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(54) Headlight for vehicles with screen actuated by means of solenoid

(57) A headlight (1) for vehicles is disclosed, comprising a lamp (2), a rotating screen (9) adapted to rotate to partially dim the light beam, and a solenoid actuator (4) comprising a stator (5) fixed to a fixed flange (3) and a rotor (6) connected to said rotating screen (9), said solenoid actuator (4) being actuated by the vehicle's driver by means of a specific control to cause the rotation of said rotating screen (9). The rotor (6) of the solenoid actuator (4) is revolvingly mounted around said stator (5) in such a way that the stator is inside the rotor.

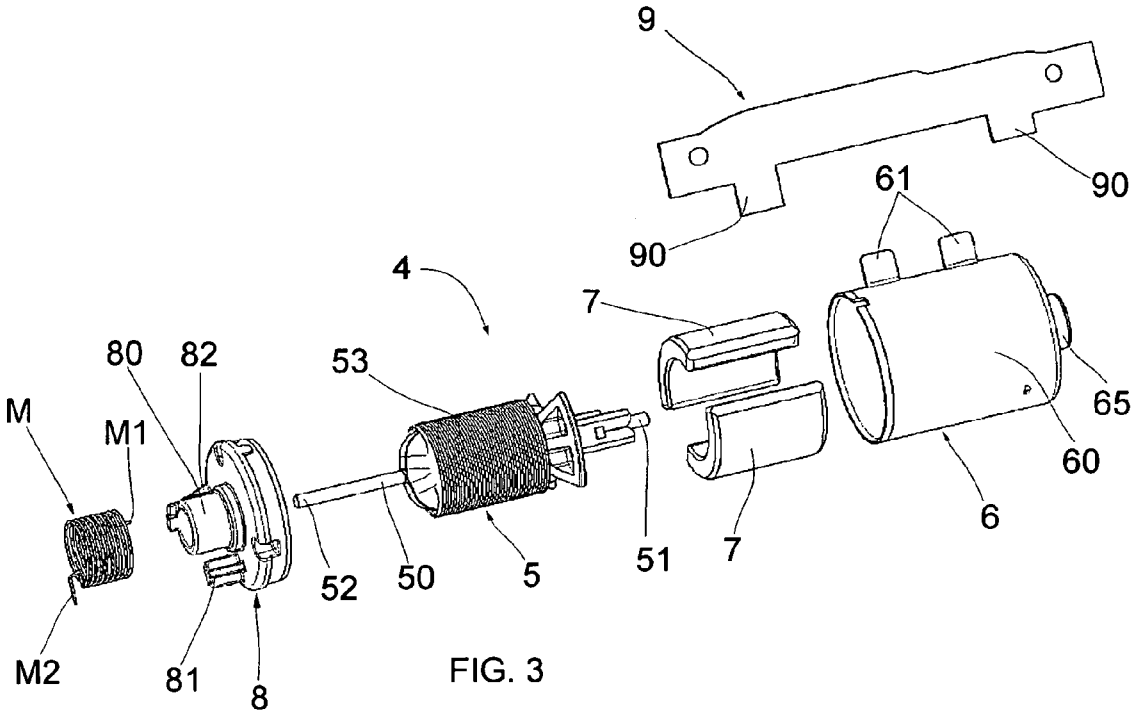

FIG. 3

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Description

[0001] The present patent application relates to a headlight for cars and motor vehicles provided with a partial dimming screen, actuated by means of a solenoid actuator.

[0002] As it is known, all vehicles circulating on the road are provided with headlights with different power. In fact, in addition to the so-called position lights, they must be provided with dipped lights and main lights, designed to be alternatively used according to the different visibility and traffic conditions.

[0003] DE 100 51 833 discloses a motor vehicle head lamp with mobile screen for high and low beam settings, using motor with air coupling to activate the screen that returns to rest position under the influence of spring or counterweight.

[0004] FR 2868507 discloses an headlight device for motor vehicles, provided with case and support units to maintain a rod of a support part of a swiveling shutter, so that motor and shutter axes are parallel and a toothed wheel and terminal pinion of the motor constitute a gear.

[0005] DE102004025228 discloses a headlight for vehicles provided with electrical actuator having a spool as stator and a spring unit for adjustment of rotor and aperture shaft in three predetermined rotary positions around the same angle of rotation, i.e. acute angle.

[0006] Said solutions have proved not very reliable, because actuators, spring units and screen of headlight are subject to high mechanical stress and may be damaged after short operation time.

[0007] These inconveniences are at least partially solved in W02008/035385, in the name of the same applicant, which discloses a vehicle head lamp, wherein the screen is actuated by a solenoid actuator comprising an internal rotor that rotates inside an external fixed stator. Nevertheless, the head lamp disclosed in W02008/035385 is impaired by the complex fixing of the screen to the shaft of the rotor.

[0008] The purpose of the present invention is to eliminate the inconveniences of the prior art by disclosing a vehicle head lamp with screen actuated by means of solenoid that is reliable, resistant, efficient, inexpensive and simple to make and install.

[0009] Said purposes are achieved according to the present invention, with the characteristics listed in the enclosed independent claim 1.

[0010] Advantageous embodiments appear from the dependent claims.

[0011] The vehicle head lamp according to the invention comprises:

a lamp,

- a rotating screen adapted to rotate to reduce the light beam, passing from initial closed position with dipped lights to open position with main lights, and
- a solenoid actuator comprising a stator fixed to a fixed flange and a rotor connected to said rotating screen.

[0012] The solenoid actuator can be actuated by the vehicle's driver by means of a specific control to cause the rotation of said rotating screen.

[0013] The rotor of the solenoid actuator is revolvingly mounted around said stator in such a way that the stator is inside the rotor.

[0014] Said configuration allows for safer and more reliable mounting of the screen on the rotor that is situated in external position on the stator.

[0015] Moreover, said configuration allows for avoiding the use of return springs to bring the rotor back to the initial position. In fact, it is possible to use the magnetic attraction force between the magnetic poles of the rotor and the support flange that is suitably made of magnetic sheet metal.

[0016] Further characteristics of the invention will appear more evident from the detailed description below, which refers to a merely illustrative, not limiting embodiment, shown in the enclosed drawings, wherein:

Fig. 1 is a diagrammatic side view of the headlight of the invention with screen in closed dipped lights position;
Fig. 1A is a top view of the headlight of Fig. 1,
Fig. 2 is an exploded perspective view of the various parts of the headlight of Fig. 1;
Fig. 3 is an exploded perspective view of the parts of the solenoid actuator of the headlight of Fig. 1;
Fig. 4 is a perspective view of the solenoid actuator of Fig. 3 in assembled condition;
Fig. 5 is a front view of the solenoid actuator of Fig. 4 assembled in a flange of the headlight, with screen in closed dipped lights beam position;
Fig. 6 is a cross-sectional view along the vertical plane VI-VI of Fig. 5, showing the screen in closed dipped lights position;
Fig. 7 is the same view as Fig. 6, with screen in open high beam position;
Figs. 8 and 9 are two electrical diagrams showing the operation of the electrical circuit of the solenoid actuator when it is respectively in closed (dipped lights) and open (main lights) position.

