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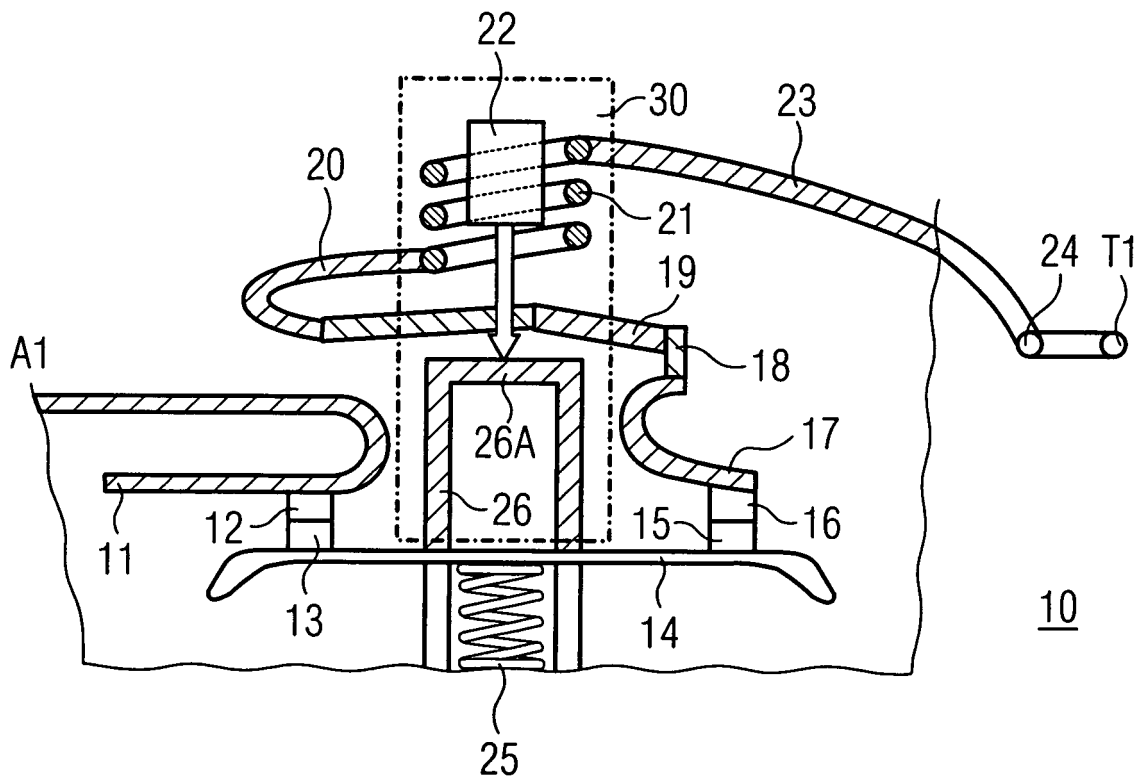
Amended claims in accordance with Rule 137(2)  
EPC.

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(54) **A current limiter**

(57) A current limiter (10) comprises an electromagnetic drive unit (30) adapted to limit the current carried by a current circuit by displacing at least one movable contact piece (13, 15) from a responsive stationary contact piece (12, 16) in response to at least one current phase carrying an excessive current. The current limiter

(10) further comprises a bimetallic block (18, 19) adapted to undergo such a thermal expansion in response to at least one current phase carrying an excessive current that the bimetallic block (18, 19) after the expansion is adapted to prevent said at least one movable contact piece (13, 15) from returning to contact with the responsive stationary contact piece (12, 16).



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## Description

### Field of the invention

[0001] The invention relates to current limiters

### Background

[0002] Current limiters are devices that are used limit current in a current circuit in the low voltage range which usually is understood to cover voltages from 100 V up to 1000 V. Typically, current limiters are adapted to limit current in a current circuit carrying three-phase currents, but it is also possible that the current circuit is a one-phase current circuit only.

[0003] Limiting a current in a current circuit can be used to avoid adverse effects of an overload condition, for example.

[0004] Current limiter is an electromechanical switching device that typically comprises at least one electromagnetic drive unit, of which there may be provided one for each phase. Such an electromagnetic drive unit follows the current in the at least one phase and is adapted to limit the current in the phase or phases upon detecting an excessive current.

[0005] A problem specific for current limiters is that, since there, in contrast to circuit breakers or overload relays, is no latching mechanism available that would prevent the movable contact piece or pieces from returning to the responsive stationary contact pieces after the current has been limited, the contact pieces may weld together, after which the current limiter cannot operate reliably any more.

