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(54) **Titre : DISJONCTEUR THERMIQUE DE PROTECTION CONTRE LES SURINTENSITES**
(54) **Title: THERMAL OVERCURRENT CIRCUIT BREAKER**

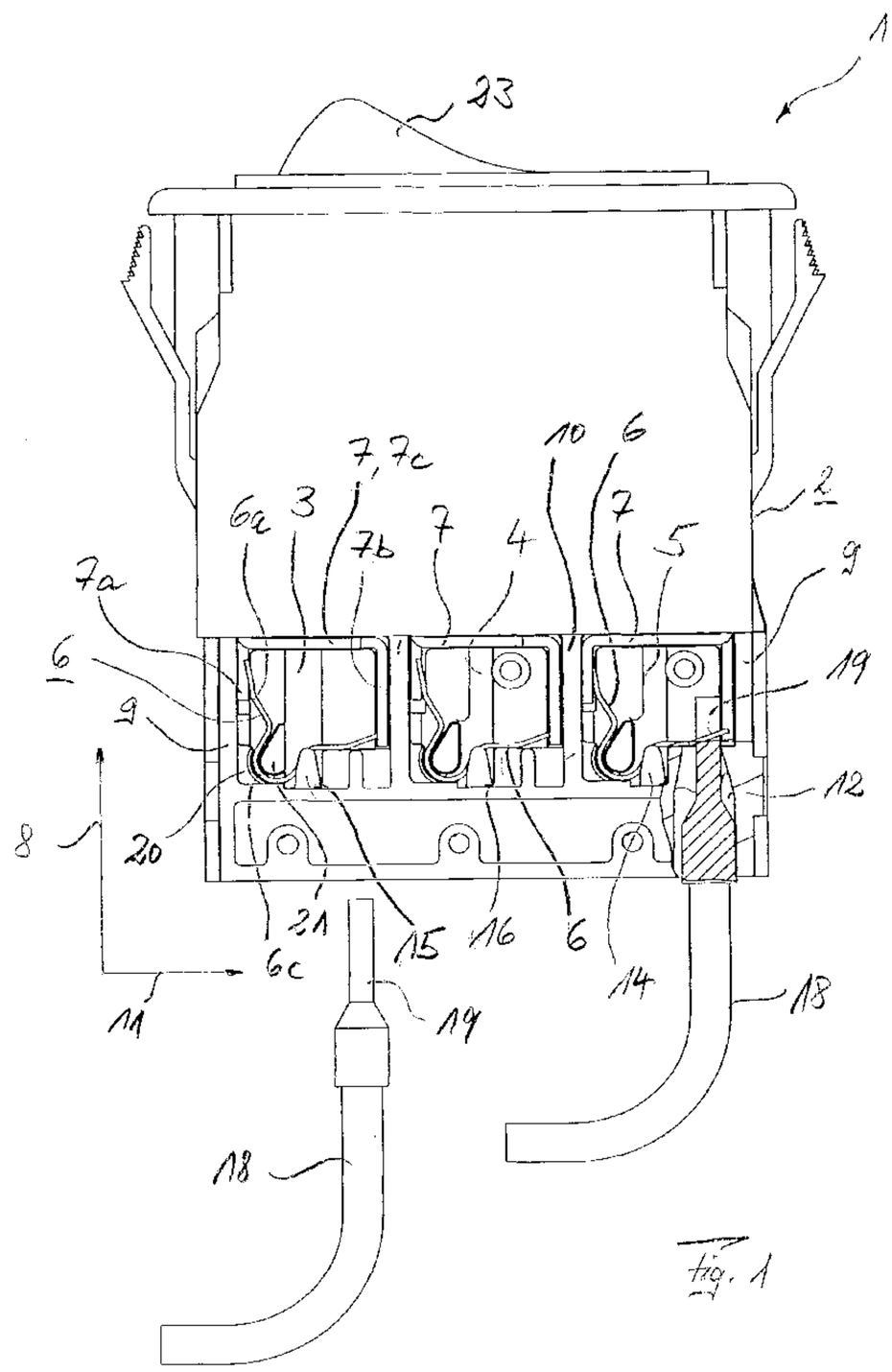


fig. 1

(57) Abrégé/Abstract:
The invention relates to a thermal overcurrent circuit breaker (1) having a switch housing (2) in which a thermal expansion element (30) and a snap-action switching mechanism (25, 26, 29, 30), which is coupled to said thermal expansion element and can be

CA 2939551 A1 2015/08/20

(21) 2 939 551

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(57) **Abrégé(suite)/Abstract(continued):**
manually operated, and also a moving contact (27), which interacts with said snap-action switching mechanism, and a fixed contact (28) are arranged, said fixed contact being connected to a first connection rail (7) while contact is made with the moving contact (27) by a second connection rail (7) by means of the thermal expansion element (30). The switch housing (2) has a number of connection chambers (3, 4, 5) in which in each case one of the connection rails (7) is arranged, wherein a two-limb spring element (6) for making clamping contact with a connection line (18), which is guided into the connection chamber (3, 4, 5) via a first housing opening (12) and has the connection rail (7), is arranged in each connection chamber (3, 4, 5).

