

(19)



(11)

EP 2 922 080 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
17.05.2017 Bulletin 2017/20

(51) Int Cl.:
H01H 50/16 (2006.01) **H01H 50/34** (2006.01)
H01H 50/26 (2006.01) **H01H 50/30** (2006.01)

(21) Application number: **14160833.1**

(22) Date of filing: **20.03.2014**

(54) **Electromagnetic relay**

Elektromagnetisches Relais

Relais électromagnétique

(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 MK MT NL NO
PL PT RO RS SE SI SK SM TR**

(43) Date of publication of application:
23.09.2015 Bulletin 2015/39

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US-A- 2 884 574

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Description

[0001] The present invention relates to an electromagnetic relay according to claim 1.

It is known in the state of the art to use electromagnetic relays for controlling electric circuits by low-power signals. Electromagnetic relays use an electromagnet to operate a switching mechanism mechanically. Known electromagnetic relays comprise a coil of wire wrapped around a core. A yoke provides a low reluctance path for magnetic flux. A movable armature is hinged to the yoke and mechanically linked to moving electric contacts. The coil is provided to generate a magnetic field that moves the armature towards the core which leads to a collision between the armature and the core. This collision can result in audible noise.

The EP 1 376 636 B1 describes a low noise relay with means for reducing acoustic noise. The means comprises a resilient protrusion between the armature and the core. DE-A-19625657 discloses an electromagnetic relay according to the preamble of claim 1. It is an object of the present invention to provide an electromagnetic relay. This objective is achieved by an electromagnetic relay according to claim 1. Preferred embodiments are disclosed in the dependent claims.

An electromagnetic relay according to the invention comprises a core having a pole portion and an end portion, a coil being arranged around the pole portion of the core, and an armature being movable relative to the core between a first position and a second position. The coil is provided for generating a magnetic field that moves the armature from the first position to the second position. The armature comprises a hole. The end portion of the core is arranged in the hole when the armature is in the second position.

[0002] An air gap is arranged between the armature and the core in the first position and in the second position of the armature. Advantageously, the armature of this electromagnetic relay does not collide with the core when the armature is moved from the first position to the second position. The remaining air gap between the core and the armature in the second position of the armature insures that the armature does not collide with the core when the armature is moved from the first position to the second position. Consequently, the electromagnetic relay does not create an acoustic noise that is caused by a collision between the armature and the core.

[0003] In an embodiment of the electromagnetic relay, the air gap is smaller in the second position of the armature than in the first position of the armature. Advantageously, this allows to automatically move the armature from the first position to the second position using a magnetic field generated by the coil that is arranged around the pole portion of the core of the electromagnetic relay. As reducing the size of the air gap between the armature and the core reduces a magnetic reluctance, the magnetic field generated by the coil results in a magnetomotive force that drives the armature from the first position

to the second position.

[0004] In an embodiment of the electromagnetic relay, the core extends in a longitudinal direction. The pole portion of the core comprises a first diameter in a radial direction which is perpendicular to the longitudinal direction. The end portion of the core comprises a second diameter in the radial direction. The second diameter is larger than the first diameter. Advantageously, the increased diameter of the end portion of the core with respect to the pole portion of the core insures that a magnetic reluctance is minimized when the end portion of the core is arranged in the hole of the armature in the second position of the armature. This prevents the armature from moving beyond the second position when the armature is moved from the first position to the second position.

[0005] In an embodiment of the electromagnetic relay, the end portion comprises a first length in the longitudinal direction. The hole comprises a second length. The first length and the second length differ by less than 20 %, preferably by less than 10 %, in particular by less than 5 %. Advantageously, the agreement of the lengths of the end portion of the core and the hole of the armature support minimization of magnetic reluctance when the armature is in its second position.

[0006] In an embodiment of the electromagnetic relay, the armature is in contact with a mechanical stop in the second position. Advantageously, the mechanical stop can prevent the armature from moving beyond the second position when the armature is moved from the first position to the second position.

[0007] In an embodiment of the electromagnetic relay, the mechanical stop comprises an elastic material. Advantageously, an elastic material of the mechanical stop avoids the generation of acoustic noise when the armature gets into contact with the mechanical stop when the armature is moved from the first position to the second position.

[0008] In an embodiment of the electromagnetic relay, the mechanical stop is rigidly connected to the core. Advantageously, the rigid connection between the mechanical stop and the core of the electromagnetic relay allows to precisely control the second position of the armature with respect to the core.

[0009] In an embodiment of the electromagnetic relay, the electromagnetic relay further comprises a yoke which is connected to the core. The yoke can provide a low reluctance path for magnetic flux generated by the coil of the electromagnetic relay.

[0010] In an embodiment of the electromagnetic relay, the armature is hinged to the yoke. Advantageously, this allows to move the armature relative to the yoke and thus also relative to the core of the electromagnetic relay.

[0011] In an embodiment of the electromagnetic relay, the electromagnetic relay further comprise a spring acting to move the armature from the second position to the first position. Advantageously, the spring can ensure that the armature moves back from the second position to the first position when the coil of the electromagnetic relay

does not generate a magnetic field.

[0012] In an embodiment of the electromagnetic relay, the electromagnetic relay further comprises a first electric contact connected to the armature. The first electric contact can be engaged and disengaged with a second electric contact by movement of the armature. Advantageously, this allows to use the electromagnetic relay for switching an electric circuit connected to the first electric contact and the second electric contact. The electromagnetic relay can for example belong to the normally closed type or the normally open type.

[0013] The invention will now be explained in more detail with reference to the Figures in which

Fig. 1 shows a schematic perspective view of a first electromagnetic relay with its armature in a first position;

Fig. 2 shows a schematic sectional view of the first electromagnetic relay with the armature in the first position;

Fig. 3 shows a schematic perspective view of the first electromagnetic relay with its armature in a second position;

Fig. 4 shows a schematic sectional view of the first electromagnetic relay with the armature in the second position;

Fig. 5 shows a schematic sectional view of the first electromagnetic relay with the armature in a third position;

Fig. 6 shows a schematic sectional view of a second electromagnetic relay; and

Fig. 7 shows a schematic sectional view of a third electromagnetic relay.

[0014] Fig. 1 shows a schematic and partially transparent view of a first electromagnetic relay 10. Fig. 2 shows a schematic sliced side view of the first electromagnetic relay 10.

