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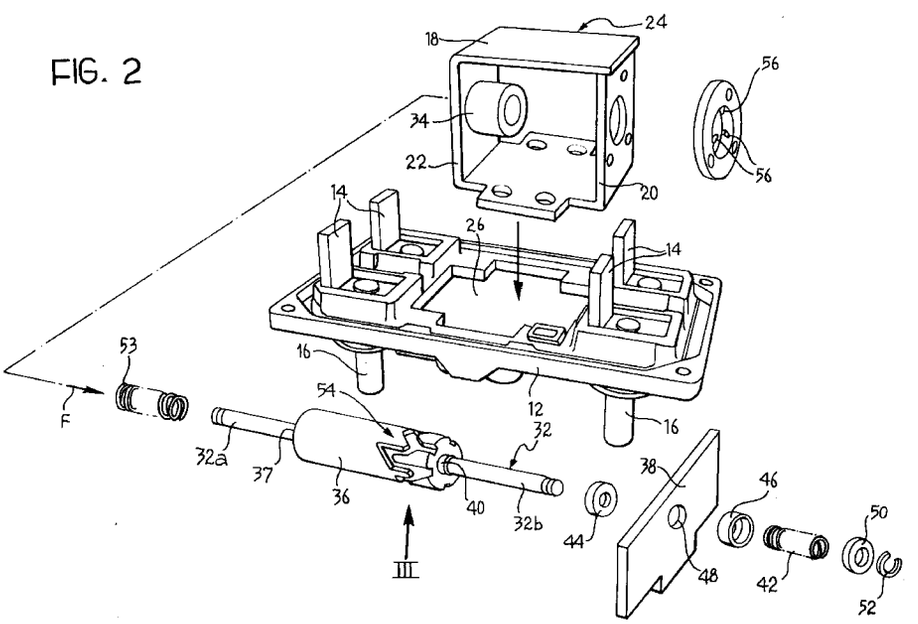
(54) A contactor, in particular for isolating the battery of an electrical installation on board a vehicle

(57) A contactor utilisable in particular as a battery isolator in an electrical installation on board a vehicle, comprising:

- a static base (12, 18) carrying at least one fixed contact (14),
- a shaft (32) which is movable with respect to the base (12, 18) and carries at least one movable contact (38),
- resilient means (53) which urge the shaft towards a first operative position, and
- an electromagnetic control device capable of generating a force which urges the shaft (32) towards a second operative position.

The contact includes a retaining device (54, 56) operatively associated with the shaft (32) and the base (18, 12), and having two stable retaining positions corresponding with the first and second operative positions of the shaft.

FIG. 2



EP 0 863 531 A1

Description

The present invention concerns a contactor, in particular of the type intended for use as a battery isolator in an electrical installation on board a vehicle.

Contactors of this type generally have a static base carrying one or more fixed contacts, an axially-movable shaft carrying one or more movable contacts which cooperate with the fixed contacts, resilient means which tend to urge the shaft towards a first operative position and an electromagnetic control device capable of generating a force which urges the shaft towards a second operative position against the action of the said resilient means.

In the currently commercially available contactors of the type specified above, one of the two operative contactor positions (the contacts being open or closed) is an unstable configuration which is maintained against the thrust of the resilient means by maintaining a voltage across the electrical coil, which generates an electromagnetic biasing force on the shaft carrying the mobile contacts. The electrical consumption of the coil, even though rather low under normal circumstances, is undesirable where the contactor is to be used as a general battery-isolator switch in the electrical installation of a vehicle.

The so-called stepping relays used, for example, in domestic light installations have two stable working positions which do not need a voltage to be maintained across the coil of the electromagnetic control device. However, the structure of these relays makes them inappropriate for use in low voltage electrical installations where the switch currents are very high, often of the order of tens or even hundreds of amperes.

With the aim of overcoming the aforesaid disadvantages, the object of the present invention is a contactor having the characteristics forming the subject of the main claim.

Further characteristics and advantages of the present invention will become clear in the course of the following detailed description, given purely by way of non-limitative example, with reference to the accompanying drawings, in which:

- Figure 1 is a schematic perspective view of a contactor according to the present invention;
- Figure 2 is an exploded perspective view of the contactor of Figure 1;
- Figure 3 is a schematic view showing in plan the development of the part indicated by the arrow III in Figure 2; and
- Figures 4 to 8 are schematic axial sections illustrating the sequence of operations of the contactor according to the invention.