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(54) **Title**: THERMAL OVERCURRENT CIRCUIT BREAKER

(54) **Bezeichnung** : THERMISCHER ÜBERSTROMSCHUTZSCHALTER

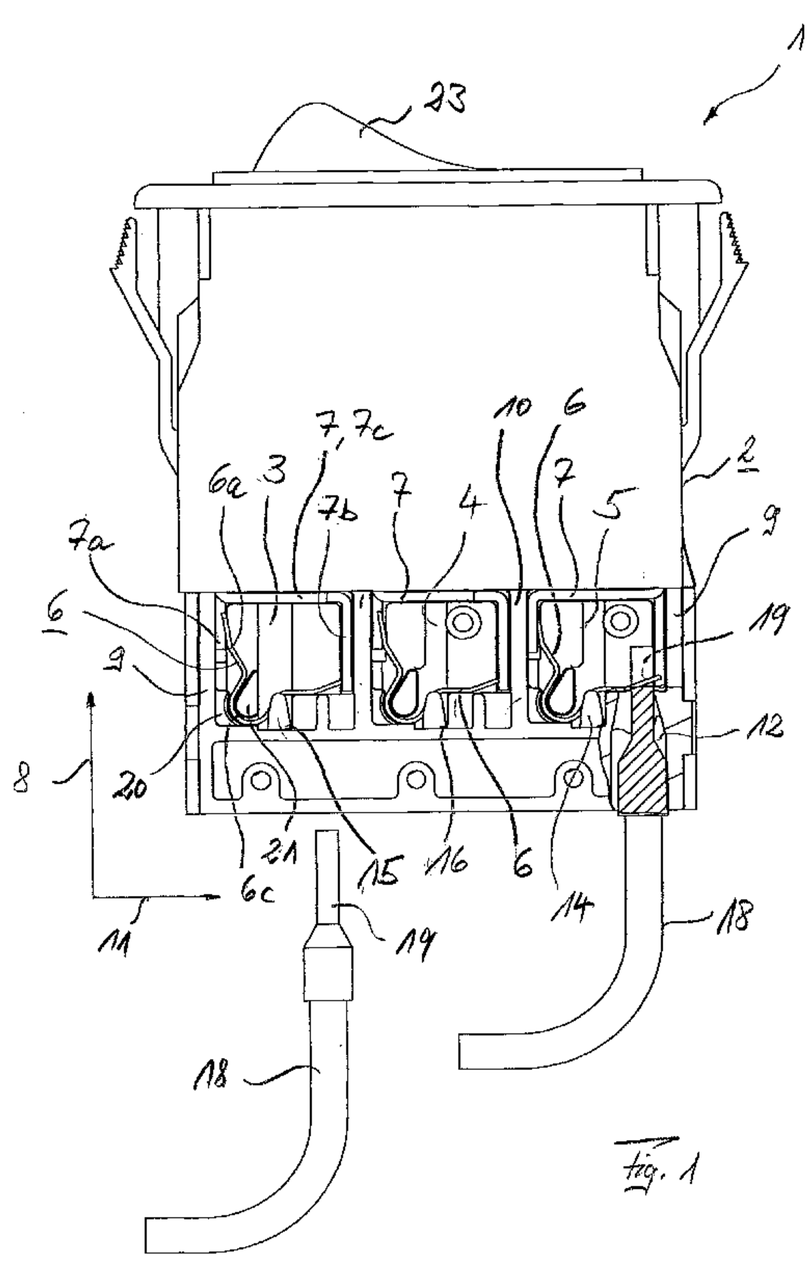


fig. 1

(57) **Abstract**: The invention relates to a thermal overcurrent circuit breaker (1) having a switch housing (2) in which a thermal expansion element (30) and a snap-action switching mechanism (25, 26, 29, 30), which is coupled to said thermal expansion element and can be manually operated, and also a moving contact (27), which interacts with said snap-action switching mechanism, and a fixed contact (28) are arranged, said fixed contact being connected to a first connection rail (7) while contact is made with the moving contact (27) by a second connection rail (7) by means of the thermal expansion element (30). The switch housing (2) has a number of connection chambers (3, 4, 5) in which in each case one of the connection rails (7) is arranged, wherein a two-limb spring element (6) for making clamping contact with a connection line (18), which is guided into the connection chamber (3, 4, 5) via a first housing opening (12) and has the connection rail (7), is arranged in each connection chamber (3, 4, 5).

(57) **Zusammenfassung**: Die Erfindung betrifft einen thermischer Überstromschutzschalter (1) mit einem Schaltergehäuse (2), in dem ein thermisches Dehnelement (30) und ein mit diesem gekoppelter, manuell betätigbarer Sprungschaltmechanismus (25, 26, 29, 30) sowie ein mit diesem zusammenwirkender Bewegkontakt (27) und ein Festkontakt (28) angeordnet sind, der mit einer ersten Anschlussschiene (7) verbunden ist, während der Bewegkontakt (27) über das thermische Dehnelement (30) mit einer zweiten

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WO 2015/120951 A1

WO 2015/120951 A1

IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Veröffentlicht:

— *mit internationalem Recherchenbericht (Artikel 21 Absatz 3)*

Anschlussschiene (7) kontaktiert ist. Das Schaltergehäuse (2) weist eine Anzahl von Anschlusskammern (3, 4, 5) auf, in denen jeweils eine der Anschlussschienen (7) angeordnet ist, wobei in jeder Anschlusskammer (3, 4, 5) ein zweischenkliges Federelement (6) zur Klemmkontaktierung einer über eine erste Gehäuseöffnung (12) in die Anschlusskammer (3, 4, 5) geführten Anschlussleitung (18) mit der Anschlussschiene (7) angeordnet ist.