[0015] The first electromagnetic relay 10 can serve as an electrically operated switch. In particular, the first electromagnetic relay 10 can be used to switch an electric load circuit by an electric control circuit that is electrically isolated from the load circuit. The control circuit may employ a lower power than the load circuit.

[0016] The first electromagnetic relay 10 comprises a core 100. The core 100 comprises a magnetic material, preferably iron. The core 100 comprises an elongate shape and extends into a longitudinal direction 101. The core 100 comprises a pole portion 110 and an end portion 120. The pole portion 110 and the end portion 120 are arranged one after another along the longitudinal direction 101. In the example depicted in Figs. 1 and 2, the

pole portion 110 of the core 100 comprises the shape of a circular cylinder with a longitudinal axis that is arranged in parallel to the longitudinal direction 101. The pole portion 110 of the core 100 comprises a diameter 111 in a radial direction 102 that is perpendicular to the longitudinal direction 101. The end portion 120 of the core 100 is integrally connected to one longitudinal end of the pole portion 110 of the core 100. The end portion 120 also comprises the shape of a circular cylinder with a longitudinal axis that is arranged in parallel to the longitudinal direction 101 and coaxial to the longitudinal axis of the pole portion 110. The end portion 120 comprises a diameter 121 in the radial direction 102 that is larger than the diameter 111 of the pole portion 110 of the core 100. The end portion 120 comprises a length 122 in the longitudinal direction 101 that is shorter than the length of the pole portion 110 of the core 100 in the longitudinal direction 101.

[0017] It is possible to design the end portion 120 of the core 100 with another shape than the shape of a circular cylinder. In particular, the end portion 120 of the core 100 can be designed with another cylindrical shape, for example with the shape of a prism.

[0018] A coil 200 of wire is wrapped around the pole portion 110 of the core 100 of the first electromagnetic relay 10. An electric current can be passed through the coil 200 to generate a magnetic field.

[0019] A yoke 400 provides a low reluctance path for magnetic flux of a magnetic field created by the coil 200. The yoke 400 comprises a magnetic material, preferably iron. The yoke 400 is connected to the longitudinal end of the pole portion 110 of the core 100 that is opposed to the end portion 120 of the core 100. The pole portion 110 of the core 100 of the first electromagnetic relay 10 and the yoke 400 may be integrally connected. The yoke 400 is bent around the coil 200 such that a portion of the yoke 400 extends in parallel to the core 100 and the coil 200 in the longitudinal direction 101.

[0020] An armature 300 is connected to the yoke 400 by a hinge 320. The hinge 320 allows to move the armature 300 relative to the core 100 of the first electromagnetic relay 10 by tilting the armature 300 around the hinge 320. The armature 300 comprises a magnetic material, preferably iron.

[0021] By tilting the armature 300 around the hinge 320, the armature 300 can be moved between a first position 301 and a second position 302. Figs. 1 and 2 depict the first electromagnetic relay 10 with the armature 300 arranged in the first position 301. Fig. 3 shows a schematic and partially transparent view of the first electromagnetic relay 10 with the armature 300 arranged in the second position 302. Fig. 4 shows a schematic and sliced side view of the first electromagnetic relay 10 with the armature 300 arranged in the second position 302.

[0022] The first electromagnetic relay 10 comprises a first electric contact 600, a second electric contact 610 and a third electric contact 620. The first electric contact 600, the second electric contact 610 and the third electric

contact 620 are only depicted schematically in Figs. 2 and 4. In Figs. 1 and 3, the first electric contact 600, the second electric contact 610 and the third electric contact 620 are omitted for clarity.

[0023] The first electric contact 600 is mechanically connected to the armature 300 of the first electromagnetic relay 10 such that the first electric contact 600 is moved upon movement of the armature 300 relative to the core 100 of the first electromagnetic relay 10.

[0024] When the armature 300 of the first electromagnetic relay 10 is in the first position 301 depicted in Figs. 1 and 2, the first electric contact 600 is in electric contact with the second electric contact 610 such that a first electric load circuit is closed. At the same time, the first electric contact 600 and the second electric contact 610 are separated and electrically isolated from the third electric contact 620 such that a second electric load circuit is broken.

[0025] When the armature 300 of the first electromagnetic relay 10 is in the second position 302 depicted in Figs. 3 and 4, the first electric contact 600 is in electric contact to the third electric contact 620 such that the second electric load circuit is closed. At the same time, the first electric contact 600 and the third electric contact 620 are separated and electrically isolated from the second electric contact 610 such that the first electric load circuit is broken.

[0026] It is possible to omit either the second electric contact 610 or the third electric contact 620. In this case the first electromagnetic relay 10 serves to only close or break either the first electric load circuit or the second electric load circuit.

[0027] A spring 500 is connected to the armature 300 of the first electromagnetic relay 10. The spring 500 is schematically depicted in Figs. 2 and 4. In Figs. 1 and 3 the spring 500 is omitted for clarity. The spring 500 exerts a force on the armature 300 that moves the armature 300 from the second position 302 to the first position 301. In case that no other force acts on the armature 300, the armature 300 is maintained in its first position 301 by the spring 500.

[0028] The spring 500 is schematically depicted as a coil spring in Figs. 2 and 4. The spring 500 may however be any kind of spring suitable to exert a force on the armature 300 that moves the armature 300 from the second position 302 to the first position 301. It is possible to design and arrange the first electromagnetical relay 10 such that a gravitational force acting on the armature 300 may be used instead of the spring 500.

[0029] If no electric current passes through the coil 200 of the first electromagnetic relay 10, no magnetic field is created and the armature 300 is held in the first position 300 by the spring 500.

[0030] If the coil 200 of the first electromagnetic relay 10 is energized such that an electric current passes through the coil 200, a magnetic field is generated. The core 100, the yoke 400 and the armature 300 form a magnetic circuit as a path for the magnetic flux of the magnetic field. In the first position 301 of the armature

300, a first air gap 330 is arranged between the armature 300 and the end portion 120 of the core 100 of the first electromagnetic relay 10. The first air gap 330 forms part of the magnetic circuit. The magnetic field generates a force that aims to reduce the reluctance of the magnetic circuit and thus aims to reduce the size of the first air gap 330. This force acts to move the armature 330 towards the end portion 120 of the core 100. The force generated by the magnetic field overcomes the force generated by the spring 500 and thus moves the armature 300 from the first position 301 towards the second position 302.

