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(54) **CONTACTOR DEVICE**

(57) A contactor device (1) for industrial or railway applications comprises a pair of contact elements (8, 10) connected to a pair of terminals (13, 14) of the contactor device (1) having at least one fixed contact (9), a movable contact element (11) having at least one movable contact (12), and a casing (2) for supporting and protecting said fixed and movable contact elements (8, 10, 11). It further comprises a moving mechanism (15) for moving the movable contact element (11) to move the at least one movable contact (12) into contact to the at least one fixed contact (9) to electrically connect the first and second fixed contact elements (8, 10) to one another or apart from the at least one fixed contact (9) to electrically separate the first and second fixed contact elements (8, 10) from one another, and a driving means (16) for activating the moving mechanism (15). The contactor device (1) also comprises an indicator means (27) for indicating a connecting status of the first and second fixed contact elements (8, 10), wherein the moving mechanism (15) is arranged and configured such that it is acting on the indicator means (27) when it is activated by the driving means (16) to move the movable contact element (11) to move the at least one movable contact (12) into contact to the at least one fixed contact (9).

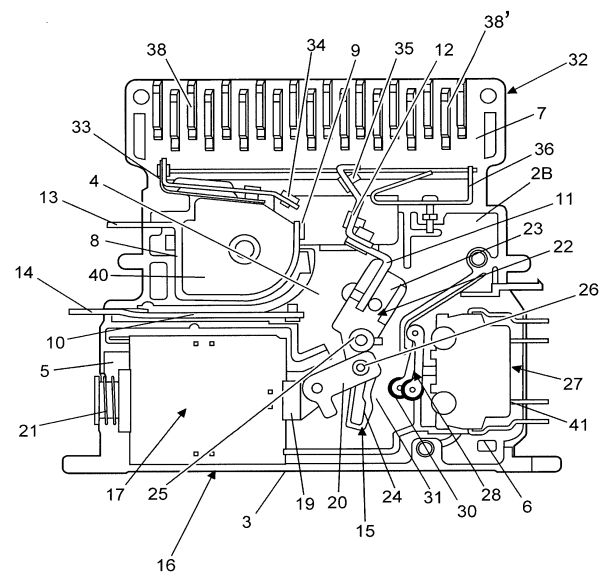


FIG. 2

Description

[0001] The present invention relates to a contactor device, in particular to a contactor device for industrial or railway applications.

[0002] As it is well known in the art, a contactor device is an electrically controlled switch used for switching an electrical power circuit. Contactor devices are used to control e.g. electric motors, lighting, heating, capacitor banks, thermal evaporators, and other electrical loads.

[0003] A contactor may be considered similar to a relay except with higher current ratings and a few other differences. Unlike general-purpose relays, contactors are designed to be directly connected to high-current load devices. Relays tend to be of lower capacity and are usually designed for both normally closed and normally open applications only. Moreover, unlike relays, contactors usually are designed with means to control and suppress the arc produced when interrupting heavy motor currents. Generally speaking, devices switching more than 15 amperes or in circuits rated more than a few kilowatts are usually called contactors. A contactor is controlled by a circuit which has a much lower power level than the switched circuit. Unlike a circuit breaker, a contactor device is not intended to interrupt a short circuit current. Contactors range from those having a breaking current of several amperes to thousands of amperes and 24 VDC to many kilovolts. The physical size of contactors ranges from a device small enough to pick up with one hand, to large devices approximately a meter on a side.

[0004] A conventional contactor device has substantially three main components. At least two contact elements (at least one fixed contact element and at least one movable contact element) being the current carrying part of the contactor device, which may include power contacts, auxiliary contacts, and contact springs; an electromagnetic driving means providing the driving force to close the contacts; and a casing for housing the contact elements and the driving means. Casings are usually made of insulating materials like Bakelite, Nylon, and thermosetting plastics to protect and insulate the contact elements and to provide some measure of protection against personnel touching the contacts. The driving means may be driven by either an AC or DC supply depending on the contactor design. The magnetic coil of the driving means may be energized at the same voltage as a load the contactor is controlling, or may be separately controlled with a lower coil voltage. Apart from optional auxiliary low current contacts, the contactors are almost exclusively fitted with normally open ("form A") contact elements. When current passes through the magnetic coil, a magnetic field is produced attracting a moving core of the contactor. The magnetic coil draws more current initially, until its inductance increases when the metal core enters the coil. The movable contact element is moved by the moving core, the force developed by the magnetic coil holding the contacts of the fixed and movable contact elements together. When the magnetic

coil is de-energized, gravity or a spring returns the moving core back to its initial position, resulting in opening the contacts of the contact elements.

[0005] In addition, many contactor devices include an indicator means in the form of an auxiliary switch which may be a single-pole or a double-pole switch. This auxiliary switch may be used to remotely indicate the position of the main circuit contacts of the contact elements, whether open or closed. Auxiliary switches can be used to operate e.g. indicator lights, relays or other accessories used for safety reasons. A known solution for acting on the auxiliary switch provides a lever having one end linked to the casing of the contactor device and the opposite end free to move in a cantilever manner under the force of the moving core of the electromagnetic driving means. Such a lever is used to physically act on the auxiliary switch button to activate the auxiliary switch. The inventors of the present invention has noted that the efficiency of this lever mechanism acting on the auxiliary switch is very much reduced during the working life of the contactor device causing malfunctions and even faults.

[0006] It is the object of the present invention to provide a contactor device having an improved mechanism acting on the indicator means to reduce malfunction situations and extend the working life of the contactor device.

[0007] According to the present invention, this object is achieved by a contactor device cited in claim 1. Advantageous configurations and further developments of the invention are defined in the dependant claims.

[0008] The contactor device according to the present invention comprises:

- a first fixed contact element connected to a first terminal of the contactor device and a second fixed contact element connected to a second terminal of the contactor device, these pair of fixed contact elements having at least one fixed contact;
- a movable contact element having at least one movable contact;
- a casing for supporting and protecting the fixed and movable contact elements;
- a moving mechanism for moving the movable contact element to move the at least one movable contact into contact to the at least one fixed contact to electrically connect the first and second fixed contact elements to one another or apart from the at least one fixed contact to electrically separate the first and second fixed contact elements from one another;
- a driving means for activating the moving mechanism; and
- an indicator means for indicating a connecting status of the first and second fixed contact elements.