Description

Thermal overcurrent circuit breaker

The invention relates to a thermal overcurrent circuit breaker with a switch housing in which a thermal expansion element, in particular a bimetal, and a manually operated snap-action switching mechanism coupled thereto, and a moving contact cooperating therewith and a fixed contact are arranged, which is connected to a first connection rail while the moving contact is contacted with a second connection rail via the thermal expansion element.

In a thermal circuit breaker, the trigger point depends on the amount of overcurrent. With increasing current, an expansion element, in particular a bimetal, is increasingly heated up to a defined trigger point. The thermal expansion element is coupled, for example, to a trip-free, manually operable snap-action mechanism which interacts with a moving contact of a contact pair. Such a circuit breaker, also referred to as an overcurrent circuit breaker, with thermal triggering usually serves to protect loads such as electric motors, household and office equipment, power tools, power supplies and low voltage lines against overcurrent. Such circuit breakers can be designed single-pole, two-pole or three-pole and are used for rated voltages of AC (alternating current) 240V or DC (direct current) 50V with current ratings in the range between 0.1A and 20A.

A thermal overcurrent circuit breaker of the mentioned type is known for example from DE 27 21 162 A1 and DE 94 22 029 U1. In the known circuit breakers, the connections to the contact pair, that is, to the fixed contact and via a bimetal to the moving contact carried by a contact spring, are designed as so-called tab connectors which lead out of the switch housing on a connection side opposite an ON / OFF switching rocker.

The connection of lines is made with flat plug sockets or by means of cable lugs screwed with the flat plugs.

The basis of the invention is to provide an improved thermal circuit breaker of the type mentioned, in particular in respect of touch protection, easy connection and contact and connection safety.

This object is achieved according to the invention by the features of claim 1. Advantageous embodiments and developments are the subject matter of the dependent claims.

For this purpose, the thermal overcurrent circuit breaker has a switch housing with a plurality of connection chambers, in each of which a connection rail and a two-limb spring element for clamp contacting of a connection line that is guided through a housing opening into the respective connection chamber are arranged there with the connection rail. Preferably, each spring element has a first spring limb and a second spring limb extending at an angle thereto. A second housing opening opens into the respective connection chamber, said housing opening overlapping from the second spring limb of the spring element to its resting position and being provided for pivoting actuation of this spring limb.

The switch housing also preferably includes a contact chamber extending between an operating side for a manually operable switching element and the connection chambers in which the snap-action switching mechanism and the thermal expansion element and the contact pair of movable and fixed contacts are arranged.

The first spring limb is supported in a contacting manner on a first rail or connecting limb of the connection rail. The angle between the two spring limbs of the spring element is preferably greater than 45°, most preferably greater than 60°, and smaller than 180°, in particular smaller than or equal to 90°. The second spring limb can be moved within the connection chamber from a contact position that preferably at least partially overlaps both the second housing opening and the first housing opening, at a chamber contour against the spring force, in a pivoting position directed toward the first spring limb for clamp contacting of the connection conductor that is run into the connection chamber.

A particularly expedient embodiment of the, or of each, spring element provides that the two spring limbs are connected via an intermediate limb with which the spring element bears against a housing contour within the connection chamber. The intermediate limb is shaped suitably in the manner of an open loop. The housing contour adjusted to the loop shape within the respective connection chamber preferably extends on both sides of the intermediate limb to form a bearing contour for the loop outer side of the spring element and a supporting contour which is enclosed by the looped intermediate limb opening towards to the spring limbs.

Another embodiment provides U-shaped connection rails which rest with both U-connection limbs or with at least one of the two U-connection limbs and the middle limb connecting these on a chamber wall of the connection chamber.

For a particularly simple release of the clamp contacting of a connected connection line, a second housing opening situated parallel to the first housing opening opens into the, or into each, connection chamber, said second housing opening also being covered by the second spring limb in its contact position. Indeed, generally the second spring limb can be pivoted by means of a tool directly inserted into the second housing opening. Advantageously, however, an actuating sleeve for indirect pivoting of the second spring limb by means of a tool is arranged in the second housing opening, so that the clamp contacting can be released in a particularly simple, reliable and non-destructive manner and the connection line can be unplugged.

An exemplary embodiment of the invention is illustrated by a drawing in further detail below. The drawings show:

Fig. 1 a side view of a thermal overload circuit breaker with a view to three connection chambers of a partially opened switch housing, and

Figs. 2 and 3 the thermal overload circuit breaker in two different perspective exploded views.

Mutually corresponding parts are provided in all figures with the same reference numerals.

Figures 1 to 3 show a thermal overcurrent circuit breaker 1 with a switch housing 2, in which in the embodiment, three connection chambers 3, 4, 5 are arranged side by side. In each connection chamber 3, 4, 5, a two-limbed spring element 6 is arranged. In each connection chamber 3, 4, 5, a connection rail 7 is further disposed, which is in each case U-shaped. The U-shape of the respective connection rail 7 is formed by a first rail limb 7a extending through the housing longitudinal direction 8 indicated in Figure 1, and a corresponding, interspaced parallel rail limb 7b and a connecting middle limb 7c. With these rail limbs 7a to 7c, the respective connection rails 7 bear against chamber exterior walls 9 or chamber partitions 10. For the sake of clarity, the identical rail limbs of the connection rails 7 in the other two connection chambers 4 and 5 are not further specified.

