23 of the fin 22.

[0028] The so configured fin 22 is rotatably movable between a raised position and a lowered position around a rotation axis A. In figure 5 arrow F shows for example the rotational movement from the raised position towards the lowered position- The raised position corresponds to the above mentioned first position of the flow vent device. In this position, the upper part 22' of the fin (wherein "upper" is to be intended with reference to the orientation shown in the figures, which corresponds to the normal operation conditions of the relay 1) is in proximity to the magnet/s 20, such that the magnetic contrast force is maximized. Instead, the lowered position corresponds to the above mentioned second position, and the same upper part is at a distance from the magnet/s 20, such that the magnetic contrast force is null or, in any case, not strong enough to oppose to the force exerted on the fin 22 by the oil flow.

[0029] In order to ensure that magnets 20, or any magnetic means, are able to exert the magnetic force on the fin 22, the latter should be metallic, at least partially metallic, or should comprise at least a magnetic portion so to magnetically interact with the magnetic means.

[0030] In accordance with an embodiment, the regulation device 19 comprises a wedge element 24. The wedge element 24 can move relative to the support frame 2, and consequently relative to the fin 22, particularly the upper part 22' thereof, in a translational manner between a raised position (see figure 4) and a lowered position (see figure 5). When approaching the lowered position (see arrow C in figure 5), the wedge element 24 starts to interact with the fin 22, particularly it wedges between the upper portion 22' of the fin (the one being attracted by the magnets 20) and the rear wall 26 of the support frame 2 where the magnets 20 are positioned. In this manner, the wedge element 24, when moving towards the lowered position, tends to move the upper portion 22' of the fin 22, which rotates around its rotation axis A, in a position less close to the magnets, i.e. it tends to move the fin 22 towards its lowered position however keeping it in a sufficient proximity to the magnets such that a magnetic contrast force is still exerted, even if lower. Since the relative position of the upper portion 22' of the fin 22 and the magnets 20 changes, particularly their distance increases, the magnetic contrast force decreases. Consequently, the predetermined oil flow speed threshold value causing the enabling of the transformer trip decreases. In the same manner, of course, by moving the wedge element 24 towards the raised position, the oil flow speed threshold value can be increased.

[0031] In accordance with a possible embodiment, the wedge element 24 comprises a V-shaped plate, comprising a first plate 24', which for example can be substantially parallel to the rear wall 26 of the support frame 2, and a second plate 24" transversal to the first plate 24', so to form a wedge suitable to interact with the upper part of the fin 22' as described above.

[0032] Advantageously, the regulation device 19 comprises an adjustment knob 27, or similar component, which can be directly operated by the user so to modify the predetermined oil flow speed threshold value. The adjustment knob or similar component 27 can be for example arranged inside a housing delimited by lid 8. The regulation device 19 further comprises a screw-nut group which in turns couples the adjustment knob or similar component 27 with the wedge element 24, such that a rotational movement of the adjustment wheel 27 results in a translational movement of the wedge element 24. Particularly, the screw-nut group can comprise a screw

28 rotationally integral with the adjustment knob or similar component 27. The screw 28 can be for example positioned extending along the rear wall 26 of the support frame 2 on the same side of the magnets 20. A nut 29 is coupled to the screw 28 and is free to translate relative the support frame 2 but is not free to rotate relative the latter. Therefore, a rotation of the screw 28 results in a translation of the nut 29. Moreover, the nut 29 is rigidly fixed to the wedge element 24, for example with the first plate 24'. The connection can be realized through a connecting portion free to at least partially slide inside a slit 31 formed in the rear wall 26 of the support frame 2. The nut 29 and the first plate 24' can be connected for example by one or more connecting screws 32.

[0033] From the description above the skilled person will appreciate how the Buchholz relay according to the invention allows the user to adjust the predetermined oil flow speed threshold value by simply acting on the regulation device. Hence, the adjustment can be performed easily without disassembling the relay and a "trial and error approach" is no longer needed.

[0034] To the above-mentioned embodiments of the Buchholz relay according to the invention, the skilled person, in order to meet specific current needs, can make several additions, modifications, or substitutions of elements with other operatively equivalent elements, without however departing from the scope of the appended claims.