[0009] According to the present invention, the moving mechanism is arranged and configured such that it is acting on the indicator means when it is activated by the driving means to move the movable contact element to

move the at least one movable contact into contact to the at least one fixed contact.

[0010] In other words, the same moving mechanism for moving the movable contact element is also used to act on the indicator means. Thus, an additional lever for acting on the indicator means is omitted. As a result, the contactor device has a more reliable mechanism acting on the indicator means, has a longer working life, can be produced with reduced overall cost, and can have a more compact structure.

[0011] Preferably, the first and second terminals project from the same lateral side of the casing of the contactor device.

[0012] In a preferred configuration of the invention, the moving mechanism comprises a lever hingedly supported in the casing by a supporting pin, wherein this lever has a first arm supporting the movable contact element and a second arm coupled to the driving means. In this configuration, the second arm of the lever is acting on the indicator means when the moving mechanism is activated by the driving means to move the movable contact element to move the at least one movable contact into contact to the at least one fixed contact.

[0013] In a preferred configuration of the invention, an actuator is arranged between the moving mechanism and the indicator means to receive an action of the moving mechanism and to act on a button of the indicator means when receiving the action of the moving mechanism. Preferably, this actuator is biased to a position not acting on the button of the indicator means.

[0014] In this configuration, the actuator preferably comprises at least one lever being hingedly supported in the casing and a resilient wheel arranged on the lever at a position to come into contact with the moving mechanism when receiving the action of the moving mechanism. In this case, the second arm of the lever of the moving mechanism, on its side facing the actuator, may be provided with a recess mating with the resilient wheel of the lever of the actuator.

[0015] In a preferred configuration of the invention, the driving means comprises a slider and the moving mechanism is coupled to this slider via a connecting element. Preferably, this connecting element is hingedly connected to the moving mechanism at one side and is hingedly connected to the slider at the other side. In this case, the one side of the slider may be hingedly connected to the second arm of the lever of the moving mechanism by a connecting pin. Preferably, this connecting pin is positioned in proximity of the supporting pin of the lever of the moving mechanism.

[0016] In a preferred configuration of the invention, the driving means comprises a magnetic coil, wherein a number of windings of this magnetic coil is variably determined according to a desired voltage operating the driving means.

[0017] To reduce the manufacturing costs, a squared coil housing may be provided with a metal case having a squared section wherein a cylindrical core of a sprocket

is accommodated. The variable number of windings of the magnetic coil is formed around this sprocket.

[0018] In another preferred configuration of the invention, the contactor device further comprises an arc elimination means covering the fixed and movable contacts.

[0019] Preferably, this arc elimination means comprises a plurality of dissipation plates arranged in parallel to each other in slots formed in an arc eliminator housing portion of the casing. Preferably, the dissipation plates are made of ceramic.

[0020] Preferably, the dissipation plates are arranged in a staggered manner in the arc eliminator housing portion of said casing. In addition or alternatively, the plurality of dissipation plates comprises a plurality of odd-numbered dissipation plates and a plurality of even-numbered dissipation plates being alternately arranged in the arc eliminator housing portion of the casing, wherein said odd-numbered dissipation plates each have a first shape and the even-numbered dissipation plates each have a second shape, the second shape being (slightly) different from the first shape.

[0021] In a preferred configuration of the invention, the casing is assembled from two casing shells to define housing portions for the various components of the contactor device therebetween.

[0022] Preferably, a half base flange is formed integrally with each casing shell so that the base flange is obtained once the casing shells are assembled.

[0023] Preferably, the casing or its casing shells, respectively, are made of a synthetic plastic material having a predetermined isolation coefficient.

[0024] Above and other features and advantages of the present invention will be better understood from the following specific description of an exemplary, non-limiting embodiment with reference to the accompanying drawings. In the drawings, partially schematically:

Fig. 1 is a perspective view of a conductor device according to an embodiment of the present invention;

Fig. 2 is a side view of the conductor device of Fig. 1 with one casing shell removed;

Fig. 3 is a perspective side view of the conductor device of Fig. 1 with one casing shell removed;

Fig. 4 is a perspective side view of the various components of the conductor device of Fig. 1 with the casing removed;

Fig. 5 is a further perspective side view of the various components of the conductor device of Fig. 1 with the casing removed, from the opposite side compared to Fig. 4; and

Fig. 6 is a still further perspective side view of the various components of the conductor device of Fig.

1 with the casing removed, from the same side as in Fig. 4.

[0025] Figs. 1 to 6 show in different views an exemplary embodiment of a contactor device of the present invention. The various components of the contactor device are given the same reference signs in all figures.

[0026] The contactor device 1 is a switching device specifically provided for industrial or railway applications wherein a high AC or DC current must be switched on and off for high-frequency switching actions. More specifically, the contactor device 1 is intended for high voltage ratings applications in the electric traction and in particular for railway and underground systems.

[0027] Just to give an idea of the working conditions and the range of current values involved for this kind of contactor device, it should be noted that these devices must be able to efficiently switch currents of at least 50 A under operating voltage ranges between 900 V and 1800 V. These operating ranges may even be applied to a single pole of the contactor device. In this respect, the contactor device 1 of the present embodiment is disclosed hereinafter with a single pole configuration with a single interruption in air, an electromagnetic control by full power coil and single state functioning.

[0028] The contactor device 1 has a casing 2 accommodating and protecting all the various components of the contactor device 1 as will be described hereinafter. The casing 2 is made by a synthetic plastic material having a predetermined isolation coefficient. The casing 2 is formed by a pair of moulded casing shells 2A and 2B which are connected together to define housing portions for the various components of the contactor device 1. More particularly, the assembled casing 2 provides a central contact housing portion 4, a lower driver housing portion 5, a lower indicator housing portion 6, and an upper arc eliminator housing portion 7.

[0029] As indicated in Figs. 1 to 3, the casing 2 has a half base flange formed integrally with each casing shell 2A, 2B so that the base flange 3 is obtained once the casing shells 2A, 2B are assembled together. The base flange 3 serves for installing the contactor device 1 e.g. on a supporting wall that may be vertical or horizontal depending on the application needs.