[0031] The armature 300 comprises a hole 310. The hole 310 comprises the shape of a circular cylinder with a diameter 311 and a length 312. The diameter 311 of the hole 310 of the armature 300 is somewhat larger than the diameter 121 of the end portion 120 of the core 100. The length 312 of the hole 310 of the armature 300 approximately matches the length 122 of the end portion 120 of the core 100. It is preferred that the length 312 of the hole 310 and the length 122 of the end portion 120 of the core 100 differ by less than 20 % or, even more preferred, by less than 10 %. It is particularly preferred that the length 312 of the hole 310 of the armature 300 and the length 122 of the end portion 120 of the core 100 differ by less than 5 %.

[0032] The end portion 120 of the core 100 and the hole 310 of the armature 300 are designed such that the end portion 120 of the core 100 can be arranged in the hole 310 of the armature 300 when the armature 300 is in the second position 302. In case that the end portion 120 of the core 100 comprises a shape that is different from the shape of the circular cylinder, the hole 310 of the armature 300 may be shaped accordingly.

[0033] When the armature 300 of the first electromagnetic relay 10 is in the second position 302, a second air gap 340 is arranged between the armatures 300 and the end portion 120 of the core 100. The second air gap 340 is smaller than the first air gap 330. The reluctance of the magnetic circuit formed by the core 100, the yoke 400, the armature 300 and the air gaps 330, 340 is thus smaller when the armature 300 is in the second position 302 than when the armature 300 is in the first position 301. Consequently, the magnetic field generated by the coil 200 moves the armature 300 from the first position 301 to the second position 302.

[0034] Fig. 5 shows a schematic sliced side view of the first electromagnetic relay 10. In the depiction of Fig. 5 the armature 300 of the first electromagnetic relay 10 is in a third position 303. In the third position 303 the armature 300 is tilted further around the hinge 320 than in the second position 302 such that the armature 300 is closer to the pole portion 110 of the core 100 in the third position 303 than in the second position 302. Consequently, the end portion 120 of the core 100 of the first electromagnetic relay 10 has partially passed through the hole 310 of the armature 300 in the third position 303 of the armature 300. After having moved from the first position 301 to the second position 302 the armature 300 may have

moved on to the third position 303 because of its inertia.

[0035] A third air gap 350 is arranged between the armature 300 and the end portion 120 in the third position 303 of the armature 300. The third air gap 350 is larger than the second air gap 340. Consequently, the reluctance of the magnetic circuit created by the core 100, the yoke 400, the armature 300 and the third air gap 350 is larger than the reluctance of the magnetic circuit when the armature 300 is in the second position 302. This results in a force that drives the armature 300 from its third position 303 back to its second position 302.

[0036] As a result, the armature 300 will be moved to the second position 302 and will remain in the second position 302 if the coil 200 is energized and an electric current passes through the coil 200 of the first electromagnetic relay 10. Once the coil 200 is de-energized, the magnetic force created by the magnetic field created by the coil 200 vanishes and the spring 500 pulls the armature 300 back into the first position 301.

[0037] Fig. 6 shows a schematic sliced side view of a second electromagnetic relay 20. The second electromagnetic relay 20 is largely similar to the first electromagnetic relay 10 depicted in Figs. 1 to 5. Like components are referenced with the same numerals in Fig. 6 as in Figs. 1 to 5 and will not be discussed in detail again. The following description emphasizes the differences between the second electromagnetic relay 20 and the first electromagnetic relay 10. The electric contacts 600, 610, 620 and the spring 500 of the second electromagnetic relay 20 are not shown in Fig. 6.

[0038] The second electromagnetic relay 20 comprises a mechanical stop 700. In Fig. 6, the mechanical stop 700 is only depicted schematically. The mechanical stop 700 is rigidly connected to the second electromagnetic relay 20 such that the relative arrangement between the mechanical stop 700 and the core 100 of the second electromagnetic relay 20 is fixed. The mechanical stop 700 can for example be connected to the core 100 or to the yoke 400.

[0039] The mechanical stop 700 is arranged such that the armature 300 is in contact with the mechanical stop 700 when the armature 300 is in the second position 302, as depicted in Fig. 6. When the armature 300 is in the first position 301, the armature 300 is not in contact with the mechanical stop 700. When the armature 300 is moved from the first position 301 to the second position 302, the armature 300 abuts against the mechanical stop 700 once the armature 300 has reached the second position 302. This prevents the armature 300 from moving beyond the second position 302 towards the third position 303.

[0040] The mechanical stop 700 may comprise an elastic or otherwise resilient material to oppress the generation of noise when the armature 300 abuts against the mechanical stop 700.

[0041] Fig. 7 shows a schematic sliced side view of a third electromagnetic relay 30. The third electromagnetic relay 30 is largely similar to the second electromagnetic

relay 20. Like components of the second electromagnetic relay 20 and the third electromagnetic relay 30 are referenced with the same numerals in Fig. 7 as in Fig. 6 and Figs. 1 to 5 and will not be explained in detail again. The following description focuses on the differences between the third electromagnetic relay 30 and the second electromagnetic relay 20. The first electric contact 600, the second electric contact 610 and the third electric contact 620 as well as the spring 500 are not depicted in the schematic drawing of Fig. 7 for reasons of clarity.

[0042] The third electromagnetic relay 30 comprises a core 1100 that replaces the core 100 of the first electromagnetic relay 10 and the second electromagnetic relay 20. The core 1100 of the third electromagnetic relay 30 comprises a pole portion 1110 that extends in parallel to the longitudinal direction 101. The pole portion 1110 of the core 1100 comprises a diameter 1111 in the radial direction 102 that is perpendicular to the longitudinal direction 101. An end portion 1120 of the core 1100 is arranged at a longitudinal end of the pole portion 1110. The end portion 1120 comprises a diameter 1121 in the radial direction 102. The diameter 1121 of the end portion 1120 of the core 1100 is approximately equal to the diameter 1111 of the pole portion 1110 of the core 1100.