The same kind of two-limbed spring elements 6 are seated in the connection chambers 3 to 5, which for reasons of clarity, are again not equally or individually designated with regard to the subsequent details. With a first spring limb 6a, also referred to as a contact limb, oriented in the longitudinal direction of the housing 8, the respective spring element 6 contacts the rail limbs 7a of the corresponding connection rail 7. The second spring limb 6b of the respective spring member 6 hereinafter also referred to as a clamping limb is oriented in the housing transverse direction 11, perpendicular to the housing longitudinal direction 8, there covering a first housing opening 12. The respective clamping limb 6b of the spring element 6 also covers a second housing opening 13 (Fig. 2) situated parallel to said first housing opening 12. In this, an actuating sleeve 14 closed on one side is seated, which end projects into the respective connection chamber 3, 4, 5, and there bears against the clamping limb 6b of the respective spring element 6. Also for reasons of clarity, the similar second housing openings of the other connection chambers 3 and 4 are again not further specified.

The respective actuating sleeve 14 is at least slightly movable in the associated housing opening 13 in the housing longitudinal direction 8. In the assembled state of the actuating sleeve 14, an integrally formed latching nose 15 undercuts an edge contour 16 of the respective housing opening 13 within the respective connection chamber 3, 4, 5. As a result, the actuation sleeve 14 which has a support contour 17 (Fig. 2) for a tool at the opposite insertion end is secured within the respective housing opening 13.

As illustrated in the Figures on the basis of the connection chamber 5 shown there on the right, by means of the spring elements 6, a clamp contacting of a connection line 18 inserted over the first housing opening 12 into the respective connection chamber 3, 4, 5 occurs with the respective connection rail 7 and there, with its respective second rail limb 7b. Due to design, assembly and spring force of the spring element 6, the clamp contacting is self-locking. In other words, the respective clamping limb 6b can be resiliently pivoted in the insertion direction by means of the connection line 18 or its stripped line end 19 in the housing longitudinal direction 8, thereby also resiliently pivoting towards the contact limb 6a by reducing the angle α (Fig. 3) existing between these spring limbs 6a and 6b. A tensile load on the respective connection line 18 counter to the insertion direction causes, on the other hand, reinforcement of the clamping action with increasing tensile force.

The spring element 6 is mounted precisely positioned in the respective connection chamber 3, 4, 5. To this end, in the area of an intermediate limb 6c of the spring element 6, formed in the manner of an open loop and connecting the two spring limbs 6a and 6b, in the connection chamber 3, 4, 5, a contacting contour 20 and a supporting contour 21 are formed, between which the intermediate limb 6c of the spring element 6 is seated.

As can be seen relatively clearly in Figures 2 and 3, the switch housing 2 is comprised of several parts. It comprises a housing main body 2a, and a housing cap 2b as well as two housing covers 2c. The housing body 2a contains the connection chambers 3 to 5, into which the housing openings 12, 13 open that are introduced into a housing base 2d. As can be seen from Fig. 2, the overcurrent circuit breaker 1 is designed 2-poled, so that the connection chambers 3 to 5 and the housing openings 12, 13 opening into said chambers and the connection rails 7 and spring elements 6 are suitably provided in a multiple number.

As seen in the housing longitudinal direction 8 between the connection chambers 3 to 5 and an operating side 2e of the switch housing 2, there is a contact chamber 22 (Fig. 3) in which a snap-action switching mechanism is arranged, which cooperates with a switching rocker 23 on the operating side 2e. In the assembly state, the housing cap 2b covers the housing main body 2a

from the region of the contact chamber 22. The switching rocker 23 at least partly protrudes through a cap opening 24 of the housing cap 2b from the switch housing 2 in order to be manually operated for purposes of a trip-free release. The two housing covers 2c are preferably latched to the housing body 2a and cover the connection chambers 3 to 5 provided on both sides of the housing main body 2a.

The snap-action switching mechanism includes a latching lever 25 coupled to the switching rocker 23, said lever cooperating with a contact spring 26 that supports a movable contact 27 at its free end. Opposite this is a fixed contact 28, which forms a contact pair with the movable contact 27. A tripping lever 29 is coupled with the latching lever 25, said trigger lever in turn cooperating with a thermal expansion element 30 in the form of a U-shaped bimetal. The bimetal 30 is connected via its two U-limbs with the two connection rails 7 in the connection chambers 3 and 4. The connection rail 7 of the connection chamber 3 is in turn electrically connected to the contact spring 26 and through this, with the moving contact 27.

This connection configuration ensures that in an overcurrent circuit breaker 1 arranged between a current / voltage source and a load (consumer), the load current always flows over the bimetal 30 so that in case of overload, i.e., due to an overcurrent, this can trigger the thermal trip. To this end, the bimetal 30 actuates, if necessary as a consequence of its deflection, the tripping lever 29 so that its latch with the latching lever 25 is opened and the contact spring 26 held by said latching lever in the contact position of the contact pair 27, 28 can pivot as a result of the spring restoring force, so that the contact between the moving contact 27 and the fixed contact 28 opens. A contact opening may also be effected manually by means of the switching rocker 23, wherein it is pivoted to the OFF position, thereby manually unlatching the latching lever 25.

