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(54) **SECURE MAGNETIC KEY AND LOCK SYSTEM**

(57) The present invention refers to a key (1) for opening and/or closing of at least one lock (2). The key according to the present invention preferably comprises at least a main rod (4), wherein at least one support means (6) for holding of magnets is arranged at the rod (4), wherein the support means (6) has a diameter greater

than the adjacent section of the rod (4), wherein positive magnets (8) and negative magnets (10) are arranged at the support means (6), wherein the positive magnets (8) and the negative magnets (10) of the support means (6) are arranged in the same distance to a central axis of the rod (4).

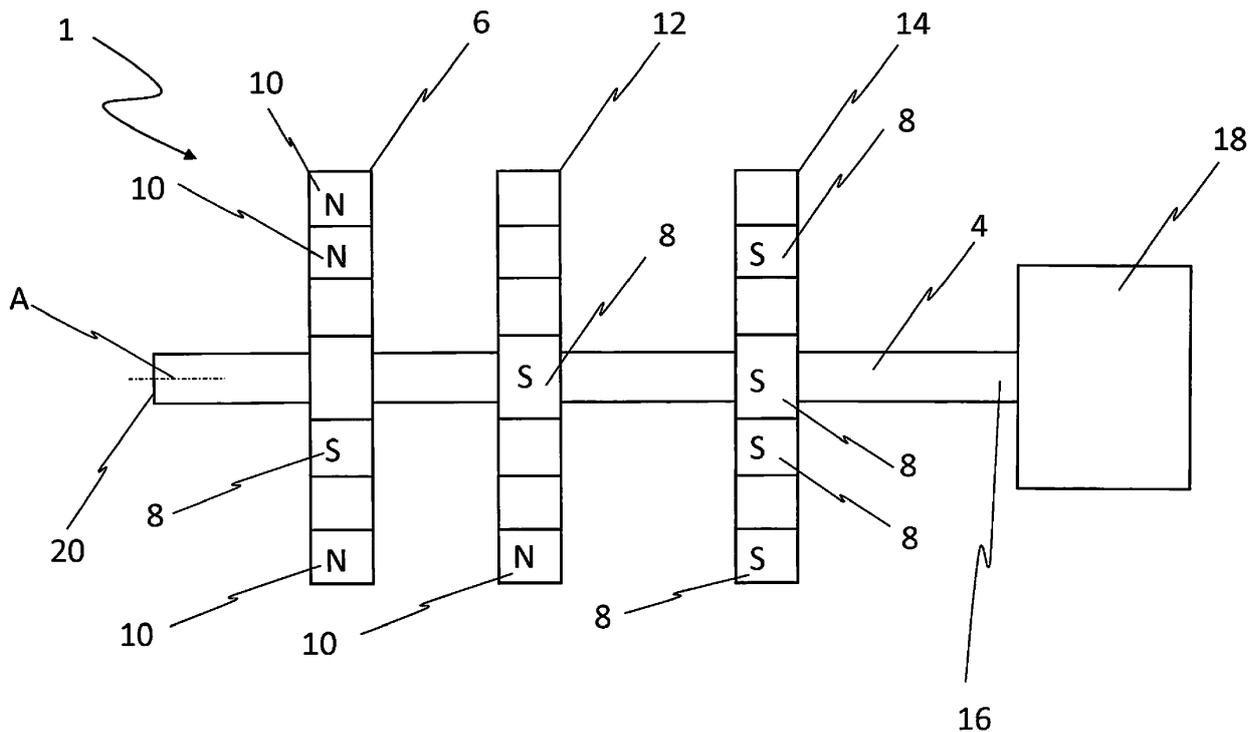


Fig. 1

## Description

[0001] The present invention refers according to claim 1 to a key for opening and/or closing of at least one lock, in particularly one locked unit like a car, door, house, safe, suitcase, etc. The invention further refers according to claim 9 to a lock, in particularly for interacting with a key according to claim 1. According to claim 13 the present invention refers to a key-lock system and according to claim 14 to a method and according to claim 15 to a unit having such a lock.

## Background of the invention

[0002] Document US3633393A discloses a lock comprising rotary tumblers each having a magnet and provided rotatably inside a main body of the lock, said tumblers being permitted to rotate to a given position through operation of magnets incorporated in a key, and a locking or unlocking mechanism operating in relation to said rotary tumblers.