[0030] In the central contact housing portion 4, the contactor device 1 comprises a first fixed contact element 8 connected to a first terminal (e.g. positive pole) of the contactor device 1, a second fixed contact element 10 connected to a second terminal (e.g. negative pole) of the contactor device 1, and a movable contact element 11. In this embodiment, the lower end of the movable contact element 11 is electrically connected to the second fixed contact element 10 via a conventional braid (not shown in the figures), the first fixed contact element 8 comprises a fixed contact 9, and the movable contact element 11 comprises a movable contact 12. The movable contact element 11 can be moved in a way to move the movable contact 12 into contact to the fixed contact

9 to electrically connect the two fixed contact elements 8, 10 or apart from the fixed contact 9 to electrically separate the two fixed contact elements 8, 10. The two terminals 13, 14 of the contactor device 1 are provided on the same lateral side of the casing 2.

[0031] In the upper arc eliminator housing portion 7, the contactor device 1 is provided with an arc elimination means 32 covering the fixed and movable contacts 9, 12 of the fixed and movable contact elements 8, 11. Especially, the arc elimination means 32 includes a plurality of dissipation plates 38, 38' (described later on in more detail), a first polar element 33 having an arc contact 34, a second polar element 36, and a further movable contact 35 provided on the movable contact element 11. The fixed contact 9 of the first fixed contact element 8 may be made by a silver alloy, while the arc contact 34 of the first polar element 34 may be made by a tungsten alloy having higher resistive characteristics.

[0032] A conventional blowing coil 40 is provided between the first fixed contact element 8 and the first polar element 33. This blowing coil 40 is used at the opening phase of the contactor device 1 to facilitate the dissipation of the electric field energy of the positive pole 13 toward the arc elimination means 32 to reduce the possible electric arc.

[0033] In the lower driver housing portion 4, the contactor device 1 comprises an electromagnetic driving means 15. The driving means 15 has a magnetic coil 17 accommodated in a squared coil housing 18. The magnetic coil 17 may be realized with a variable number of windings depending on the voltage value under which the coil 17 shall operate. The windings may be formed around a cylindrical core of a conventional sprocket.

[0034] Independently from the number of windings, the coil housing 18 is provided with a metal case having a squared section in which the sprocket is accommodated. Thus, the squared coil housing 18 may accommodate any kind of magnetic coil 17 needed for the specific application of the contactor device 1.

[0035] The driving means 16 has a coil slider 19 projecting outside the magnetic coil 17 and the coil housing 18. This coil slider 19 is pushed by electromagnetic force generated by the magnetic coil 17 against the biasing force of a spring 21 that is mounted on an opposite end of the coil slider 19 projecting from the opposite side of the magnetic coil 17.

[0036] The coil slider 19 is coupled to a moving mechanism 15, via a connecting element 20. The moving mechanism 15 comprises a lever 22 which is hingedly supported in the casing 2, via a supporting arm 25 being transversely fixed in the casing 2. The lever 22 has a first arm 23 extending upwardly for supporting the movable contact element 11, and a second arm 24 extending downwardly for connection to the connecting element 20.

[0037] The connecting element 20 is hingedly connected to the end of the coil slider 19 at its one side, and hingedly connected to the second arm 24 of the lever 22 at its other side, via a connecting pin 26. The connecting

pin 26 is preferably positioned in the proximity of the supporting pin 25 of the lever 22.

[0038] When the coil slider 19 of the driving means 16 is pushed by electromagnetic force generated by the magnetic coil 17, the lever 22 of the moving mechanism 15 is rotated via the connecting element 20. Due to this rotation of the lever 22, the movable contact element 11 is moved in a direction towards the first fixed contact element 8 so that the movable contact 12 comes into contact with the fixed contact 9. When the generation of the electromagnetic force by the magnetic coil 17 ends, the coil slider 19 is pulled back by the biasing force of the spring 21. As a result, the lever 22 of the moving mechanism 15 is returned via the connecting element 20 so that the movable contact element 11 is moved in a direction away from the first fixed contact element 8 to separate the movable contact 12 from the fixed contact 9.

[0039] In the indicator housing portion 6, the contactor device 1 comprises an indicator means 27 being configured as an auxiliary switch. This auxiliary switch 27 may be a single-pole or a dual-pole switch.

[0040] Advantageously, an intermediate tilting actuator 28 is arranged between the auxiliary switch 27 and the moving mechanism 15 for acting on the auxiliary switch 27 when the moving mechanism 15 is activated by the coil slider 19 of the driving means 16. This actuator 28 comprises at least one lever having one end hinged to a fixed supporting point 29 of the casing 2. The lever of the tilting actuator 28 extends downwardly in a cantilever manner and is kept at a predetermined distance from the auxiliary switch 27 by the biasing force of a spring 39.

[0041] More specifically, the lever of the actuator 28 is intended to act on a button 41 of the auxiliary switch 27 against the biasing force of the spring 39 when the lever is pushed towards the auxiliary switch 27 by the combined action of the coil slider 19 and the second arm 24 of the moving mechanism 15. In case of a dual-pole auxiliary switch 27, the actuator 28 has two levers in a parallel configuration for acting on two buttons 41 of the auxiliary switch 27.

[0042] Further, the lower end of the lever of the actuator 28 is provided with a small resilient wheel 30 for reducing the impact of the second arm 24 of the moving mechanism 15 when it is pushed towards the free end of the actuator's lever. In addition, the side portion of the second arm 24 of the lever 22 of the moving mechanism 15 facing towards the actuator 28 may be shaped with a circular recess 31 mating with the resilient wheel 30 for rendering even smoother the impact between the side portion of the second arm 24 and resilient wheel 30 of the actuator's lever, in consideration of the high number of switching actions performed by the contactor device 1.

[0043] Now, the above-mentioned arc elimination means 32 is explained in more detail.

[0044] As a matter of fact, without adequate contact protection, the occurrence of electric current arcing causes significant degradation of the contacts 9, 12, which

suffer significant damage. An electrical arc occurs between the two contacts 9, 12 when they are separated from one another ("break arc") and when they are brought into contact to each other ("make arc"). The break arc is typically more energetic and thus more destructive. The heat developed by the resulting electrical arc can be very high, ultimately causing the metal on the contacts to migrate with the current. The extremely high temperature of the arc slowly destroys the contact metal, causing some material to escape into the air as fine particulate matter.