The thermal overcurrent circuit breaker 1 is designed for DC and AC voltages in the low voltage range (250V AC and 50V DC or 65V DC) with current ratings between 0.05A and 20A and provided in particular for the protection of electrical machinery, electrical systems of vehicles, transformers and low voltage lines. Connection lines 18 with a conductor cross-section in the range between 0.14mm^2 and 4mm^2 can hereby be contact-clamped, wherein not only rigid, but

also uncompressed and compressed flexible connection lines can be used with or without a core sleeve, with or without a plastic sleeve.

The invention is not limited to the embodiments described above. Rather, other variations of the invention can be derived therefrom by those skilled in the art without departing from the scope of the invention. In particular, moreover all individual features described in the context of the embodiments can be combined with each other in other ways without departing from the scope of the invention.

List of Reference Numbers

1	overcurrent circuit breaker
2	switch housing
2a	housing main body
2b	housing cap
2c	housing cover
2d	housing base
2e	operating side
3	connection chamber
4	connection chamber
5	connection chamber
6	spring element
6a	first spring limb
6b	second spring limb
6c	intermediate limb
7	connection rail
7a	first rail limb
7b	second rail limb
8	housing longitudinal direction
9	chamber outer wall
10	chamber partition
11	housing transverse direction
12	first housing opening
13	second housing opening
14	actuating sleeve
15	latching nose
16	edge contour
17	supporting contour
18	connection line
19	line end
22	contact chamber
23	switching rocker
24	cap opening
25	latching lever
26	contact spring
27	moving contact
28	fixed contact
29	tripping lever
30	bimetal

20 contacting contour

21 supporting contour

Claims

1. Thermal overcurrent circuit breaker (1) comprising a switch housing (2) in which a manually operated snap-action switching mechanism (25 to 29) and a thermal expansion element (30) cooperating therewith, in particular a bimetal, and a moving contact (27) cooperating with the snap-action switching mechanism (25 to 29) and a fixed contact (28) are arranged, which is connected to a first connection rail (7), while the moving contact (27) is contacted via the thermal expansion element (30) with a second connection rail (7), characterized in that the switch housing (2) comprises a housing main body (2a) having a plurality of connection chambers (3, 4, 5) and a contact chamber (22) positioned between these and an operating side (2e), in which the snap-action switching mechanism (25 to 29) is arranged together with the thermal expansion element (30), that in each connection chamber (3, 4, 5), one of the connection rails (7) and a two-limbed spring element (6) for clamp contacting a connection line (18) guided via a first housing opening (12) into the connection chamber (3, 4, 5) is arranged with the connection rail (7) with a first spring limb (6a) and a second spring limb (6b), and that a second housing opening (13) parallel to the first housing opening (12) and covered by the second spring limb (6b) in its contact position opens into the respective connection chamber (3, 4, 5) for pivotal actuation of the second spring limb (6b).

2. Overcurrent circuit breaker (1) according to claim 1, characterized in that the first spring limb (6a) of the spring element (6) is supported in a contacting manner on a first rail limb (7a) of the connection rail (7) and the second spring limb (6b) of the spring element (6) extends at an angle greater than 45°, preferably greater than 60° and smaller than 180°, in particular smaller than or equal to 90°, to its first spring limb (6a).

3. Overcurrent circuit breaker (1) according to claim 1 or 2, characterized in that seen in the direction of the free end of the second spring limb (6a) of the spring element (6), the second housing opening (13) of the respective first housing opening (12) that opens into the respective connection chamber (3, 4, 5) is arranged upstream.

4. Overcurrent circuit breaker (1) according to any one of claims 1 to 3, characterized in that an actuating sleeve (14), in particular with a supporting contour (17) for a tool, is inserted or insertable in the second housing opening (13) for the indirect pivotal actuation of the second spring limb (6b).

5. Overcurrent circuit breaker (1) according to claim 4, characterized in that the actuating sleeve (14) is at least slightly movable in the second housing opening (13) in the housing longitudinal direction (8).

6. Overcurrent circuit breaker (1) according to claim 4 or 5, characterized in that on the actuating sleeve (14), a latching nose (15) is formed, which in the assembled state of the actuating sleeve (14) undercuts an edge contour (16) of the second housing opening (13) within the respective connection chamber (3, 4, 5).

7. Overcurrent circuit breaker (1) according to any one of claims 1 to 6, characterized in that within the connection chamber (3, 4, 5), the second spring limb (6a) of the spring element (6) can be moved against the spring force from a contact position at least partially overlapping the second housing opening (13), and the first housing opening (12) into a pivot position directed toward the first spring limb (6a) for clamp contacting the connection line (18) that is guided via the first housing opening (12) into the connection chamber (3, 4, 5).

8. Overcurrent circuit breaker (1) according to any one of claims 1 to 7, characterized in that the two spring limbs (6a, 6b) of the spring element (6) are connected by an intermediate limb (6c) shaped in the manner of an open loop, and that within the connection chamber (3, 4, 5), it has a contacting and / or supporting contour (20, 21) adapted to the loop shape between which the intermediate limb (6c) bearing thereon is seated.

9. Overcurrent circuit breaker (1) according to any one of claims 1 to 8, characterized by a U-shaped connection rail (7) which bears on a chamber wall (9, 10) of the connection

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chamber (3, 4, 5) with at least one of the two rail limbs (7a, 7b) and / or the middle limb (6c) connecting these to the U-shape.

10. Overcurrent circuit breaker (1) according to any one of claims 1 to 9, characterized in that the snap-action switching mechanism (25 to 29) has a latching lever (25) coupled with a manually operable switching element (2), in particular a switching rocker, and cooperating with a contact spring (26) supporting the moving contact (27) and a tripping lever (29) coupled thereto, which cooperates with the thermal expansion element (30).