[0017] Referring to the aforementioned figures, the headlight for vehicles of the invention is described, being generally indicated with reference numeral (1).

[0018] Referring to Figs. 1, 1A and 2, the headlight (1) comprises a single lamp (2) with wattage comparable with traditional high beam lamps. The lamp (2) is fitted into a traditional support and power supply assembly (20). A reflecting body (21) is disposed around the lamp (2) to convey the light emitted by the lamp (2) into a preferential direction. The reflecting body (21) is fixed to the power supply support (20) by means of a ring (22).

[0019] On the sides of the reflecting body (21) two brackets (23) are mounted to fix the headlight to the chassis of the vehicle and adjust the inclination of the luminous beam emitted by the lamp.

[0020] A flange (3) is mounted on the front border of the reflecting body (21). The flange (3) (see also Fig. 5) is composed of a rectangular frame that defines a central opening (30) for passage of light.

[0021] A solenoid actuator (4) is supported by the flange (3). The solenoid actuator (4) actuates a screen (9) that partially covers the opening (30) of the flange in such a way to screen part of the luminous beam coming from the lamp (2).

[0022] The screen (9) can go from closed position (Fig. 6) to open position (Fig. 7). When the screen (9) is in closed position, it interferes with the luminous beam emitted by the lamp (2), thus generating a dipped light. Instead, when the screen (9) is in open position, it does not interfere with the luminous beam emitted by the lamp (2), thus generating a high beam.

[0023] An electrical cable (40) is connected to the solenoid actuator (4) and protrudes from the headlight (1) to power and operate the solenoid actuator.

[0024] A front mask (24) is fixed to the reflecting body (21) in order to lock the flange (3) firmly. A transparent body (25), such as glass, is mounted on the mask (24) in order to protect the inside of the headlight.

[0025] Referring to Figs. 3 - 5, the solenoid actuator (4) comprises an internal stator (5) and an external rotor (6) revolvingly mounted around the stator (5). The internal stator (5) is fixed to the flange (3). Instead, the screen (9) is fixed on the external rotor (6).

[0026] The stator (5) comprises a shaft (50) provided with first end (51) and second end (52) supported in corresponding supports (31, 32) of the flange (3). The shaft (5) of the stator is fixed to the flange (3), for example by means of splining, in such a way to prevent rotation with respect to the flange (3). A pack of plates with winding (53) of the stator is mounted on the shaft (50). The winding (53) of the stator is made of two parts, using high-temperature resistant copper wire in order to guarantee electrical insulation of the stator (5).

[0027] The rotor (6) is made of an internally empty cylindrical body (60). From the external surface of the cylinder (60) of the rotor two wings (61) protrude radially outwards, being fixed to the screen (9) so that the screen (9) forms a plane that protrudes radially outwards from the cylinder (60) of the rotor. Preferably, the wings (61) of the cylinder of the rotor are fixed in a central portion of the screen (9). Advantageously, the wings (61) are welded to the screen (9).

[0028] The screen (9) consists in a basically rectangular plate and can advantageously have a predominantly U-shaped configuration with two wings (90, 91) extending in the vicinity of the two lateral borders of the rotor (6) to screen the light near the sides of the rotor.

[0029] Inside the cylinder (60) of the rotor, two magnetic elements (7) are mounted, being the North and South poles of the rotor. The magnetic elements (7) can be permanent magnets fixed in diametrally opposite positions to the internal surface of the cylinder (60) of the rotor. Advantageously, each magnetic element (7) is shaped as arc of a circle, in cross-sectional view, with subtended angle of approximately 90° - 120°.

[0030] The stator (5) is inserted into the rotor (6), in such a way that a toroidal air space (T) known as 'air gap' is generated between the external surface of the pack of plates (53) (Figs. 6 and 7).

[0031] On a lateral border of the cylinder (60) of the rotor, a head (8) is mounted (8), being basically shaped as a disc with central shank (80). Two stop means (81, 82) are provided on the peripheral part of the head (8) in such a way to protrude outwards. The stop means (81, 82) act as stops when they come in contact with a stop surface obtained in the flange (3). The stop means (81, 82) define the rotation travel of the rotor (6) from the closed position of the screen (9) (Fig. 6) to the open position of the screen (9) (Fig. 7).

[0032] Referring to Figs. 4 and 5, it must be noted that the two ends (51, 52) of the shaft of the stator protrude externally from the two sides of the rotor in order to be firmly engaged in the supports (31, 32) of the flange (3).

[0033] Moreover, on one side of the cylinder (60) of the rotor an axial shank (65) is provided, wherein a first bush revolvingly supported in the fixed shaft (50) of the stator is obtained. Similarly, the head (8) is provided, inside the shank (80), with a second bush that is revolvingly supported on the fixed shaft (50) of the stator. So, the two ends of the rotor (6) are revolvingly supported by the fixed shaft (50) of the stator.

[0034] Optionally, a helicoidal spring (M) is disposed around the shank (80) of the head of the rotor. The spring (M) is provided with first end (M1) engaged in the head (8) and second end (M2) engaged in the flange (3).

[0035] The spring (M) is suitably pre-loaded in such a way that when the screen (9) is in open position (high beam), the spring (M) generates a return force that tends to bring the rotor (6) back to the initial position with screen closed (dipped lights).

[0036] In the initial position the screen (9) is closed (dipped lights). The actuation of a high beam activation control by the vehicle's driver determines, in an instantaneous sequence, the passage of current in the windings (53) of the stator (5), the electrical excitation of the solenoid actuator (4), the forward rotation of the cylinder of the rotor (6) and the downward-forward overturning of the screen (9) fixed to the rotor (up to the specific position shown in Fig. 7).

[0037] The actuation of a high beam deactivation control by the vehicle's driver determines, in an instantaneous sequence, the passage of current in the windings (53) of the stator (5), the electrical de-excitation of the solenoid actuator (4), the backward rotation of the cylinder of the rotor (6) and the upward movement of the screen (9) fixed to the rotor (up to the specific position shown in Fig. 6), with the cooperation of the spring (M).

