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(54) **POWER SUPPLY AND CONTROL CIRCUIT OF A SOLENOID AND PILOTING OR SWITCHING DEVICE PROVIDED WITH SAID CIRCUIT**

STROMVERSORGUNGS- UND -STEUERUNGSSCHALTUNG EINES SOLENOIDS UND DAMIT AUSGESTATTETE STEUERUNGS- ODER SCHALTVORRICHTUNG

CIRCUIT D'ALIMENTATION ET DE COMMANDE D'UN SOLÉNOÏDE, ET DISPOSITIF DE PILOTAGE OU DE COMMUTATION ÉQUIPÉ DUDIT CIRCUIT

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Description

[0001] The present invention concerns a power supply and control circuit that enables a driving or switching device that includes a solenoid to be supplied with alternating or direct current, variable both in voltage and in frequency, when of alternating type. The invention also concerns a driving or switching device of this kind equipped with said power supply and control circuit. In particular, according to the invention, said circuit is integrated in the body or in the casing of said device.

[0002] In the industrial sector there are various devices equipped with coils or solenoids used as actuator devices, among which the most widely used are solenoid valves, relays, or similar switching or driving devices.

[0003] With reference to these products, it is known that there is no global standardization on electrical specifications, in particular on supply current, but on the contrary that there is a marked differentiation of models, each destined to be supplied with direct or alternating current and with a given voltage and possibly also frequency range.

[0004] For a manufacturer of these devices this means high production costs due to the need to keep a stock of components dedicated to each model and to provide dedicated assembly lines, as the various models generally also have different structures to one another.

[0005] In the same way, manufacturers of apparatus equipped with driving devices such as solenoid valves, relays or the like, which have different supply specifications, must in turn stock their warehouses with a wide range of models of said devices compatible with the different specifications of the apparatus.

[0006] However, these known devices have further limits or disadvantages.

[0007] For example, in coils for alternating current solenoid valves or relays it is necessary to provide a phase displacement element, known as shading ring, to prevent cancellation of the magnetic field acting on the plunger of the valve or on the contacts of the relay each time the current is close to zero, and hence prevent the typical buzzing phenomenon that often affects these devices.

[0008] However, providing the body of the coil or of the relay with said shading ring means significant additional processing costs with respect to direct current coils.

[0009] The solenoids of direct current solenoid valves and of relays, and more precisely those comprising a single winding, instead have the disadvantage of absorbing high and constant current even when the device has reached the operating condition or after switching has taken place. This means higher energy consumption and excessive heat generation that can lead to early deterioration of parts sensitive to temperature, such as seals or other rubber or plastic parts.

[0010] Moreover, the high operating temperatures and voltages require the use of polymer materials with suitable features to produce the outer casing, with an increase in production costs.

[0011] EP 3147923 A1 describes a driving device of an electromagnet in a contactor that comprises a direct current power supply circuit, a voltage measurement circuit, a connected resistor for detecting the excitation current and a control microcomputer that controls the excitation current of the electromagnets. The device described in this document has particularly high production costs due to the use of a microcomputer and of a complex circuit such as the one described. These high costs are justifiable only for some types of contactors but not for low cost devices such as coils for solenoid valves or relays.

[0012] US 7907947 A1 describes an electromagnetic contactor comprising a coil for generating a magnetic field, a magnetic circuit comprising a stationary part and a moving part and a printed circuit board comprising means for controlling the power supplied to the coil. Also in this case, the contactor has a complex structure, formed of various parts to be assembled, which has high implementation costs.

[0013] In this context, the object of the present invention is to provide a driving or switching device of the coil type for solenoid valve or the like that is simple and inexpensive to produce.

[0014] Another object of the present invention is to propose a power supply and control circuit of a coil or solenoid that enables the aforesaid problems encountered in prior art devices to be solved.

[0015] Therefore, the object of the present invention is to provide a power supply and control circuit that enables a solenoid or a coil of a solenoid valve, of a relay or of similar switching or driving devices to be supplied both with direct and alternating current and with variable voltage and possibly also frequency.

[0016] A further object of the present invention is to provide a power supply and control circuit that can be integrated in the body of the driving or switching device, typically a coil for solenoid valves or a relay, without changing the typical shape and dimensions thereof.

[0017] Yet another object of the present invention is to provide a power supply and control circuit that enables a reduction in the power consumption of the device in which it is integrated and, consequently, also in the heat generation and operating temperature, with respect to prior art devices.

[0018] One more object of the present invention is to provide a power supply and control circuit of a coil or solenoid that enables monitoring of the correct operation of the device and planning repair and maintenance operations.

[0019] The aforesaid objects of the invention are thus achieved with a driving device such as a relay or a coil, in particular for solenoid valves, or similar, which includes at least a solenoid and a power supply circuit in conformity with one or more of the features described below, in which the body or the casing of the device encloses said solenoid and said power supply and control circuit.

[0020] According to the invention, the power supply

and control circuit, can receive in input alternating or direct current with variable voltage and possibly also frequency. The circuit comprises:

- a multi-voltage rectifier circuit which can be supplied with alternating or direct input current;
- a power driver adapted to be connected to the coil or to the solenoid to be supplied;
- a PWM controller of the output circuit; and
- a current control circuit.

