(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 819 180 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
07.10.2026 Bulletin 2026/41

(21) Application number: **25168656.4**

(22) Date of filing: **04.04.2025**

(51) International Patent Classification (IPC):
H01H 9/32 *(2006.01)* ***H01H 9/38*** *(2006.01)*
H01H 1/22 *(2006.01)* *H01H 9/30* *(2006.01)*

(52) Cooperative Patent Classification (CPC):
H01H 9/32; H01H 9/38; H01H 1/226;
H01H 2009/305

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
GE KH LA MA MD TN

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(54) SWITCH POLE FOR ELECTRICAL SYSTEMS

(57) A switch pole for a low voltage switching device comprising:
- an insulating casing defining an internal space with a contact region and an arc extinguishing region of said switch pole;
- a first pole terminal and a second pole terminal couplable with corresponding line conductors of an electric line;
- a fixed contact assembly and a movable contact assembly positioned in said contact region and including fixed contacts and movable contacts, respectively, which can be mutually coupled or uncoupled.

Sais movable contact assembly comprises an insulating baffle protruding towards said fixed contact assembly and slidingly inserted, at least partially, in a receiving recess defined by said insulating casing.

Said insulating baffle is interposed between one or more first fixed contacts and one or more second fixed contacts of said fixed contact assembly and being interposed between one or more first movable contacts and one or more second movable contacts of said movable contact assembly.

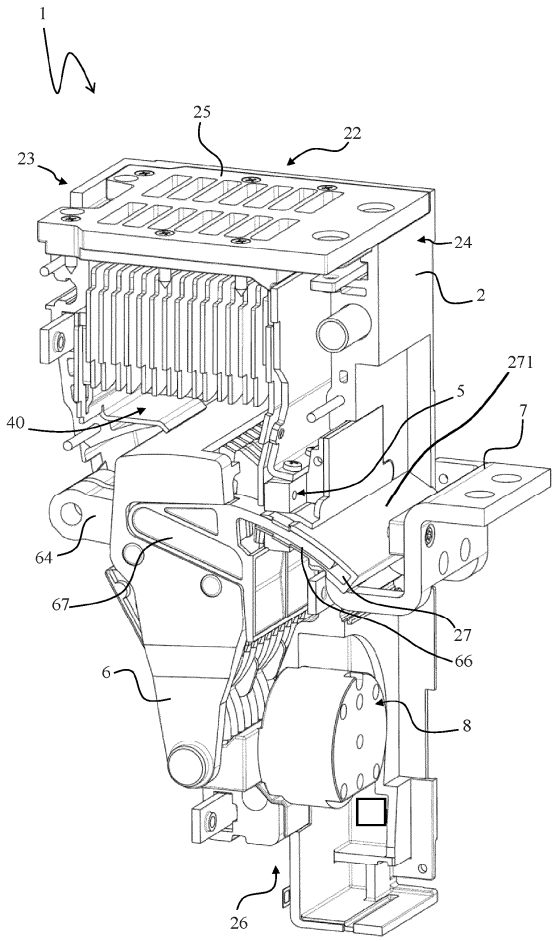


FIG. 2

EP 4 819 180 A1

Description

[0001] The present invention relates to a switch pole for a switching device suitable for installation in low-voltage electrical systems. The invention likewise relates to a switching device comprising one or more of said switch poles.

[0002] Low voltage switching devices, such as for example circuit breakers, disconnectors, contactors, or the like, comprise one or more switch poles, each including electric contacts that can be coupled to and uncoupled from one another.

[0003] As is known, during an opening manoeuvre of a switching device, electric arcs may arise between the electric contacts of the switch poles under separation, particularly under stress conditions (e.g., in presence of overload currents or short-circuit currents).

[0004] In order to break currents circulating along the switch poles, such arcing phenomena have to be extinguished as quickly as possible. To this aim, a switching device generally comprises, for each switch pole, an arc chamber including a number of arc-breaking elements positioned near the electric contacts and designed to split possible electric arcs arising between the electric contacts. Unfortunately, the arc-quenching action exerted by the arc-breaking elements is not always uniform and efficient, which may lead to a decay of the arc-quenching performances and the arising of arc-restrike phenomena.

[0005] Moreover, it has been seen that, during an opening manoeuvre of a switching device, electric arcs sometime tend to strike towards undesired areas of the switch pole. Obviously, the components affected by these phenomena may be subject to serious damage since they are not generally designed to bear high electric and thermal stresses.

[0006] The above-mentioned problems are even made more critical by the circumstance that, in modern electric power distribution grids, switching devices are often brought to operate to relatively high operating voltages (e.g. up to 2,0-2,5 kV either AC or DC). Electric arcs with a huge energy content may therefore arise between the electric contacts under separation during the opening manoeuvres of a switching device.

[0007] The main purpose of the present invention is to provide a switch pole for low voltage switching devices, which allows overcoming or mitigating the above-mentioned shortcomings.

[0008] In particular, the present invention is aimed at providing a switch pole, in which electric arcs arising between the electric contacts under separation during the opening manoeuvres of the switching device are efficiently confined in the arc-extinguishing region of the switch pole.

[0009] A further object of the present invention is to provide a switch pole, in which arcing phenomena towards undesired parts of the switch pole are prevented or remarkably reduced.

[0010] A still further object of the present invention is to provide a switch pole reliable in operation and relatively easy and cheap to manufacture at industrial level.

[0011] The above aims and purposes, as well as other purposes that will emerge clearly from the following description and attached drawings, are provided, according to the invention, by a switch pole for a low voltage switching device, according to the following claim 1 and the related dependent claims.

[0012] The switch pole, according to the invention, comprises an insulating casing defining an internal space of the switch pole, a first pole terminal and a second pole terminal couplable with corresponding line conductors of an electric line.

[0013] The switch pole, according to the invention, comprises a fixed contact assembly including a plurality of fixed electric contacts electrically connected to the first pole terminal. The fixed electric contacts include one or more first fixed contacts, and one or more second fixed contacts spaced apart and electrically insulated from the first fixed contacts.

[0014] The switch pole, according to the invention, comprises a movable contact assembly including a plurality of movable electric contacts electrically connected to the second pole terminal. The movable electric contacts include one or more first movable contacts and one or more second movable contacts.

[0015] The movable contact assembly is reversibly movable around a rotation axis, so that the first movable contacts can be coupled to or decoupled from the first fixed contacts and the second movable contacts can be coupled to or decoupled from the second fixed contacts, when the movable contact assembly moves about the rotation axis, during a manoeuvre of the switch pole.

[0016] Preferably, the movable contact assembly comprises a supporting structure of the movable contacts of the movable contact assembly.

[0017] Preferably, the movable contact assembly comprises an insulating cover at least partially covering one or more conductive portions of the movable contact assembly. The insulating cover is mounted on the supporting structure in such a way to move together with the supporting structure, when the movable contact assembly moves about its rotation axis, during a manoeuvre of the switch pole.

[0018] According to the invention, the movable contact assembly comprises an insulating baffle protruding towards the fixed contact assembly and slidingly inserted, at least partially, in a receiving recess defined by the insulating casing.

[0019] The insulating baffle is interposed between the one or more first fixed contacts and the one or more second fixed contacts of the fixed contact assembly and is interposed between the one or more first movable contacts and the one or more second movable contacts of the movable contact assembly.

[0020] Preferably, the insulating baffle is fixed to the supporting structure of the movable contact assembly in such a way to move together with the supporting struc-

ture, when the movable contact assembly moves about its rotation axis, during a manoeuvre of the switch pole.

[0021] Preferably, the insulating baffle is positioned at a first spacing region between the one or more first movable contacts and the one or more second movable contacts of the movable contact assembly.

[0022] Preferably, the receiving recess has an aperture for the passage of insulating baffle, which is positioned at a second spacing region between the one or more first fixed contacts and the one or more second fixed contacts of the fixed contact assembly.

[0023] Preferably, the insulating baffle has a free end in an opposite position relative to the movable contacts of the movable contact assembly. The free end of the insulating baffle is inserted in the receiving recess and slidingly moves along this latter, when the movable contact assembly moves about the rotation axis, during a manoeuvre of the switch pole.

[0024] According to some embodiments of the invention, the insulating baffle has a piston portion slidingly moving along the receiving recess, when the movable contact assembly moves about the rotation axis, during a manoeuvre of the switch pole. Such a piston portion of the insulating baffle causes a flux of pressurized air to blow towards the one or more second fixed contacts of the fixed contact assembly and the one or more second movable contacts of the movable contact assembly, during an opening manoeuvre of the switch pole.

[0025] Preferably, the piston portion is formed by the L-shaped free end of the insulating baffle. According to some embodiments of the invention, the insulating cover of the movable contact assembly is fixed to the supporting structure of the movable contact assembly.

[0026] Preferably, the above-mentioned insulating baffle is preferably formed by a portion of the insulating cover.

[0027] According to other embodiments of the invention, the insulating cover of the movable contact assembly is hinged on the supporting structure and can reversibly move relative to the supporting structure, when the movable contact assembly moves about its rotation axis, during a manoeuvre of the switch pole.

[0028] Preferably, the insulating cover can move reversibly between a first shield position, at which the insulating cover has no portions interposed between the electric contacts of the switch pole, and a second shield position, at which the insulating cover has a shield portion interposed between the one or more first fixed contacts of the fixed contact assembly and the one or more first movable contacts of the movable contact assembly.

[0029] Preferably, the insulating cover moves from the above-mentioned first shield position to the above-mentioned second shield position during an opening manoeuvre of the switch pole. Preferably, when it is in the second shield position, the shield portion of the insulating cover covers the one or more first movable contacts of the movable contact assembly.

[0030] In a further aspect, the present invention relates to a low voltage switching device, preferably a circuit breaker, including at least a switch pole, according to invention, as described above. Further features and advantages of the present invention will be evident from the description of preferred but not exclusive embodiments of a switch pole, according to the invention, shown by way of examples in the accompanying drawings, wherein:

- Figure 1 is a schematic view of a switching apparatus including the switch pole, according to the invention;
- Figures 2-6 schematically show the structure and operation of the switch pole, according to an embodiment of the invention;
- Figures 7-10 schematically show the structure and operation of the switch pole, according to another embodiment of the invention;
- Figures 11, 11A-11B, 12-14 schematically show the structure and operation of the switch pole, according to a further embodiment of the invention;
- Figures 15-17 schematically show the structure and operation of the switch pole, according to a further embodiment of the invention.

[0031] With reference to the attached figures, the present invention relates to a switch pole 1 for a low voltage switching device, e.g., a circuit breaker, a disconnector, a contactor, or the like.

[0032] The switching device is particularly adapted for use in AC low-voltage electrical systems, and it will be described with particular reference to these applications. However, in principle, it may be used also in electric systems of different type, e.g., in DC low-voltage electrical systems. For the purposes of the present invention, the term "low voltage" typically relates to operating voltages up to 2,0 kV AC and 2,5 kV DC, as widely known.

[0033] The switching device comprises one or more switch poles 1, according to the invention.

[0034] The number of switch poles may vary, according to the needs.

[0035] In some embodiments, the switching device may be of the three-phase type, and it comprises three switch poles. However, according to other embodiments of the invention, the switching device may include a different number of switch poles depending on the number of electric phases of the electric circuit, in which it has to be installed.

[0036] According to the invention, a switch pole 1, according to the invention, comprises an insulating casing 2 defining an internal volume including a contact region 3 and an arc extinguishing region 4 (figures 6, 10, 14, 17).

[0037] In general terms, the contact region 3 is a portion of internal volume of the switch pole where the contact assemblies of the switch pole are arranged and operate. On the other hand, the arc-extinguishing region 4 is a portion of internal volume of the switch pole where there are arranged arc-quenching means de-

signed to extinguish possible electric arcs arising between the electric contacts of the switch pole, during the opening manoeuvres.

[0038] The contact region 3 and the arc extinguishing region 4 are adjacent and in fluid-dynamic communication one with another.

[0039] Preferably, the arc extinguishing region 4 is positioned at an upper level with respect to the contact region 3, i.e., in proximal position relative to a top side of this latter.

[0040] For the sake of clarity, it is specified that relative terms used in this disclosure, e.g., "front," "rear," "lateral", "upper", "lower", "top" and "bottom" relate to the switch pole 1 in its normal installation conditions, namely in a "vertical" installation mode (figure 1).

[0041] The insulating casing 2 of the switch pole is shaped as a contoured box with opposite front and rear walls 23, 24, opposite lateral walls 21, 22 and opposite top and bottom walls 25, 26.

[0042] Preferably, the insulating casing 2 is formed by first and second half shields joined to each other. Preferably, the top wall 25 is provided with a number of through openings to allow the exit of hot gases from the internal volume of the switch pole, in particular from the arc extinguishing region. The insulating casing 2 is made of an electrically insulating material, e.g., a thermosetting or thermoplastic material.

[0043] According to the invention, the switch pole 1 comprises a first pole terminal 7 and a second pole terminal 8 couplable with corresponding line conductors of an electric line.

[0044] In operation, the pole terminals 7, 8 are electrically coupled (in a known manner) with corresponding line conductors of an electric line. Such line conductors may be, in turn, electrically connected to an electric power source (e.g., an electric power feeding or generation system or a section of electric grid) and to an electric load (e.g., an electric system or apparatus or a section of electric grid), respectively.