[0006] The problem may occur in particular after a short circuit when the operator turns the circuit breaker or overload relay to a conducting state without removing the cause of the short circuit. Since the contacts of the current limiter tend to melt in contrast to those of an overload relay, for example, repeated short-circuit may weld the contacts and thus destroy the current limiter.

### Summary of the invention

[0007] It is an object of the invention to improve a current limiter of a known kind to be less sensitive to contact welding. This object can be achieved with a current limiter as set out in claim 1.

[0008] The dependent claims describe various advantageous aspects of the invention.

### Advantages of the invention

[0009] A current limiter comprising an electromagnetic drive unit adapted to limit the current carried by a current circuit by displacing at least one movable contact piece from a responsive stationary contact piece in response to at least one current phase carrying an excessive current can be improved by making it to further comprise a

bimetallic block adapted to undergo such a thermal expansion in response to at least one current phase carrying an excessive current that the bimetallic block after the expansion is adapted to prevent said at least one movable contact piece from returning to contact with the responsive stationary contact piece, since this gives time for the contact pieces to cool down or, if they are melt, to solidify.

[0010] The bimetallic block may adapted to have after the expansion such a geometry that it inhibits the at least one movable contact piece to return to contact with the responsive stationary contact piece, which may help to avoid the need to use of complex or expensivly components.

[0011] The bimetallic block may be adapted to in its expanded state to inhibit a plunger adapted to move the at least one movable contact piece from returning to a position in which it makes a contact with the responsive stationary contact piece. In this manner, it may be possible to avoid modifying the electromagnetic drive unit which saves effort since the dimensioning and design of the electromagnetic drive unit can be tedious.

[0012] The bimetallic block may be adapted in its expanded state to inhibit the electromagnetic drive unit from returning to a position it had before detecting that the at least one current phase carries an excessive current. This may be an advantageous solution if the structure of the electromagnetic drive unit enables it, since the plunger and the contact bridge may be left unmodified.

[0013] The bimetallic block may be adapted to undergo the thermal expansion before the electromagnetic drive unit is adapted to displace said at least one movable contact piece. This makes it easier to have the thermal expansion, since after the movable contact piece has been displaced, in the current limiter there may be too little current available for heating.

[0014] If a current limiter further comprises a unit adapted to reduce phase current passed through said bimetallic block or voltage over the bimetallic block, such as by using a voltage or current divider, the bimetallic block can be made smaller and it does not need to cause that much heat dissipation.

### Detailed description

[0015] The sole Figure shows a simplified current limiter 10. The current limiter 10 comprises an input terminal A1 and an output terminal T1 for each phase. Typically, a current limiter 10 comprises thus three input terminals A1, A2, A3 and three output terminals T1, T2, T3. For the sake of simplicity, the components for the second and third phase have been omitted from the Figure.

[0016] The input terminal A1 receives an input current, passes it along the current rail 11 to a stationary contact piece 12. If the contact bridge 14 is appropriately positioned, the stationary contact piece 12 has an electrical contact with the movable contact piece 13, which in turn is in electrical connection with a second movable contact

piece 15 over the contact bridge 14. The second movable contact piece 15, given that the contact bridge 14 is still appropriately positioned, is then in electrical contact with the second stationary contact piece 16.

[0017] The current limiter 10 comprises an electromagnetic drive unit 30 adapted to limit the current carried by a current circuit, i.e. between the input terminal A1 and the output terminal T1, by displacing the movable contact pieces 13, 15 from the responsive stationary contact pieces 12, 16 in response to at least one current phase carrying an excessive current.

[0018] The electromagnetic drive unit 30 comprises a yoke 22 and a coil 21 around the yoke 22. The current entering via the input terminal A1 to the current rail 17 is led through a bimetallic block comprising a first leg 18 and a second leg, before it gets to the coil 21 through a metallic conductor 20. From the coil 21 the current continues through a metallic conductor 23 to a connection point 24 that is located before the output terminal T1.

[0019] If the current in the coil 21 is too high, indicating that the current circuit carries an excessive current, the magnetic field caused by the coil 21 and the yoke 22 cause the armature 26A to move downwards and to push the plunger 26 to overcome the balancing force at the biasing spring 25 so that the contact bridge 26 is pushed downwards, moving the movable contact pieces 13, 15 away from the stationary contact pieces 12, 16 and thus opening the current circuit.

[0020] The bimetallic block, in the example shown in the Figure, comprising the first leg 18 and the second leg 19, is preferably adapted to undergo such a thermal expansion in response to at least one current phase carrying an excessive current that the bimetallic block after the expansion is adapted to prevent the movable contact pieces 13, 15 from returning to contact with the responsive stationary contact pieces 12, 16.