[0021] The rectifier circuit supplies the power driver and the PWM controller. In particular, the rectifier circuit has the task of transforming the input supply current into a current compatible with the aforesaid components.

[0022] The PWM controller of the output circuit is configured to supply power to the solenoid and is driven by the power driver. In detail, said PWM controller is configured to maintain the output current at a value adequate for correct operation of the solenoid. According to the invention, the PWM controller is activated immediately when a voltage is supplied to the circuit. In this way the switching times are minimized, and in any case generally lower with respect to those of devices that analyse the input voltage before modulation, for example devices provided with a microcontroller such as the one in EP 3147923 A1.

[0023] The current circulating in the solenoid can be measured by the current control circuit. When the solenoid is supplied with the power supply voltage, the value of the current circulating therein increases. When the current reaches a predetermined value that enables correct operation of the solenoid, i.e. creating a magnetic field that enables switching, or driving, of the device in which the solenoid is integrated, the power driver is configured to interrupt the power supply from the rectifier circuit to the solenoid for a pre-set time. Said time interval is defined as OFF time.

[0024] During this time interval the value of the current in the solenoid decreases as a result of the dissipative effects. After the OFF time interval has elapsed, the power driver is configured to re-activate the power supply to the solenoid. This cycle is repeated during the whole of the period of "activation" or "switching" of the device.

[0025] The OFF time, just as the power supply time interval, is managed by power drivers so that the current in the solenoid during the period of activation of the device is substantially constant, regardless of the power supply voltage.

[0026] The circuit thus configured enables the solenoid device, in which it is integrated, to be supplied with both alternating and direct current, with a range of voltages substantially compatible with all industrial and automation applications.

[0027] According to a preferred aspect of the invention, the rectifier circuit can be configured to receive in input alternating current with a voltage ranging from a minimum value defined by the construction parameters of the so-

lensoid, for example 10 V, to a value of 264 V and a frequency from 10 Hz to 100 Hz. Said rectifier circuit can also be configured to receive in input direct current with a voltage, also in this case, ranging from minimum value defined by the construction parameters of the solenoid, for example 10 V, to a maximum value up to 53 V.

[0028] The circuit according to the invention thus allows the construction of a driving or switching device such as a coil for solenoid valves or a relay of universal type. This enables a reduction of the production costs of the device and of those relating to the storage and procurement of components, as it is possible to significantly reduce the number of models to cover all applications in which these devices are used.

[0029] According to an aspect of the invention, the current control circuit is configured to measure the resistance of the solenoid. This value varies when the temperature varies and can thus be monitored to detect an abnormal or excessively high operating temperature of the switching device. In fact, with the same power supply voltage, when the temperature increases the resistance of the solenoid also increases and, therefore, the value of the PWM controller changes. The resistance value of the solenoid can be sent to an external monitoring apparatus with a control logic configured to verify the state of the driving device, in particular with reference to the operating temperature.

[0030] According to another aspect of the invention, the current control circuit is configured to measure the inductance of the solenoid. In solenoid valves and in driving devices with a plunger the variation of the current in the solenoid, in particular during the OFF time, is a useful parameter to monitor. In fact, this current depends on the inductance of the solenoid, which in turn depends on the position of the plunger inside the solenoid. The inductance value can thus be processed to supply information on the correct and/or complete switching of the driving device. Also in this case, the parameter measured by the current control circuit can be sent to an external monitoring apparatus with a control logic configured to verify correct operation of the driving device.

[0031] Advantageously, according to the invention, sending the aforesaid signals, the resistance value, the solenoid inductance value or other values, to the external apparatus can be implemented using the same power cable as the circuit exploiting a frequency modulation that can be re-encoded by the logic unit of the external apparatus.

[0032] Also the time employed by the device to complete switching is a further parameter useful to determine the correct operation thereof. For example, a higher switching time can indicate a possible malfunction, such as jamming of the plunger or higher resistance to its movement, which can be caused by dirt or by damaged parts.

[0033] Again, through the aforesaid external monitoring apparatus, it is possible to count and memorize the number of switching cycles carried out by the device, so

as to be able to plan any maintenance operations.

[0034] Said external apparatus can be part of a driving system that includes at least a driving device equipped with the circuit according to the invention and an external monitoring apparatus of this type.

[0035] According to an aspect of the invention, the PWM controller is configured to drive, by means of the power driver, the coil or the solenoid in two distinct phases.

[0036] In a first phase (P1) the coil or solenoid is supplied with a peak current I1 for a limited time. This peak current, which generates a high magnetic field, serves to ensure switching of the device, for example complete travel of the plunger of a valve or closing of the contacts of a relay.

[0037] In a subsequent second phase, generally after only a few milliseconds from switching, the PWM controller drives the driver to supply a holding current I2, of a lower intensity than the current I1 but sufficient to keep the driving or switching device switched.

[0038] Typically, the value of the current I2 ranges from around 50 % to 70 % of the value of the peak current I1.

[0039] This configuration enables a reduction in the energy consumption of the device during the "active" switching period and consequently also in the production of heat. The consequent reduction of the operating temperature reduces stress of the sensitive or soft parts, such as seals, or other rubber or plastic parts, and increases their useful life.