[0003] Document US433327A relates to a magnetic tumbler lock comprising an inner cylinder adapted to turn in an external housing, said inner cylinder having a keyhole for receiving a key, locking means including at least one magnetic tumbler, which is adapted to rotate about a rotary axis extending substantially transversely of the longitudinal axis of the inner cylinder, and a key which is provided with a magnet for co-operating with the magnetic tumbler causing the magnetic tumbler to rotate into an unlocked position when the key is inserted into the lock.

[0004] The more complex the keys of the doors are, the more often they are mechanically copied. Furthermore, the narrowness of the keyholes makes it difficult to use the key in the dark or when the hands are full.

## Object of the invention

[0005] It is the object of the present invention to provide an alternative key and a corresponding lock that is more secure compared to the state of the art.

## Description of the Invention

[0006] The before mentioned object is solved by a key for opening and/or closing of at least one lock according to claim 1. Said key preferably comprises at least a rod, in particularly a main rod, wherein at least one support means for holding of magnets is arranged at the rod, wherein the support means has a diameter greater than the adjacent section of the rod, wherein positive magnets and negative magnets are arranged at the support means, wherein the positive magnets and the negative magnets of the support means are arranged in the same distance to a central axis of the rod.

[0007] This solution is beneficial since to the circumferential size of the support means a high number of mag-

nets can be provided per support element. Since the order of the magnets can be chosen individually a high number of potential combinations results. Said high number of potential combinations leads to a very strong code. Each further support means increases the complexity significantly.

[0008] Thus, the invention is about a new door locking mechanism. This new locking system can be used in every area which is using keys. It is intended that the key and lock mechanism is more secure with the present invention. In addition, the installation of the key is facilitated. Invention can be used on doors, security systems, cases, cars, and so on.

[0009] Further preferred embodiments are subject matter of the following specification passages and/or of the dependent claims.

[0010] According to a preferred embodiment of the present invention the magnetic field of each positive magnet and each negative magnet extends in radial direction beyond the physical structure of the support means. It is further or alternatively possible that the magnets are forming parts of the radial ends of the support means. This embodiment is beneficial since magnets or elements arranged inside the lock can be arranged in such a position that they are in close vicinity to the magnets of the support means. Thus, the lock can be designed in a small manner to the small distance between the magnets of the key and the magnets of a lock.

[0011] The distance between a first pair of adjacent magnets is according to a further preferred embodiment of the present invention different to a second pair of adjacent magnets of the support means. This embodiment is beneficial since the complexity of the code of the key can be increased not only by the order of the magnets, even the distance between individual magnets can be used to increase the code complexity. Thus, the code can be more complex without a need of increasing the size of the support means.

[0012] More than four magnets are arranged according to a further preferred embodiment of the present invention in one plane at the support means. Thus, it is possible to have more than 5 or more than 10 or more than 20 or more than 30 or more than 50 or up to 50 or up to 100 or up to 200 or up to 500 magnets per support means. This embodiment is beneficial since each further magnet increases the complexity of the code of the key.

[0013] According to a further preferred embodiment of the present invention the support means has a disc like shape, in particular a circular disc shape. This embodiment is beneficial since all magnets of one support means can be arranged in one plane and in the same distance to a central axis of the rod.

[0014] At least one further support means, and preferably multiple further support means, having multiple positive magnets and negative magnets is arranged according to a further preferred embodiment coaxial to the support means at the rod, wherein the further support means and the support means are arranged in a predefined dis-

tance to each other. This embodiment is beneficial since the complexity of the key can be increase significantly. Furthermore, corresponding magnetic actuator can be actuated by one or multiple support means at the same time or in a predefined order respectively sequence.

**[0015]** One axial end of the rod comprises a handle member and the support means which is arranged close to the second axial end of the rod has a diameter smaller than the diameter of at least one further support means.

**[0016]** The before mentioned object is also solved by a lock according to claim 8. Said lock preferably comprises at least a preferably circular key hole for inserting a key, in particularly a key according to any of the before mentioned claims, multiple magnetic actuators arranged in a first plane, in particular in a circular direction, around the key hole, a processor unit for detecting actuations of the magnetic actuators, a locking member, in particularly a bar, and a motor for moving the locking member in dependency of the detected actuations of the magnetic actuators. This solution is beneficial since the number and position of magnetic actuators can be chosen in dependency of the required security level. Thus, the more magnetic actuator the more information can be gathered from a key respectively analyzed at a time.