11. Overcurrent circuit breaker (1) according to any one of claims 1 to 10, characterized by a third connection rail (7) directly connected to the moving contact (27) and to the second connection rail (7) via the thermal expansion element (30), said third rail being arranged with a further, two-limbed spring element (6) in another connection chamber (3, 4, 5) for clamp contacting a connection line (18) that is guided into said chamber via a housing opening (12, 13).

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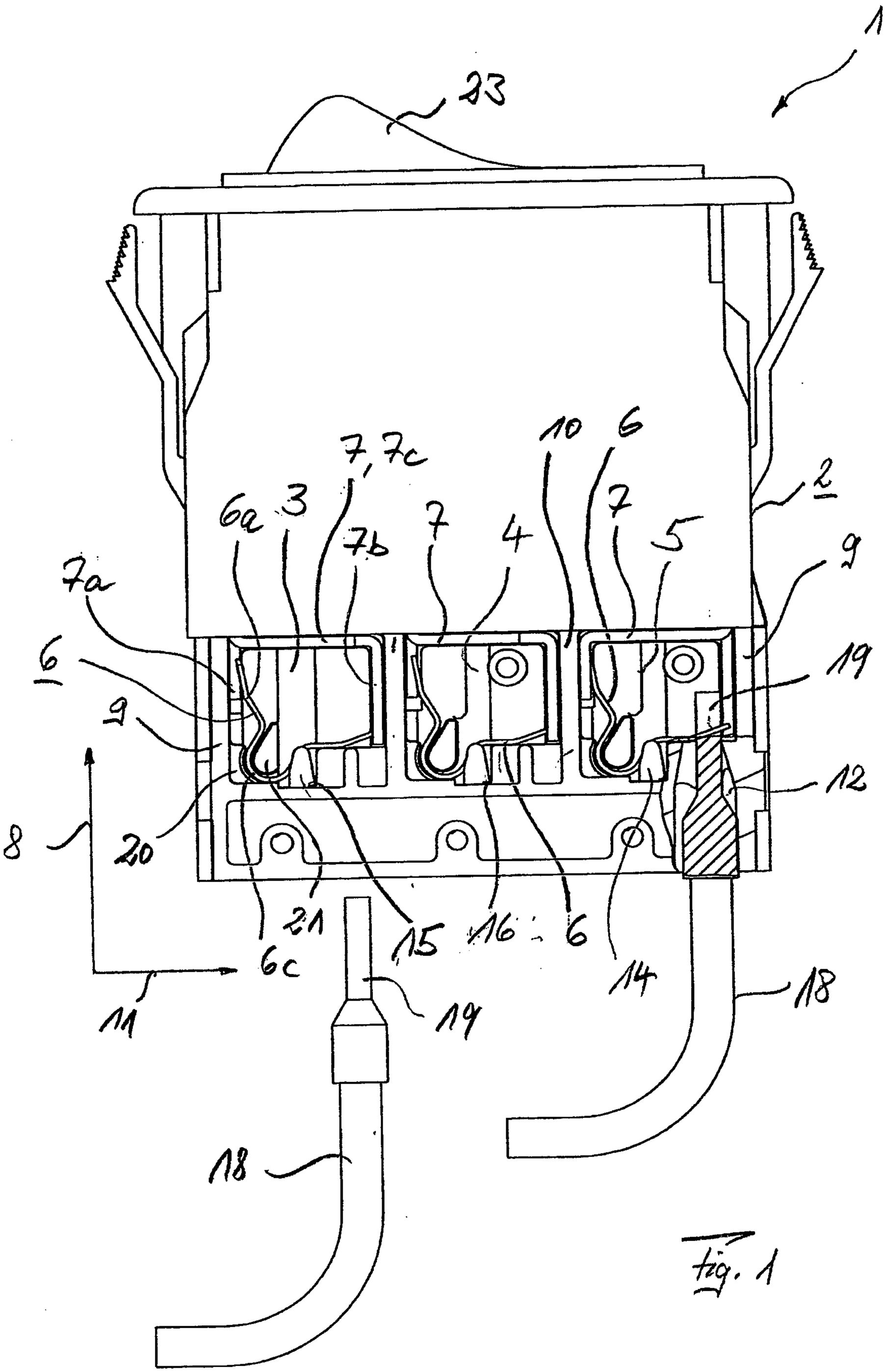