[0040] Therefore, the increased overall useful life of the device reduces the need for maintenance or replacement operations and, consequently, related costs for the user.

[0041] According to the invention, the components of the circuit are mounted on a printed circuit. Advantageously, said components can be selected so as to reduce the dimensions of the circuit in order to be able to integrate it in the driving or switching device, i.e., in the casing or body of the coil or of the relay.

[0042] According to a possible alternative variant, the aforesaid components of the circuit are included in an integrated circuit. In this way it is possible to further reduce the production costs when numerous units are to be produced.

[0043] The aforesaid objects of the invention are thus achieved with a driving device such as a relay or a coil, in particular for solenoid valves, or similar, which includes at least a solenoid and a power supply circuit in conformity with one or more of the features described above, in which the body or the casing of the device encloses said solenoid and said power supply and control circuit.

[0044] According to the invention, the power supply and control circuit is produced on a printed circuit, the latter is provided with connectors for connection of the input power supply.

[0045] According to the invention, the printed circuit can be fixed to the metal yoke of the coil, when provided, or to the solenoid, and more precisely to the support tube

of the winding.

[0046] According to a possible variant, the power supply control circuit, the solenoid and the other components of the device can be incorporated in the casing obtained by means of an insert moulding process. This solution allows a reduction in production costs as well as protecting the components of the circuit from liquids or dampness.

[0047] Further features and advantages of the present invention will become more apparent from the description of an example of a preferred, but not exclusive, embodiment of a coil for solenoid valves, as illustrated in the accompanying figures, wherein:

- Fig. 1 is a perspective view of a coil for solenoid valves according to the invention;
- Fig. 2 is an exploded perspective view of the coil of Fig. 1;
- Fig. 3 is an exploded perspective view of the coil according to another embodiment;
- Fig. 4 is a schematic representation of the power supply and control circuit according to the invention.

[0048] With reference to the accompanying figures, the reference number 1 indicates as a whole a coil of the type adapted to drive a valve for circuits of liquid or gaseous fluids.

[0049] The coil comprises a body 10, which encloses a solenoid 11, a yoke 12 and a power supply and control circuit 20.

[0050] The solenoid 11 comprises a winding 15 wound around a support tube 16, the inner cavity of which can house a mobile control element, or "plunger", not shown in the figure.

[0051] In the examples illustrated, the yoke 12 comprises a metal strip bent in the shape of a C with a central core 12a extending from which are two transverse wings 12b. The two wings are provided with two holes 13, substantially aligned with the cavity of the tube 16 when the coil is assembled.

[0052] According to the invention, the power supply and control circuit 20 is obtained on a printed circuit 21 which includes connectors 22 for connection of the input power supply.

[0053] According to a first variant illustrated in Fig. 2, the power supply and control circuit 20 is mounted on the yoke 12 and more precisely is fixed to the core 12a. In this configuration, the circuit 20 remains interposed between the yoke 12 and the solenoid 11. As already stated, the configuration of said circuit 20 enables the use of components of limited dimensions which allow the dimensions of the circuit 20 to be limited so that it can be integrated in the body of the coil without modifying the shape or dimension thereof with respect to an equivalent known device, which can be supplied with a limited alternating or direct voltage range.

[0054] According to this variant the connectors 22 are inserted into respective passages 14 obtained in the core

12a so as to be able to extend beyond the body 10. Preferably, a further connector 12c for connection of the ground conductor is fixed to the yoke 12.

[0055] The power supply and control circuit 20 also comprises two pins 23 for the output of the power driver, which are connected to the winding 15 of the solenoid 11.

[0056] In this configuration, the core 12a can be placed in contact with the circuit 20 so as to allow the conduction of heat and consequently promote heat dissipation from the electronic components mounted on said circuit 20.

[0057] In the example of Fig. 3, the power supply and control circuit 20 is fixed directly to the support tube 16 of the solenoid 11. According to this variant the ground connector 13 is obtained in a separate element, fixed to the printed circuit 21, and is connected by means of a tab 18a to the yoke 12. This latter is preferably positioned with the core 12a on the opposite side of the solenoid 11 with respect to the circuit 20.

[0058] In both variants illustrated, the body 10 is preferably made of plastic, preferably a thermoplastic. The body 10 can comprise an element which substantially encloses the internal components or, according to a preferred variant, can be obtained by an insert moulding process together with the aforesaid internal components, for example injection moulding or equivalent processes.

[0059] As a result of limiting the value of the current circulating in the solenoid during the active phase, and thus limiting the temperature, the body or casing 10 can be made using common plastic materials, which are less costly with respect to those used in prior art coils.

[0060] Fig. 4 schematically represents the power supply and control circuit 20. The circuit comprises a rectifier circuit 25 that receives the input power supply current. The rectifier circuit 25 can, for example, be of the type with diodes, with semiconductors or comprising MOSFETs used as synchronous rectifiers.

[0061] The rectifier circuit 25 supplies a universal driver 26, in turn comprising a direct current power driver 27 and a PWM controller 28.