[0045] For the sake of clarity, it is specified that the terms "coupled," "decoupled" or "couplable" used in this disclosure relate to both an electrical and mechanical coupling/decoupling of various parts unless otherwise specified or self-evident from the description or figures.

[0046] Preferably, the pole terminals 7, 8 are positioned at the rear wall 24 of the insulating casing of the switch pole.

[0047] According to the invention, a switch pole 1 comprises a fixed contact assembly 5 and a movable contact assembly 6 arranged in the contact region 3.

[0048] The fixed contact assembly 5 comprises fixed electric contacts 51, 52 electrically connected to the first pole terminal 7.

[0049] More particularly, the fixed contact assembly 5 includes one or more first fixed contacts 51 and one or more second fixed contacts 52, which are spaced apart from the fixed contacts 51 and electrically insulated from these latter.

[0050] The first and second fixed contacts 51, 52 are therefore electrically connected in parallel to the first pole terminal 7 but they are mutually spaced and electrically insulated.

[0051] Preferably, the first and second fixed contacts 51, 52 are positioned at the rear wall 24 of the insulating casing of the switch pole.

[0052] Preferably, the first and second fixed contacts 51, 52 are arranged respectively in distal position and in proximal position relative to the arc-extinguishing region 4 of the switch pole.

[0053] The first fixed contacts 51 may be formed by a pair of conductive tips arranged on a first conductive base directly coupled to the first pole terminal 7. Similarly, the second fixed contacts 52 may be formed by a pair of conductive tips arranged on a second conductive base electrically connected to the first pole terminal 7 through other conductive components of the switch pole. In general, the pole terminals 7, 8 and the fixed contact assembly 5 may be realized according to solutions of known type. In the following, this component of the switch pole will be described only in relation to the aspects of interest of the invention, for the sake of brevity.

[0054] The movable contact assembly 6 comprises movable electric contacts 61, 62 electrically connected to the second pole terminal 8. More particularly, the movable contact assembly 6 includes one or more first movable contacts 61 and one or more second movable contacts 62. The first movable contacts 61 can be coupled to or decoupled from the first fixed contacts 51 while the second movable contacts 62 can be coupled to or decoupled from the second fixed contacts 52.

[0055] The movable contact assembly 6 is reversibly movable around a rotation axis A1, which is preferably perpendicular to the lateral walls 22 of the insulating casing of the switch pole.

[0056] The movable contact assembly 6 can move, about the rotation axis A1, between a first position corresponding to a closed state of the switch pole, in which electric currents are allowed to flow between the pole terminals 7, 8 of the switch pole, and second position corresponding to an open state of the switch pole, in which electric currents flowing along the switch pole are interrupted.

[0057] The movable contact assembly 6 moves between the above-mentioned first and second positions by rotating about the rotation axis A1 according to opposite rotation directions.

[0058] A transition of the movable contact assembly 6 from the first position to the second position constitutes an opening manoeuvre of the switch pole, whereas an opposite transition of the movable contact assembly 6 from the second position to the first position constitutes a closing manoeuvre of the switch pole.

[0059] Preferably, the first and second movable contacts 61, 62 are arranged in distal position and in proximal position relative to the arc-extinguishing region 4 of the switch pole, respectively. Preferably, the movable electric

contacts 61, 62 are electrically connected one to another and electrically connected in parallel to the second pole terminal 8.

[0060] Preferably, the movable contact assembly 6 comprises a conductive head 65, on which the movable contacts 61, 62 are mounted.

[0061] The conductive head 65 is electrically connected to the second pole terminal 8, for example by means of suitable flexible conductors.

[0062] The first and second movable contacts 61, 62 may be formed by first and second pairs of conductive fingers, respectively, which protrude from the conductive head 65.

[0063] Preferably, the movable contact assembly 6 comprises a supporting structure 63 for the movable contacts 61, 62. Such a supporting structure can conveniently rotate about a rotation axis A1 and it comprises a connecting element 64, which protrudes outside the insulating casing of the switch pole (preferably from a suitable window of the front wall 23 thereof) for connection with a driving mechanism (not shown).

[0064] Preferably, the conductive head 65, which supports and connect electrically the movable contacts 61, 62 of the switch pole, is mounted on the supporting structure 63 in such a way to move together with said supporting structure about the rotation axis A1, during a manoeuvre of the switch pole.

[0065] Preferably, the conductive head 65 is hinged to the supporting structure 63 about a suitable hinging axis, which is conveniently parallel to the rotation axis A1 of the movable contact assembly. The conductive head 65 thus rotates together with the supporting structure 63 about the rotation axis A1 and it can slightly tilt relative to said supporting structure, when this latter moves. Namely, when the supporting structure 63 rotates according to a given rotation direction, the conductive head 65 can tilt with an opposite rotation movement relative to the supporting structure.

[0066] Preferably, the movable contact assembly 6 comprises an insulated cover 67 covering, at least partially, one or more conductive parts, for example the conductive head 65. The insulating cover 67 is mounted on the supporting structure 63 in such a way to move together with this latter when the movable contact assembly moves about the rotation axis A1, during a manoeuvre of the switch pole.

[0067] As mentioned above, in general terms, the switch pole 1 can take in operation a closed state and an open state and can carry out an opening manoeuvre to switch from a closed state to an open state and a closing manoeuvre to switch from an open state to a closed state.

[0068] In the switch pole 1, the fixed and movable contact assemblies 5, 6 are arranged so that a pole current flows along the one or more first fixed contacts 51 and the one or more first movable contacts 61 when the switch pole is in a closed state. The electric contacts 51, 61 thus form the so-called "main contacts" of the switch pole.

[0069] Additionally, the fixed and movable contact assemblies 5, 6 are arranged so that electric arcs normally develop between the electric contacts 52, 62 under separation during an opening manoeuvre of the switch pole. The electric contacts 52, 62 thus form the so-called "arc contacts" of the switch pole.

[0070] In the embodiments shown in the cited figures, the first and second movable contacts 61, 62 decouple from the first and second fixed contacts 51, 52, according to a specific opening sequence (described in the following), during an opening manoeuvre of the switch pole. When the movable contact assembly 6 is the above-mentioned first position (closed state of the switch pole), the first movable contacts 61 are coupled to the first fixed contacts 51 while the second movable contacts 62 are decoupled from the second fixed contacts 52.

[0071] In this situation, a pole current can flow along the switch pole between the pole terminals 7, 8. The pole current passes entirely through the first movable contacts 61 and the first fixed contacts 51. No electric arcs arise between the movable contact assembly 6 and the fixed contact assembly 5 as the pole terminals 7, 8 are short-circuited.

[0072] During an opening manoeuvre of the switch pole, upon an initial movement according to a suitable rotation direction about the rotation axis, the movable contact assembly 6 moves from the first position to a first intermediate position, in which:

- the first movable contacts 61 are coupled to the first fixed contacts 51;
- the second movable contacts 62 are coupled to the second fixed contacts 52.

[0073] In this situation, a pole current can still flow between the pole terminals 7, 8. The pole current is however split between a first current passing through the first movable contacts 61 and the first fixed contacts 51 and a second current passing through the second movable contacts 62 and the second fixed contacts 52. The magnitude of the first and second currents depends on equivalent resistance of the respective conductive paths.

[0074] No electric arcs arise between the movable contact assembly 6 and the fixed contact assembly 5 as the pole terminals 7, 8 are still short-circuited.

[0075] Upon a further movement according to the rotation direction, the movable contact assembly 6 moves from the above-mentioned first intermediate position to a second intermediate position, in which:

- the first movable contacts 61 are decoupled from the first fixed contacts 51;
- the second movable contacts 62 are coupled to the second fixed contacts 52.

[0076] In this situation, a pole current can still flow along the switch pole between the pole terminals 7, 8

as these latter are still short-circuited. The pole current passes entirely through the second movable contacts 62 and the second fixed contacts 52. No currents flow along the first movable contacts 61 and the first fixed contacts 51 as these latter are decoupled.

[0077] No electric arcs arise between the movable contact assembly 6 and the fixed contact assembly 5 as the pole terminals 7, 8 are still short-circuited.

[0078] Upon yet a further movement according to the rotation direction, the movable contact assembly 6 moves from the second intermediate position to the above-mentioned second position. In this phase of the opening manoeuvre, also the second movable contacts 62 decouple from the second fixed contacts 52 (the first movable contacts 61 are decoupled from the first fixed contacts 51). In this situation, as the movable electric contacts 61, 62 are now separated from the corresponding fixed electric contacts 51, 52, a difference of voltage potential is established between the first and second pole terminals 7, 8. At any time, the second pole terminal (and the movable contacts 61, 62) may have a positive voltage polarity while the first pole terminal 7 (and the fixed contacts 51, 52) may have a negative voltage polarity, or vice-versa). Since the dielectric distance between the movable contacts 61, 62 and the fixed contacts 51, 52 is relatively short, electric arcs may develop between the movable contact assembly 6 and the fixed contact assembly 5, particularly between the second fixed contacts 52 and the second movable contacts 62 under separation.

[0079] According to different embodiments of the invention, the first and second movable contacts 61, 62 may decouple from the first and second fixed contacts 51, 52, according to a different opening sequence, during an opening manoeuvre of the switch pole.

[0080] In the embodiments shown in the cited figures, the first and second movable contacts 61, 62 couple to the first and second fixed contacts 51, 52, according to a specific closing sequence, during a closing manoeuvre of the switch pole. The closing sequence of the electric contacts is basically the opposite compared to the opening sequence described above.

[0081] According to different embodiments of the invention, however, the first and second movable contacts 61, 62 may couple to the first and second fixed contacts 51, 52, according to a different closing sequence, during a closing manoeuvre of the switch pole.

[0082] Preferably, the switch pole 1 comprises an arc chamber 40 positioned in the arc extinguishing region 4, conveniently above the contact region 3 and in fluid-communication with this latter. The arc chamber 40 comprises a plurality of arc-breaking elements designed to extinguish possible electric arcs arising between the electric contacts of the switch pole when these latter separate during an opening manoeuvre. The arc-breaking elements may be arc-breaking plates arranged in parallel, preferably along reference planes parallel to the front and rear walls 23, 24 and perpendicular to the lateral walls 22 of the insulating casing 2. The arc-breaking plates are preferably arranged at subsequent positions between the front and rear walls 23, 24, at increasing distances from the fixed contact assembly 5. Preferably, the arc-breaking plates may be formed by contoured metallic or ceramic plates, which can have different dimensions and shapes according to solutions of known type.

[0083] An essential aspect of the invention consists in that the movable contact assembly 6 comprises an insulating baffle 66, which is arranged in such a way to segregate the main contacts 51, 61 of the switch pole from the arc contacts 52, 62 of the switch pole.

[0084] The insulating baffle 66 protrudes towards the fixed contact assembly 5 and is slidingly inserted, at least partially, in a receiving recess 27 of the insulating casing 2.

[0085] As it is possible to notice from the cited figures, the insulating baffle 66 is always interposed between the one or more first fixed contacts 51 and the one or more second fixed contacts 52 of the fixed contact assembly and to be interposed between the one or more first movable contacts 61 and the one or more second movable contacts 62 of the movable contact assembly. The insulating baffle 66 can thus prevent the diffusion of hot gases towards the lower regions of the internal volume of the switch pole, thereby greatly favouring their flow towards the arc-extinguishing region 4. This helps to confine hot gases in the arc-extinguishing region 4 and makes the quenching performance of the arc chamber 40 more effective.

[0086] As the insulating baffle 66 substantially segregates the main contacts 51, 61 of the switch pole from the arc contacts 52, 62 of the switch pole, the probability of re-striking phenomena involving the main contacts 51, 61 of the switch pole is remarkably decreased, which greatly helps to preserve these electric contacts from an excessive erosion, thus prolonging their operating life.

[0087] The insulating baffle 66 additionally effectively prevents electric arcs from "jumping" towards conductive components of the switch pole outside the arc-extinguishing region 4.

[0088] Preferably, the insulating baffle 66 is made of an electrically insulating material, e.g., a thermosetting or thermoplastic material.

[0089] Preferably, the insulating baffle 66 is fixed to the supporting structure 63 in such a way to move together with this latter about the rotation axis A1, during a manoeuvre of the switch pole. Preferably, the insulating baffle 66 is positioned and protrudes towards the fixed contact assembly 5 at a first spacing region between the one or more first movable contacts 61 and the one or more second movable contacts 62 of the movable contact assembly.

[0090] Preferably, the insulating baffle 66 has a free end 661 in an opposite position relative to the movable contacts 61, 62 of the movable contact assembly. The free end 661 is inserted in the receiving recess 27 and

slidingly moves along this latter, when the movable contact assembly moves about the rotation axis A1, during a manoeuvre of said switch pole.

[0091] Preferably, the receiving recess 27 is defined at the rear wall 24 of the insulating casing, at a region where the fixed contact assembly 5 is arranged.

[0092] Preferably, the receiving recess 27 has an aperture 270 for the passage of the insulating baffle 66, which is positioned at a second spacing region positioned between the one or more first fixed contacts 51 and the one or more second fixed contacts 52 of the fixed contact assembly. Preferably, at the region where the fixed contact assembly 5 is arranged, the rear wall 24 of the insulating casing has a pass-through hole and a hollow protrusion 271 defining the receiving recess 27, in which insulating baffle 66 is slidingly inserted. This solution allows reducing the lateral size of the switch pole despite of the presence of the insulating baffle.