Claims

1. Buchholz relay (1) for the protection of oil insulated power electrical equipment, comprising:

- a support frame (2) suitable to be in contact with the oil;
- floating means (3) coupled with said support frame (2) and movable relative thereto;
- switching means (4) operatively connected with said floating means (3) and suitable to enable/disable an alarm circuit and/or a trip circuit of said electrical equipment;
- at least one flow vent device (5) coupled with said support frame (2) and operatively connected to said trip circuit, suitable to be affected by the oil flow and movable between a first position, in which the flow vent device (5) maintains said trip circuit disabled, and a second position, in which the flow vent device (5) enables said trip circuit;
- contrast means (6) suitable to exert on the flow vent device (5) a contrast force suitable to maintain the flow vent device (5) in the first position until the oil flow speed does not exceed a predetermined oil flow speed threshold value, and to release the flow vent device (5) such that it reaches the second position when the oil flow speed exceeds said predetermined oil flow speed threshold value,

characterized in that it comprises a regulation device (19) suitable to act on the contrast means (6) and/or on the flow vent device (5) so to modify said contrast force.

2. Buchholz relay (1) according to claim 1, wherein said contrast means (6) are configured such that the contrast force depends on the position of the flow vent device (5) relative to said contrast means (6), said regulation device (19) being suitable to modify said relative position.

3. Buchholz relay (1) according to claim 1 or 2, wherein said regulation device (19) is configured so to move the contrast means (6) relative to the flow vent device (5).

4. Buchholz relay (1) according to claim any preceding claim, wherein said contrast means (6) comprise magnetic contrast means suitable to exert a magnetic contrast force between the flow vent device (5) and the contrast means (6).

5. Buchholz relay (1) according to claim 4, wherein said magnetic contrast means are suitable to exert a magnetic attraction contrast force.

6. Buchholz relay (1) according to claim 4 or 5, wherein said magnetic contrast means comprises one or more magnets (20) fixedly coupled to the support frame (2).

7. Buchholz relay (1) according to any preceding claim, wherein said flow vent device (5) comprises a fin (22) pivotably coupled to the support frame (2) and movable between a raised position, corresponding to said first position of the flow vent device (5), and a lowered position, corresponding to said second position of the flow vent device (5).

8. Buchholz relay (1) according to claim 7 when dependent from any claim 4-6, wherein said fin (22) is at least partially metallic or comprises at least a magnetic portion so to be magnetically coupled with the magnetic contrast means when it is in the raised position.

9. Buchholz relay (1) according to claim 7 or 8, wherein said regulation device (19) comprises a wedge element (24) movable between a raised position and a lowered position relative to the support frame (2) and suitable to interact with said fin (22) when the latter is in the raised position, so to modify the position of said fin corresponding to said raised position.

10. Buchholz relay (1) according to claim 9, wherein said

regulation device (19) comprises and adjustment wheel (27) connected to the wedge element (24) through a screw-nut group, such that a rotation of the adjustment wheel (27) results in a translation of the wedge element (24).