[0062] The power driver 27 can be produced with various semiconductor technologies, such as MOSFET, BJT, JFET, IGBT.

[0063] The power supply output from the PWM controller 28 is managed by the power driver 27 which supplies a regulated direct current to the solenoid 11.

[0064] A current control circuit 29 is connected to the PWM controller 28 and has the task of measuring the current circulating in the solenoid 11.

[0065] Moreover, the power driver 27 is configured to drive the PWM controller 28 so as to provide two distinct phases of supplying the solenoid with two different currents: a peak current I1 and a holding current I2, as explained above.

Claims

1. A switching or driving device (1) of coil type for so-

lenoid valves, comprising:

- a body or a casing (10);
 - a solenoid (11);
 - a yoke (12);
 - a power supply and control circuit (20);
- wherein the power supply and control circuit (20) of a coil or of a solenoid is configured for receiving in input alternating or direct current with variable voltage and possibly also frequency, said supply and control circuit (20) comprising:

- a multi-voltage rectifier circuit (25) that can be supplied with alternating or direct input current;
- a driver (26) comprising:

- a direct current power driver (27), adapted to be connected to the coil or to the solenoid to be supplied;
- a PWM controller (28) of the output circuit;

- a current control circuit (29);

wherein the rectifier circuit (25) supplies the power driver (27), wherein said power driver (27) drives the PWM controller (28) of the output circuit that is adapted to provide a power supply current to the coil or to the solenoid and wherein the driver (26) is connected to the current control circuit (29) and is driven in feedback thereby, wherein the body or casing (10) encloses at least said solenoid (11) and said power supply and control circuit (20), wherein the components of the supply and control circuit (20) are mounted on a printed circuit (21), wherein said circuit (20) is fixed to said yoke (12) or to the solenoid (11) and wherein the printed circuit (21) comprises connectors (22) for connecting the circuit (20) to an input power supply, said connectors (22) comprising at least a portion that projects beyond the casing (10), whereby the solenoid (11) comprises a winding (15) wound around a support tube (16) whose inner cavity can house a mobile control element, wherein the yoke (12) comprises a metal strip bent in the shape of a C with a central core (12a) extending from which are two transverse wings (12b) provided with respective holes (13) aligned with the cavity of the support tube (16) and wherein the power supply and control circuit (20) is fixed to the core (12a), interposed between the yoke (12) and the solenoid (11), or directly to the support tube (16) of the solenoid (11) on the opposite side with respect to said core (12a).

2. The switching or driving device (1) according to claim 1, wherein the rectifier circuit (25) is configured to receive in input alternating current with a voltage up to 264 V and a frequency ranging from 10 Hz to 100 Hz or direct current with a voltage up to 53 V. 5
3. The switching or driving device (1) according to claim 1 or 2, wherein the power driver (27) is configured to drive the PWM controller (28) of the output circuit to supply the coil or the solenoid in two distinct phases (P1, P2) where in a first phase (P1) the coil is supplied with a peak current I1 for a limited time and in a subsequent phase (P2) it is supplied with a holding current I2 lower than the current I1. 10
4. The switching or driving device (1) according to any one of the preceding claims, wherein the components of said power supply and control circuit (20) are included in an integrated circuit. 15
5. The switching or driving device (1) according to any one of the preceding claims, wherein the current control circuit (29) is configured to measure the resistance value of the solenoid (11) and to send a signal corresponding to said measurement to an external monitoring apparatus configured to determine an operating temperature parameter of said solenoid (11). 20
6. The switching or driving device (1) according to any one of the preceding claims, in which the current control circuit (29) is configured to measure the inductance value of the solenoid (11) and to send a signal corresponding to said measurement to an external monitoring apparatus configured to determine a parameter relating to the position of the plunger placed inside the solenoid (11). 25
7. The switching or driving device (1) according to claim 5 or 6, wherein the power supply and control circuit is configured to send said measured values to the monitoring apparatus through the power cable of the circuit by means of a frequency modulation. 30
8. The switching or driving device (1) according to any one of the preceding claims, wherein the connectors (22) are housed in respective passages (14) obtained in the core (12a) of the yoke (12) so as to be able to extend beyond the body (10). 35
9. The switching or driving device (1) according to any one of the preceding claims, wherein the power supply and control circuit (20) comprises two output pins (23) of the power driver connected to the winding (15) of the solenoid (11). 40
10. A driving system comprising monitoring apparatus and one or more driving or switching devices according to any one of the preceding claims. 45

Patentansprüche

1. Eine Schalt- oder Antriebsvorrichtung des Spulentyps für Magnetventile, umfassend:

- einen Körper oder ein Gehäuse (10);
- ein Solenoid (11);
- einen Bügel (12);
- eine Stromversorgungs- und Steuerschaltung (20);

wobei die Stromversorgungs- und Steuerschaltung (20) einer Spule oder eines Solenoids konfiguriert ist, um am Eingang Wechsel- oder Gleichstrom mit variabler Spannung und möglicherweise auch Frequenz zu empfangen, wobei die besagte Stromversorgungs- und Steuerschaltung (20) Folgendes umfasst:

- eine Multispannungs-Gleichrichterschaltung (25), die mit Wechsel- oder Gleichstrom versorgt werden kann;
- einen Treiber (26), umfassend:

- einen Gleichstromtreiber (27), der geeignet ist, um mit der Spule oder dem zu versorgenden Solenoid verbunden zu werden;
- einen PWM-Controller (28) für die Ausgangsschaltung;

- eine Stromsteuerschaltung (29);

wobei die Gleichrichterschaltung (25) den Leistungstreiber (27) versorgt, wobei der besagte Leistungstreiber (27) den PWM-Controller (28) der Ausgangsschaltung ansteuert, der geeignet ist, um der Spule oder dem Solenoid eine Stromversorgung zuzuführen, und wobei der Treiber (26) mit der Stromsteuerschaltung (29) verbunden ist und dadurch in Feedback gesteuert wird, wobei der Körper oder das Gehäuse (10) zumindest das besagte Solenoid (11) und die besagte Stromversorgungs- und Steuerschaltung (20) einschließt,

wobei die Komponenten der Versorgungs- und Steuerschaltung (20) auf einer gedruckten Schaltung (21) montiert sind,

wobei die besagte Schaltung (20) an dem besagten Bügel (12) oder an dem Solenoid (11) befestigt ist und wobei die gedruckte Schaltung (21) Konnektoren (22) zum Verbinden der Schaltung (20) mit einer Eingangsstromversorgung umfasst, wobei die besagten Konnektoren (22) mindestens einen Teil umfassen, der über das Gehäuse (10) hinausragt,

wobei das Solenoid (11) eine Wicklung (15) umfasst, die um ein Stützrohr (16) gewickelt ist, dessen innerer Hohlraum ein bewegliches Steu-

- erelement aufnehmen kann, wobei der Bügel (12) einen C-förmigen Metallstreifen mit einem zentralen Kern (12a) umfasst, von dem sich zwei Querflügel (12b) erstrecken, die mit entsprechenden Löchern (13) versehen sind, die mit dem Hohlraum des Stützrohrs (16) ausgerichtet sind, und wobei die Stromversorgungs- und Steuerschaltung (20) an dem Kern (12a) befestigt ist, eingefügt zwischen dem Bügel (12) und dem Solenoid (11) oder direkt an dem Stützrohr (16) des Solenoids (11) auf der dem besagten Kern (12a) gegenüberliegenden Seite.
2. Die Schalt- oder Antriebsvorrichtung (1) gemäß Anspruch 1, wobei die Gleichrichterschaltung (25) konfiguriert ist, um am Eingang Wechselstrom mit einer Spannung von bis zu 264 V und einer Frequenz im Bereich von 10 Hz bis 100 Hz oder Gleichstrom mit einer Spannung von bis zu 53 V zu empfangen.
 3. Die Schalt- oder Antriebsvorrichtung (1) gemäß Anspruch 1 oder 2, wobei der Leistungstreiber (27) konfiguriert ist, um den PWM-Controller (28) der Ausgangsschaltung anzusteuern, um die Spule oder das Solenoid in zwei verschiedenen Phasen (P1, P2) zu versorgen, wobei die Spule in einer ersten Phase (P1) für eine begrenzte Zeit mit einem Spitzenstrom I1 versorgt wird und in einer nachfolgenden Phase (P2) mit einem Haltestrom I2 versorgt wird, der niedriger als der Strom I1 ist.
 4. Die Schalt- oder Antriebsvorrichtung (1) gemäß einem jeden der vorhergehenden Ansprüche, wobei die Komponenten der besagten Stromversorgungs- und Steuerschaltung (20) in einer integrierten Schaltung enthalten sind.
 5. Die Schalt- oder Antriebsvorrichtung (1) gemäß einem jeden der vorhergehenden Ansprüche, wobei die Stromsteuerschaltung (29) konfiguriert ist, um den Widerstandswert des Solenoids (11) zu messen und ein der besagten Messung entsprechendes Signal an ein externes Überwachungsgerät zu senden, das konfiguriert ist, um einen Betriebstemperaturparameter des besagten Solenoids (11) zu bestimmen.
 6. Die Schalt- oder Antriebsvorrichtung (1) gemäß einem jeden der vorhergehenden Ansprüche, bei der die Stromsteuerschaltung (29) konfiguriert ist, um den Induktivitätswert des Solenoids (11) zu messen und ein der besagten Messung entsprechendes Signal an ein externes Überwachungsgerät zu senden, das konfiguriert ist, um einen Parameter zu bestimmen, der sich auf die Position des im Inneren des Elektromagneten (11) angeordneten Plungers bezieht.
 7. Die Schalt- oder Antriebsvorrichtung (1) gemäß Anspruch 5 oder 6, wobei die Stromversorgungs- und Steuerschaltung konfiguriert ist, um die besagten Messwerte mittels einer Frequenzmodulation über das Stromkabel der Schaltung an das Überwachungsgerät zu senden.
 8. Die Schalt- oder Antriebsvorrichtung (1) gemäß einem jeden der vorhergehenden Ansprüche, wobei die Konnektoren (22) in entsprechenden Durchgängen (14) untergebracht sind, die im Kern (12a) des Bügels (12) ausgebildet sind, so dass sie in der Lage sind, sich über den Körper (10) hinaus erstrecken zu können.
 9. Die Schalt- oder Antriebsvorrichtung (1) gemäß einem jeden der vorhergehenden Ansprüche, wobei die Stromversorgungs- und Steuerschaltung (20) zwei Ausgangsstifte (23) des Leistungstreibers umfasst, die mit der Wicklung (15) des Solenoids (11) verbunden sind.
 10. Ein Antriebssystem, umfassend ein Überwachungsgerät und eine oder mehrere Antriebs- oder Schaltvorrichtungen nach einem jeden der vorhergehenden Ansprüche.
- ### Revendications
1. Dispositif de commutation ou de pilotage (1) du type à bobine pour électrovannes, comprenant :
 - un corps ou un boîtier (10) ;
 - un solénoïde (11) ;
 - un étrier (12) ;
 - un circuit d'alimentation et de commande (20) ;
 où le circuit d'alimentation et de commande (20) d'une bobine ou d'un solénoïde est configuré pour recevoir en entrée un courant alternatif ou continu à tension variable et éventuellement aussi à fréquence variable, ledit circuit d'alimentation et de commande (20) comprenant :
 - un circuit redresseur multi-tension (25) pouvant être alimenté par un courant d'entrée alternatif ou continu ;
 - un circuit d'attaque universel (26) comprenant :
 - une commande de courant continu (27), adaptée pour être connectée à la bobine ou au solénoïde à alimenter ;
 - un contrôleur PWM (28) du circuit de sortie ;
 - un circuit de contrôle du courant (29) ;