[0093] Figures 2-6 show the switch pole, according to an embodiment of the invention. In figures 4-6, the movable contact assembly 6 is shown in different operating positions during a manoeuvre of the switch pole.

[0094] The insulating baffle 66 has a rectilinear free end 661 inserted in the receiving recess 27 and slidingly moving along this latter. The receiving recess 27 is formed as a blind recess.

[0095] The insulating baffle 66 and the receiving recess 27 have curved (namely arc-shaped) complementary profiles along a reference plane perpendicular to the rotation axis A1. According to other embodiments of the invention, the insulating baffle 66 and the receiving recess 27 may be arranged differently from the solution shown in figures 2-6.

[0096] For example, the insulating baffle 66 and the receiving recess 27 may have a differently shaped profile. As a further example, the receiving recess 27 may have additional apertures configured to put the receiving recess in fluid-dynamic communication with the internal volume of the switch pole and/or the outer environment.

[0097] Figures 7-10 show the switch pole, according to an embodiment of the invention. In figures 8-10, the movable contact assembly 6 is shown in different operating positions during a manoeuvre of the switch pole.

[0098] In many respects, this embodiment of the invention is similar to the embodiment of figures 2- 6. In this case, however, the insulating baffle 66 has a piston portion 661, which is always positioned in the receiving recess 27 and slidingly moves along this latter, when the movable contact assembly 6 moves about the rotation axis A1 during a manoeuvre of the switch pole.

[0099] The piston portion 661 is arranged in such a way to cause a flux of pressurized air to blow towards the one or more second fixed contacts 52 of the fixed contact assembly and the one or more second movable contacts 62 of the movable contact assembly, during an opening manoeuvre of said switch pole (figures 9-10, dotted lines).

[0100] The injection of pressurized air in the contact regions 3 at level of the arc contacts 52, 62 favors the flow of hot gases towards the arc-extinguishing region 4 and exerts a remarkable cooling action on the arc electric contacts of the switch pole.

[0101] Preferably, the insulating baffle 66 has a L-shaped free end 661 in an opposite position relative to the movable contacts 61, 62 of the movable contact assembly. Conveniently, such a shaped portion of the insulating baffle 66 forms the above-mentioned piston portion of the insulating buffer member.

[0102] Preferably, the transversal section of the receiving recess 27 is designed in such a way to be geometrically complementary and tightly match the shape of the piston portion 661. This helps to increase the pressure of the air blow towards the arc electric contacts 52, 62 of the switch pole.

[0103] In the embodiments shown in figures 2-10, the insulated cover 67 of the movable contact assembly is fixed to the supporting structure 63 and it moves together with this latter.

[0104] Figures 11, 11A-11B, 12-14 show the switch pole, according to another embodiment of the invention. In figures 12-14, the movable contact assembly 6 is shown in different operating positions during a manoeuvre of the switch pole.

[0105] In many respects, this embodiment of the invention is similar to the embodiment of figures 2-6. In this case, however, the insulated cover 67 is arranged in such a way to move together with the supporting structure about the rotation axis A1 and be also capable of moving relative to the supporting structure 63 during a manoeuvre of the switch pole.

[0106] The insulating cover 67 is hinged to the supporting structure 63 about a suitable hinging axis, which is conveniently parallel to the rotation axis A1 of the movable contact assembly.

[0107] The insulating cover 67 preferably comprises lateral legs 69 hinged to the supporting structure 62 and arranged in such a way to cover portions of the conductive head 65 facing the lateral walls 22 of the insulated casing.

[0108] The above-mentioned lateral legs 69 have protrusions 670 slidingly inserted into corresponding grooves 220 of the lateral walls 22 of the switch pole (figures 11A-11B).

[0109] During a manoeuvre of the switch pole, the movable contact assembly 6 moves and the lateral protrusions 670 of the insulating cover slide along the groves 220. The insulating cover 67 is thus forced move relative to the supporting structure 63 by rotating about its hinging axis. According to other embodiments of the invention, however, the insulating cover 67 may be arranged differently to move relative to the supporting structure 63 during a manoeuvre of the switch pole. For example, it may be arranged in such a way to move by inertia or upon actuation by suitable elastic means coupled to the insulating cover 67 and the supporting structure 63. In general, the insulating cover 67 can move (relative to the

supporting structure 63) between a first shield position (figure 12) and a second shield position (figure 14).

[0110] When it is in the first shield position, the insulated cover 67 has no portions interposed between the electric contacts of the switch pole.

[0111] When it is in the second shield position, the insulated cover 67 has a shield portion 68 interposed between the main electric contacts 51, 61 of the switch pole, i.e., between the one or more first fixed contacts 51 of the fixed contact assembly and the one or more first movable contacts 61 of the movable contact assembly.

[0112] Preferably, when the insulating cover 67 is in the second shield position, the shield portion 68 covers the movable contacts 61 of the movable contact assembly, thereby segregating these electric contacts from the corresponding fixed contacts 51 of the fixed contact assembly.

[0113] The arrangement of the insulating cover 67 decreases the probability that electric arcs develop between the main electric contacts of the switch pole during an opening manoeuvre of the switch pole.

[0114] Figures 15-17 show the switch pole, according to another embodiment of the invention, with the movable contact assembly 6 in different operating positions during a manoeuvre of the switch pole.

[0115] In many respects, this embodiment of the invention is similar to the embodiment shown in figures 8-10 described above. In this case, however, the movable contact assembly 6 includes a movable insulating cover 67 as explained above with reference to the embodiment of figures 11, 11A-11B, 12-14.

[0116] The switch pole, according to the present invention, allows the proposed aims and the objects to be achieved.

[0117] The insulating baffle 66 of the movable contact assembly allows electric arcs arising between the electric contacts under separation to be efficiently confined in the arc extinguishing region of the switch pole, during an opening manoeuvre of the switching device.

[0118] This remarkably favours a uniform distribution of electric arcs along the arc chamber, which allows making more efficient their arc-quenching performances.

[0119] The arrangement of the insulating baffle 66 interposed between the main contacts and the arc contacts of the switch pole remarkably decreases the probability that electric arcs strike towards other conductive components of the switch pole, which are located outside the arc-extinguishing region 4.

[0120] In some embodiments, the insulating baffle 66 causes a flow of pressurized air towards the arc contacts 52, 62 of the switch pole under separation during an opening manoeuvre of the switch pole. This solution allows further improving the segregation of electric arcs in the arc extinguishing region 4 of the switch pole (figures 16-17, dotted lines).

[0121] In some embodiments, the movable contact assembly of the switch pole is provided with a movable insulating cover having a shield portion, which can interpose between the main electric contacts of the switch pole, during an opening manoeuvre of the switch pole.

[0122] This solution allows remarkably the probability that electric arcs develop between the main electric contacts of the switch pole, thus reducing erosion phenomena and prolonging the operating life of said electric contacts.

[0123] The switch pole of the invention has a relatively simple and compact structure, which is relatively easy to manufacture at industrial level, at competitive costs compared to the currently available solutions on the market.

Claims

1. A switch pole (1) for a switching device (100) comprising:

- an insulating casing (2) defining an internal space of said switch pole;
- a first pole terminal (7) and a second pole terminal (8) couplable with corresponding line conductors of an electric line;
- a fixed contact assembly (5) including a plurality of fixed electric contacts (51, 52) electrically connected to said first pole terminal (7), said fixed electric contacts including one or more first fixed contacts (51) and one or more second fixed contacts (52) spaced apart and electrically insulated from said first fixed contacts;
- a movable contact assembly (6) including a plurality of movable electric contacts (61, 62) electrically connected to said second pole terminal (8), said movable electric contacts including one or more first movable contacts (61) and one or more second movable contacts (62), said movable contact assembly being reversibly movable around a rotation axis (A1), so that said first movable contacts (61) can be coupled to or decoupled from said first fixed contacts (51) and said second movable contacts (62) can be coupled to or decoupled from said second fixed contacts (52), when said movable contact assembly (6) moves about said rotation axis (A1), during a manoeuvre of said switch pole;

characterized in that said movable contact assembly (6) comprises an insulating baffle (66) protruding towards said fixed contact assembly (5) and slidingly inserted, at least partially, in a receiving recess (27) defined by said insulating casing, said insulating baffle being interposed between the one or more first fixed contacts (51) and the one or more second fixed contacts (52) of said fixed contact assembly and being interposed between the one or more first movable contacts (61) and the one or more second movable contacts (62) of said movable contact assembly.

2. Switch pole, according to claim 1, **characterized in that** said insulating baffle (66) is positioned at a first spacing region between the one or more first movable contacts (61) and the one or more second movable contacts (62) of said movable contact assembly.

3. Switch pole, according to one of the previous claims, **characterized in that** said receiving recess (27) has an aperture (270) for the passage of said baffle (66), said aperture being positioned at a second spacing region between the one or more first fixed contacts (51) and the one or more second fixed contacts (52) of said fixed contact assembly.

4. Switch pole, according to one of the previous claims, **characterized in that** said insulating baffle (66) has a free end (661) in an opposite position relative to the movable contacts (61, 62) of said movable contact assembly, the free end of said insulating baffle being inserted in said receiving recess (27) and slidingly moving along said receiving recess, when said movable contact assembly (6) moves about said rotation axis (A1), during a manoeuvre of said switch pole.

5. Switch pole, according to one of the previous claims, **characterized in that** said insulating baffle (66) has a piston portion (661) slidingly moving along said receiving recess (27), when said movable contact assembly (6) moves about said rotation axis (A1), during a manoeuvre of said switch pole, said piston portion (611) causing a flux of pressurized air to blow towards the one or more second fixed contacts (52) of said fixed contact assembly and the one or more second movable contacts (62) of said movable contact assembly, during an opening manoeuvre of said switch pole.

6. Switch pole, according to claim 4 and 5, **characterized in that** said piston portion (661) is formed by the free end of said insulating baffle (66).

7. Switch pole, according to one of the previous claims, **characterized in that** said movable contact assembly (6) comprises a supporting structure (63) of the movable contacts (61, 62) of said movable contact assembly, said insulating baffle (66) being fixed to said supporting structure in such a way to move together with said supporting structure, when said movable contact assembly (6) moves about said rotation axis (A1), during a manoeuvre of said switch pole.

8. Switch pole, according to claim 7, **characterized in that** said movable contact assembly (6) comprises an insulating cover (67) at least partially covering one or more conductive portions (65) of said movable contact assembly, said insulating cover being mounted on said supporting structure (63) in such a way to move together with said supporting structure, when said movable contact assembly (6) moves about said rotation axis (A1), during a manoeuvre of said switch pole.

9. Switch pole, according to claim 8, **characterized in that** said insulating cover (67) is fixed to said supporting structure (63), said insulating baffle (66) being formed by a portion of said insulating cover.

10. Switch pole, according to claim 8, **characterized in that** said insulating cover (67) is hinged on said supporting structure (63) and reversibly moves relative to said supporting structure, when said movable contact assembly (6) moves about said rotation axis (A1), during a manoeuvre of said switch pole.

11. Switch pole, according to claim 10, **characterized in that** said insulating cover (67) can move reversibly between a first shield position, at which said insulating cover has no portions interposed between the electric contacts (51, 61) of said switch pole, and a second shield position, at which said insulating cover (67) has a shield portion (68) interposed between the one or more first fixed contacts (51) of said fixed contact assembly and the one or more first movable contacts (61) of said movable contact assembly.

12. Switch pole, according to claim 11, **characterized in that** said insulating cover (67) moves from said first shield position to said second shield position during an opening manoeuvre of said switch pole.

13. A low voltage switching device **characterized in that** it comprises at least a switch pole (1), according to one of the previous claims.