**[0017]** A magnetic actuator comprises according to a further preferred embodiment of the present invention at least one magnetic element, in particularly a positive magnet and/or a negative magnet, for interacting with corresponding positive magnets and/or negative magnets of a key, wherein the magnetic element moves from a first position into a second position or from a first alignment into a second alignment in dependency of the interaction. This embodiment is beneficial since the movements of the magnetic elements can be analyzed in an easy manner.

**[0018]** The magnetic element comprises according to a further preferred embodiment of an electric circuit modification means, wherein the electric circuit modification means moves in dependency of a movement of the magnetic element, wherein the electric circuit modification means opens or closes one or multiple electric circuits in dependency of the respective position, wherein the processor unit at least determines which electric circuit is closed. The electric circuit modification means preferably directly follows the movements of the magnetic element. This embodiment is beneficial since sensor elements or circuits can be biased in dependency of the movements of the magnetic element. Thus, multiple signals can be gathered at a time or in a predefined sequence. In case the pattern of signals does not fit to a predefined pattern the key will not be accepted. Thus, the processor unit will not actuate the motor to move the locking member.

**[0019]** The electric circuit modification means comprises according to another embodiment of the present invention a contact means for closing of at least one mechanic switch of the electric circuit by mechanical interaction. This embodiment is beneficial since a hardware

interaction is caused and therefore the key analysis is not just based on a digital analysis and thus even harder to break.

**[0020]** Further magnetic actuators are arranged according to a further preferred embodiment of the present invention in a further plane, wherein the further plane is orientated in parallel to the first plane, wherein the magnetic actuators are arranged in the same distance to a center axis of the key hole, wherein the first plane has a predefined distance to the second plane. Alternatively, it is possible that at least the magnets of two planes are arranged on circular paths, wherein each path has a different diameter, wherein the magnets of the first plane are arranged in a first distance to a center of the key hole and wherein the magnets of the second plane are arranged in a second distance to the center of the key hole. It is further possible that the lock comprises more planes with magnets arranged on a circular path around the key hole compared to the number of support means of a key fitting into the key hole. This solution is beneficial since differently shaped keys can be used for one lock.

**[0021]** The before mentioned object is also solved by a key-lock system according to claim 13. The key-lock system according to the present invention preferably comprises at least a key according to any of claims 1 to 8 and a lock according to any of claims 8 to 12, wherein the predefined distance between the support means of the key is the same as the predefined distance between the first plane and the second plane. This solution is beneficial since the lock and the key are providing elements that can be used to increase the complexity of a legitimation code.

**[0022]** The before mentioned object is also solved by a method for actuating a lock according to any of claims 8 to 12 with a key according to any of claims 1 to 7. This method is preferably characterized by the steps: inserting the key into the lock, wherein a stop is provided for causing a predefined position between the key and the lock, rotating the key for actuating the magnetic actuators of the lock for opening and/or closing of multiple electric circuits at the same time, analyzing the sequence of closed and/or opened circuits, in particularly by a processor unit, operating a motor for moving a locking member from a first position to a second position in case the analyzed sequence fits to a predefined sequence.

**[0023]** The before mentioned object is also solved by a unit, in particularly car or house, comprising at least one lock according to claims 8 to 12 and at least one key according to claim 1 to 7.

**[0024]** Further benefits, goals and features of the present invention will be described by the following specification of the attached figure, in which exemplarily components of the invention are illustrated. Components of the devices, units and methods according to the invention, which match at least essentially with respect to their function can be marked with the same reference sign, wherein such components do not have to be marked or described multiple times with respect to said figure. In

the following the invention is just exemplarily described with respect to the attached figure.

### Brief Description of the Drawing

#### [0025]

Fig. 1 exemplarily shows a schematically illustration of a key of the present invention;

Fig. 2 exemplarily shows a key hole and magnetic actuators arranged in one plane around the key hole and a detailed illustration of one magnetic actuator; and

Fig. 3 exemplarily a more detailed illustration of one magnetic actuator and a processing unit.