[0038] Advantageously, the spring (M) can be omitted. In fact, in order to bring the rotor (6) back to the initial position (dipped lights), the solenoid actuator (4) of the invention uses the magnetic effect between the magnetic elements (7) disposed inside the cylinder of the rotor (6) and the external flange (3). To that end, the flange (3) is made of magnetic sheet metal. So, the spring (M) can be omitted.

[0039] It must be considered that in such a solution the magnetic elements (7) disposed in the cylinder of the rotor are suitably directed with respect to the magnetic field generated by the winding (53) of the stator crossed by current. So, it is necessary to define the relative position of the magnetic elements (7) disposed inside the rotor with respect to the flange (3).

[0040] Naturally, the counter torque to the motion of the rotor (6), generated by the attractive magnetic force between the polarized magnetic elements (7) situated inside rotor and flange (3), must not be such to prevent the forward motion of the rotor (6) when the stator (5) is powered, but it must be sufficient to bring the rotor (6), and accordingly the screen (9) coupled with it, back to the initial position.

[0041] It must be considered that the return of the rotor (6) to the initial position obtained by means of the magnetic attraction between the magnetic elements (7) of rotor and flange (3) made of magnetic sheet metal (in lack of a pre-loaded spring), generates undesired movements of the screen (9) caused by the inertia with which the magnetic field attempts to reach its stable balance position, when the mechanical stop means provided in head (8) and flange (3) stop the motion of the rotor.

[0042] In order to remedy such an inconvenience, the electromagnetic force generated during the return of the rotor (6) to the initial position (dipped lights) is used. To that end, a special electrical circuit has been devised as shown in Figs. 8 and 9, which illustrate a battery of the vehicle (V) providing electrical power, the winding (53) of the stator of the solenoid actuator and a switch (T) consisting in a controlled switch that can be switched between two positions:

- a first position (Fig. 8) wherein the switch (T) short-circuits the winding (53) of the stator, interrupting power from the battery (V).
- a second position (Fig. 9) wherein the switch (T) removes the short-circuit of the winding (53) of the stator, allowing power to the winding (53) from the battery (V).

[0043] Practically, when power to the winding (53) of the stator is cut out, the switch (T) short-circuits the winding (53) (Fig. 8) in such a way to generate current recirculation with braking effect on the return speed of the rotor to the initial position. Such current recirculation in the winding (53) obtained by short-circuiting the winding (53) acts as brake for the motion of the rotor and avoids undesired oscillations of the rotor.

[0044] Basically the switch (T) can be switched:

- to an active position (Fig. 9) wherein the switch (T) activates the electrical power supply of the winding (53) of the stator of the battery (V) of the vehicle, and
- to a passive position (Fig. 8), wherein the switch (T) deactivates power from the battery (V) and simultaneously short-circuits the winding (53) of the stator in order to allow for current recirculation that acts as brake for the return motion of the rotor (6) caused by the magnetic attraction of the magnetic elements (7) of the rotor by the sheet metal of the flange (3).

[0045] Naturally, to bring the rotor (6) back to the initial position, the two effects can be combined, meaning the magnetic attraction between the magnetic elements (7) disposed inside the rotor and the flange (3) and the pre-loaded spring (M).

[0046] So, the pre-loaded spring eliminates the effect of undesired movements of the screen (9) during the return of the device to the initial position.

[0047] Numerous variations and modifications can be made to the present embodiments of the invention by an expert of the field, while still falling within the scope of the invention as claimed in the enclosed claims.

Claims

1. Headlight (1) for vehicles comprising:

   - a lamp (2),
   - a rotating screen (9) adapted to rotate to reduce the light beam, passing from initial closed position with dipped light to open position with main light, and
   - a solenoid actuator (4) comprising a stator (5) fixed to a fixed flange (3) and a rotor (6) connected to said rotating screen (9), said solenoid actuator (4) being actuated by the driver by means of a specific control to cause the rotation of said rotating screen (9),

   characterized in that

   said rotor (6) of the solenoid actuator (4) is revolvingly mounted around said stator (5) so that the stator is inside the rotor.

2. Headlight (1) as claimed in claim 1, **characterized in that** said stator (5) comprises a pack of plates with winding (53) and said rotor (6) comprises two magnetic elements (7) that are two magnetic poles.

3. Headlight (1) as claimed in claim 1 or 2, **characterized in that** said rotor (6) comprises an internally empty cylindrical body (60) and said magnetic elements (7) are shaped as arcs of a circle, fixed to the internal surface of the cylindrical body (60) of the rotor in diametrally opposition directions.

4. Headlight (1) as claimed in any one of the preceding claims, **characterized in that** said rotor (6) comprises at least one wing (61) that protrudes radially outwards to fix said screen (9) so that said screen (9) forms a radial plane with respect to the rotor.

5. Headlight (1) as claimed in any one of the preceding claims, **characterized in that** it comprises stop means (81, 82) that cooperate with a complementary stop surface provided in said fixed flange (3), said stop means (81, 82) acting as stops for the rotational travel of the rotor.

6. Headlight (1) as claimed in any one of claims 2 to 5, **characterized in that** said support flange (3) of the solenoid actuator is made of magnetic sheet metal to generate a magnetic attraction force on the magnetic elements (7) of the rotor in such a way to bring the rotor back to initial position.

7. Headlight (1) as claimed in claim 6, **characterized in that** said solenoid actuator (4) comprises an electric circuit with a switch (T) that can be switched:

   - to active position wherein the switch (T) enables electrical power supply of the winding (53) of the stator from a battery (V) of the vehicle, and
   - to passive position wherein the switch (T) disconnects power supply from the battery (V) and simultaneously generates a short circuit of the winding (53) of the stator in such a way to allow for current recirculation that acts as brake for the return motion of the rotor caused by the magnetic attraction of the magnetic elements (7) of the rotor by the magnetic sheet metal of the flange (3).

8. Headlight (1) as claimed in any one of the preceding claims, **characterized in that** said solenoid actuator (4) comprises spring means (M) positioned between said rotor (6) and fixed flange (3) to bring back said rotor to initial position wherein the screen (9) is closed for dipped light.

9. Headlight (1) as claimed in claim 8, when depending on claim 5, **characterized in that** said solenoid actuator comprises a head (8) fixed to one side of the rotor to receive said spring means (M) and said stop means (81, 82) acting as stops.

10. Headlight (1) as claimed in any one of the preceding claims, **characterized in that** said stator (5) comprises a fixed shaft (50) with two ends (51, 52) that come out of the rotor (6) to be firmly fixed to said fixed flange (3) and **in that** said rotor (6) comprises two bushes revolvingly mounted around said fixed shaft (50).