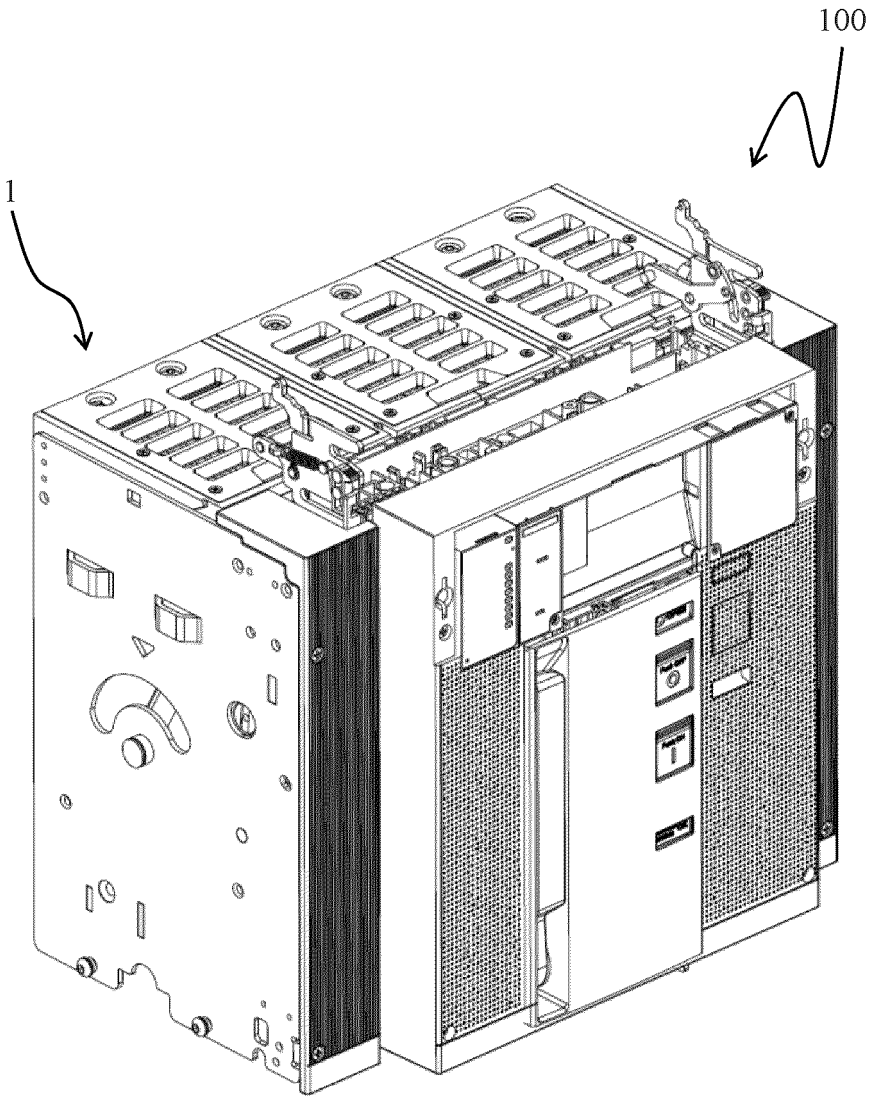


FIG. 1

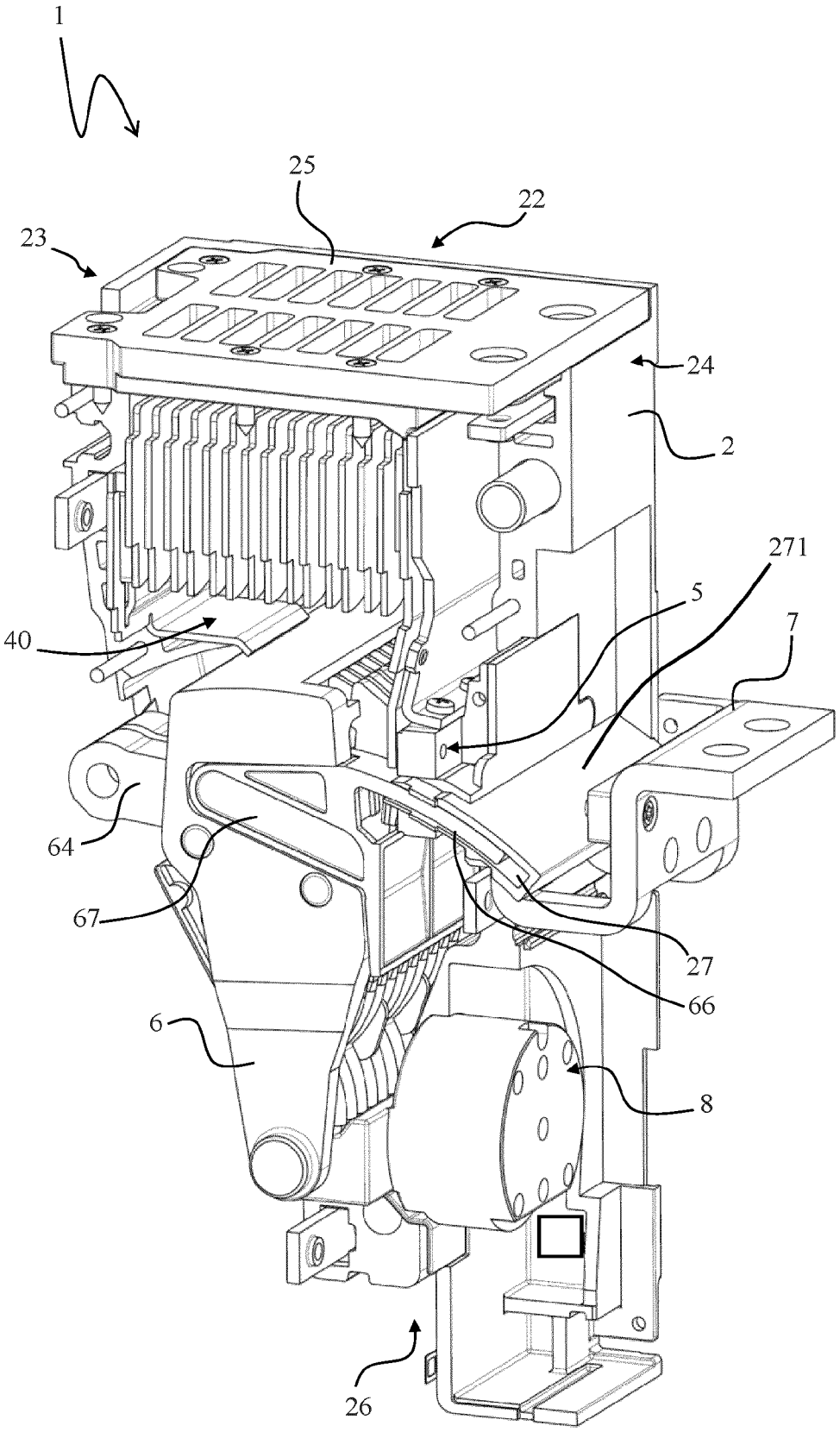


FIG. 2

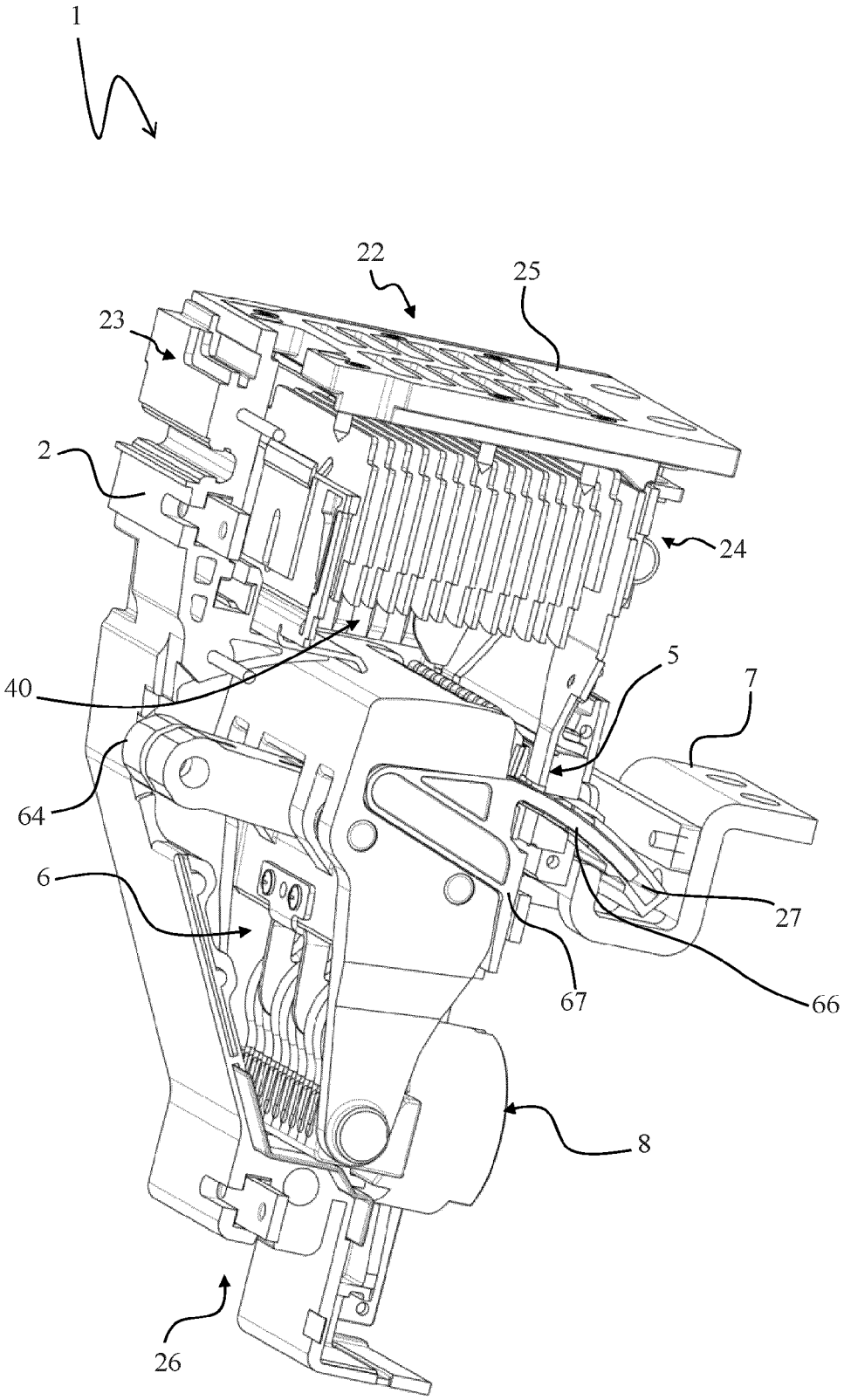


FIG. 3

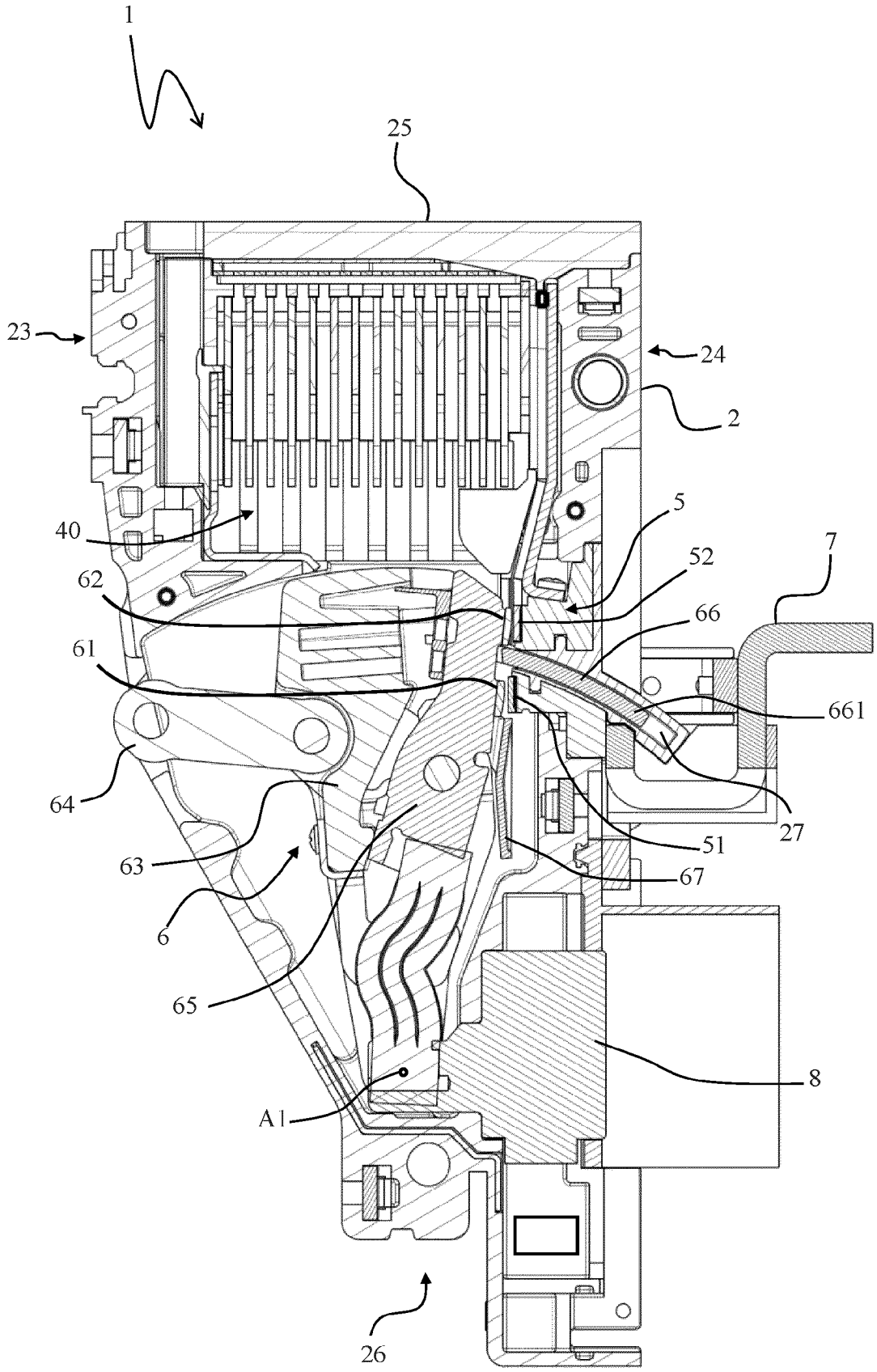


FIG. 4

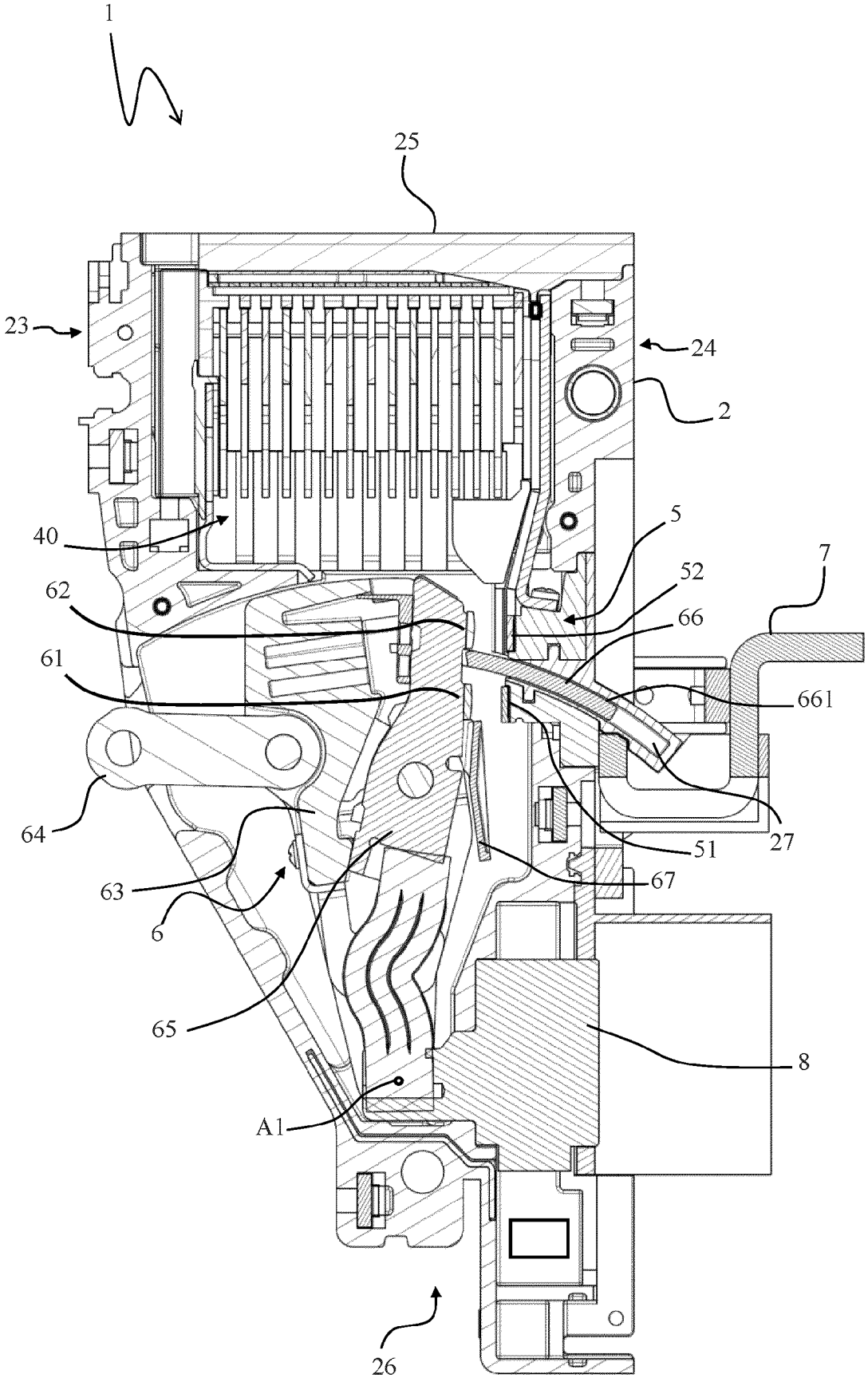


FIG. 5