- où le circuit redresseur (25) alimente le circuit d'attaque de puissance (27), où ledit circuit d'attaque de puissance (27) commande le contrôleur PWM (28) du circuit de sortie qui est adapté pour fournir un courant d'alimentation à la bobine ou au solénoïde et où le circuit d'attaque universel (26) est connecté au circuit de commande de courant (29) et est ainsi commandé en rétroaction,
- où le corps ou un boîtier (10) renferme au moins ledit solénoïde (11) et ledit circuit d'alimentation et de commande (20),
- où les composants du circuit d'alimentation et de commande (20) sont montés sur un circuit imprimé (21),
- où ledit circuit (20) est fixé audit étrier (12) ou au solénoïde (11) et où le circuit imprimé (21) comprend des connecteurs (22) pour connecter le circuit (20) à une alimentation d'entrée, lesdits connecteurs (22) comprenant au moins une partie qui fait saillie au-delà du boîtier (10),
- où le solénoïde (11) comprend un enroulement (15) autour d'un tube de support (16) dont la cavité intérieure peut abriter un élément de commande mobile, où l'étrier (12) comprend une bande métallique pliée en forme de C avec un noyau central (12a) à partir duquel s'étendent deux ailettes transversales (12b) pourvues de trous respectifs (13) alignés avec la cavité du tube de support (16) et où le circuit d'alimentation et de commande (20) est fixé sur le noyau (12a), interposé entre l'étrier (12) et le solénoïde (11), ou directement sur le tube de support (16) du solénoïde (11) du côté opposé audit noyau (12a).
2. Dispositif de commutation ou de pilotage (1) selon la revendication 2, où le circuit redresseur (25) est configuré pour recevoir en entrée du courant alternatif d'une tension allant jusqu'à 264 V et d'une fréquence allant de 10 Hz à 100 Hz ou du courant continu d'une tension allant jusqu'à 53 V.
 3. Dispositif de commutation ou de pilotage (1) selon la revendication 1 ou 2, où le circuit d'attaque de puissance (27) est configuré pour piloter le contrôleur PWM (28) du circuit de sortie afin d'alimenter la bobine ou le solénoïde en deux phases distinctes (P1, P2) où, dans une première phase (P1), la bobine est alimentée par un courant de crête I1 pendant un temps limité et, dans une phase suivante (P2), elle est alimentée par un courant de maintien I2 plus faible que le courant I1..
 4. Dispositif de commutation ou de pilotage (1) selon l'une des revendications précédentes, où les composants dudit circuit d'alimentation et de commande (20) sont inclus dans un circuit intégré (21).
 5. Dispositif de commutation ou de pilotage (1) selon l'une des revendications précédentes, dans lequel le circuit de contrôle de courant (29) est configuré pour mesurer la valeur de la résistance du solénoïde (11) et pour envoyer un signal correspondant à cette mesure à un appareil de contrôle externe configuré pour déterminer un paramètre de température de fonctionnement dudit solénoïde (11).
 6. Dispositif de commutation ou de pilotage (1) selon l'une des revendications précédentes, dans lequel le circuit de contrôle de courant (29) est configuré pour mesurer la valeur de l'inductance du solénoïde (11) et pour envoyer un signal correspondant à cette mesure à un appareil de contrôle externe configuré pour déterminer un paramètre relatif à la position du plongeur placé à l'intérieur du solénoïde (11).
 7. Dispositif de commutation ou de pilotage (1) selon la revendication 5 ou 6, où le circuit d'alimentation et de commande est configuré pour envoyer lesdites valeurs mesurées à l'appareil de surveillance à travers le câble d'alimentation du circuit au moyen d'une modulation de fréquence.
 8. Dispositif de commutation ou de pilotage (1) selon l'une des revendications précédentes, dans lequel les connecteurs (22) sont logés dans des passages respectifs (14) obtenus dans le noyau (12a) de l'étrier (12) de manière à pouvoir s'étendre au-delà du corps (10).
 9. Dispositif de commutation ou de pilotage (1) selon l'une des revendications précédentes, dans lequel le circuit d'alimentation et de commande (20) comprend deux broches de sortie (23) du circuit d'attaque de puissance reliées à l'enroulement (15) du solénoïde (11).
 10. Système de pilotage comprenant un appareil de surveillance et un ou plusieurs dispositifs de pilotage ou de commutation selon l'une des revendications précédentes.