### Detailed Description of the Drawing

[0026] Fig. 1 shows an example of a physical key 1 for opening and/or closing of at least one lock 2. The key according to the present invention preferably comprises at least a main rod 4. Said rod 4 preferably has a first axial end 16 and a second axial end 20. A handle member 18 for pulling and turning and pushing of the key is preferably arranged at the first axial end 16. Preferably at least one support means 6 for holding of magnets is arranged at the rod 4, wherein the support means 6 has a diameter greater than the adjacent section of the rod 4, wherein positive magnets 8 and negative magnets 10 are arranged at the support means 6, 12, 14, wherein the positive magnets 8 and the negative magnets 10 of the support means 6 are arranged in the same distance to a central axis of the rod 4.

[0027] To be able to create easy to use key a special key 1 and a special lock mechanism 2 (cf. fig. 3) is provided herewith. This system is very safe due to high complexity of the information provided by specific arrangements of the individual magnets 8, 10 of one or more support means (6, 12, 14). In the system there is a key 1 having discs (6, 12, 14) with magnets 8, 10 highly preferably in different arrays on it. With respect to the present invention positive magnets 8 are defined as "S" magnets and negative magnets 10 are defined as "N" magnets, wherein "S" preferably refers to "south pole" and "N" preferably refers to "north pole". The arrangement of these magnets 8, 10 respectively the positioning of the poles is preferably different for each key 1. It is possible that there is a gap between magnets 8, 10 of one support means 6, 12, 14 and/or some or multiple magnets 8, 10 or different types or of the same type are arranged side-by-side without spaces.

[0028] This sequence creates the key's own password respectively code. In the lock mechanism respectively lock 2, there are, in particularly in multiple planes respectively each corresponding plane, multiple magnetic actuators 24, 44, 46 each having a magnetic element 30

that can be moved, wherein the magnetic element preferably comprises further magnets 80, 100. The multiple magnetic actuators 24, 44, 46 preferably correspond to the alignment of the support means 6, 12, 14 respectively disks formed with the magnets 8, 10 in the key 1 (cf. fig. 2). The magnetic actuators 24, 44, 46 preferably comprise electric circuit modification means 32 for generating signals based on actuation of the respective actuation means 24, 44, 46. The electric circuit modification means 32 preferably forms a mechanical part below and in the middle of these magnets of the lock 2. That mechanical part preferably acts as contact means 38. By means of this mechanical part respectively contact means 38 the interaction between magnets 8, 10 of the key 1 and one or multiple magnet/s of the magnetic actuator 24, 44, 46 activates the mechanical switches 40, 42 underneath by moving forward or backward (cf. fig. 3). In particularly under the magnetic element 30 are two mechanical switches 40, 42. Each mechanical switch 40, 42 preferably belongs to an individual circuit 34, 36 connecting a voltage source 48 or individual voltage sources with preferably individual input ports of the processing unit 28. Thus, these switches 40, 42 are preferably connected via a circuit to voltage supply 48 and a microcontroller respectively a processor unit 28. Switch positions cut the voltage going through to microprocessor or let voltage to go through micro controller respectively processor unit 28. The system also has at least one motor, in particularly an electric motor, that will move a locking member for closing or opening of the lock 2. This engine respectively motor preferably locks the respective unit, in particularly door, car, safe or suitcase by pushing or pulling metal lugs, in dependency of the sequence of voltage applied to the processor unit 28, in particular in dependency of the voltages detected respectively analyzed during a rotation of the key around its longitudinal axis A of at least 10° or at least 30° or at least 45° or at least 60° or at least 90° or at least 120° or at least 150° or at least 180° or at least 270° or at least 360° or up to 360° or up to 720°.