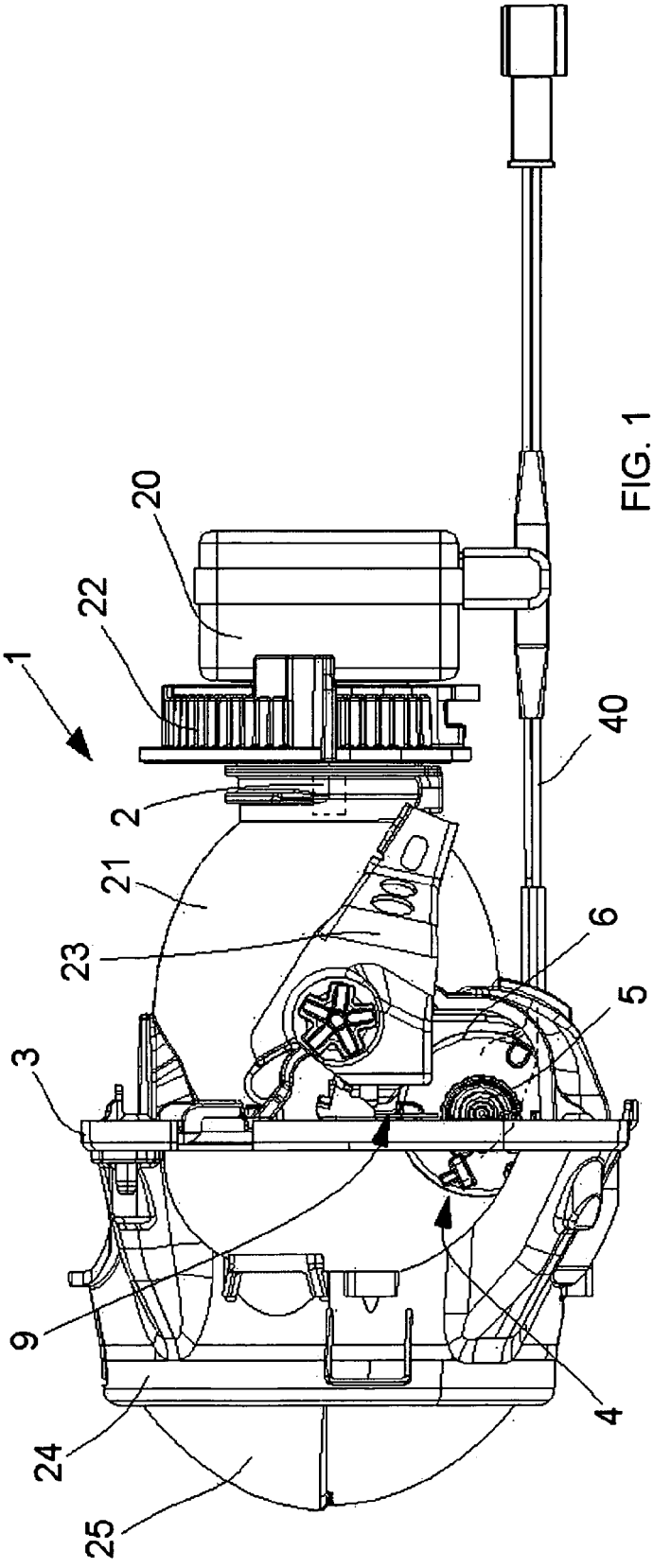


FIG. 1

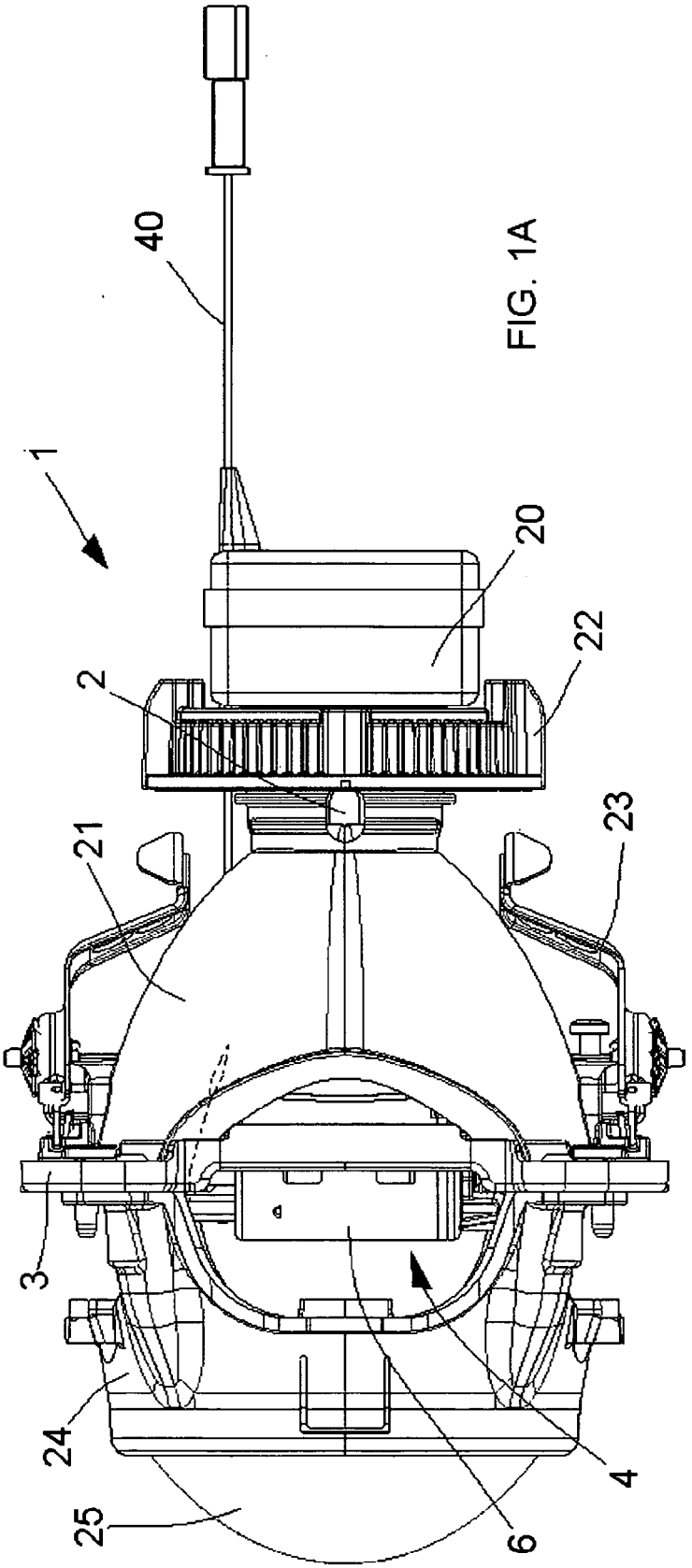