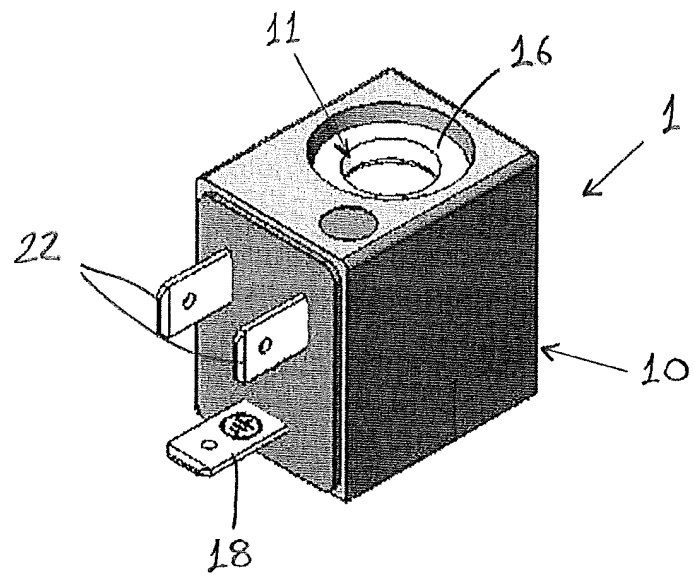


Fig. 1

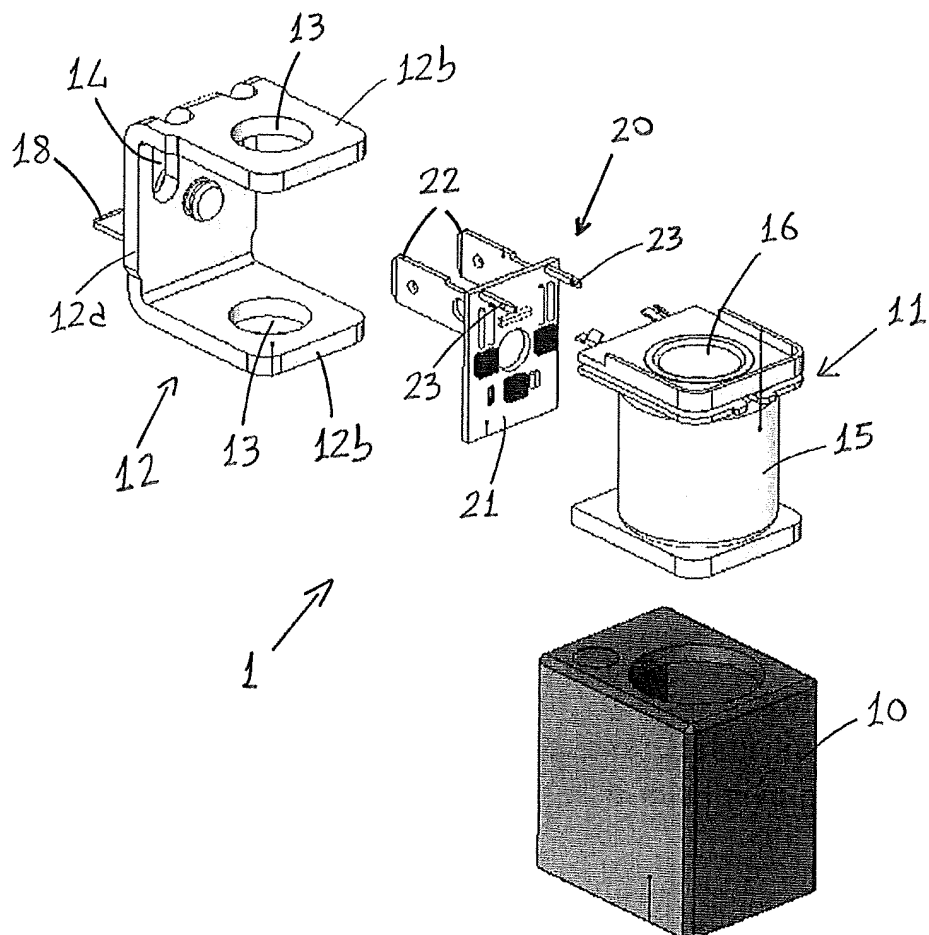


Fig. 2

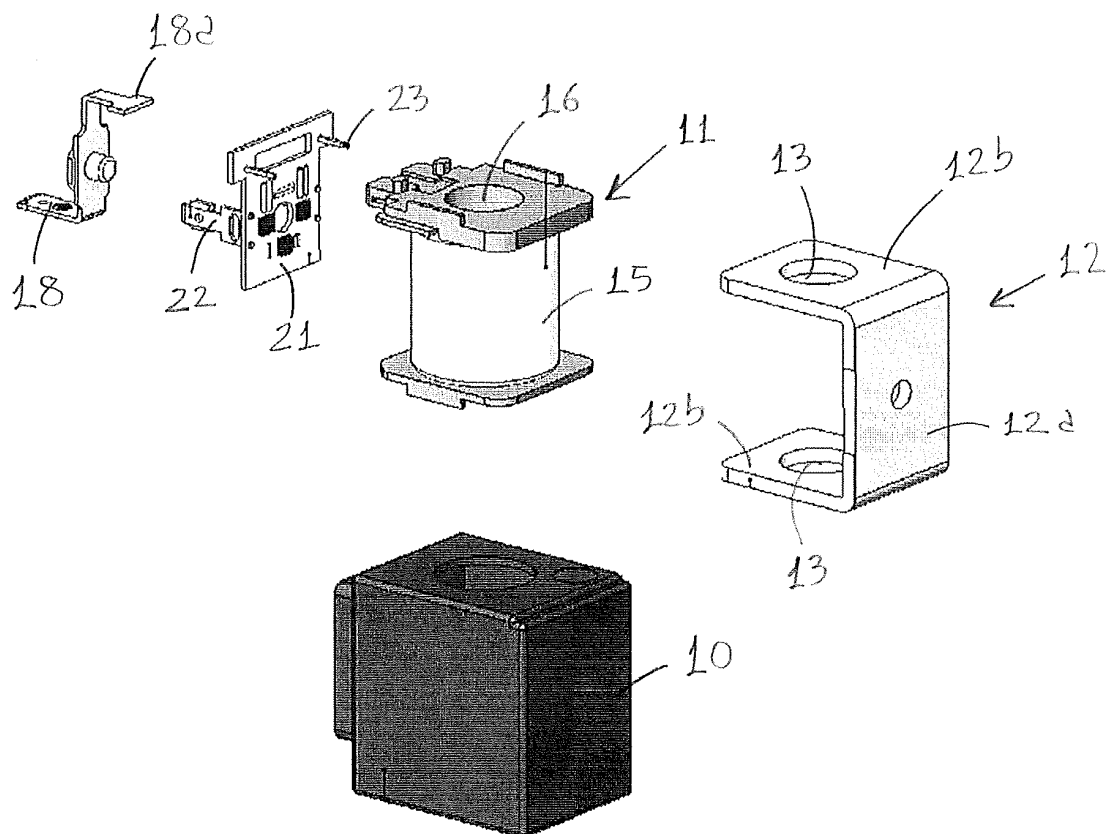