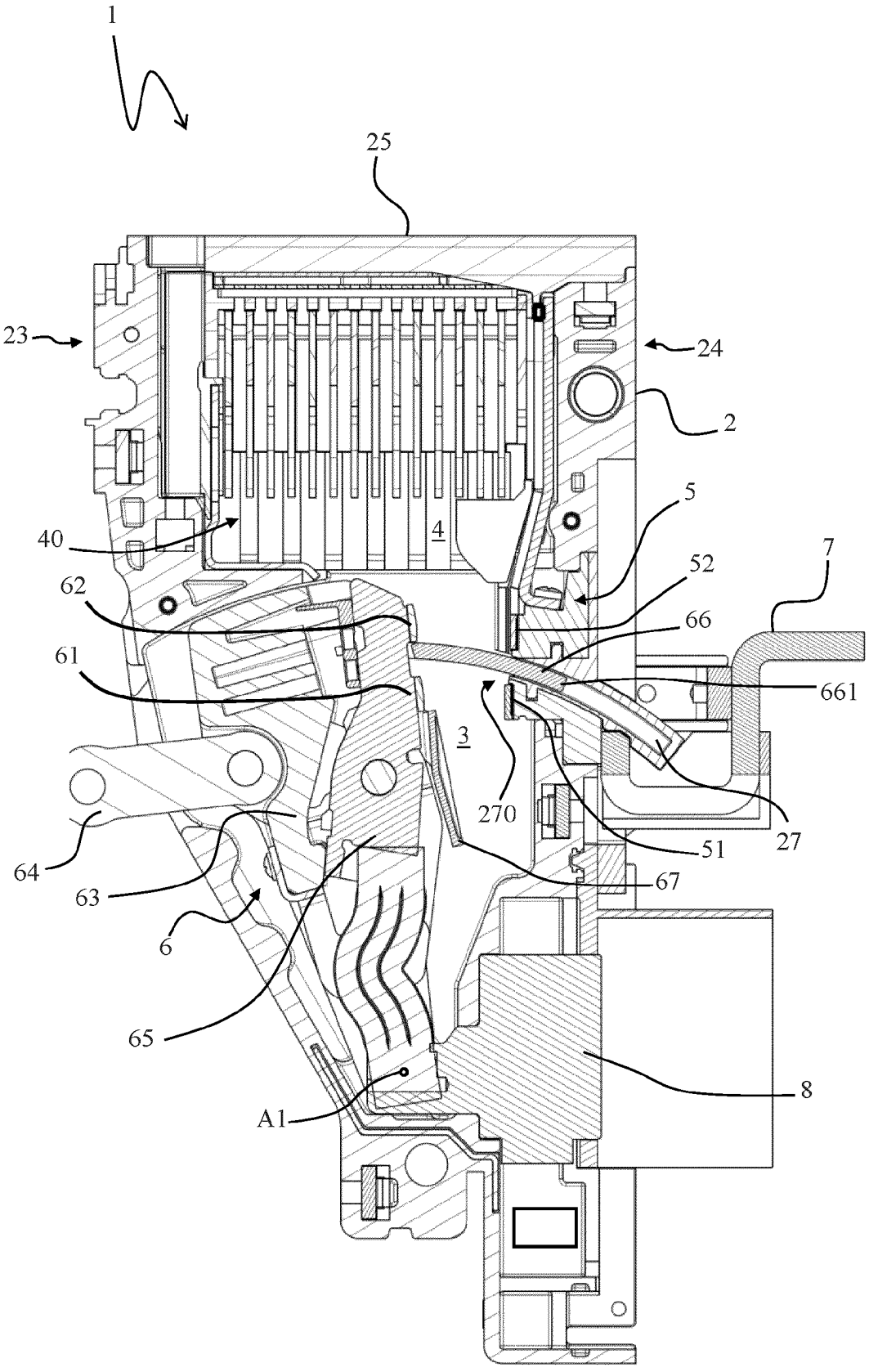


FIG. 6

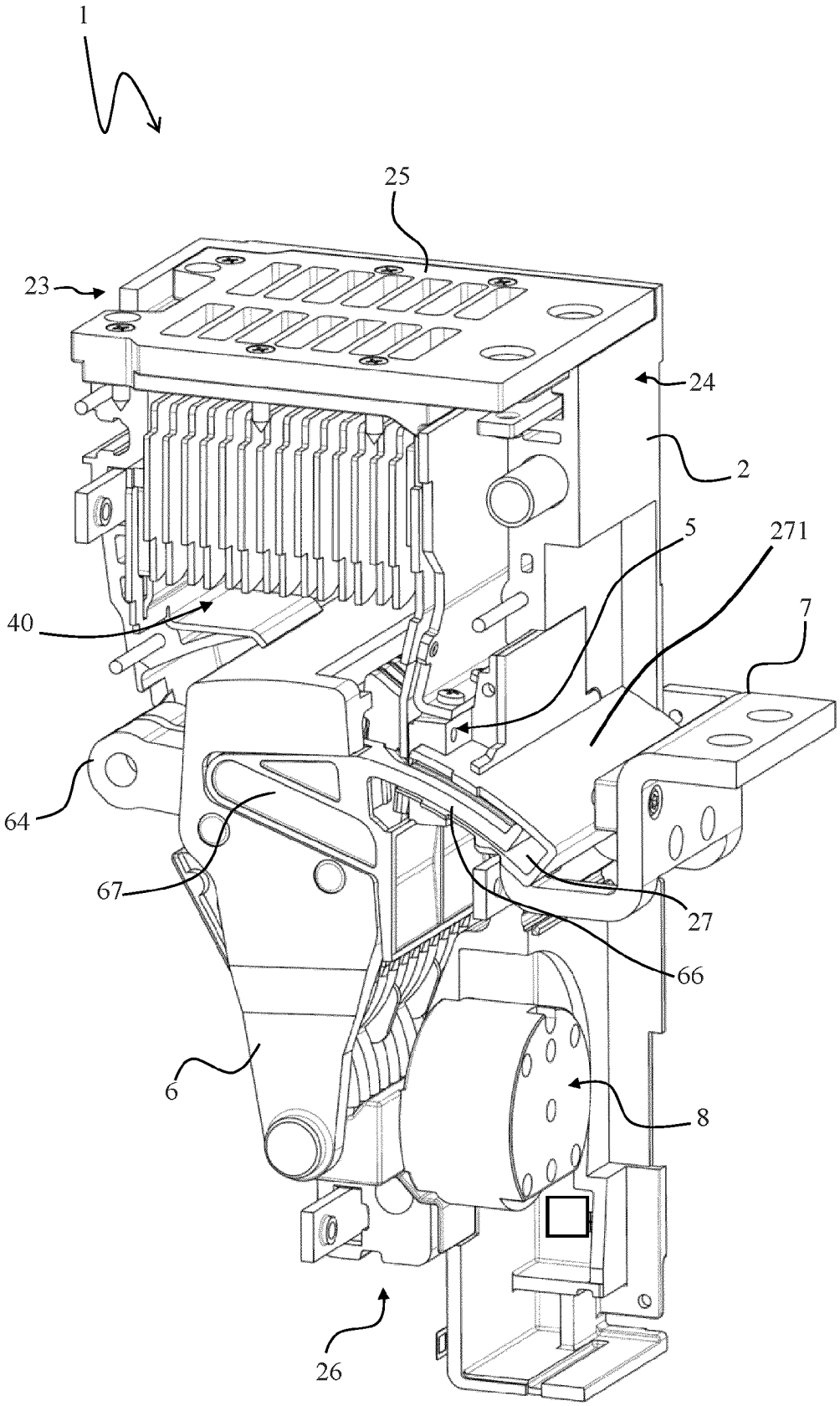


FIG. 7

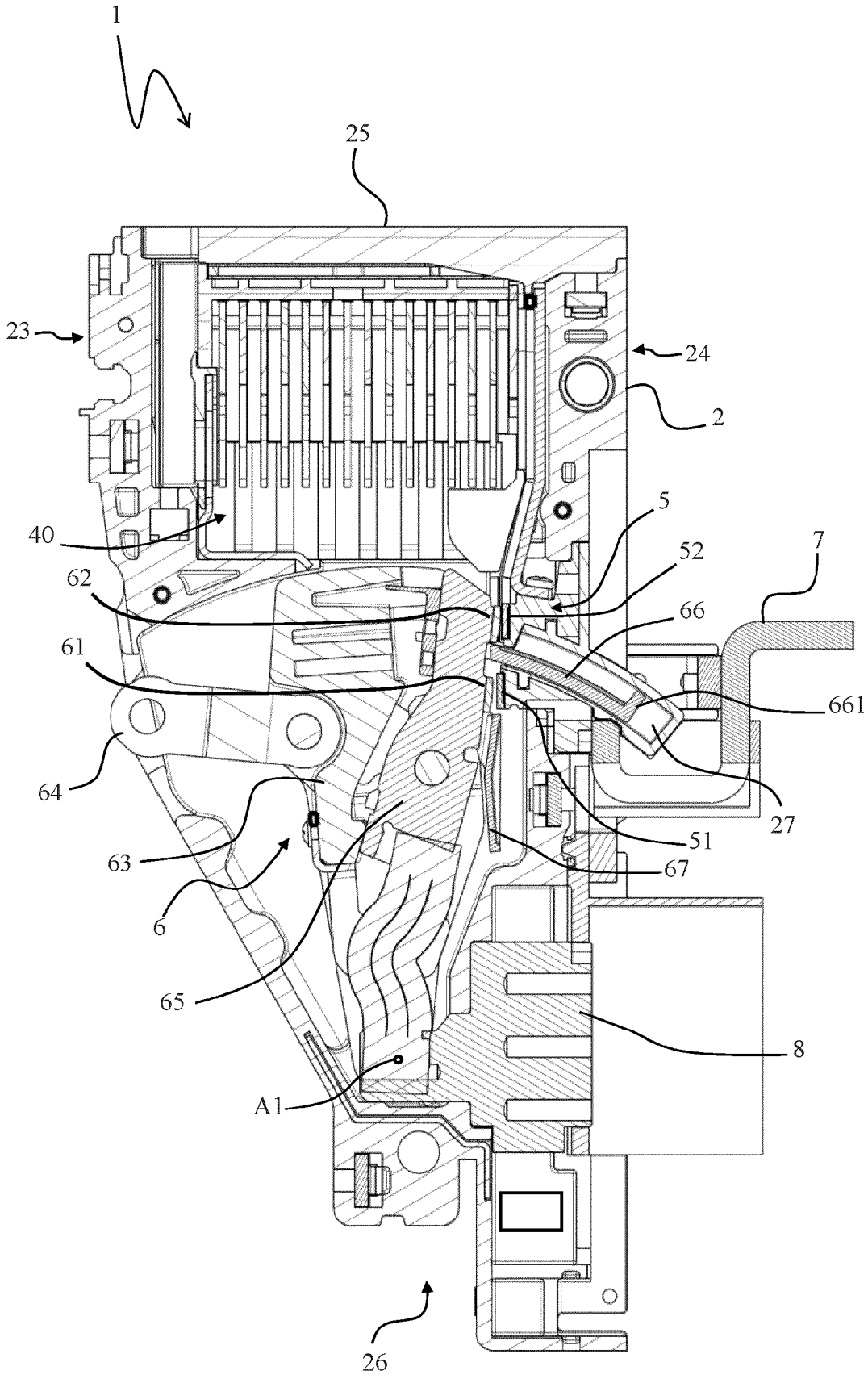


FIG. 8

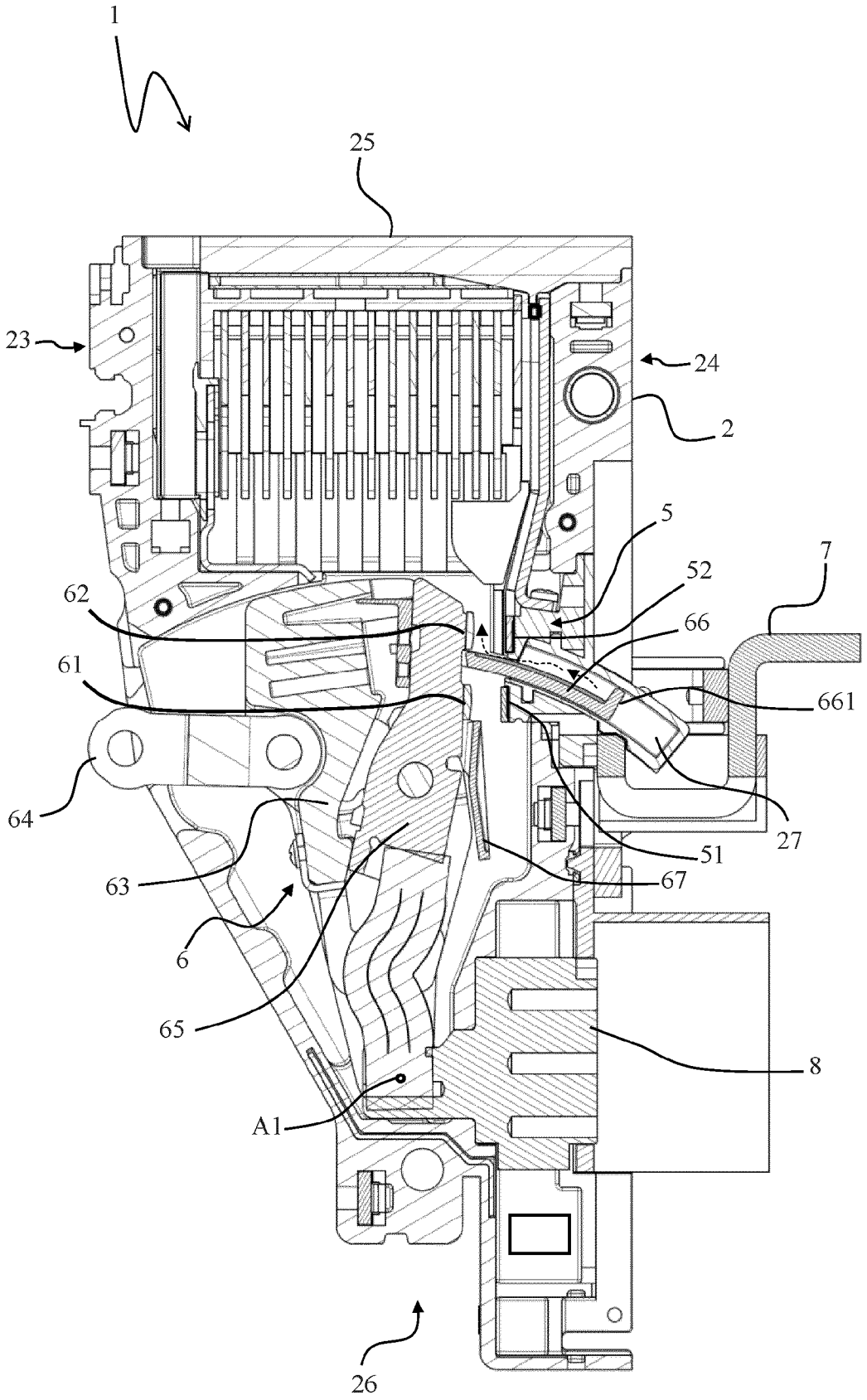


FIG. 9

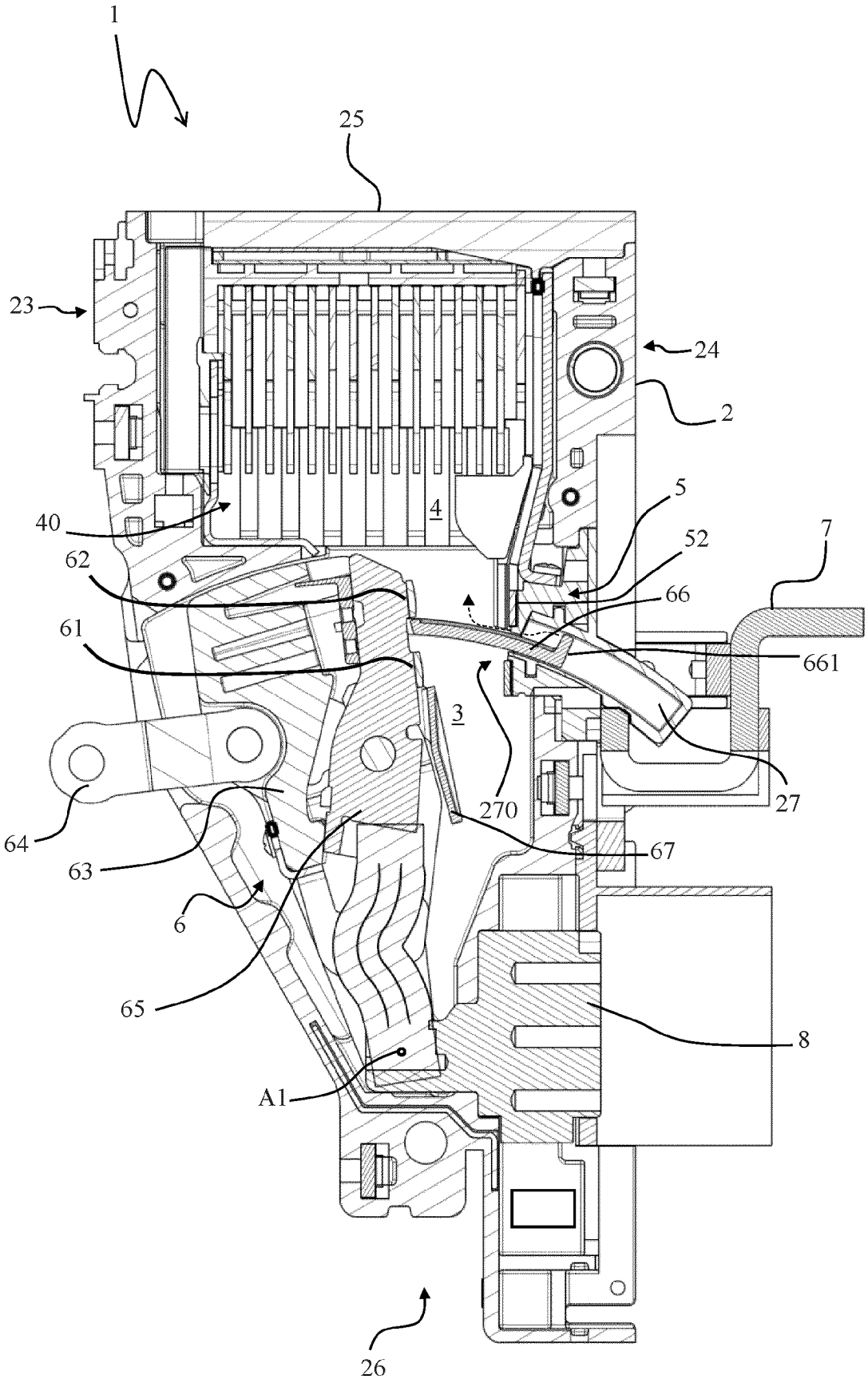


FIG. 10