[0021] The bimetallic block may be adapted after the expansion to have such a geometry that it inhibits the movable contact pieces 13, 15 to return to contact with the responsive stationary contact pieces 12, 16.

[0022] The bimetallic block may be adapted in its expanded state to inhibit the plunger 26 adapted to move the movable contact pieces 13, 15 from returning to the position in which the movable contact pieces 13, 15 make a contact with the responsive stationary contact pieces 12, 16.

[0023] The bimetallic block may be adapted in its expanded state to inhibit the electromagnetic drive unit 30 from returning to a position it had before detecting that the at least one current phase carries an excessive current.

[0024] Advantageously, the bimetallic block is adapted to undergo the thermal expansion before the electromagnetic drive unit 30 is adapted to displace the movable contact pieces 13, 15.

[0025] The bimetallic block can be placed between the coil 21 and the second movable contact piece 16.

[0026] Even though the invention was described by

way of a nonlimiting example, the skilled person appreciates that the invention can be generalized within the scope of the annexed patent claims. For example, the bimetallic block may be or comprise a snap strip or a snap disc.

## Claims

1. A current limiter (10) comprising an electromagnetic drive unit (30) adapted to limit the current carried by a current circuit by displacing at least one movable contact piece (13, 15) from a responsive stationary contact piece (12, 16) in response to at least one current phase carrying an excessive current, **characterized in that:** said current limiter (10) further comprises a bimetallic block (18, 19) adapted to undergo such a thermal expansion in response to at least one current phase carrying an excessive current that the bimetallic block (18, 19) after the expansion is adapted to prevent said at least one movable contact piece (13, 15) from returning to contact with the responsive stationary contact piece (12, 16).
2. A current limiter (10) according to claim 1, **wherein:** the bimetallic block (18, 19) is adapted after the expansion to have such a geometry that it inhibits the at least one movable contact piece (13, 15) to return to contact with the responsive stationary contact piece (12, 16).
3. A current limiter (10) according to claim 1 or 2, **wherein:** the bimetallic block (18, 19) is adapted in its expanded state to inhibit a plunger (26) adapted to move said at least one movable contact piece (13, 15) from returning to a position in which said at least one movable contact piece (13, 15) makes a contact with the responsive stationary contact piece (12, 16).
4. A current limiter (10) according to any one of the preceding claims, **wherein:** the bimetallic block (18, 19) is adapted in its expanded state to inhibit the electromagnetic drive unit (30) from returning to a position it had before detecting that the at least one current phase carries an excessive current
5. A current limiter (10) according to any one of the preceding claims, **wherein:** the bimetallic block (18, 19) is adapted to undergo the thermal expansion before the electromagnetic drive unit (30) is adapted to displace said at least one movable contact piece (13, 15).
6. A current limiter (10) according to any one of the preceding claims, **wherein:** said bimetallic block (18, 19) is between a coil (21) of the electromagnetic drive unit (30) and said at least one movable contact piece (16).

7. A current limiter (10) according to any one of the preceding claims, further **comprising**: a means (17) adapted to reduce phase current passed through said bimetallic block (18, 19).

8. A current limiter (10) according to any one of the preceding claims, further **comprising**: a means (20, 17) adapted to reduce voltage over said bimetallic block (18, 19).

9. A current limiter (10) according to any one of the preceding claims, **wherein**: the bimetallic block (18, 19) comprises a snap strip.

10. A current limiter (10) according to any one of the preceding claims, **wherein**: bimetallic block (18, 19) comprises a snap disc.

#### Amended claims in accordance with Rule 137(2) EPC.

1. A current limiter (10) comprising an electromagnetic drive unit (30) adapted to limit the current carried by a current circuit by displacing at least one movable contact piece (13, 15) from a responsive stationary contact piece (12, 16) in response to at least one current phase carrying an excessive current, said current limiter (10) further comprising a bimetallic block (18, 19) adapted to undergo such a thermal expansion in response to at least one current phase carrying an excessive current that the bimetallic block (18, 19) after the expansion is adapted to prevent said at least one movable contact piece (13, 15) from returning to contact with the responsive stationary contact piece (12, 16), whereby the thermal expansion is caused by ohmic resistance in the bimetallic block (18, 19).

2. A current limiter (10) according to claim 1, **wherein**: the bimetallic block (18, 19) is adapted after the expansion to have such a geometry that it inhibits the at least one movable contact piece (13, 15) to return to contact with the responsive stationary contact piece (12, 16).

3. A current limiter (10) according to claim 1 or 2, **wherein**: the bimetallic block (18, 19) is adapted in its expanded state to inhibit a plunger (26) adapted to move said at least one movable contact piece (13, 15) from returning to a position in which said at least one movable contact piece (13, 15) makes a contact with the responsive stationary contact piece (12, 16).