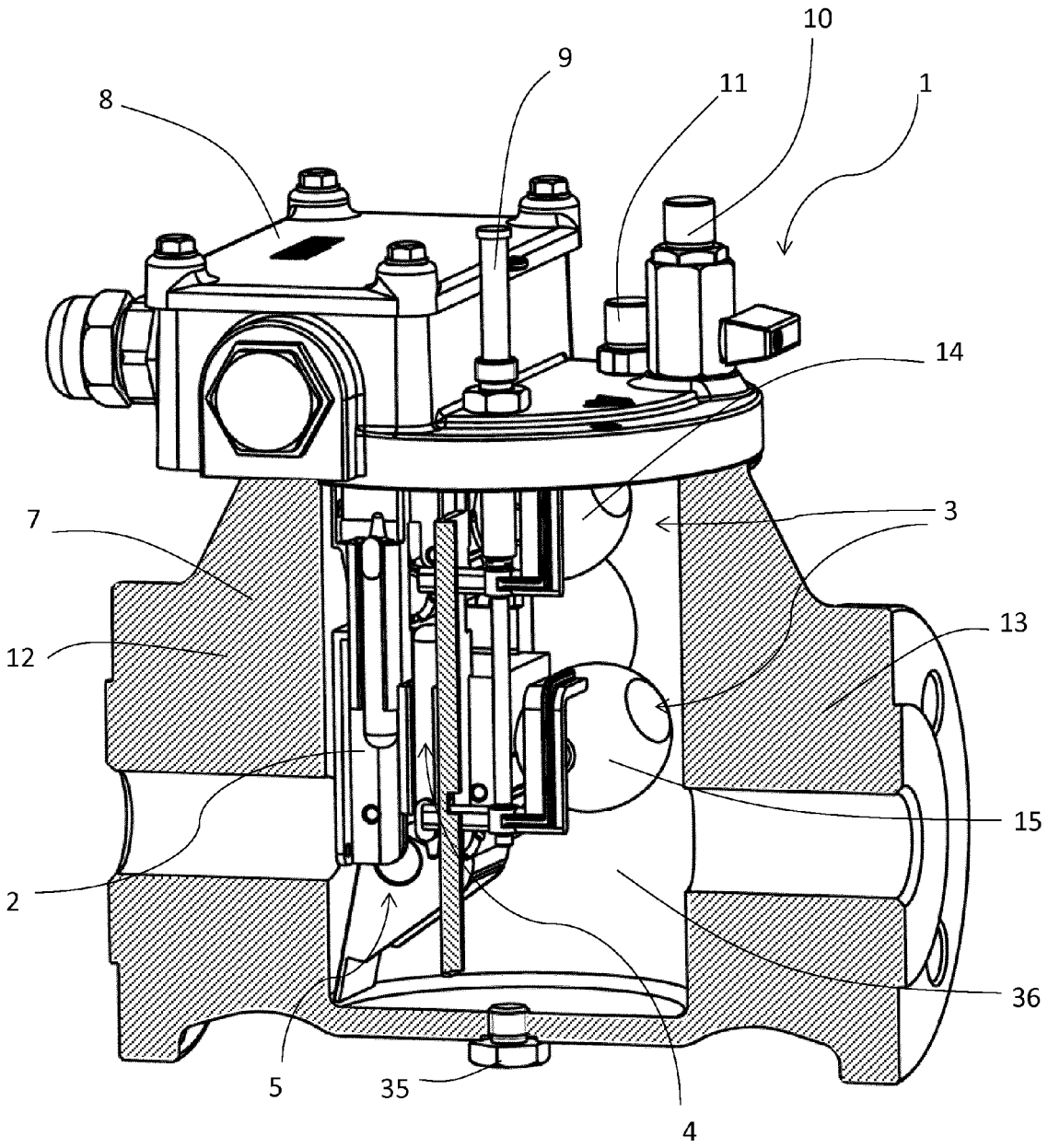

FIG. 1

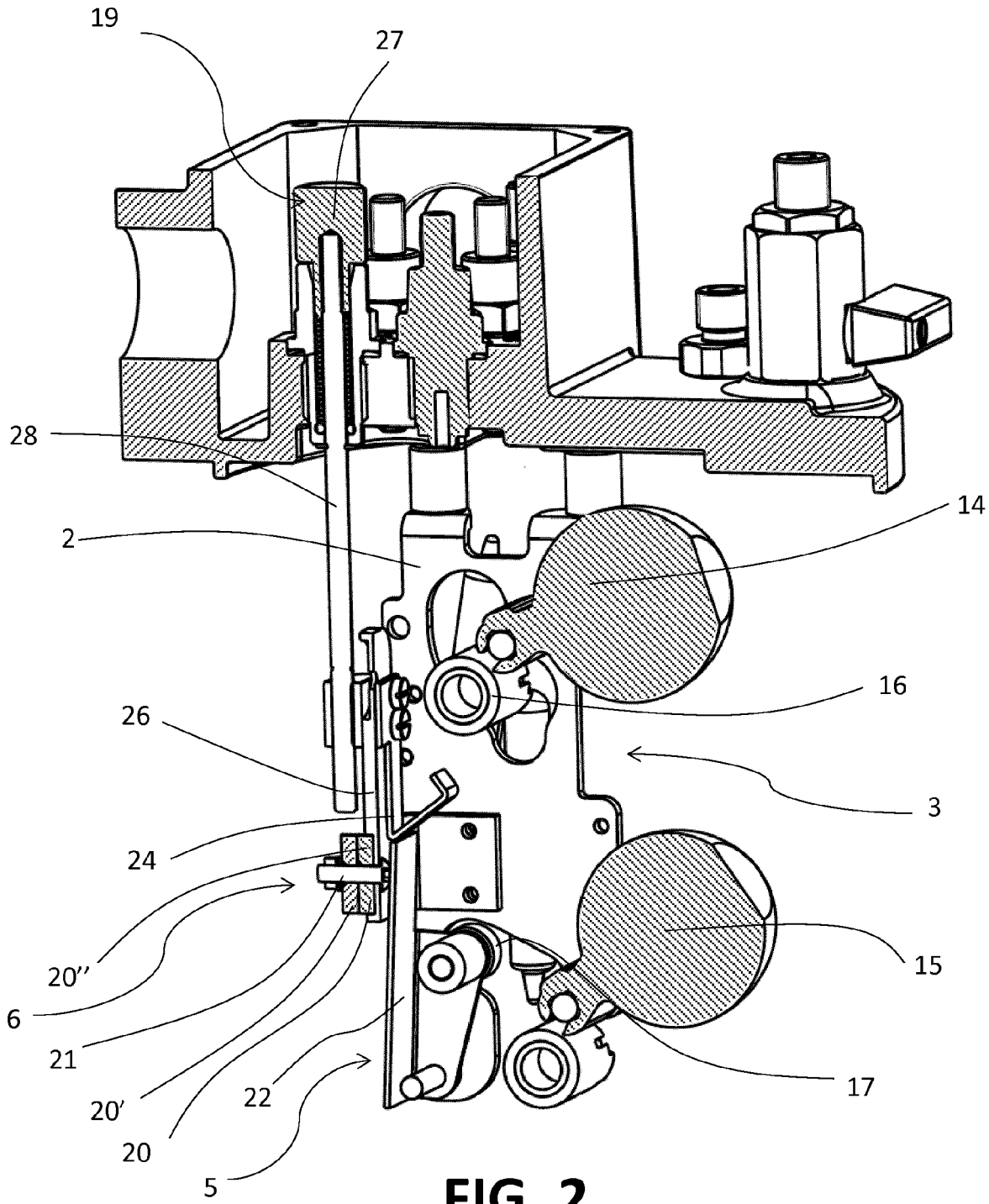

FIG. 2

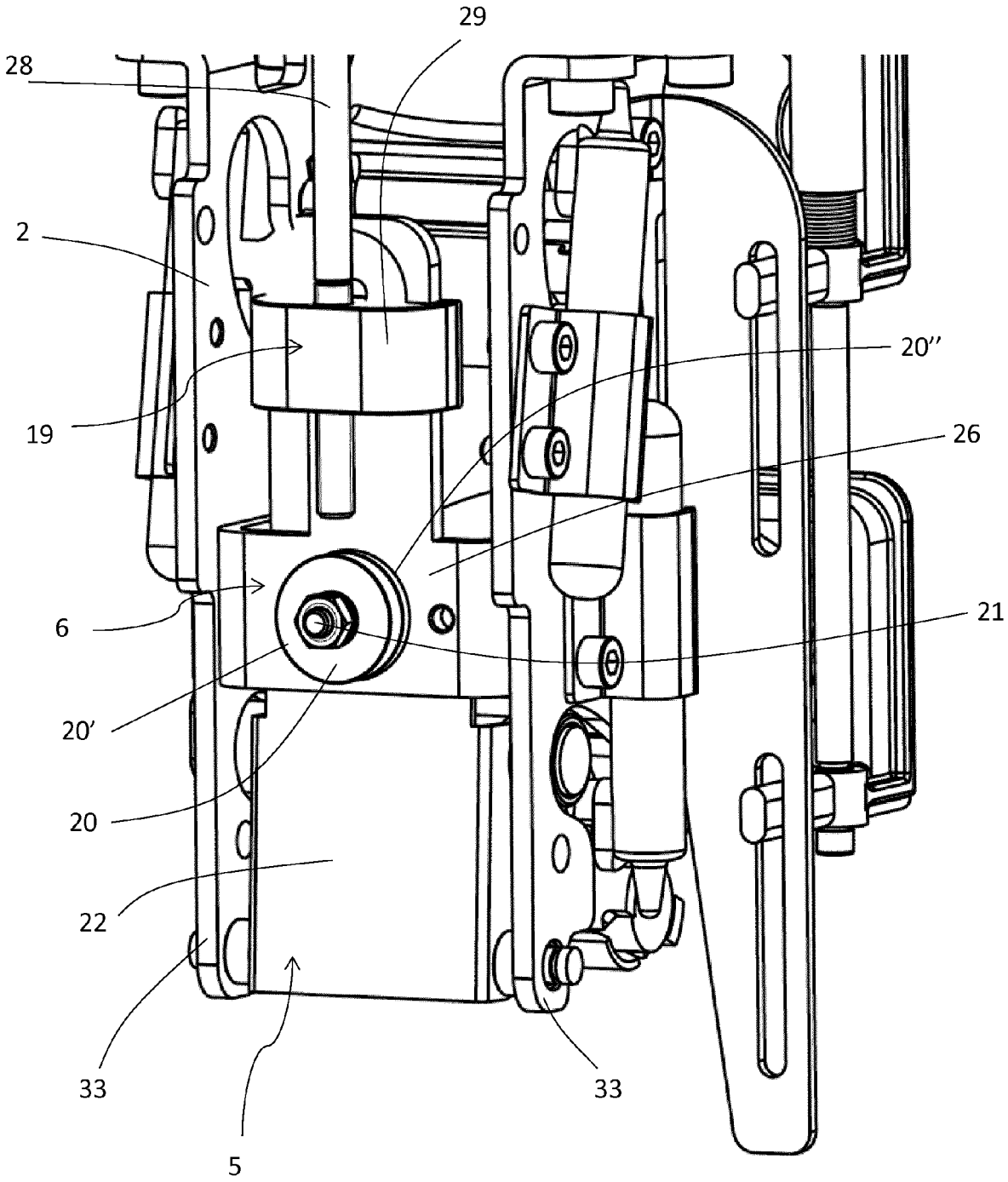