[0045] The arc elimination means 32 provided in the contactor device 1 of the present invention is structured with a plurality of parallel dissipation plates 38, 38' supported in a half cover formed in each casing shell 2A, 2B of the casing 2. In contrast to prior art solutions where a single ceramic element is inserted in the cover of the arc elimination means, in the present invention a plurality of slots are formed in the upper arc eliminator housing portion 7 of each half shell 2A, 2B of the casing 2. A dissipation plate 38, 38' is accommodated in each facing slot. The dissipation plates 38, 38' are preferably formed by ceramic but even other material may be used.

[0046] Preferably, the dissipation plates 38, 38' are arranged in a staggered manner so that each odd-numbered dissipation plate 38 has an adjacent even-numbered dissipation plate 38' that is shifted along the vertical direction. In addition or as an alternative, the odd-numbered dissipation plates 38 may have a slightly different shape if compared to the even-numbered dissipation plates 38'.

[0047] The arc elimination means 32 may be provided with a different number of plates 38, 38' depending on the different voltage ranges that must be treated and the corresponding arc chute type and energy capacity that shall be extinguished in total security. The creepage and clearance distances between the dissipation plates 38, 38' of the arc elimination means 32 may be widely dimensioned for safe application in polluted environments.

[0048] The contactor device 1 of the present invention solves the above-mentioned technical problem and achieves a number of advantages, the main of which is given by the improved reliability and longer working life. The moving mechanism 15 provided also for acting on the auxiliary switch 27 has a stronger and more reliable structure if compared with known solutions. The direct or indirect blow out circuit makes the contactor device 1 suitable to work both with high and low currents. Preferably, the contactor device 1 of the present invention is further designed for on-board applications according to IEC 60077 standard.

LIST OF REFERENCE SIGNS

[0049]

1	contactor device
2	casing

2A, 2B	casing shells	
3	base flange	
4	contact housing portion	
5	driver housing portion	
6	indicator housing portion	5
7	arc eliminator housing portion	
8	first fixed contact element	
9	fixed contact	
10	second fixed contact element	
11	movable contact element	10
12	movable contact	
13	first terminal	
14	second terminal	
15	moving mechanism	
16	driving means, esp. electromagnetic driving means	15
17	magnetic coil	
18	coil housing	
19	coil slider	
20	connecting element	20
21	spring	
22	lever	
23	first arm	
24	second arm	
25	supporting pin	25
26	connecting pin	
27	indicator means, exp. auxiliary switch	
28	actuator, esp. lever	
29	supporting point	
30	resilient wheel	30
31	recess	
32	arc elimination means	
33	first polar element	
34	arc contact	
35	further movable contact	35
36	second polar element	
38, 38'	dissipation plates	
39	spring	
40	blowing coil	
41	button	40

Claims

1. A contactor device (1), comprising:
 - a first fixed contact element (8) connected to a first terminal (13) of the contactor device (1) and a second fixed contact element (10) connected to a second terminal (14) of the contactor device (1), the pair of fixed contact elements (8, 10) having at least one fixed contact (9);
 - a movable contact element (11) having at least one movable contact (12);
 - a casing (2) for supporting and protecting said fixed and movable contact elements (8, 10, 11);
 - a moving mechanism (15) for moving said movable contact element (11) to move said at least
2. The contactor device according to claim 1, wherein said moving mechanism (15) comprises a lever (22) hingedly supported in said casing (2) by a supporting pin (25), wherein said lever (22) has a first arm (23) supporting said movable contact element (11) and a second arm (24) coupled to said driving means (16), and said second arm (24) of said lever (22) is acting on said indicator means (27) when said moving mechanism (15) is activated by said driving means (16) to move said movable contact element (11) to move said at least one movable contact (12) into contact to said at least one fixed contact (9).
3. The contactor device according to claim 1 or 2, wherein an actuator (28) is arranged between said moving mechanism (15) and said indicator means (27) to receive an action of said moving mechanism (15) and to act on a button (41) of said indicator means (27) when receiving the action of said moving mechanism (15), wherein said actuator (28) is preferably biased to a position not acting on said button (41) of said indicator means (27).
4. The contactor device according to claim 3, wherein said actuator (28) comprises at least one lever being hingedly supported in said casing (2) and a resilient wheel (30) arranged on said lever at a position to come into contact with said moving mechanism (15) when receiving the action of said moving mechanism (15).
5. The contactor device according to claims 2 and 4, wherein said second arm (24) of said lever (22) of said moving mechanism (15), on its side facing said actuator (28),

is provided with a recess (31) mating with said resilient wheel (30) of said lever of said actuator (28).

6. The contactor device according to any one of preceding claims, wherein
 said driving means (16) comprises a slider (19) and
 said moving mechanism (15) is coupled to said slider (19) via a connecting element (20), wherein said connecting element (20) is hingedly connected to said moving mechanism (15) at one side and is hingedly connected to said slider (19) at the other side.
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7. The contactor device according to claims 2 and 6, wherein
 said one side of said slider (19) is hingedly connected to said second arm (24) of said lever (22) of said moving mechanism (15) by a connecting pin (26), wherein said connecting pin (26) is positioned in proximity of said supporting pin (25) of said lever (22) of said moving mechanism (15).
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8. The contactor device according to any one of preceding claims, wherein
 said driving means (16) comprises a magnetic coil (18), wherein a number of windings of said magnetic coil (18) is variably determined according to a desired voltage operating said driving means (16).
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9. The contactor device according to any one of preceding claims, wherein
 it further comprises an arc elimination means (32) covering said fixed and movable contacts (9, 12).
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10. The contactor device according to claim 9, wherein
 said arc elimination means (32) comprises a plurality of dissipation plates (38, 38') arranged in parallel to each other in slots formed in an arc eliminator housing portion (7) of said casing (2).
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11. The contactor device according to claim 10, wherein
 said dissipation plates (38, 38') are arranged in a staggered manner in said arc eliminator housing portion (7) of said casing (2).
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12. The contactor device according to claim 10 or 11, wherein
 said plurality of dissipation plates (38, 38') comprises a plurality of odd-numbered dissipation plates (38) and a plurality of even-numbered dissipation plates (38') being alternately arranged in said arc eliminator housing portion (7) of said casing (2), wherein said odd-numbered dissipation plates (38) each have a first shape and said even-numbered dissipation plates (38') each have a second shape, said second shape being different from said first shape.
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13. The contactor device according to any one of preceding claims, wherein

said casing (2) is assembled from two casing shells (2A, 2B) to define housing portions (4, 5, 6, 7) for the various components of the contactor device (1) therebetween.