Fig. 3

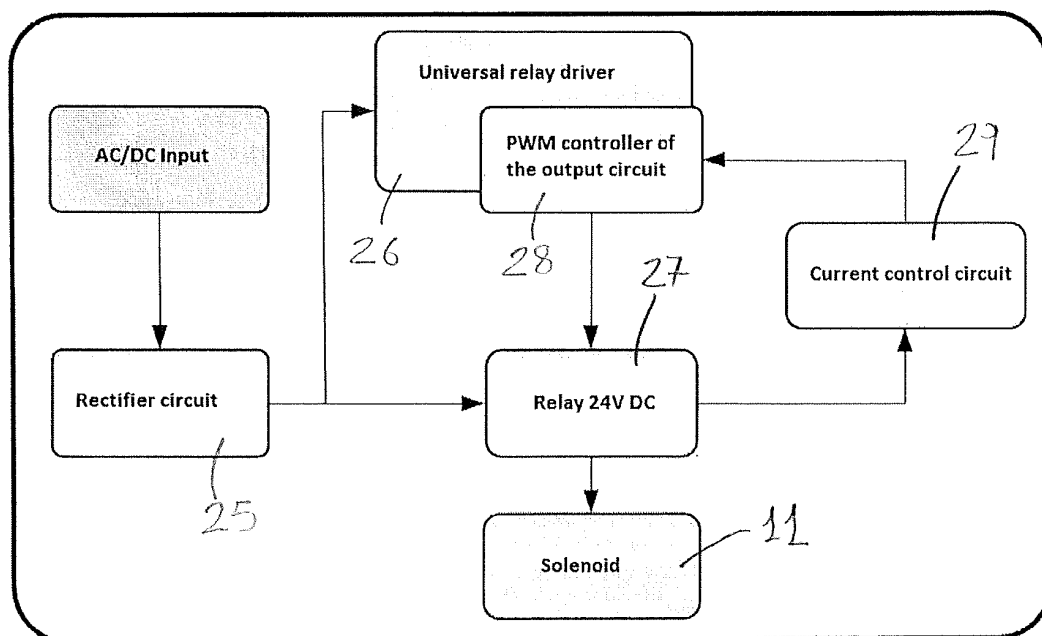


Fig. 4

REFERENCES CITED IN THE DESCRIPTION

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