[0029] The system operation can comprise the steps of inserting the key 1 through the lock hole respectively key hole 22. When the key 1 is properly installed, it preferably does not affect the magnets 80, 100 in the lock 2 corresponding to the discs alignment respectively support means 6, 12, 14. Then when the key 1 is turned towards the opening direction, the magnets 8, 10 on the discs 6, 12, 14 push or pull the magnets 8, 10 inside the lock 2 according to their poles. With the forward or backward movement of the magnets 80, 100 in the lock 2, the switches 40, 42 underneath are activated in a certain order. The knowledge that the switches 40, 42 are active or not is detected by a microprocessor respectively processor unit 28. The key 1 activates the motor which is controlling the locking member if the desired turn is completed and if the microprocessor confirms the open-door combination from the switches 40, 42. The motor rotates and opens the door by pulling the preferably metal lugs that provide locking. When the door is closed, the key is

preferably reversed or removed if it is desired to lock. The system repeats the above steps but this time the locking member respectively lugs hanging behind are pushed forward. Locking takes place in this way.

**[0030]** Thus, the present invention refers to a key 1 for opening and/or closing of at least one lock 2. The key according to the present invention preferably comprises at least a main rod 4, wherein at least one support means 6 for holding of magnets is arranged at the rod 4, wherein the support means 6 has a diameter greater than the adjacent section of the rod 4, wherein positive magnets 8 and negative magnets 10 are arranged at the support means 6, wherein the positive magnets 8 and the negative magnets 10 of the support means 6 are arranged at the same distance to a central axis of the rod 4.

#### List of reference numbers

##### [0031]

1	key
2	lock
4	rod
6	support means / first support means
8	positive magnet
10	negative magnet
12	further support means / second support means
14	further support means / third support means
16	first axial end
18	handle member
20	second axial end
22	key hole
24	magnetic actuator
28	processor unit
30	magnetic element
32	electric circuit modification means
34	first electric circuit
36	second electric circuit
38	contact means
40	first mechanic switch
42	second mechanic switch
44	further magnetic actuator / second magnetic actuator
46	further magnetic actuator / third magnetic actuator
48	voltage point
50	motor control output
80	positive magnet
100	negative magnet
A	axis

#### Claims

1. Key (1) for opening and/or closing of at least one lock (2), at least comprising a main rod (4),

wherein at least one support means (6) for holding of magnets is arranged at the rod (4), wherein the support means (6) has a diameter greater than the adjacent section of the rod (4), wherein positive magnets (8) and negative magnets (10) are arranged at the support means (6), wherein the positive magnets (8) and the negative magnets (10) of the support means (6) are arranged in the same distance to a central axis of the rod (4).

2. Key according to claim 1, **characterized in that** the magnetic field of each positive magnet (8) and each negative magnet (10) extends in radial direction beyond the physical structure of the support means (6).

3. Key according to claim 2, **characterized in that** the distance between a first pair of adjacent magnets is different to a second pair of adjacent magnets of the support means (6).

4. Key according to any of the before mentioned claims, **characterized in that** more than four magnets (8, 10) are arranged in one plane at the support means (6).

5. Key according to any of the before mentioned claims, **characterized in that** the support means (6) has a disc like shape, in particular a disc shape.

6. Key according to any of the before mentioned claims, **characterized in that** at least one further support means (12), and preferably multiple further support means (12, 14), having multiple positive magnets (8) and multiple negative magnets (10) is arranged coaxial to the support means (6) at the rod (4), wherein the further support means (12) and the support means (6) are arranged in a predefined distance to each other.

7. Key according to any of the before mentioned claims, **characterized in that** one axial end (16) of the rod (4) comprises a handle member (18) and the support means (6) which is arranged close to the second axial end (20) or at the second axial end of the rod (4) has a diameter smaller than the diameter of at least one further support means (12, 14).

8. Lock (2), at least comprising a key hole (22) for inserting a key (1), in particular a key (1) according to any of the before mentioned claims, multiple magnetic actuators (24) arranged in a first

plane, in particular in a circular direction, around the key hole (22),  
 a processor unit (28) for detecting actuations of the magnetic actuators (24),  
 a locking member, in particularly a bar,  
 and a motor for moving the locking member in dependency of the detected actuations of the magnetic actuators (24).