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fig. 1

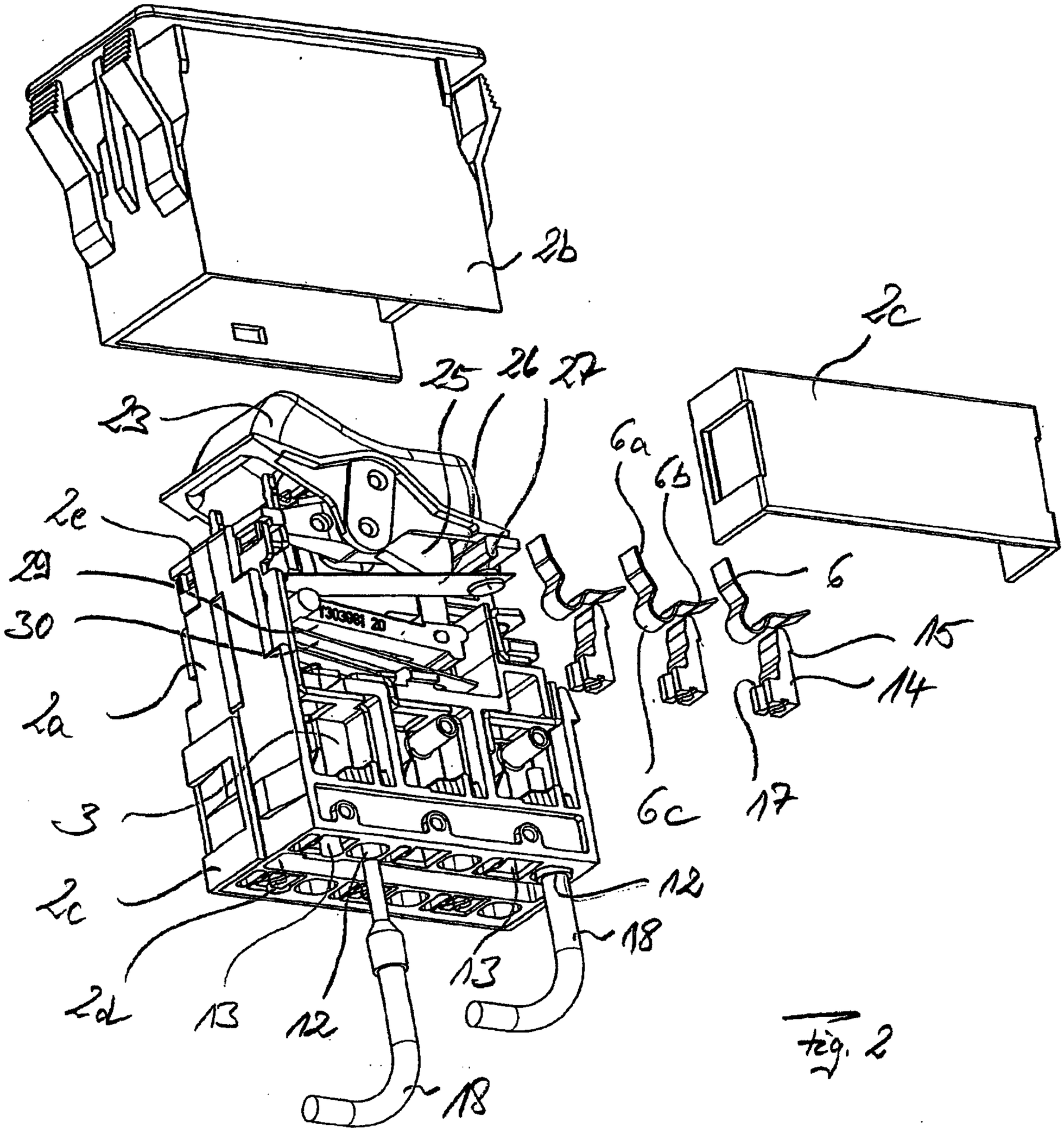

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