FIG. 1A

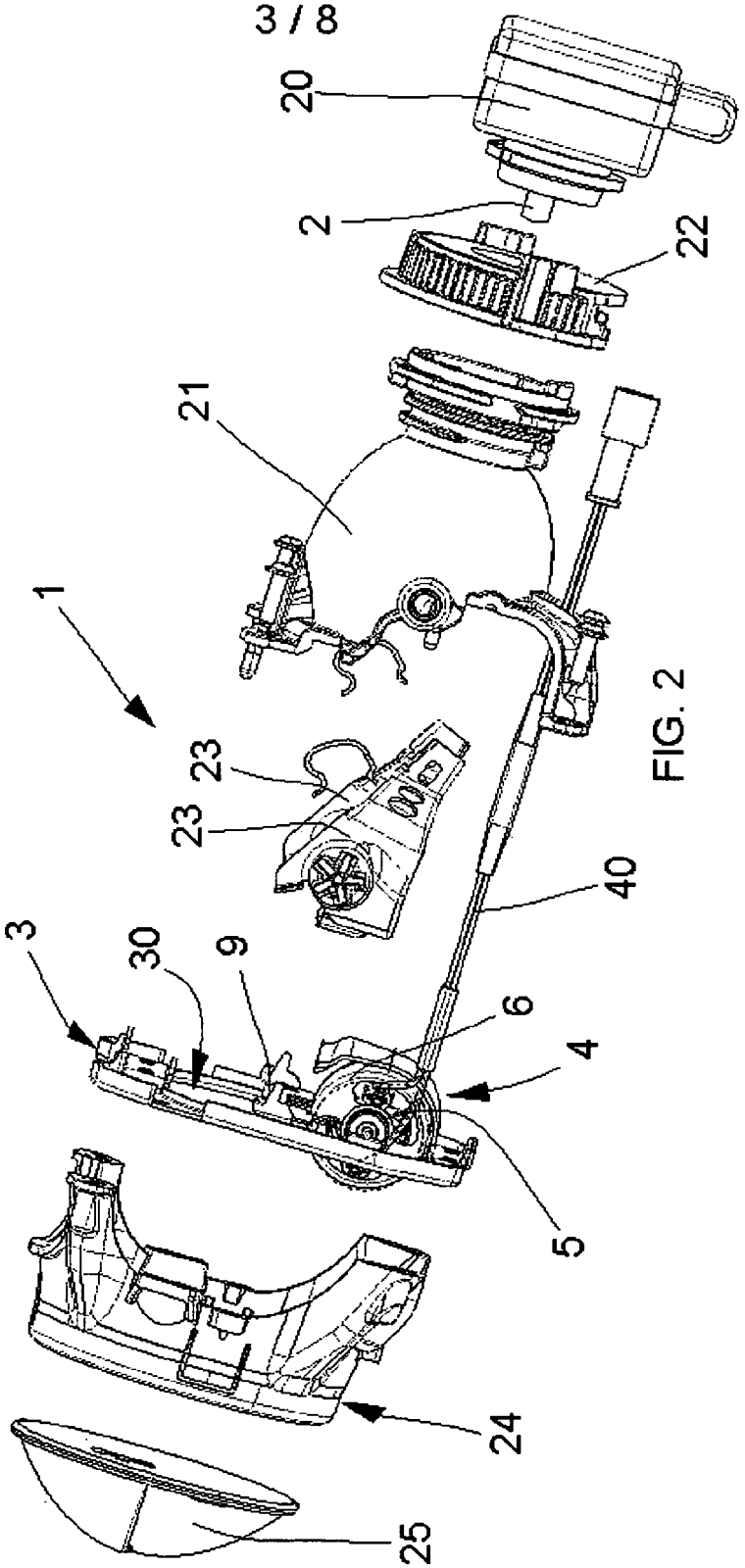
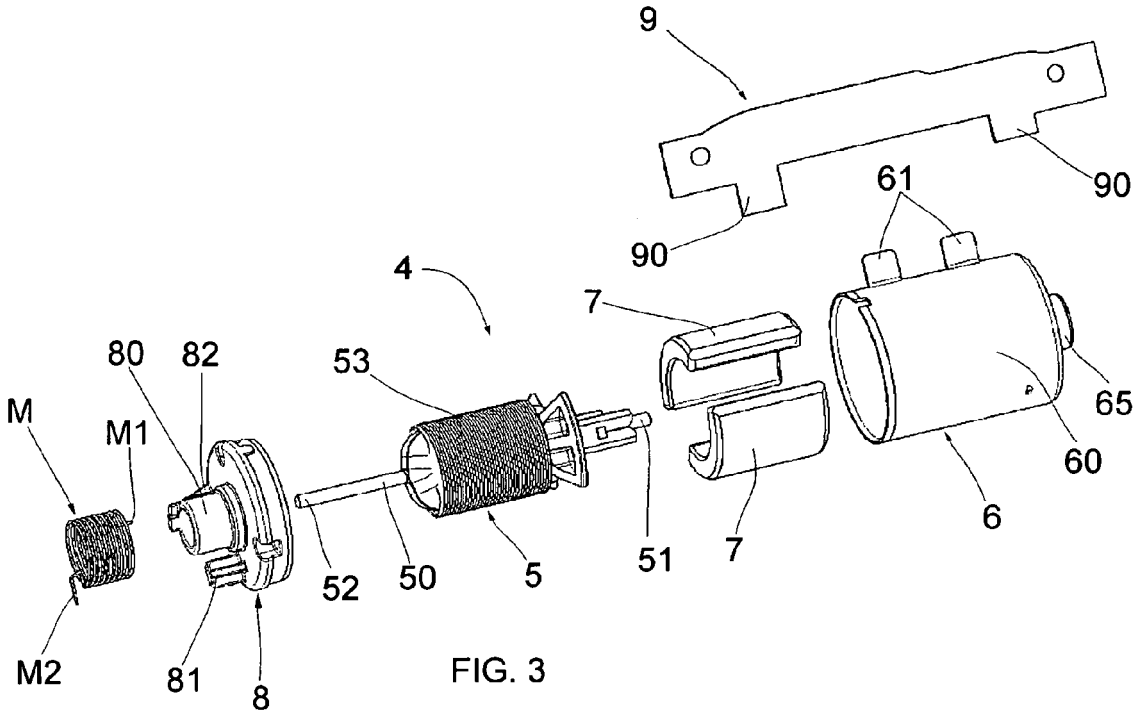