[0043] The third electromagnetic relay 30 comprises an armature 1300 that replaces the armature 300 of the first electromagnetic relay 10 and the second electromagnetic relay 20. The armature 1300 comprises a hole 1310 with a diameter 1311. The diameter 1311 of the hole 1310 of the armature 1300 is chosen such that the end portion 1120 of the core 1100 of the third electromagnetic relay 30 can be arranged in the hole 1310 of the armature 1300 when the armature 1300 is in the second position 302, as shown in Fig. 7.

[0044] Like the second electromagnetic relay 20, the third electromagnetic relay 30 comprises a mechanical stop 700. When the armature 1300 of the third electromagnetic relay 30 is in the second position 302, the armature 1300 abuts against the mechanical stop 700.

Reference symbols

[0045]

10	first electromagnetic relay
20	second electromagnetic relay
30	third electromagnetic relay
100	core
101	longitudinal direction
102	radial direction
110	pole portion
111	diameter
120	end portion
121	diameter
122	length
200	coil

300 armature
 301 first position
 302 second position
 303 third position
 310 hole
 311 diameter
 312 length
 320 hinge
 330 first air gap
 340 second air gap
 350 third air gap

400 yoke

500 spring

600 first electric contact
 610 second electric contact
 620 third electric contact
 700 mechanical stop

1100 core
 1110 pole portion
 1111 diameter
 1120 end portion
 1121 diameter

1300 armature
 1310 hole
 1311 diameter

Claims

1. An electromagnetic relay (10, 20, 30) comprising
 a core (100, 1100) having a pole portion (110, 1110)
 and an end portion (120, 1120),
 a coil (200) being arranged around the pole portion
 (110, 1110) of the core (100, 1100),
 and an armature (300, 1300) being movable relative
 to the core (100, 1100) between a first position (301)
 and a second position (302),
 wherein the coil (200) is provided for generating a
 magnetic field that moves the armature (300, 1300)
 from the first position (301) to the second position
 (302),
 wherein the armature (300, 1300) comprises a hole
 (310, 1310),
 wherein the end portion (120, 1120) of the core (100,
 1100) is arranged in the hole (310, 1310) when the
 armature (300, 1300) is in the second position (302),
characterised in that an air gap (330, 340) is ar-
 ranged between the armature (300, 1300) and the
 core (100, 1100) in the first position (301) and in the
 second position (302) of the armature (300, 1300).
 2. The electromagnetic relay (10, 20, 30) according to
 claim 1,

wherein the air gap (330, 340) is smaller in the sec-
 ond position (302) of the armature (300, 1300) than
 in the first position (301) of the armature (300, 1300).

3. The electromagnetic relay (10, 20) according to one
 of the previous claims,
 wherein the core (100) extends in a longitudinal di-
 rection (101),
 wherein the pole portion (110) comprises a first di-
 ameter (111) in a radial direction (102) which is per-
 pendicular to the longitudinal direction (101), where-
 in the end portion (120) comprises a second diam-
 eter (121) in the radial direction,
 wherein the second diameter (121) is larger than the
 first diameter (111).
 4. The electromagnetic relay (10, 20) according to
 claim 3,
 wherein the end portion (120) comprises a first length
 (122) in the longitudinal direction (101), wherein the
 hole (310, 1310) comprises a second length (312),
 wherein the first length (122) and the second length
 (312) differ by less than 20 %, preferably by less than
 10 %, in particular by less than 5 %.
 5. The electromagnetic relay (20, 30) according to one
 of the previous claims,
 wherein the armature (300, 1300) is in contact with
 a mechanical stop (700) in the second position (302).
 6. The electromagnetic relay (20, 30) according to
 claim 5,
 wherein the mechanical stop (700) comprises an
 elastic material.
 7. The electromagnetic relay (20, 30) according to one
 of claims 5 and 6,
 wherein the mechanical stop (700) is rigidly connect-
 ed to the core (100, 1100).
 8. The electromagnetic relay (10, 20, 30) according to
 one of the previous claims,
 wherein the electromagnetic relay (10, 20, 30) further
 comprises a yoke (400) being connected to the core
 (100, 1100).
 9. The electromagnetic relay (10, 20, 30) according to
 claim 8,
 wherein the armature (300, 1300) is hinged to the
 yoke (400).
 10. The electromagnetic relay (10, 20, 30) according to
 one of the previous claims,
 wherein the electromagnetic relay (10, 20, 30) further
 comprises a spring (500) acting to move the arma-
 ture (300, 1300) from the second position (302) to
 the first position (301).

11. The electromagnetic relay (10, 20, 30) according to one of the previous claims,
 wherein the electromagnetic relay (10, 20, 30) further comprises a first electric contact (600) connected to the armature (300, 1300),
 wherein the first electric contact (600) can be engaged and disengaged with a second electric contact (610, 620) by movement of the armature (300, 1300).

Patentansprüche

1. Elektromagnetisches Relais (10, 20, 30), umfassend einen Kern (100, 1100) mit einem Polabschnitt (110, 1110) und einem Endabschnitt (120, 1120), eine Spule (200), die um den Polabschnitt (110, 1110) des Kerns (100, 1100) angeordnet ist, und einen Anker (300, 1300), der relativ zu dem Kern (100, 1100) zwischen einer ersten Position (301) und einer zweiten Position (302) beweglich ist, wobei die Spule (200) vorgegeben ist zum Generieren eines Magnetfelds, das den Anker (300, 1300) von der ersten Position (301) zur zweiten Position (302) bewegt, wobei der Anker (300, 1300) ein Loch (310, 1310) umfasst, wobei der Endabschnitt (120, 1120) des Kerns (100, 1100) in dem Loch (310, 1310) angeordnet ist, wenn sich der Anker (300, 1300) in der zweiten Position (302) befindet, **dadurch gekennzeichnet, dass** ein Luftspalt (330, 340) zwischen dem Anker (300, 1300) und dem Kern (100, 1100) in der ersten Position (301) und in der zweiten Position (302) des Ankers (300, 1300) angeordnet ist.
2. Elektromagnetisches Relais (10, 20, 30) nach Anspruch 1, wobei der Luftspalt (330, 340) in der zweiten Position (302) des Ankers (300, 1300) kleiner ist als in der ersten Position (301) des Ankers (300, 1300).
3. Elektromagnetisches Relais (10, 20) nach einem der vorhergehenden Ansprüche, wobei sich der Kern (100) in einer Längsrichtung (101) erstreckt, wobei der Polabschnitt (110) einen ersten Durchmesser (111) in einer radialen Richtung (102) umfasst, die senkrecht zur Längsrichtung (101) herläuft, wobei der Endabschnitt (120) einen zweiten Durchmesser (121) in der radialen Richtung umfasst, wobei der zweite Durchmesser (121) größer ist als der erste Durchmesser (111).
4. Elektromagnetisches Relais (10, 20) nach Anspruch 3, wobei der Endabschnitt (120) eine erste Länge (122) in der Längsrichtung (101) umfasst,