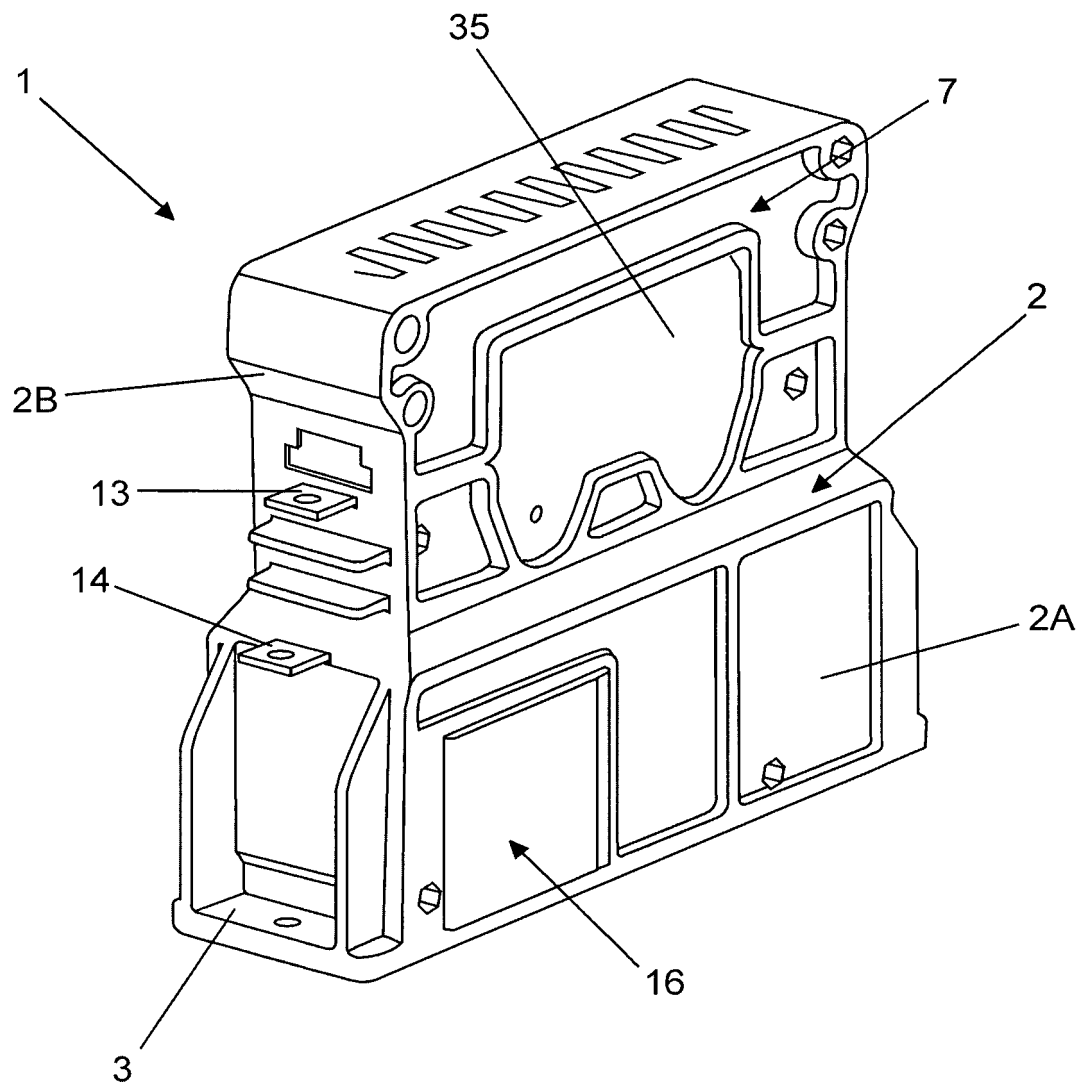


FIG. 1

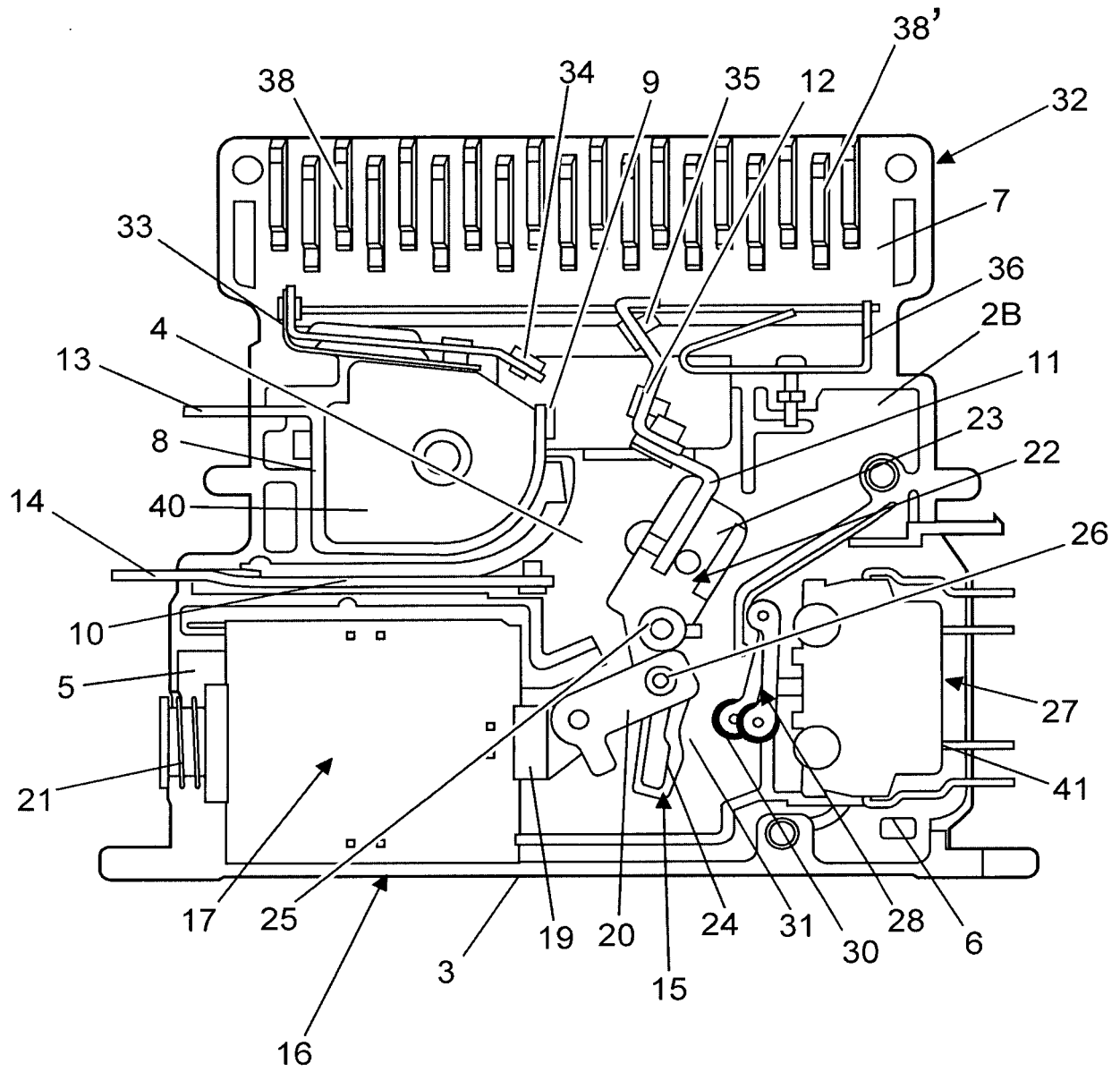


FIG. 2

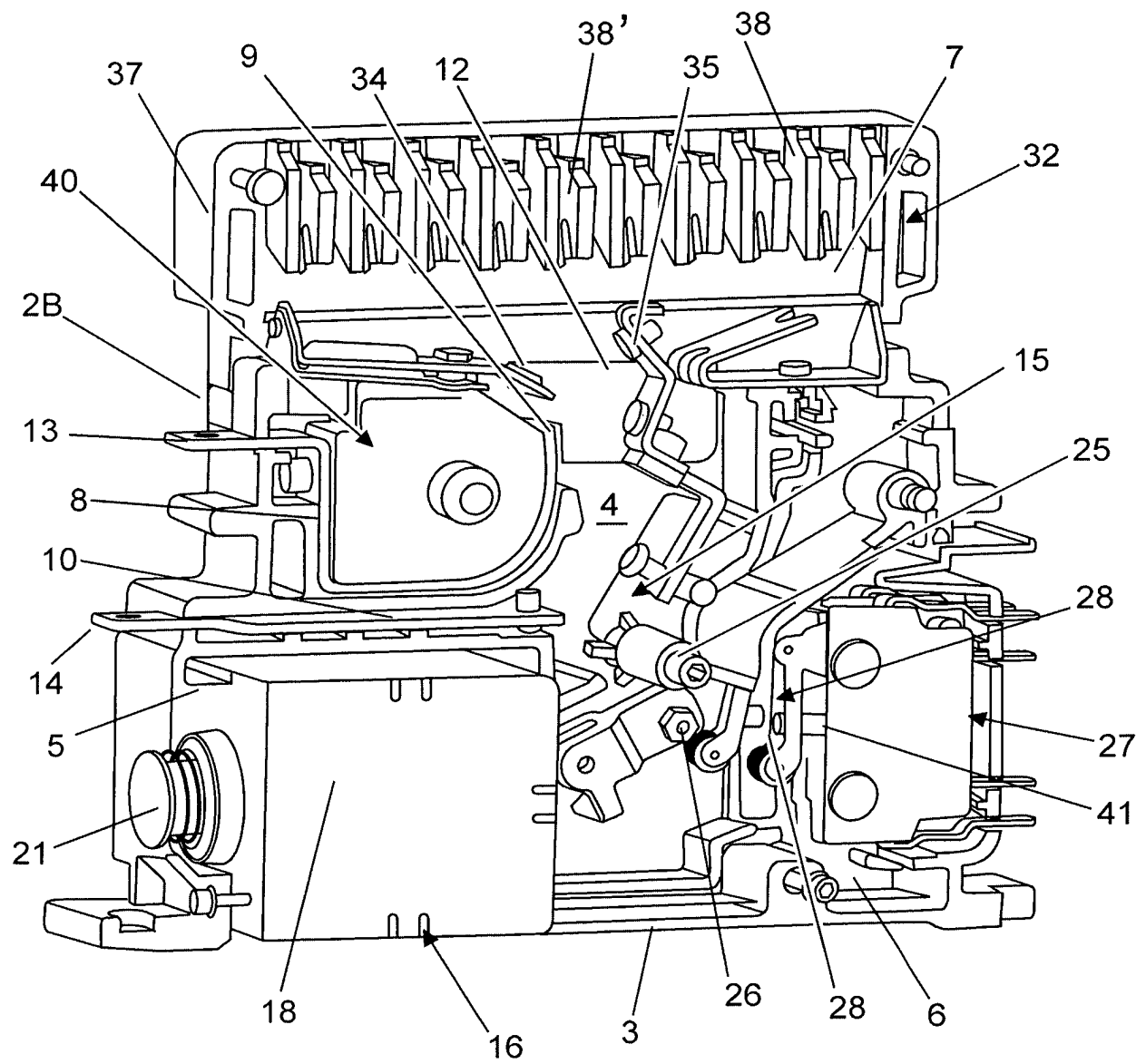


FIG. 3

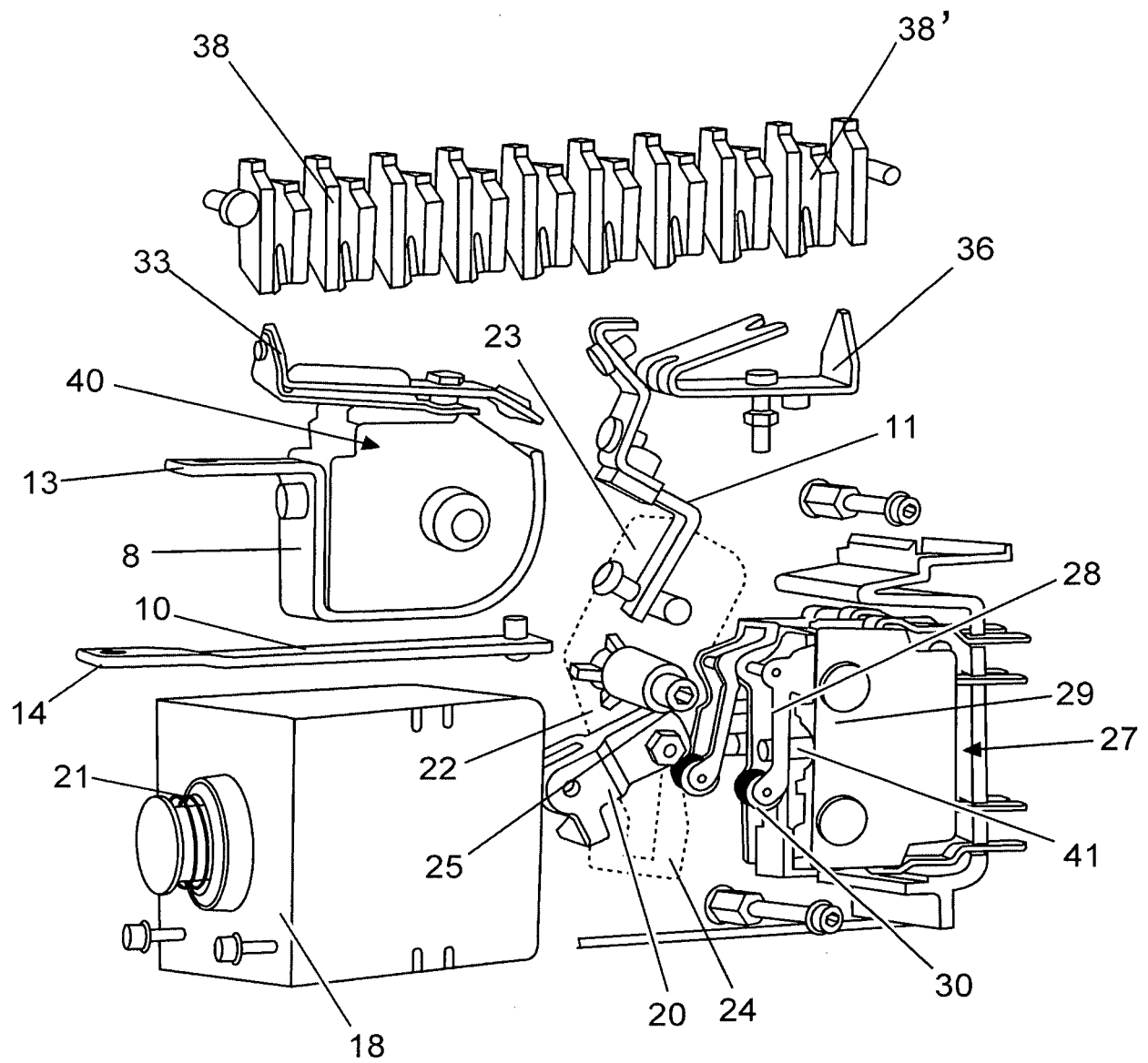


FIG. 4

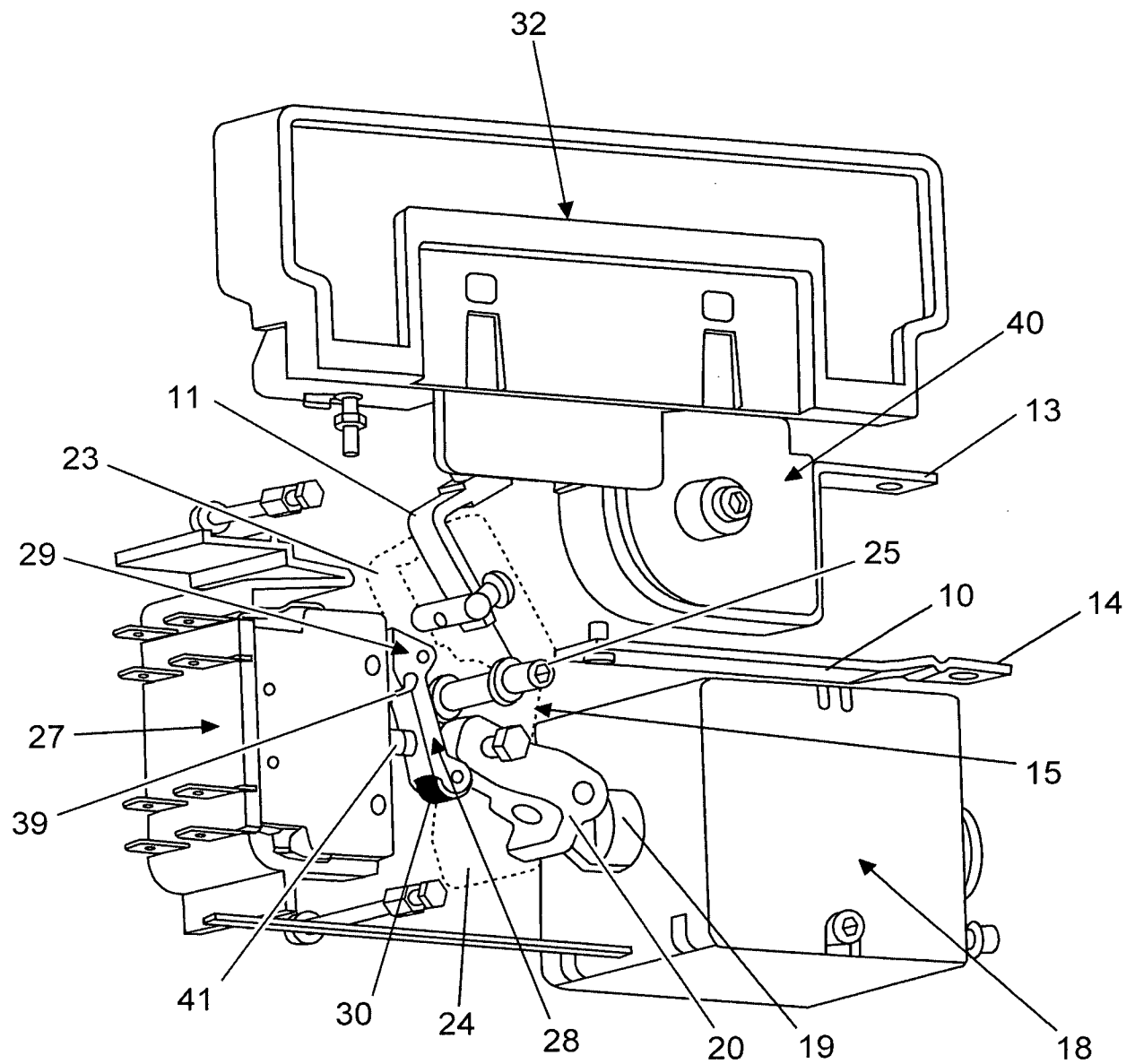


FIG. 5

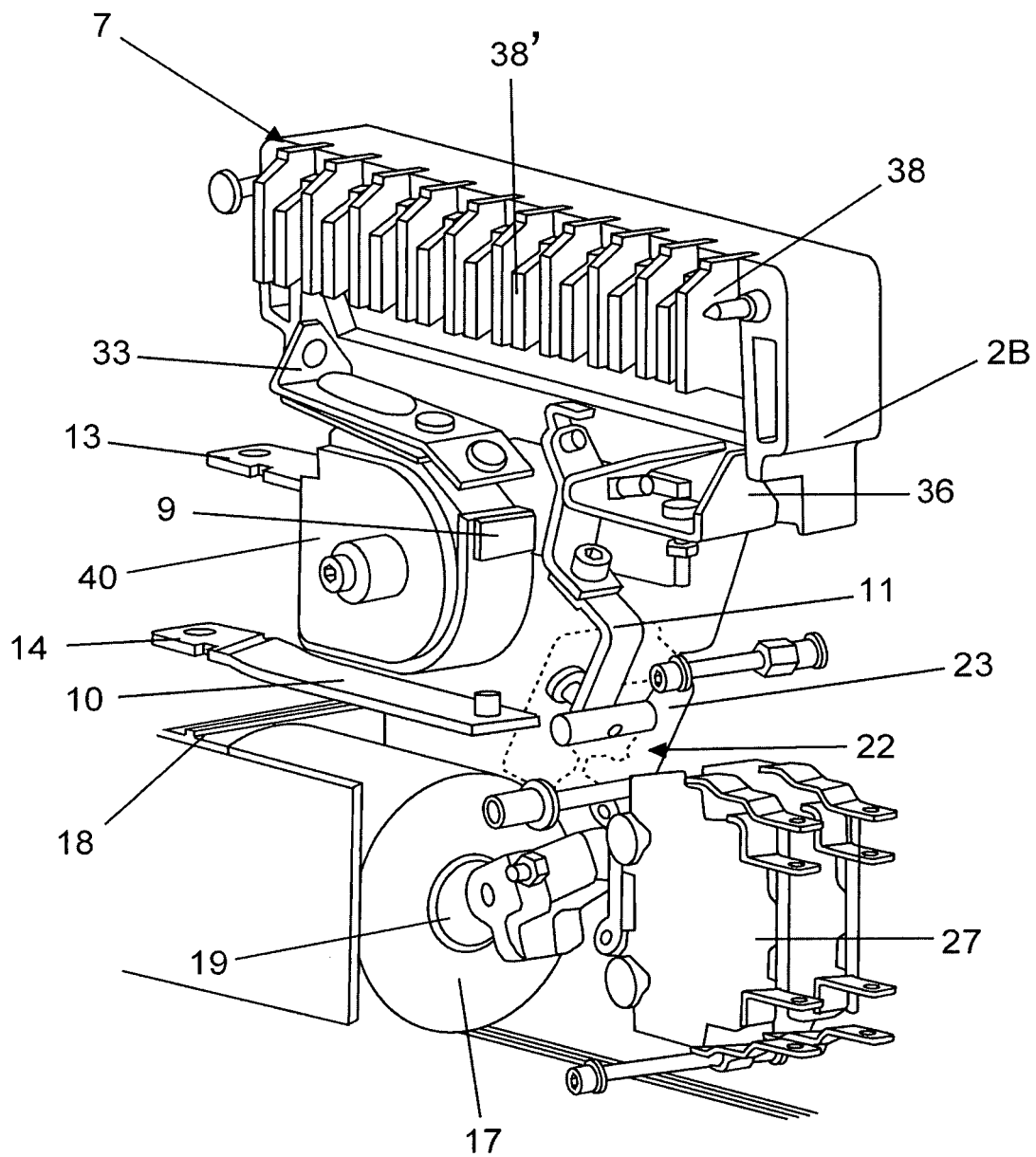


FIG. 6



EUROPEAN SEARCH REPORT

 Application Number
 EP 18 15 1977

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EPO FORM 1503 03.82 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 98/40898 A2 (BLP COMPONENTS LTD [GB]; CONNELL RICHARD ANTHONY [GB]; DARLOW BRIAN ST) 17 September 1998 (1998-09-17)	1	INV. H01H50/54 H01H9/16
Y	* page 4, paragraph 2 - paragraph 6 * * page 9, paragraph 2 - paragraph 6 * * figures 1, 3, 4 *	2-13	
Y	----- CN 206 379 313 U (MICROELETTRICA SCIENT S P A) 4 August 2017 (2017-08-04) * figures 5-8 * & EP 3 293 748 A1 (MICROELETTRICA SCIENT S P A [IT]) 14 March 2018 (2018-03-14) * paragraph [0033] - paragraph [0043] *	2-13	
A	----- EP 3 048 626 A1 (SCHALTBAU GMBH [DE]) 27 July 2016 (2016-07-27) * figures 4, 5 * -----	1-13	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			H01H
Place of search		Date of completion of the search	Examiner
Munich		17 July 2018	Fribert, Jan
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 18 15 1977

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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