FIG. 2


9
90
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61
4
7
80
82
53
M
M1
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6
7
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52
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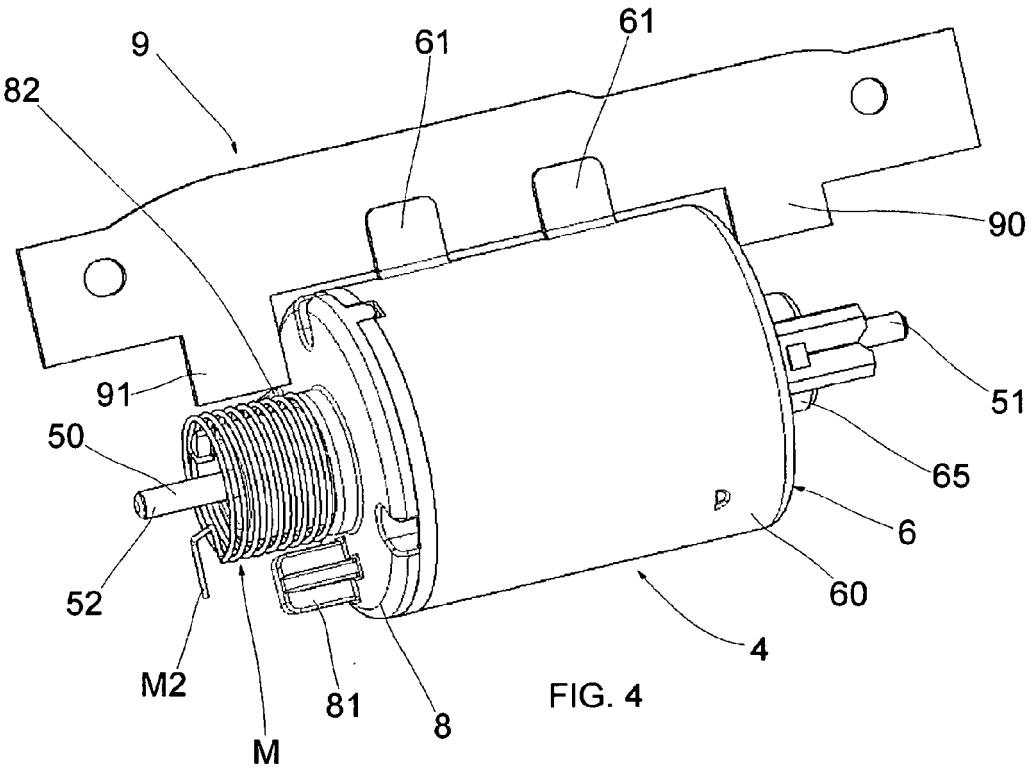
M2
81
8

FIG. 3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M2
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M