wobei das Loch (310, 1310) eine zweite Länge (312) umfasst,
 wobei die erste Länge (122) und die zweite Länge (312) um weniger als 20%, bevorzugt um weniger als 10%, insbesondere um weniger als 5% differieren.

5. Elektromagnetisches Relais (20, 30) nach einem der vorhergehenden Ansprüche, wobei der Anker (300, 1300) in der zweiten Position (302) mit einem mechanischen Anschlag (700) in Kontakt steht.
6. Elektromagnetisches Relais (20, 30) nach Anspruch 5, wobei der mechanische Anschlag (700) ein elastisches Material umfasst.
7. Elektromagnetisches Relais (20, 30) nach einem der Ansprüche 5 und 6, wobei der mechanische Anschlag (700) starr mit dem Kern (100, 1100) verbunden ist.
8. Elektromagnetisches Relais (10, 20, 30) nach einem der vorhergehenden Ansprüche, wobei das elektromagnetische Relais (10, 20, 30) weiterhin ein mit dem Kern (100, 1100) verbundenes Joch (400) umfasst.
9. Elektromagnetisches Relais (10, 20, 30) nach Anspruch 8, wobei der Anker (300, 1300) am Joch (400) angelenkt ist.
10. Elektromagnetisches Relais (10, 20, 30) nach einem der vorhergehenden Ansprüche, wobei das elektromagnetische Relais (10, 20, 30) weiterhin eine Feder (500) umfasst, die dahingehend wirkt, den Anker (300, 1300) von der zweiten Position (302) zur ersten Position (301) zu bewegen.
11. Elektromagnetisches Relais (10, 20, 30) nach einem der vorhergehenden Ansprüche, wobei das elektromagnetische Relais (10, 20, 30) weiterhin einen mit dem Anker (300, 1300) verbundenen ersten elektrischen Kontakt (600) umfasst, wobei der erste elektrische Kontakt (600) durch eine Bewegung des Ankers (300, 1300) mit einem zweiten elektrischen Kontakt (610, 620) in Eingriff und außer Eingriff gebracht werden kann.

Revendications

1. Relais électromagnétique (10, 20, 30) comprenant un noyau (100, 1100) qui possède une portion polaire (110, 1110) et une portion d'extrémité (120, 1120),

une bobine (200) étant disposée autour de la portion polaire (110, 1110) du noyau (100, 1100), et un induit (300, 1300) étant mobile par rapport au noyau (100, 1100) entre une première position (301) et une deuxième position (302), la bobine (200) étant conçue pour générer un champ magnétique qui déplace l'induit (300, 1300) de la première position (301) à la deuxième position (302), l'induit (300, 1300) comprenant un trou (310, 1310), la portion d'extrémité (120, 1120) du noyau (100, 1100) étant disposée dans le trou (310, 1310) lorsque l'induit (300, 1300) se trouve dans la deuxième position (302),