FIG. 3

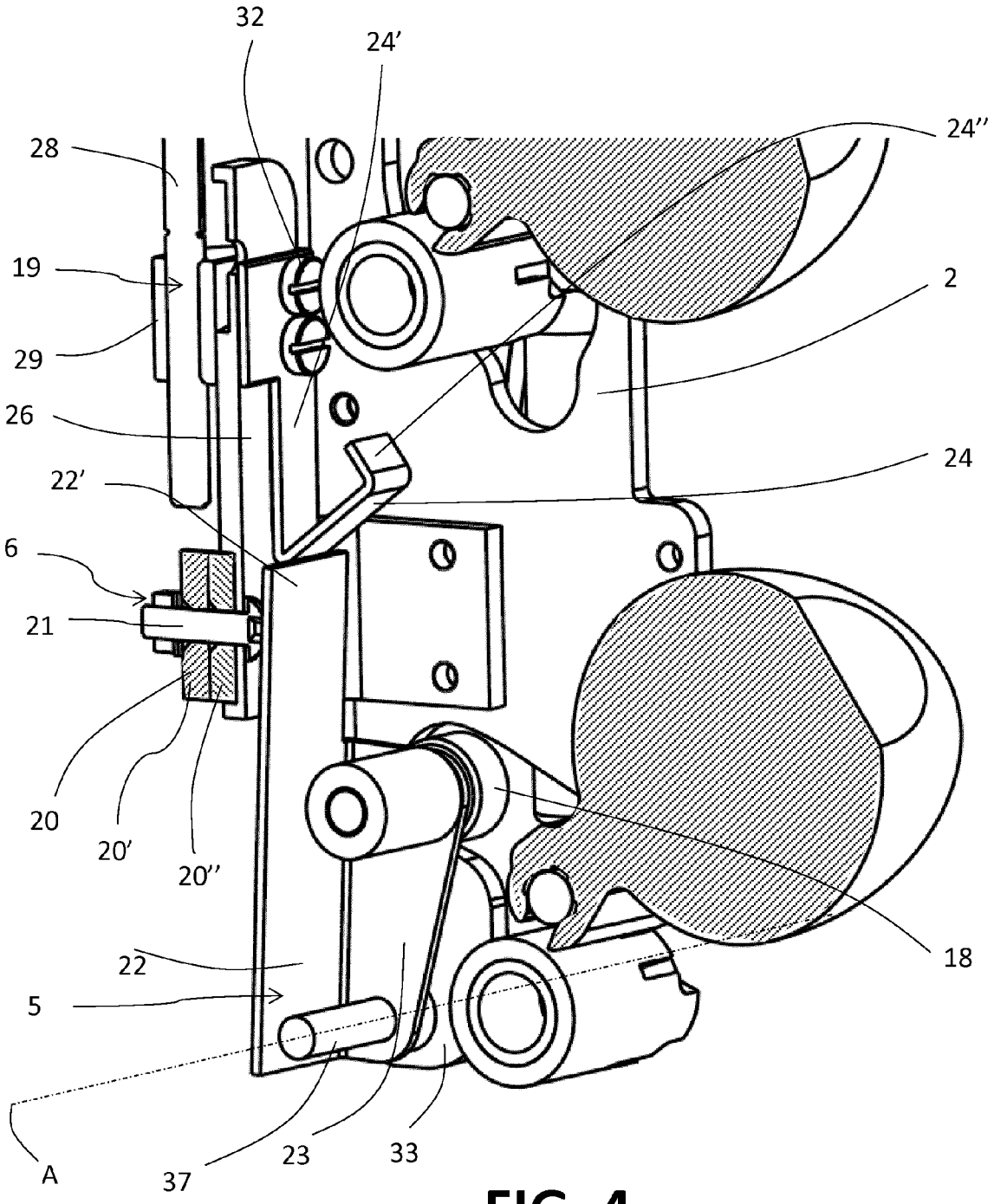

FIG. 4

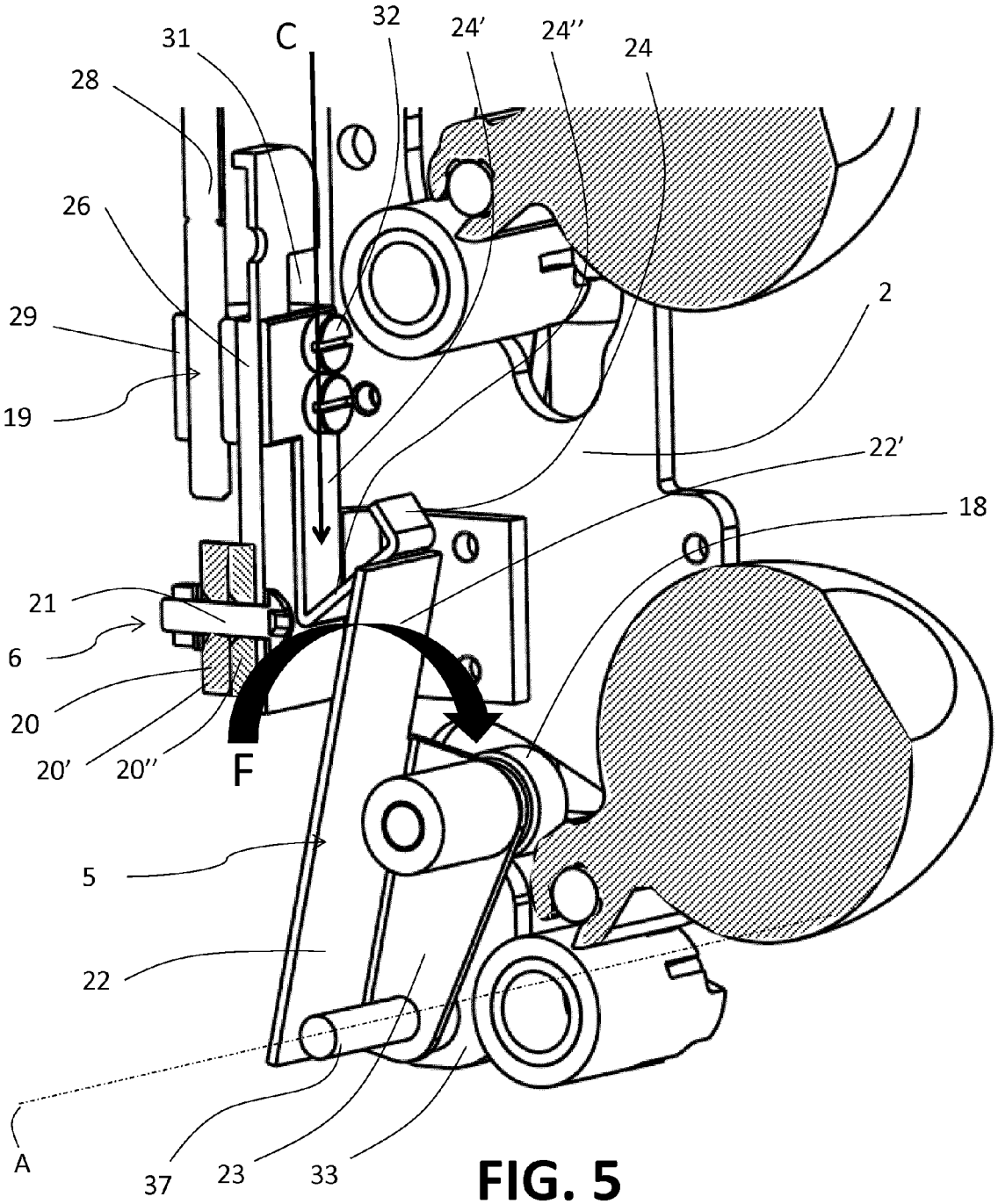

FIG. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 15 16 9198

DOCUMENTS CONSIDERED TO BE RELEVANT

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H01H
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	27 October 2015	Glaman, C

CATEGORY OF CITED DOCUMENTS

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