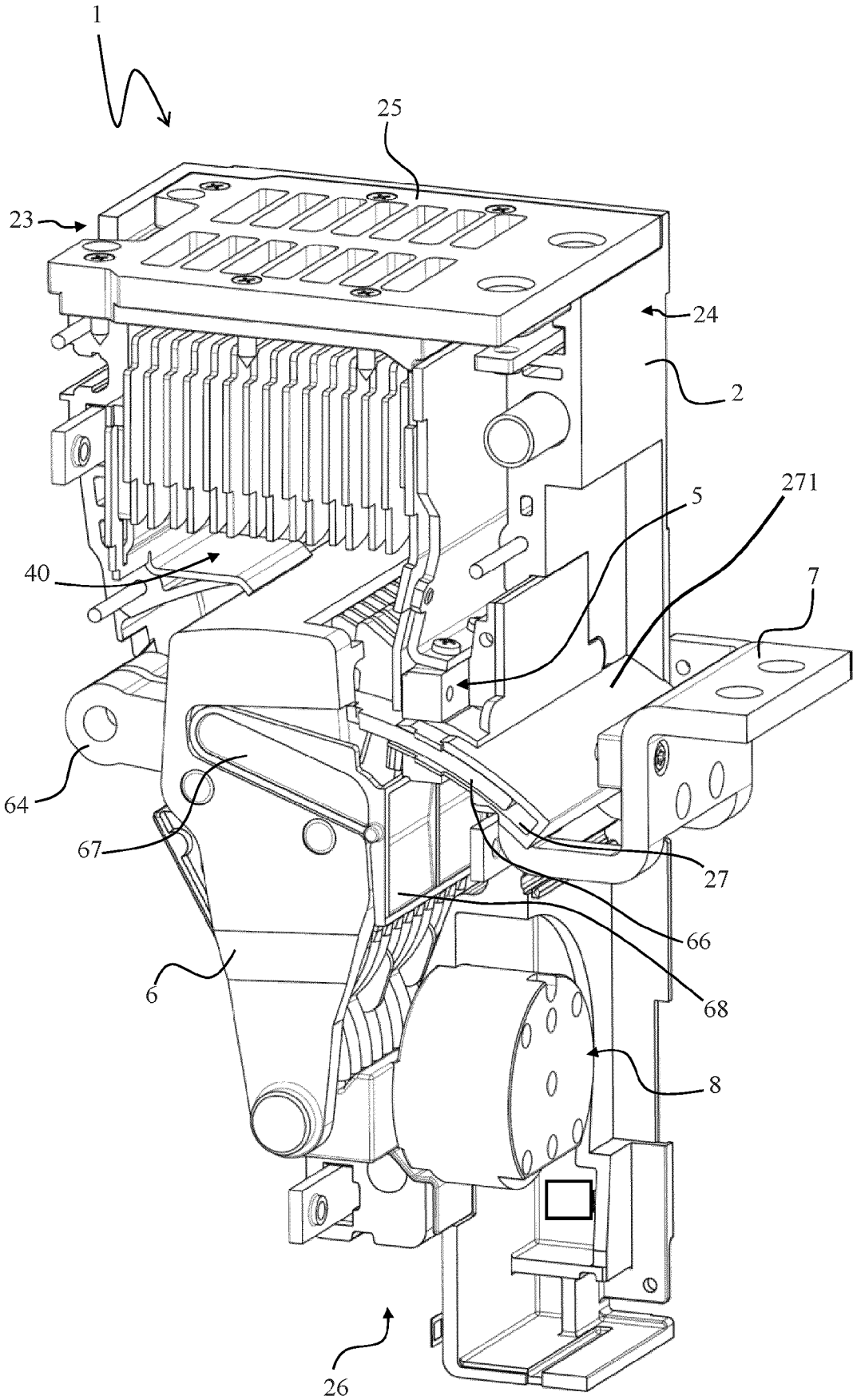


FIG. 11

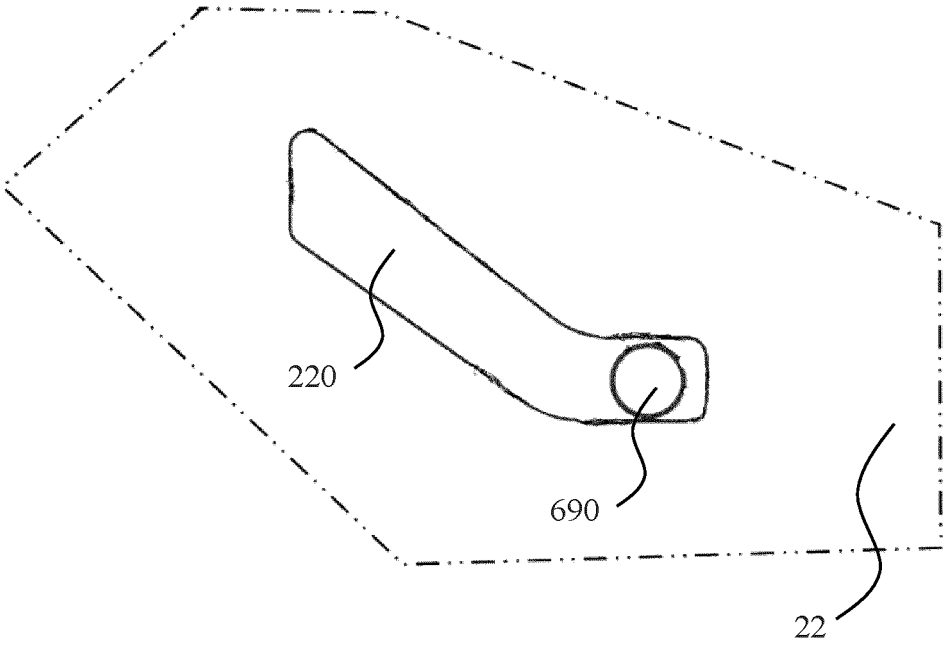


FIG. 11A

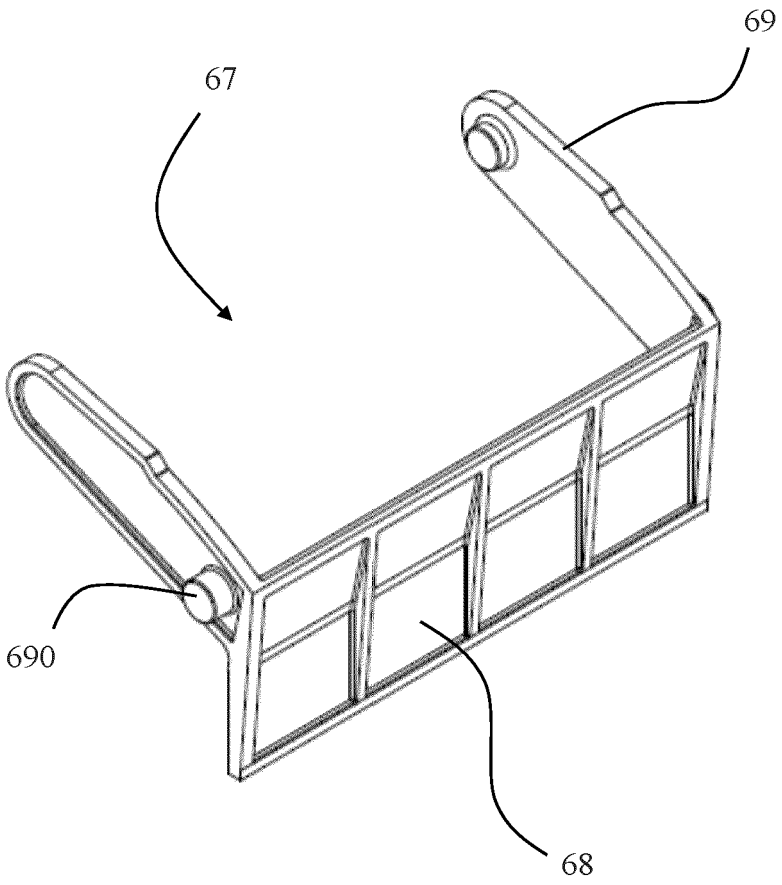


FIG. 11B

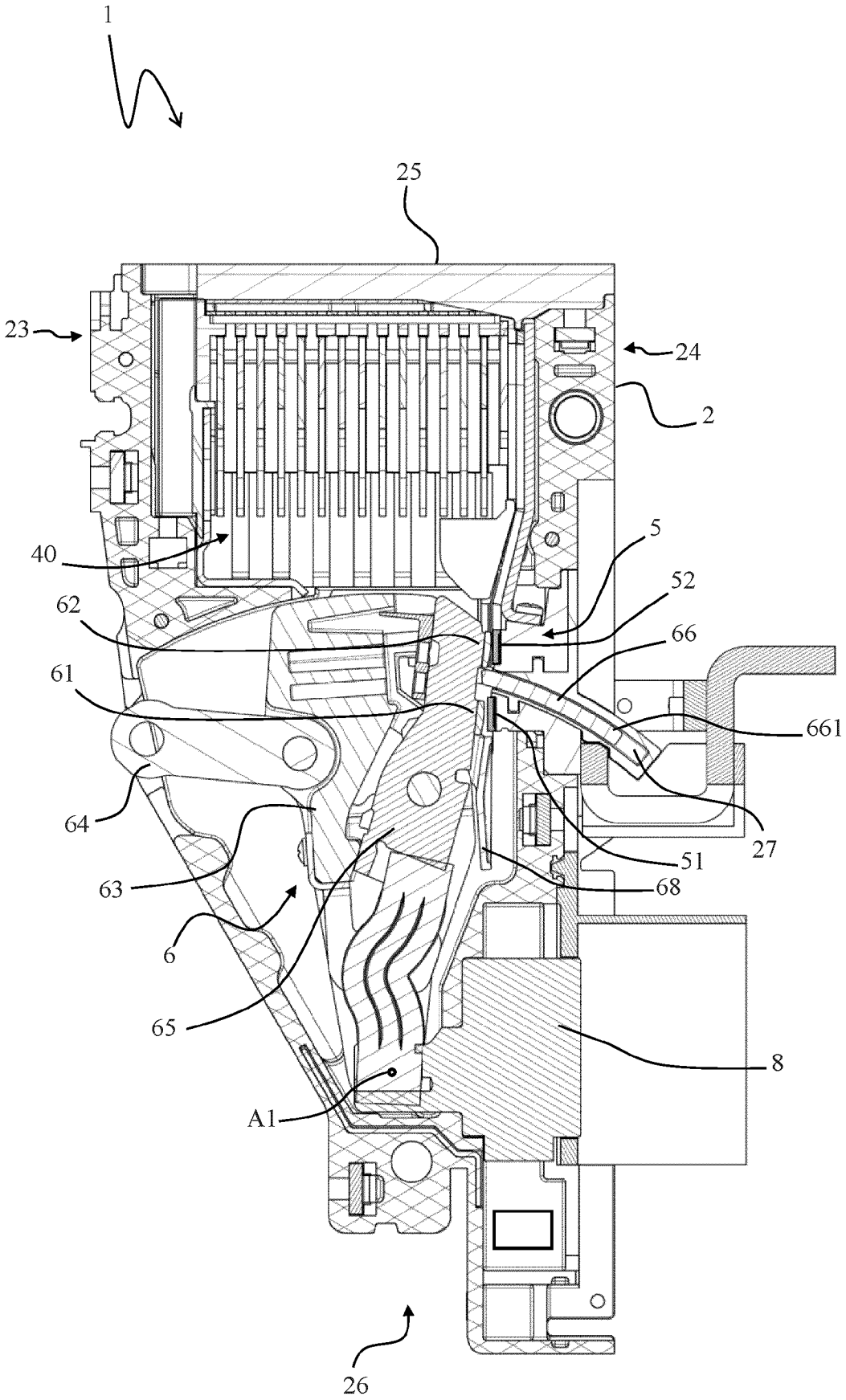


FIG. 12

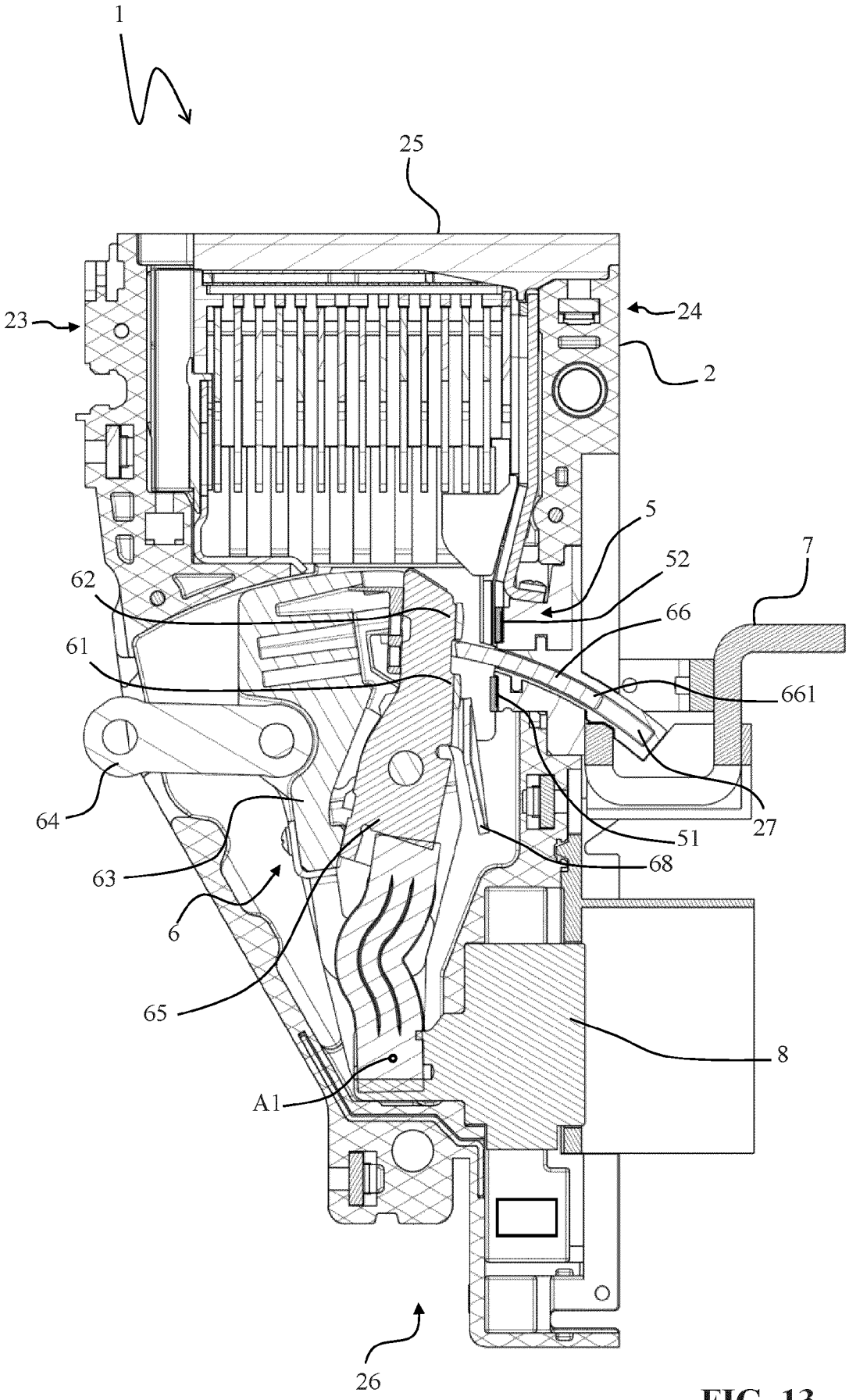