9. Lock according to claim 8,  
**characterized in that**  
 a magnetic actuator (24) comprises at least one magnetic element (30), in particularly a positive magnet (8) and/or a negative magnet (10), for interacting with corresponding positive magnets (8) and/or negative magnets (10) of a key (1), wherein the magnetic element (30) moves from a first position into a second position or from a first alignment into a second alignment in dependency of the interaction.
10. Lock according to claim 9,  
**characterized in that**  
 the magnet element (30) comprises an electric circuit modification means (32), wherein the electric circuit modification means (32) moves in dependency of a movement of the magnetic element (30), wherein the electric circuit modification means (32) opens or closes one or multiple electric circuits (34, 36) in dependency of the respective position, wherein the processor unit at least determines which electric circuit (34, 36) is closed.
11. Lock according to claim 10,  
**characterized in that,**  
 the electric circuit modification means (32) comprises a contact means (38) for closing of at least one mechanic switch (40, 42) of the electric circuit (34, 36) by mechanical interaction.
12. Lock according to any of claims 8 to 11,  
**characterized in that,**  
 further magnetic actuators (44, 46) are arranged in a further plane, wherein the further plane is orientated in parallel to the first plane, wherein the magnetic actuators (24, 44, 46) are arranged in the same distance to a center axis of the key hole (22), wherein the first plane has a predefined distance to the second plane.
13. Key-lock system,  
 at least comprising a key (1) according to any of claims 1 to 8 and a lock (2) according to any of claims 8 to 12,  
 wherein the predefined distance between the support means (4, 12, 14) of the key (1) is the same as the predefined distance between the first plane and the second plane.

14. Method for actuating a lock (2) according to any of claims 8 to 12 with a key (1) according to any of claims 1 to 7,  
**characterized by the steps:**

inserting the key (1) into the lock (2),  
 wherein a stop is provided for causing a predefined position between the key (1) and the lock (2),  
 rotating the key (1) for actuating the magnetic actuators (24) of the lock (2) for opening and/or closing of multiple electric circuits (34, 36) at the same time,  
 analyzing the sequence of closed and/or opened circuits, in particularly by a processor unit,  
 operating a motor for moving a locking member from a first position to a second position in case the analyzed sequence fits to a predefined sequence.

15. Unit, in particularly car or house, comprising at least one lock (2) according to claims 8 to 12 and at least one key (1) according to claim 1 to 7.