caractérisé en ce que

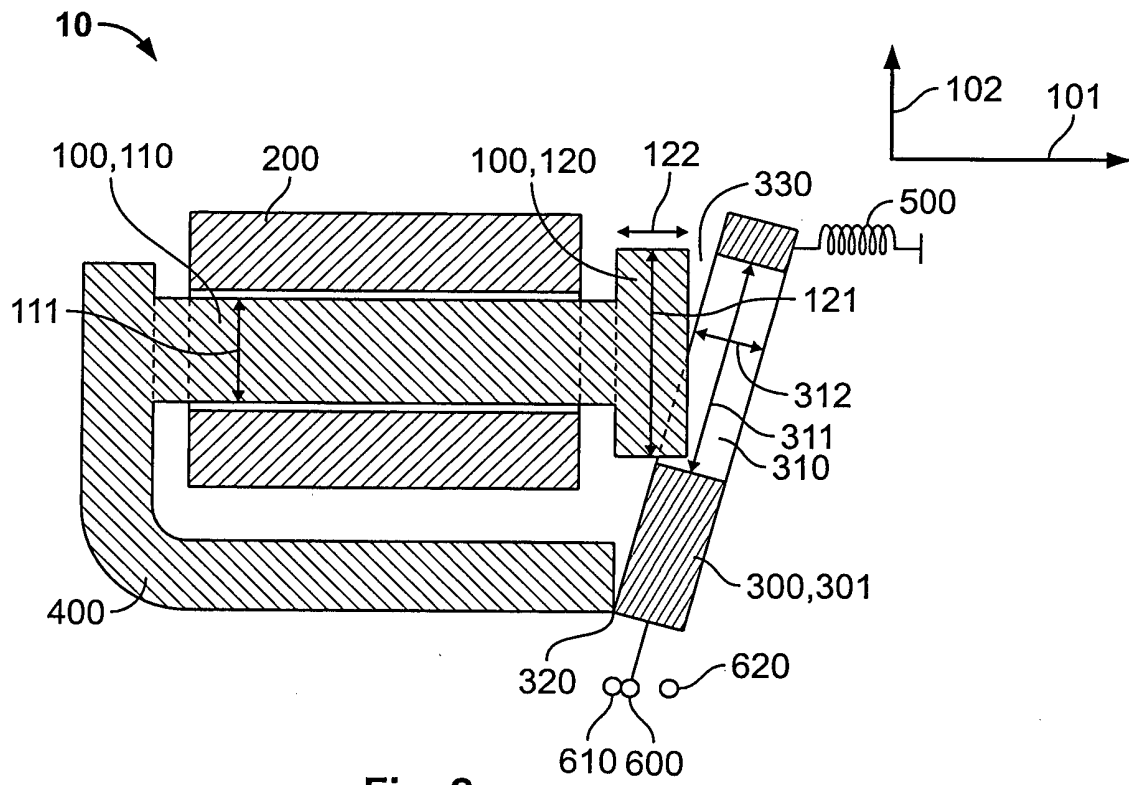
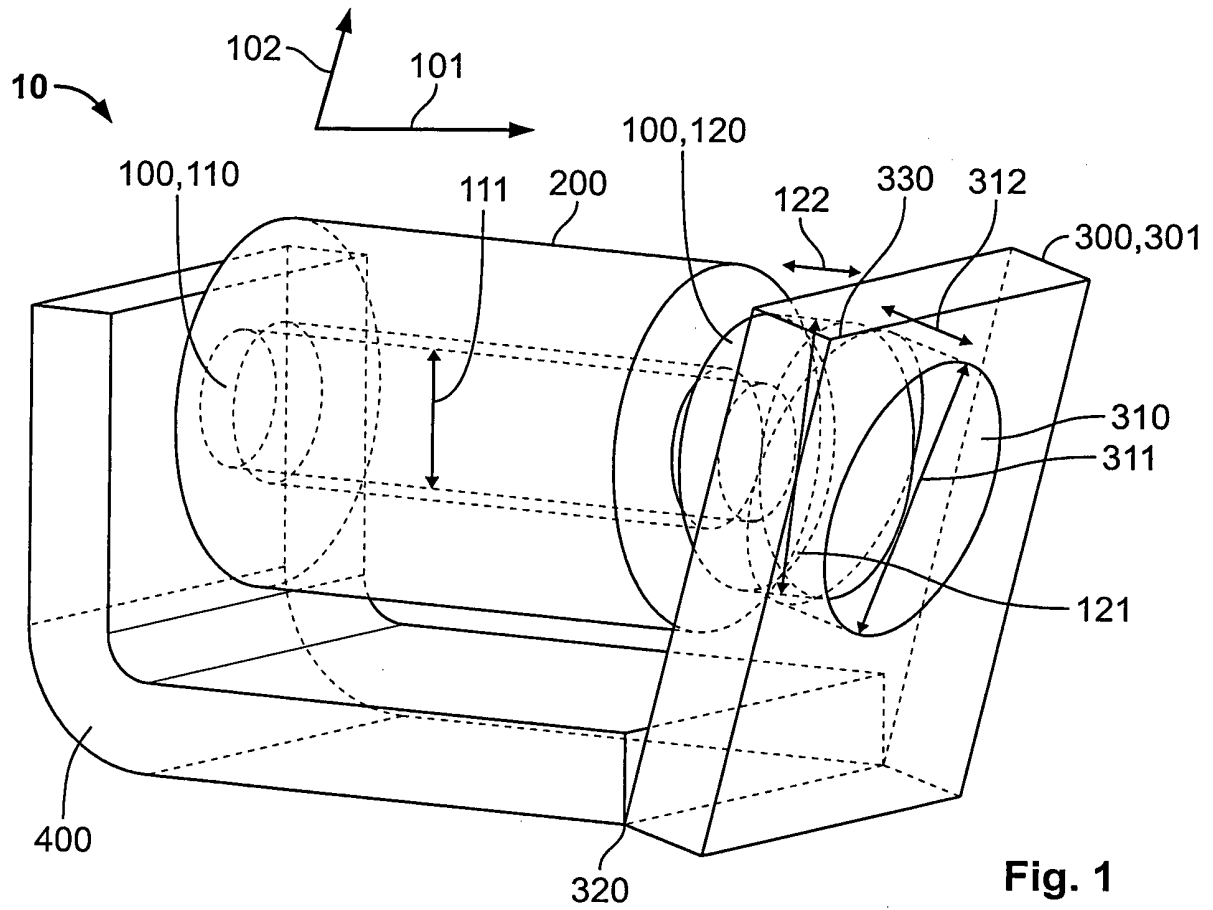
un entrefer (330, 340) se trouve entre l'induit (300, 1300) et le noyau (100, 1100) dans la première position (301) et dans la deuxième position (302) de l'induit (300, 1300).

2. Relais électromagnétique (10, 20, 30) selon la revendication 1, l'entrefer (330, 340) étant plus petit dans la deuxième position (302) de l'induit (300, 1300) que dans la première position (301) de l'induit (300, 1300). 20
3. Relais électromagnétique (10, 20) selon l'une des revendications précédentes, le noyau (100) s'étendant dans une direction longitudinale (101), la portion polaire (110) présentant un premier diamètre (111) dans une direction radiale (102) qui est perpendiculaire à la direction longitudinale (101), la portion d'extrémité (120) présentant un deuxième diamètre (121) dans la direction radiale, le deuxième diamètre (121) étant plus grand que le premier diamètre (111). 30 35
4. Relais électromagnétique (10, 20) selon la revendication 3, la portion d'extrémité (120) présentant une première longueur (122) dans la direction longitudinale (101), le trou (310, 1310) présentant une deuxième longueur (312), la première longueur (122) et la deuxième longueur (312) différant de moins de 20 %, de préférence de moins de 10 %, notamment de moins de 5 %. 40 45
5. Relais électromagnétique (20, 30) selon l'une des revendications précédentes, l'induit (300, 1300) étant en contact avec une butée mécanique (700) dans la deuxième position (302). 50
6. Relais électromagnétique (20, 30) selon la revendication 5, la butée mécanique (700) comprenant un matériau élastique. 55
7. Relais électromagnétique (20, 30) selon l'une des

revendications 5 et 6,

la butée mécanique (700) étant reliée de manière rigide au noyau (100, 1100).