FIG. 4

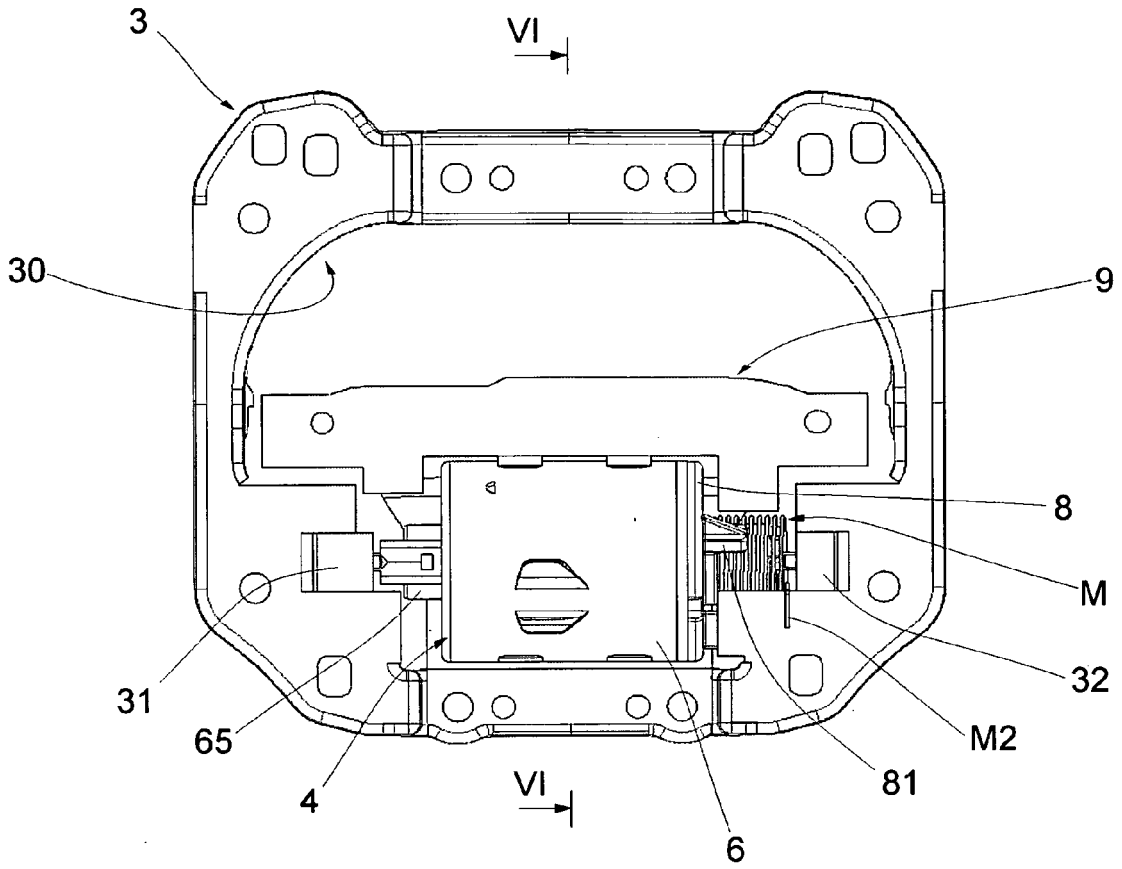

FIG. 5

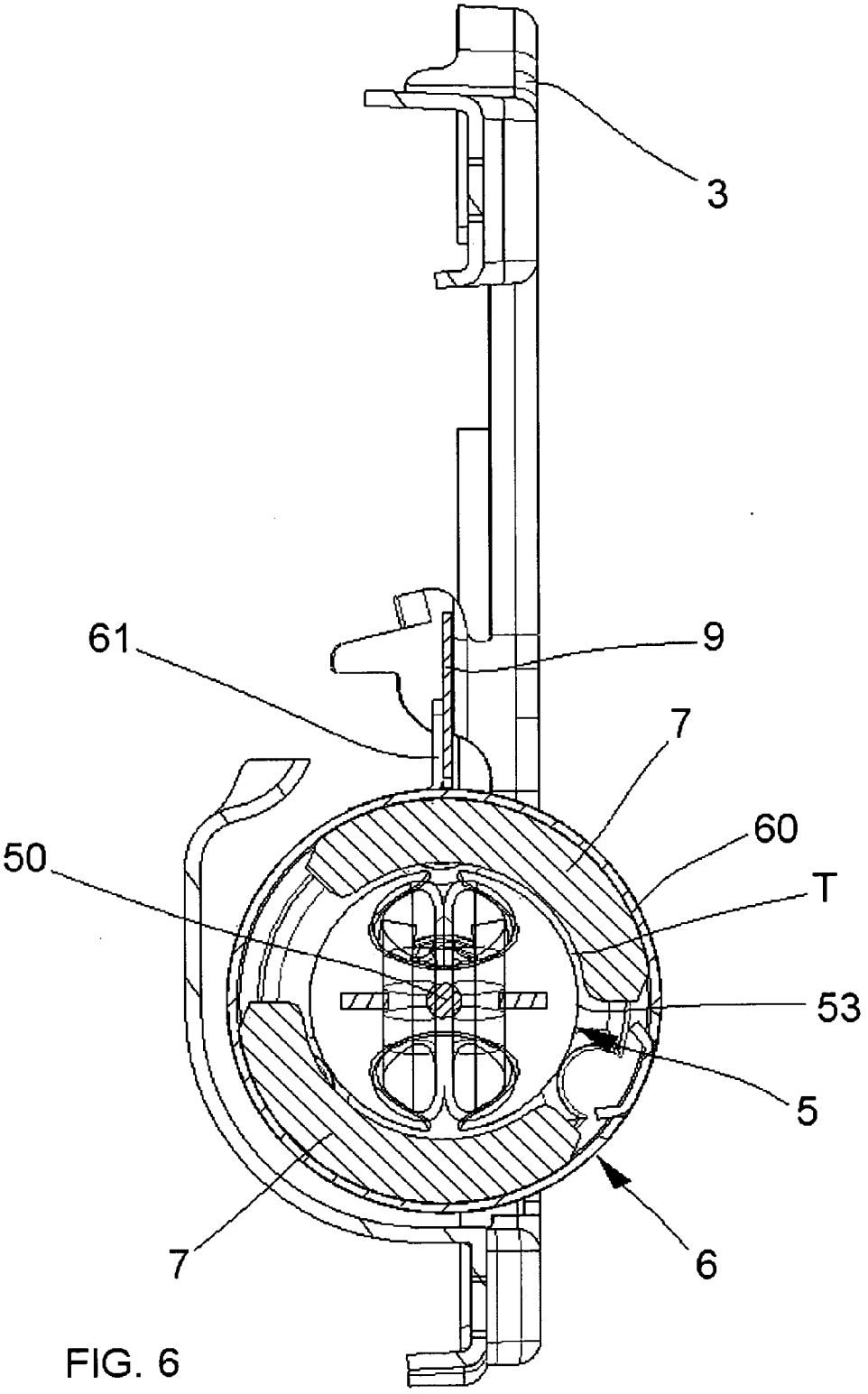

FIG. 6

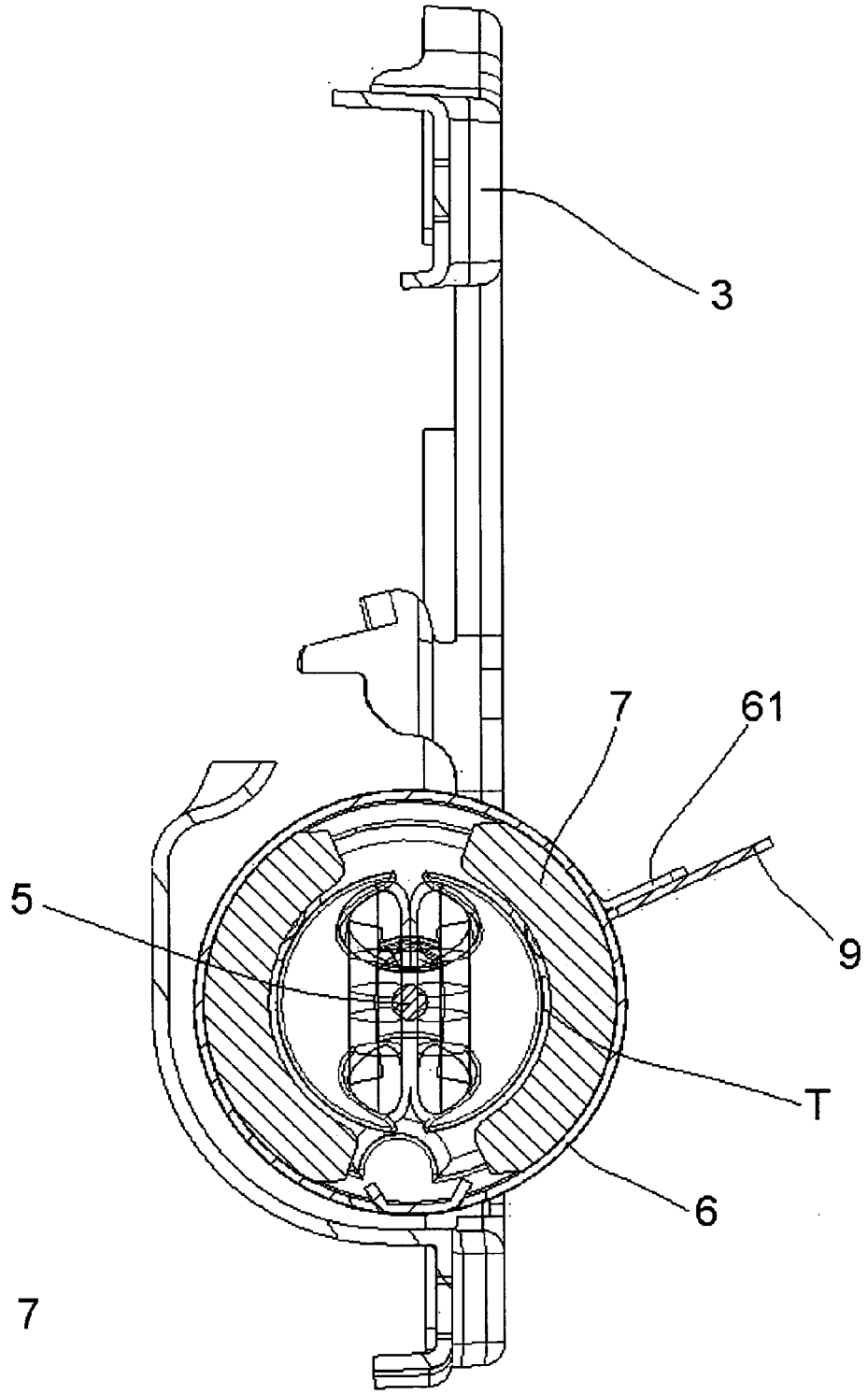

FIG. 7

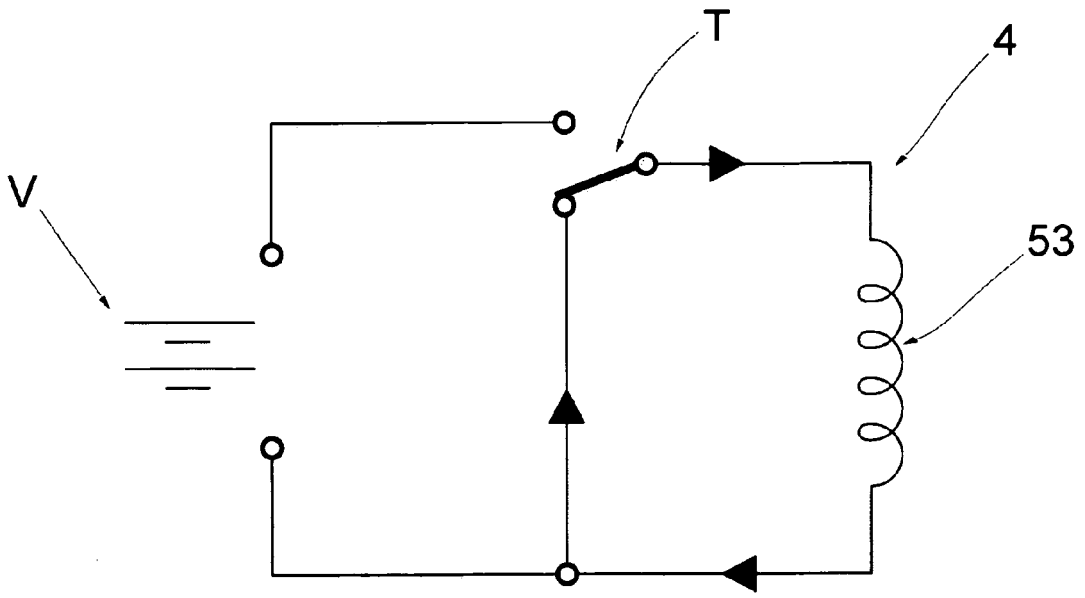

FIG. 8

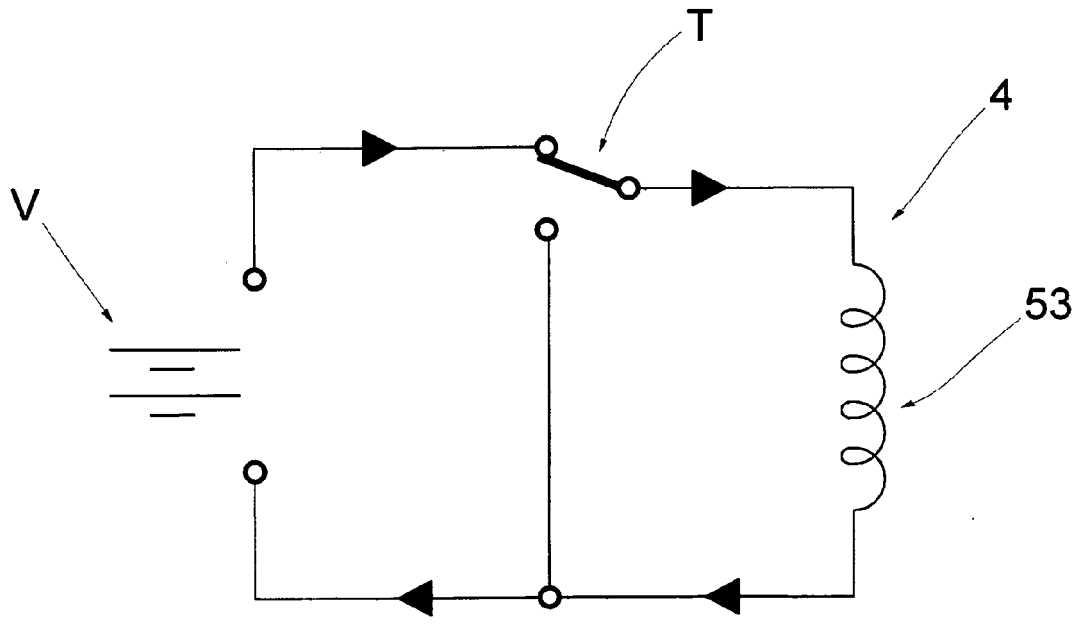

FIG. 9

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EUROPEAN SEARCH REPORT

Application Number
EP 11 17 8928

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	WO 2008/035385 A2 (SO GE MI SPA [IT]; SIROLLA RODOLFO MES SA; SIROLLA RODOLFO) 27 March 2008 (2008-03-27) * the whole document *	1-10	INV. F21V14/08
A	US 2009/190368 A1 (SMAJSER PETR [CZ] ET AL) 30 July 2009 (2009-07-30) * the whole document *	1-10	
A	JP 2002 056707 A (ICHIKOH INDUSTRIES LTD) 22 February 2002 (2002-02-22) * abstract; figures 1-4 *	1-10	
A	DE 103 34 553 A1 (HELLA KGAA HUECK & CO [DE]) 16 June 2005 (2005-06-16) * abstract; figures 1,2 *	1-10	
A	EP 1 764 550 A1 (VALEO VISION [FR]) 21 March 2007 (2007-03-21) * abstract; figure 1 *	5	
A	JP 2001 143505 A (STANLEY ELECTRIC CO LTD) 25 May 2001 (2001-05-25) * abstract; figures 1-3 *	1-10	TECHNICAL FIELDS SEARCHED (IPC) F21V B60Q F21S G03B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	9 December 2011	Giraud, Pierre

CATEGORY OF CITED DOCUMENTS

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09-12-2011

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2008035385 A2	27-03-2008	AT 473396 T	15-07-2010
		EP 2108091 A2	14-10-2009
		US 2009244919 A1	01-10-2009
		WO 2008035385 A2	27-03-2008
US 2009190368 A1	30-07-2009	NONE	
JP 2002056707 A	22-02-2002	NONE	
DE 10334553 A1	16-06-2005	NONE	
EP 1764550 A1	21-03-2007	AT 527494 T	15-10-2011
		EP 1764550 A1	21-03-2007
		FR 2891045 A1	23-03-2007
JP 2001143505 A	25-05-2001	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- DE 10051833 **[0003]**
- FR 2868507 **[0004]**
- DE 102004025228 **[0005]**
- WO 2008035385 A **[0007]**