FIG. 13

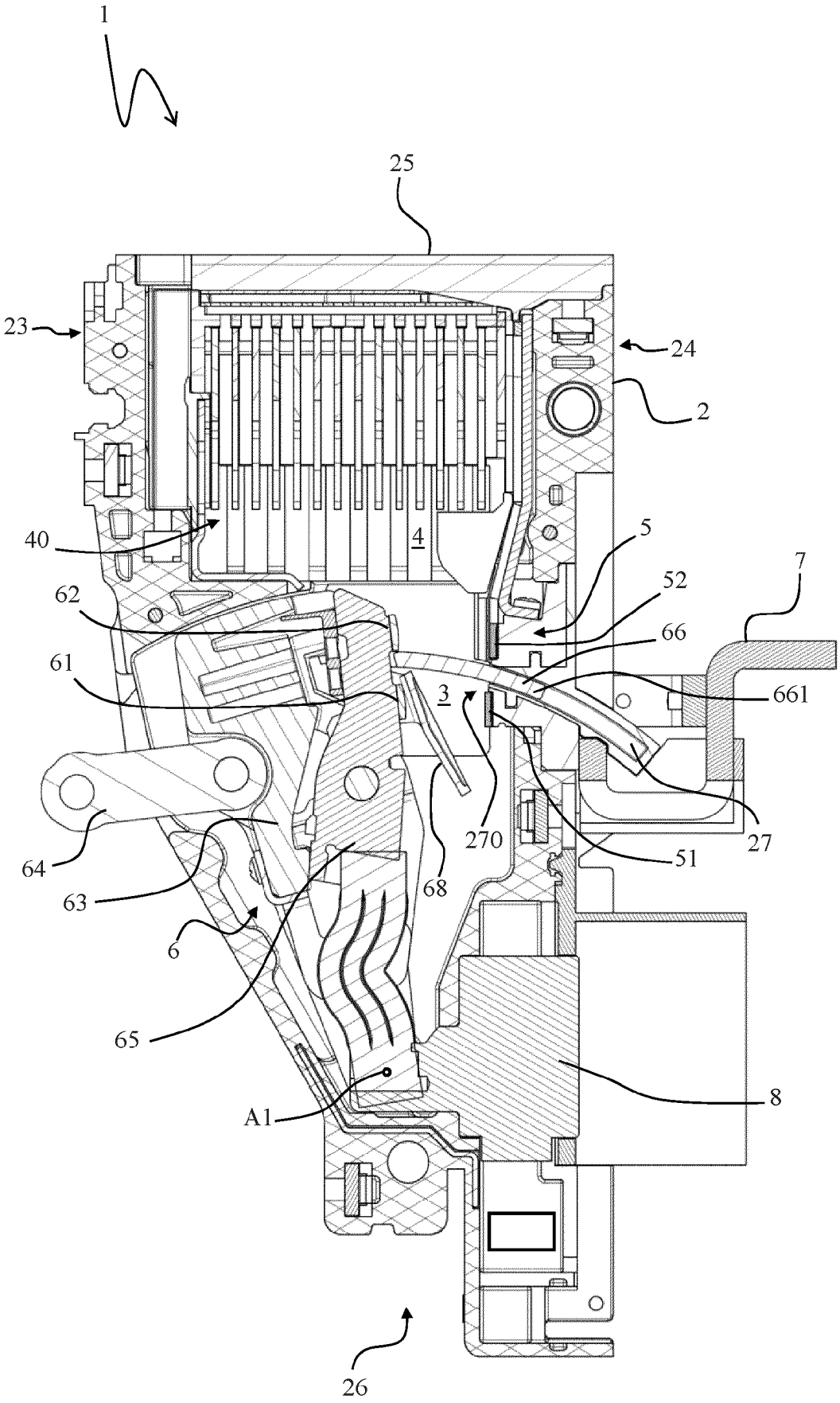


FIG. 14

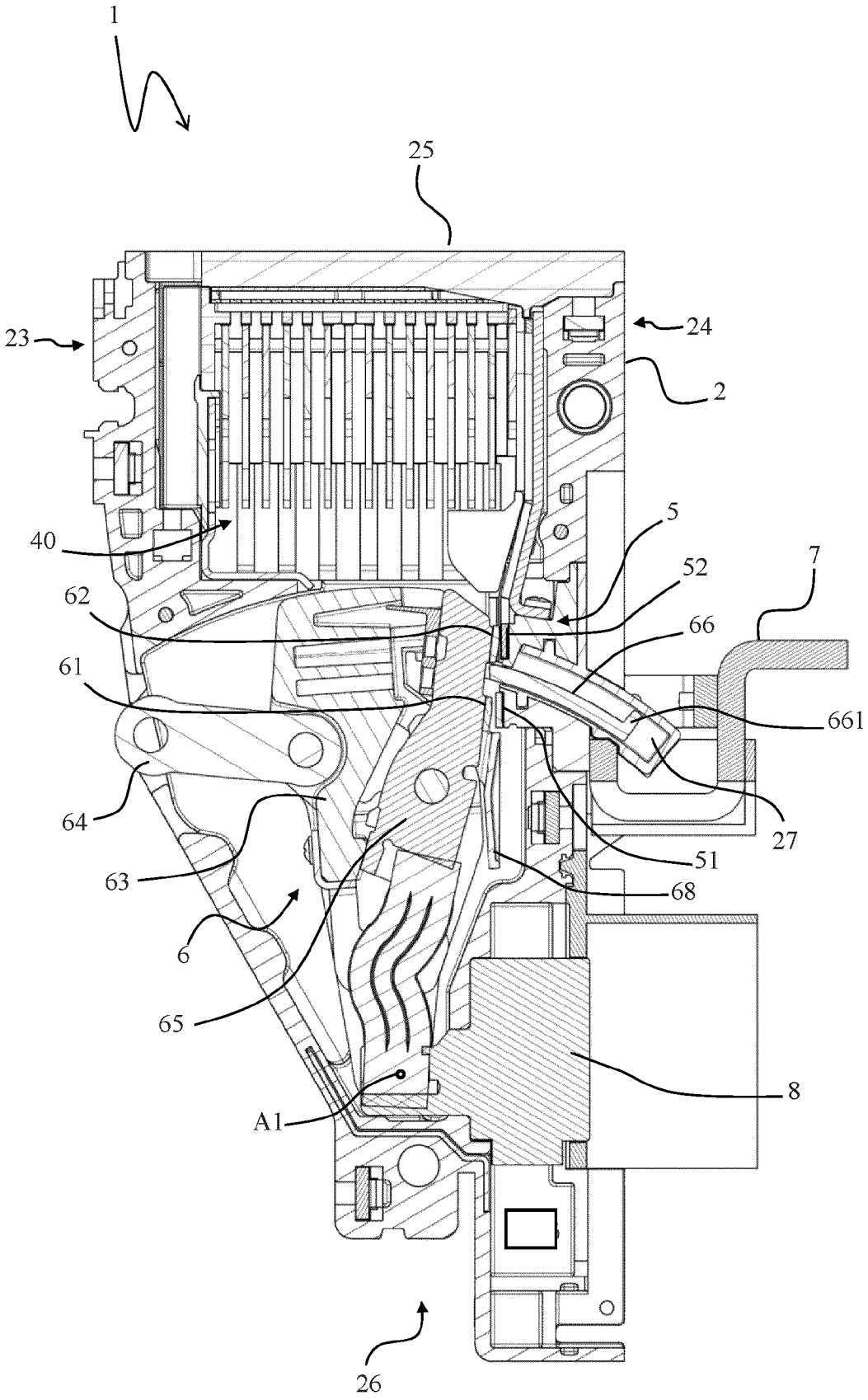


FIG. 15

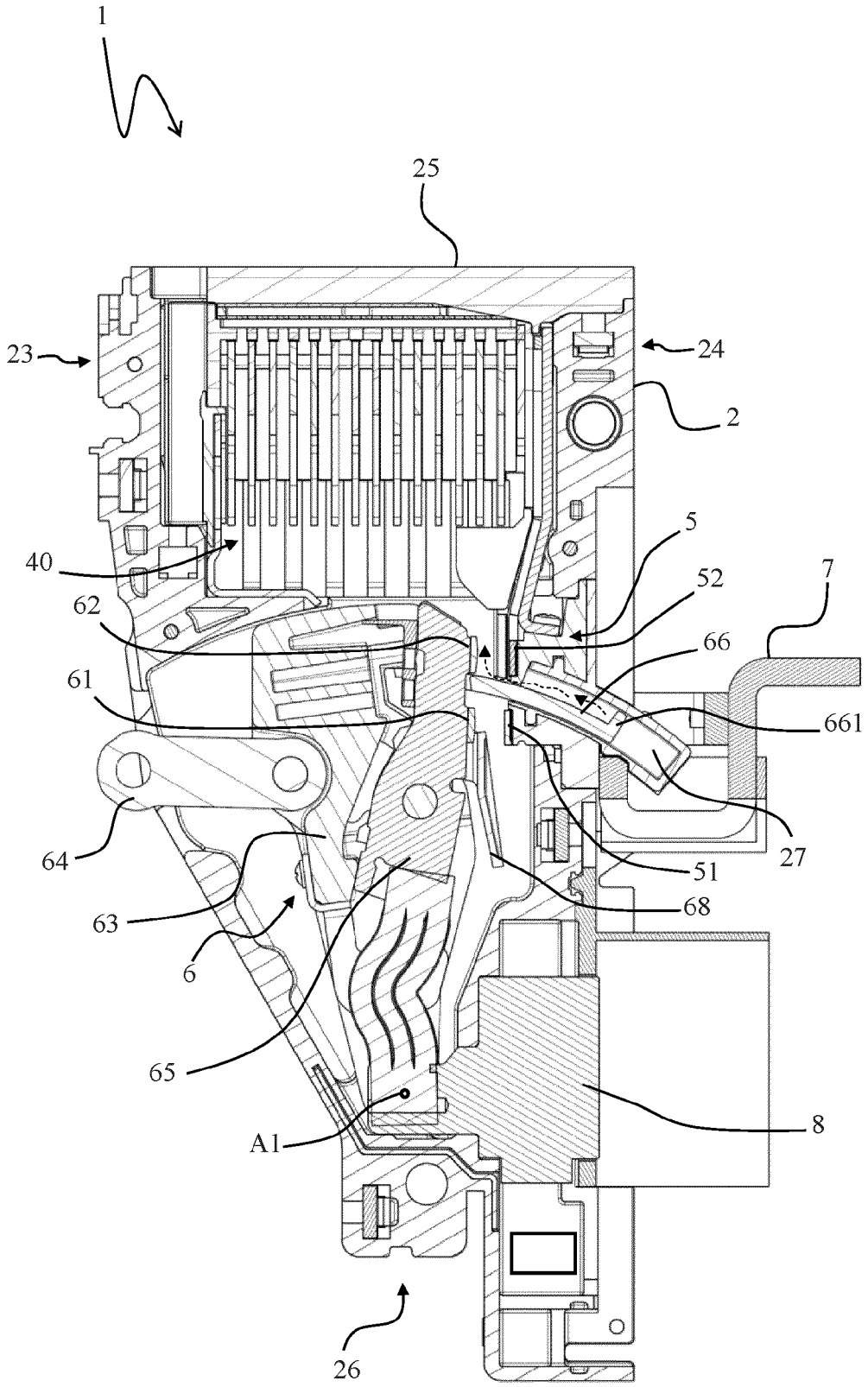


FIG. 16

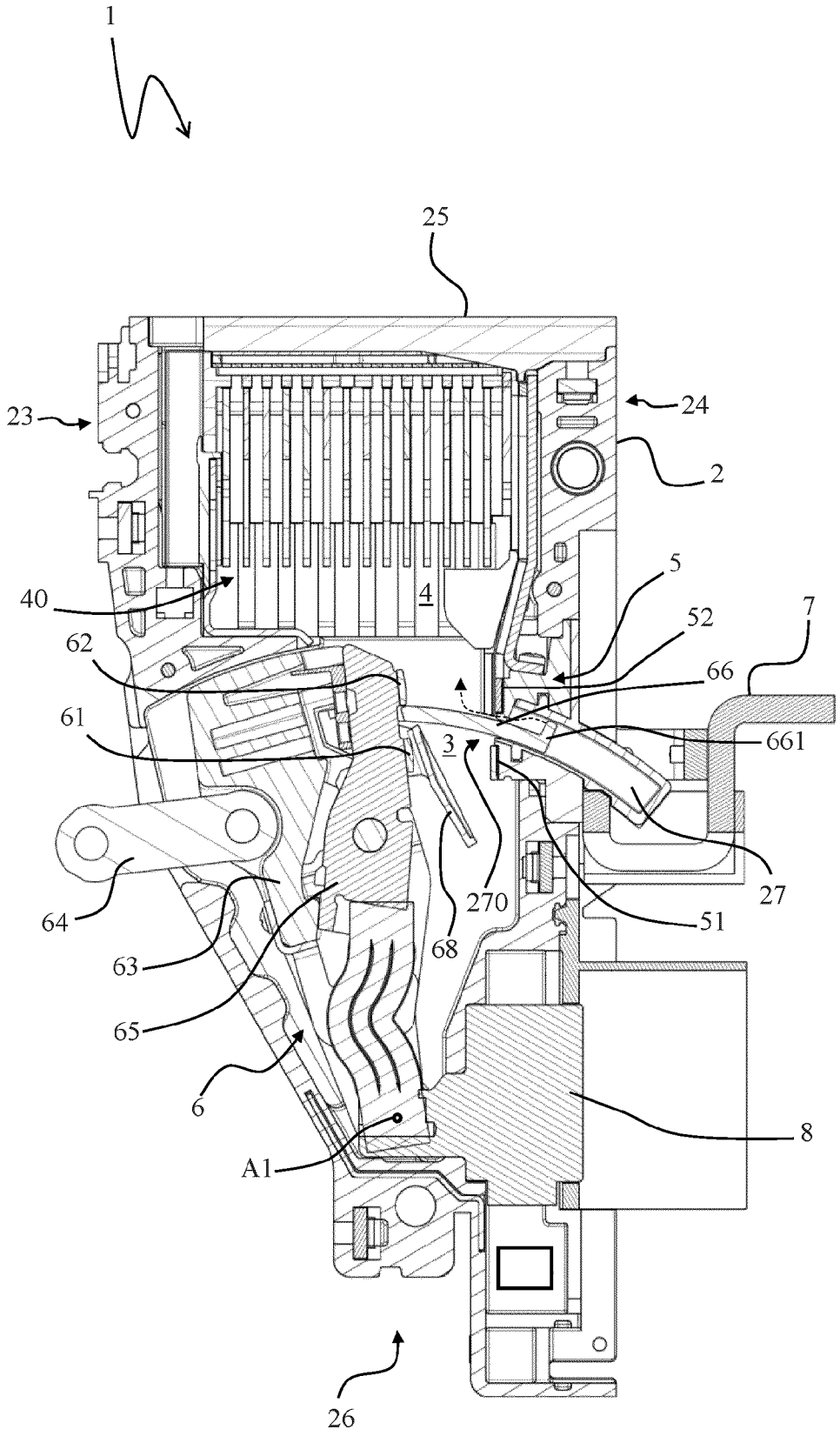


FIG. 17

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EUROPEAN SEARCH REPORT

Application Number
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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	4 September 2025	Ledoux, Serge

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