- 5 8. Relais électromagnétique (10, 20, 30) selon l'une des revendications précédentes, le relais électromagnétique (10, 20, 30) comprenant en outre une culasse (400) qui est reliée au noyau (100, 1100). 10
9. Relais électromagnétique (10, 20, 30) selon la revendication 8, l'induit (300, 1300) étant fixé de manière articulée à la culasse (400). 15
10. Relais électromagnétique (10, 20, 30) selon l'une des revendications précédentes, le relais électromagnétique (10, 20, 30) comprenant en outre un ressort (500) qui agit pour déplacer l'induit (300, 1300) de la deuxième position (302) à la première position (301). 20
11. Relais électromagnétique (10, 20, 30) selon l'une des revendications précédentes, le relais électromagnétique (10, 20, 30) comprenant en outre un premier contact électrique (600) raccordé à l'induit (300, 1300), le premier contact électrique (600) pouvant être amené en prise et hors prise avec un deuxième contact électrique (610, 620) par un mouvement de l'induit (300, 1300). 25 30 35 40 45 50 55



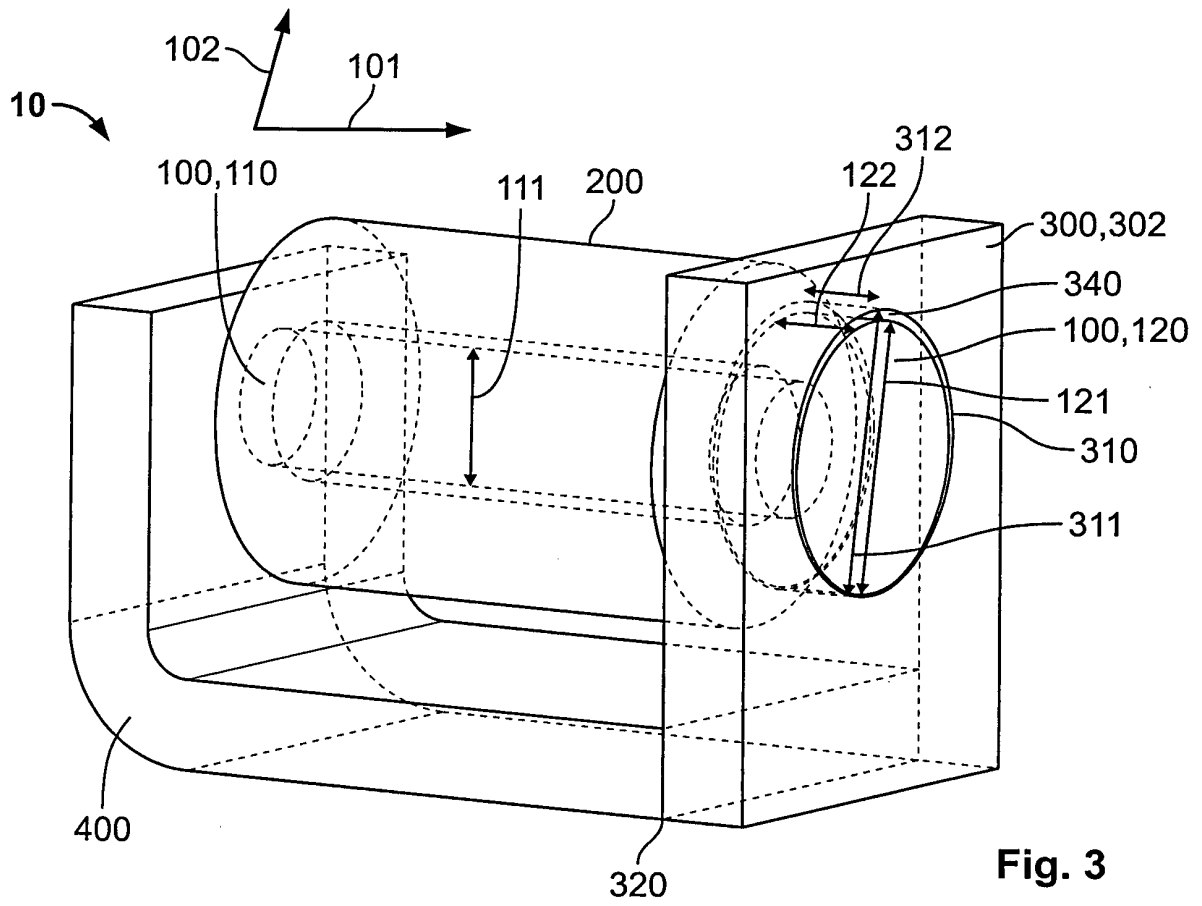


Fig. 3

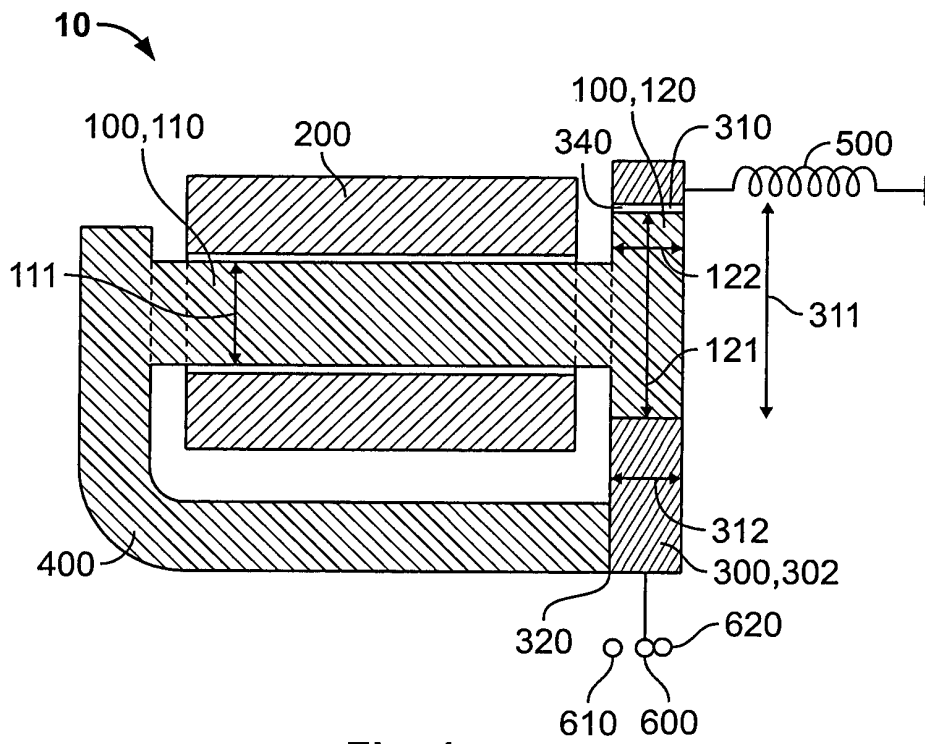


Fig. 4

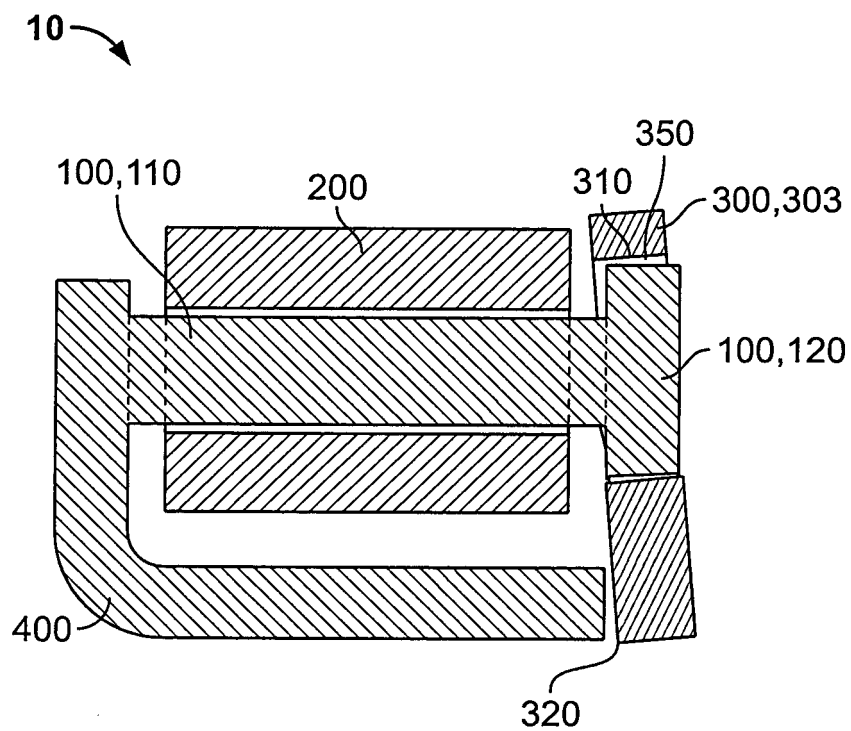


Fig. 5

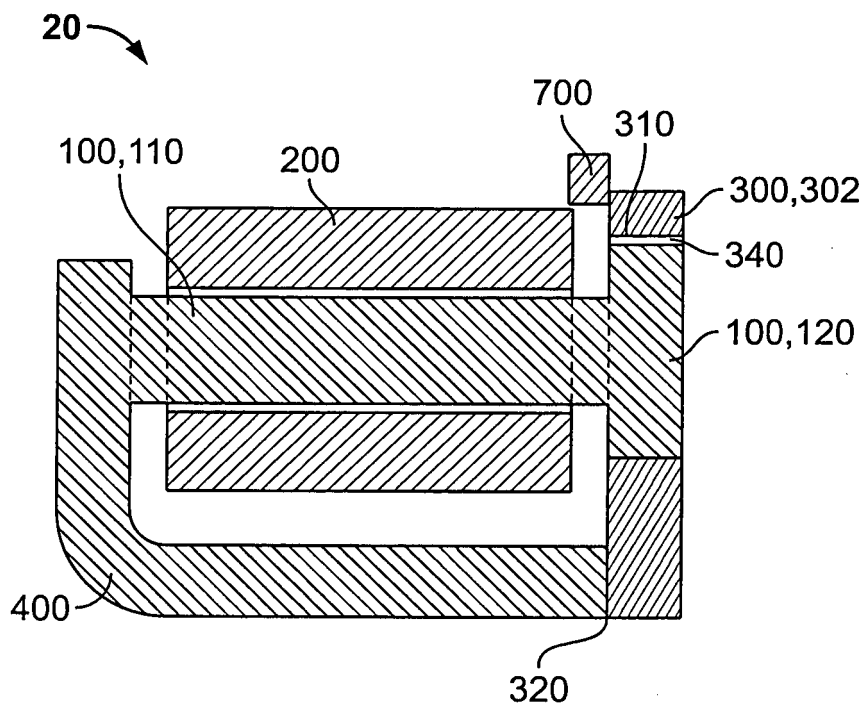


Fig. 6

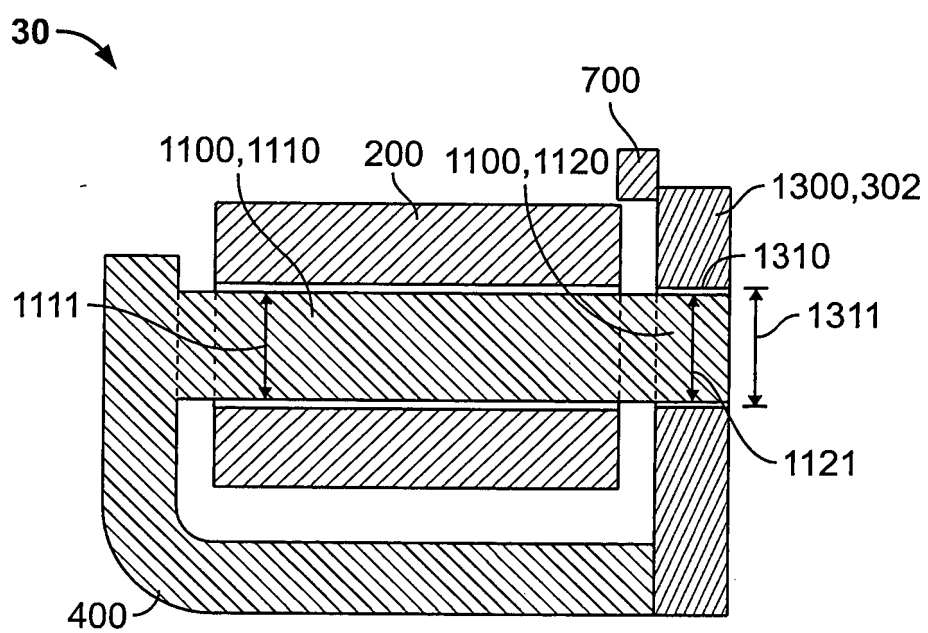


Fig. 7

REFERENCES CITED IN THE DESCRIPTION

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