Fig. 2

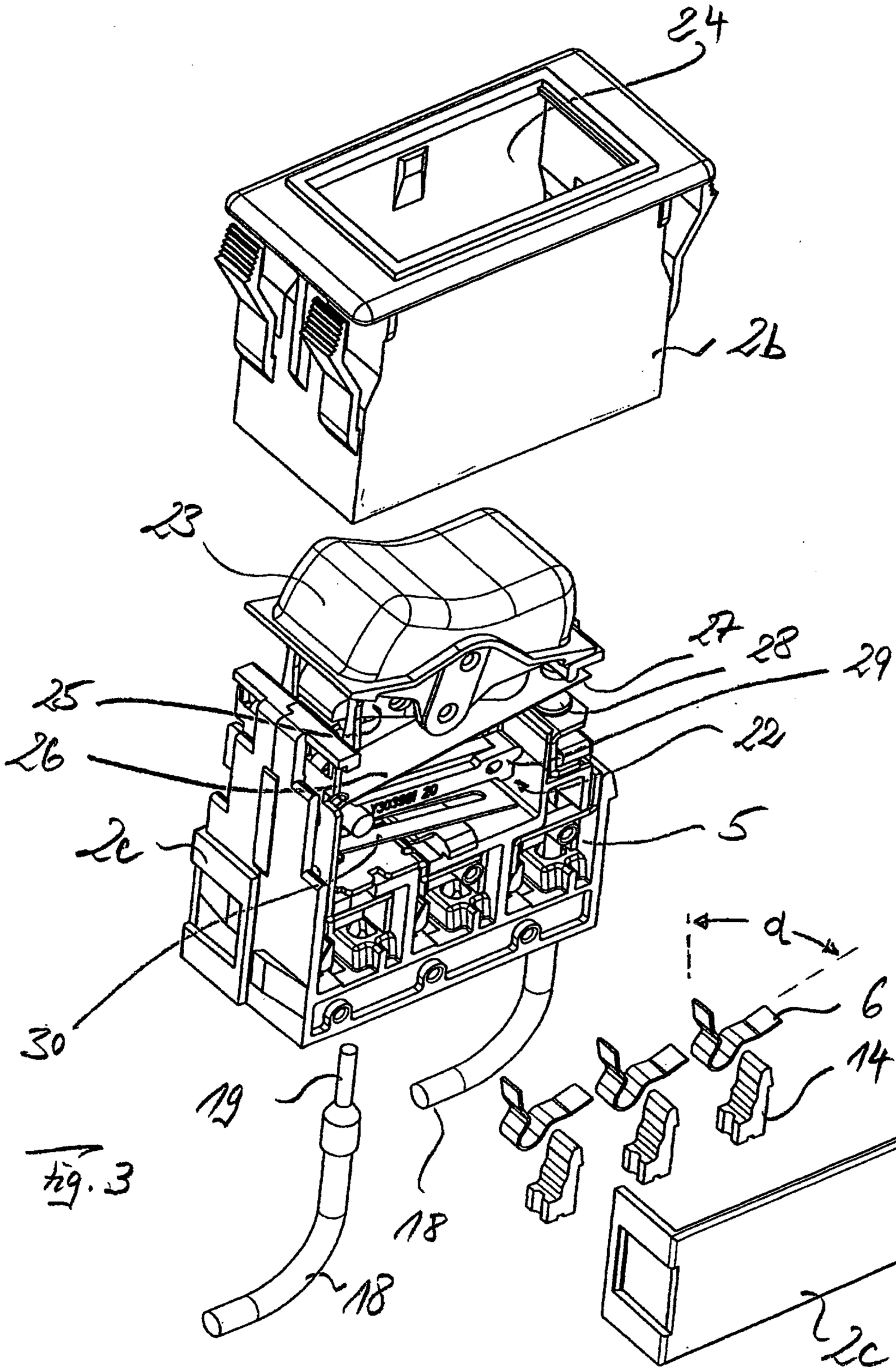


fig. 3

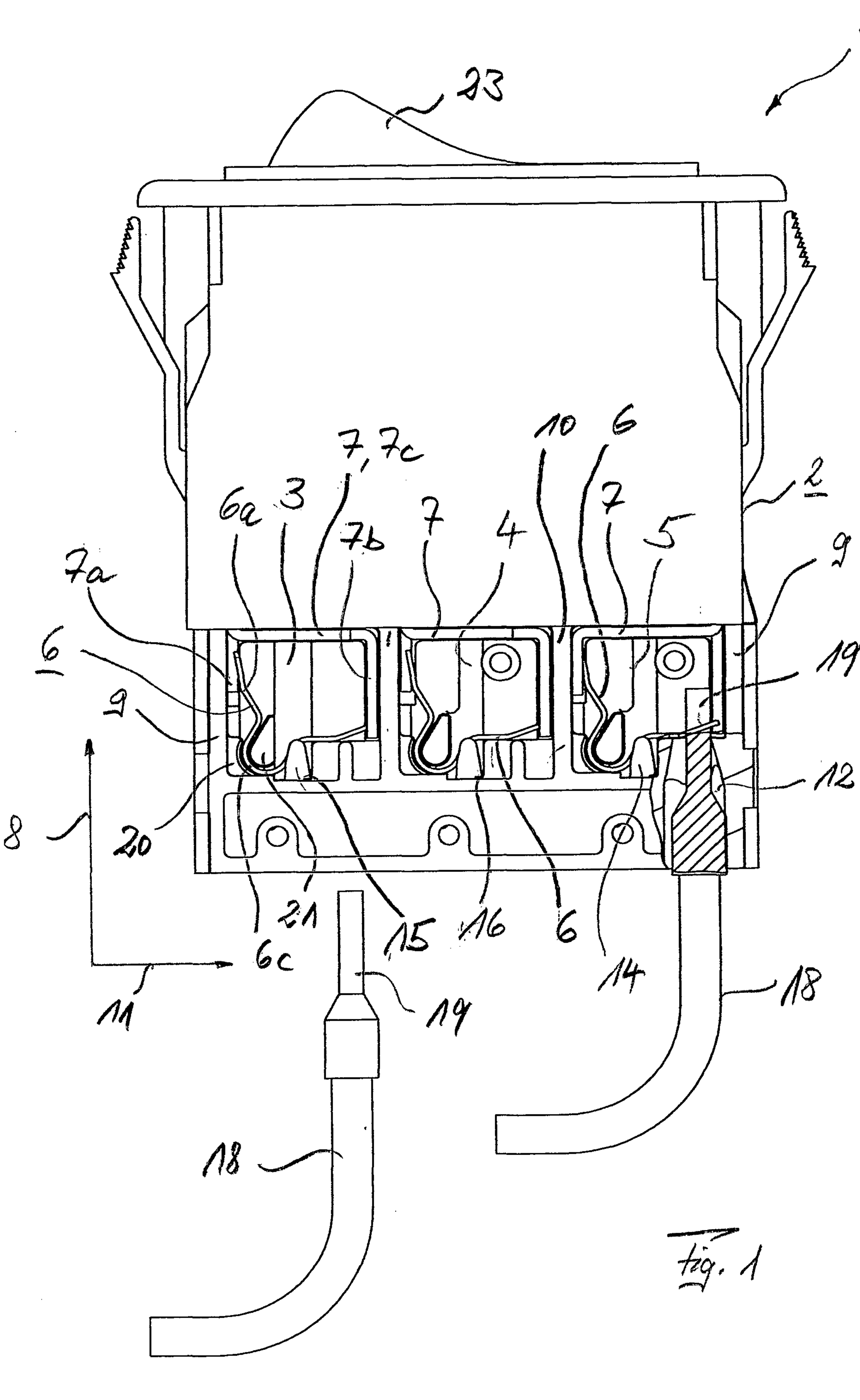


fig. 1