4. A current limiter (10) according to any one of the preceding claims, **wherein**: the bimetallic block (18, 19) is adapted in its expanded state to inhibit the electromagnetic drive unit (30) from returning to a

position it had before detecting that the at least one current phase carries an excessive current

5. A current limiter (10) according to any one of the preceding claims, **wherein**: the bimetallic block (18, 19) is adapted to undergo the thermal expansion before the electromagnetic drive unit (30) is adapted to displace said at least one movable contact piece (13, 15).

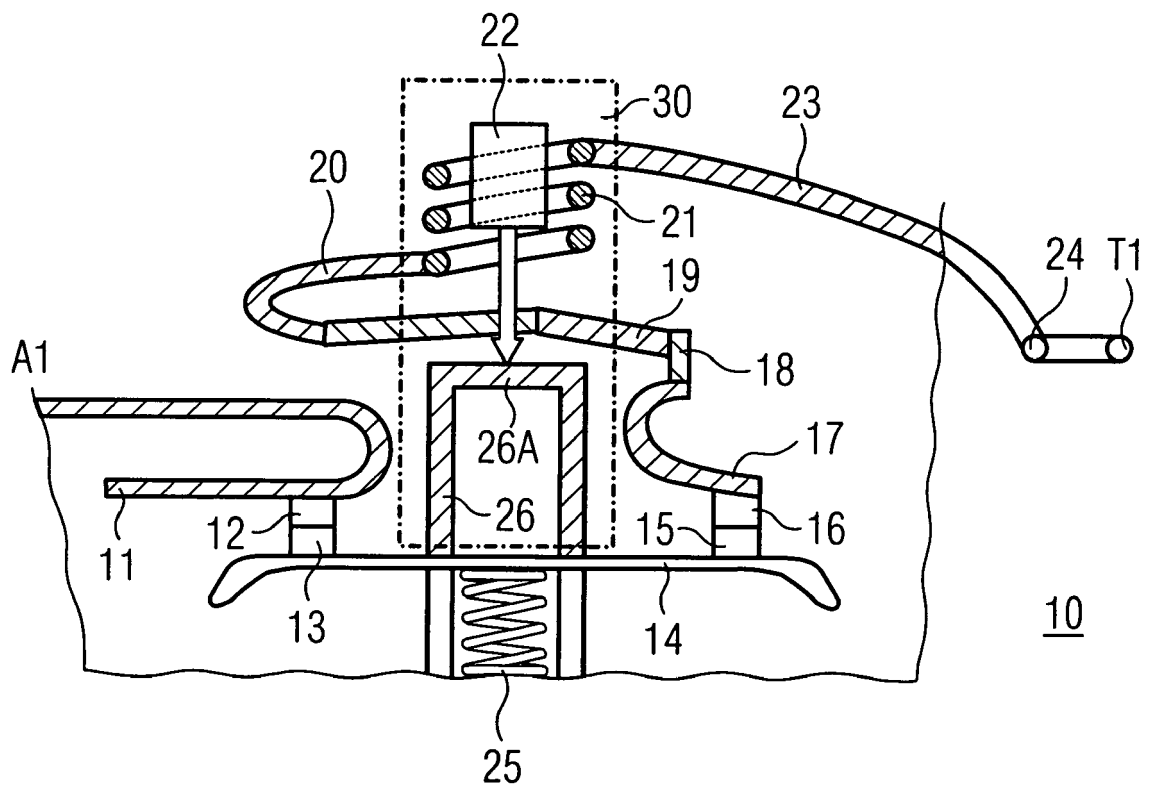
6. A current limiter (10) according to any one of the preceding claims, **wherein**: said bimetallic block (18, 19) is between a coil (21) of the electromagnetic drive unit (30) and said at least one movable contact piece (16).

7. A current limiter (10) according to any one of the preceding claims, further **comprising**: a means (17) adapted to reduce phase current passed through said bimetallic block (18, 19).

8. A current limiter (10) according to any one of the preceding claims, further **comprising**: a means (20, 17) adapted to reduce voltage over said bimetallic block (18, 19).

9. A current limiter (10) according to any one of the preceding claims, **wherein**: the bimetallic block (18, 19) comprises a snap strip.

10. A current limiter (10) according to any one of the preceding claims, **wherein**: bimetallic block (18, 19) comprises a snap disc.





European Patent  
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# EUROPEAN SEARCH REPORT

Application Number  
EP 06 01 8302

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                       |                                  |                                             |
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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT  
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EP 06 01 8302

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