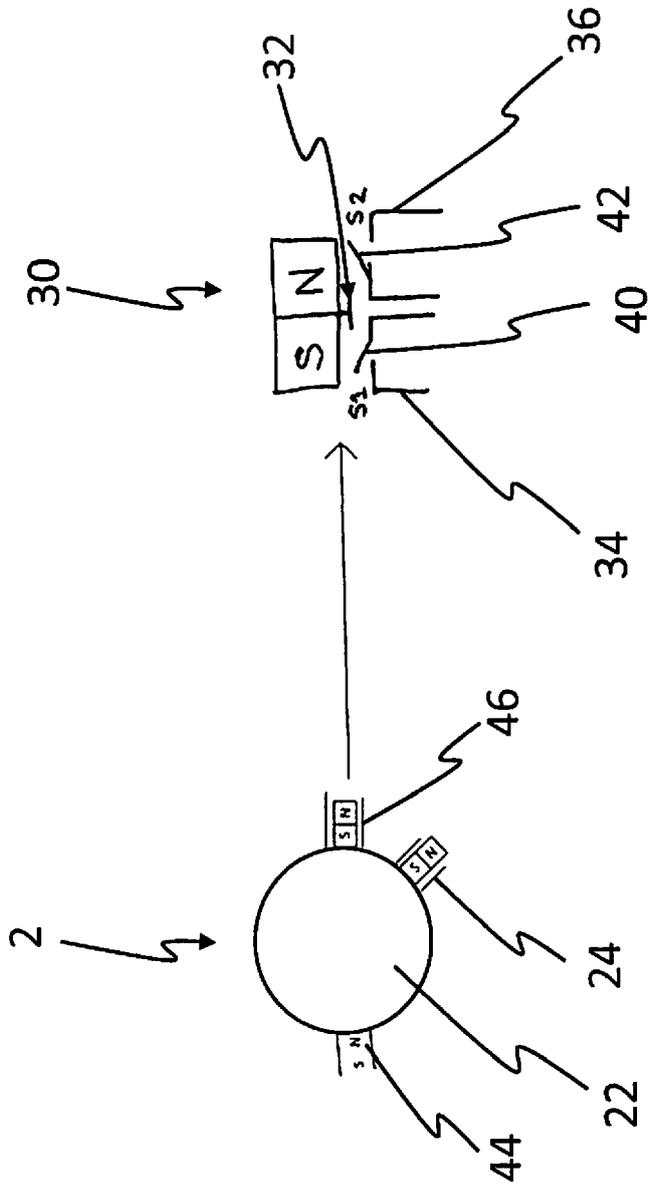


Fig. 2

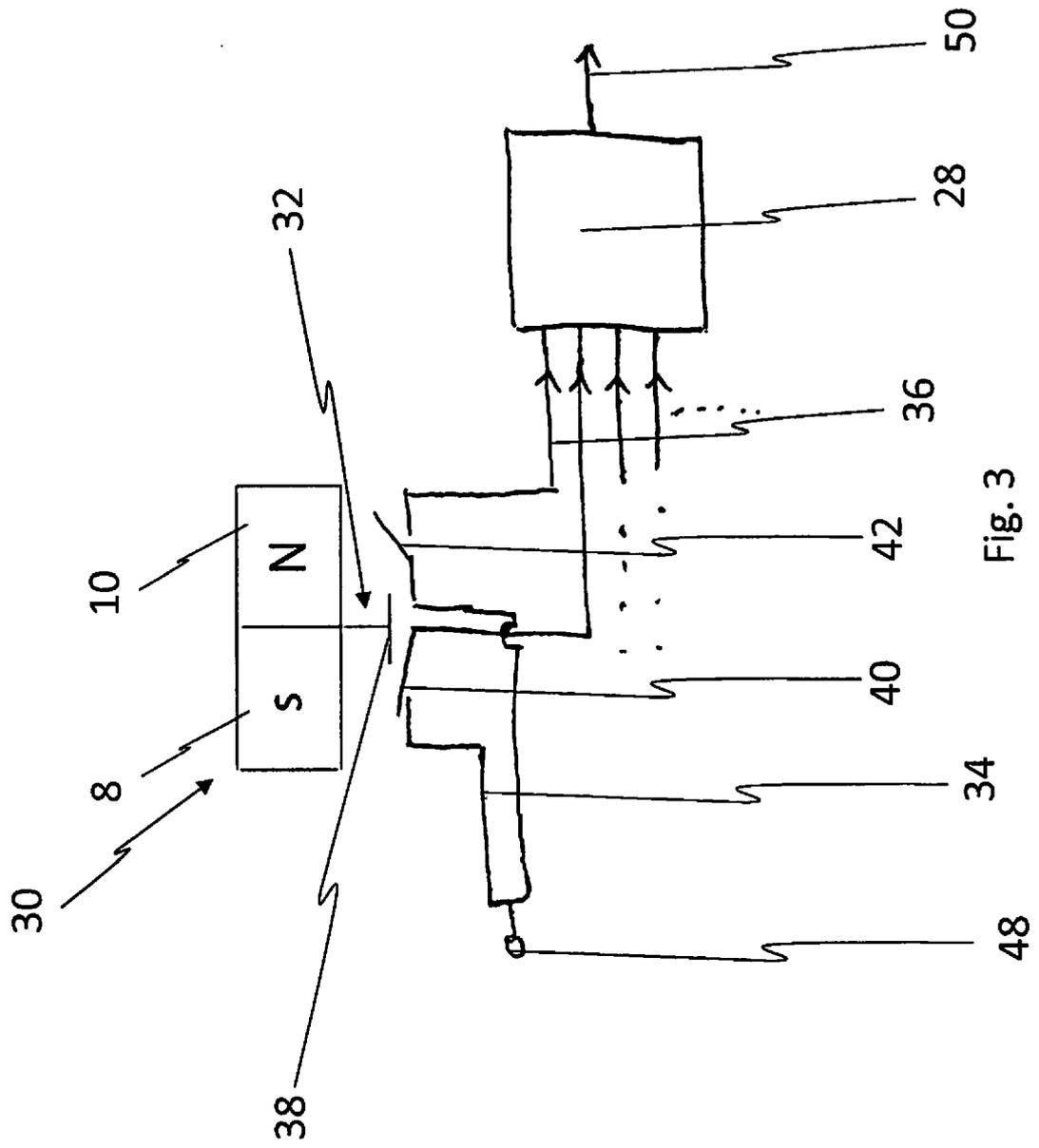


Fig. 3



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