With reference to Figures 1 and 2, the contactor 10 according to the present invention includes a static base including a plate 12 made, for example, from injection-moulded plastics material and carrying at least one fixed contact. In the embodiment illustrated in the drawings, the plate 12 has two pairs of fixed contacts 14, each of which is constituted by a square element of conductive material fixed to an associated pin 16 which extends from the side of the plate 12 opposite the fixed contacts 14. The pins 16 connect to conductors (not shown) of an electrical circuit.

The static base of the contactor 10 also includes a support element 18 formed, for example, from sheet steel having two walls 20, 22 bent at right angles to the plate 12. The support element 18 also has a cover 24 and a base 26 fixed to the plate 12, for example, by means of screws 28. The support element 18 carries a coil 30 capable of generating an electromagnetic biasing force. The coil 30 is normally deactivated and can be activated, for example, by pressing a control button (not shown).

As can be seen in Figure 2, the contactor 10 includes a shaft 32 carried by the support element 18 in such a way as to be translatable along its own longitudinal axis. To this end, a part 32a of the shaft 32 is slidably mounted within a tubular guide element 34 fixed to the wall 22 of the support element 18.

A cylindrical member 36, mounted in a freely rotatable manner on the shaft 32, is formed from ferromagnetic material and cooperates with the stationary coil 30 to form an electromagnetic drive device capable of generating a biasing force on the shaft 32. The cylindrical member 36 is freely rotatable about the axis of the shaft 32 but is held axially on the shaft 32 by two shoulders 37, 40. Therefore, for movements along the longitudinal axis of the shaft 32, the cylindrical member 36 is fixed to the shaft 32.

A movable contact constituted by a small plate 38 made from electrically conductive material is slidably mounted on a portion 32b of the shaft 32. The small plate 38 is free to slide axially along the portion 32b of the shaft 32, and is urged against the shoulder 40 by a compression coil spring 42. The small plate 38 is electrically insulated from the shaft 32 by means of an insulating washer 44 which abuts against the shoulder 40 and a bush 46 fitted in a hole 48 in the plate 38. The spring 42 is axially retained by an insulating washer 50 held to the shaft 32 by a circlip 52.

Referring still to Figure 2, a compression coil spring 53 is interposed between the tubular guide element 34 of the element 18 and the shoulder 37 of the shaft 32. The spring 53 then exerts a resilient force on the shaft 32 in the direction indicated by the arrow F in Figure 2.

The outer cylindrical surface of the cylindrical member 36 is cut as a cam profile 54. The cam profile 54 cooperates with at least one engagement member carried on the static base. In the specific embodiment illustrated in the drawings, three engagement members 56 are provided constituted by radial pins carried by the wall 20 of the support element 18. Since there are three engagement members for the cam profile 54, the cam

profile 54 has three identical cam sections in succession around the entire circumference of the cylindrical member 36. With reference to Figure 3, the three cam sections are indicated 58a, 58b and 58c and each extends over a circumferential portion of the cylindrical member 36 through an angle of 120°. With reference to the direction of application of the force F by the spring 53, each cam section 58a, 58b, 58c has two seats indicated, respectively, 60a, 62a, 60b, 62b and 60c, 62c in correspondence with which a stable relative engagement arises between the cam profile 54 and the engagement members 56. The seats 60, 62 of each cam section 58 are axially offset by a distance equal to the axial stroke followed by the shaft 32 in order to pass from a first to a second operative position. In the embodiment illustrated in the drawings, when the engagement members 56 correspond with the seats 60a, 60b and 60c, the contactor is in the operative configuration in which the contacts are open while, when the engagement members 56 correspond with the seats 62a, 62b, 62c, the contactor is in the operative position with the contacts closed. Naturally, by choosing a different relative position of the fixed and movable contacts, this situation could be reversed, that is, the operative position with the contacts closed corresponding to the seats 60a, 60b, 60c, and the operative position in which the contacts are open corresponding to the seats 62a, 62b, 62c.

Referring still to Figure 3, the cam profile 54 has inclined surfaces 64a, 66a, 68a; 64b, 66b, 68b and 64c, 66c, 68c disposed so as to cause a relative angular movement of the engagement members 56 and the cylindrical member 36 corresponding with a relative axial, to and fro movement of the cylindrical member 36 and the engagement members 56 in the directions indicated by the arrows A and B in Figure 3. In particular, the surfaces 64, 66 and 68 are disposed so as to cause an angular movement of the cylindrical member 36 equal to the angular offset between the seats 60 and 62 as a function of a complete, to and fro movement of the shaft 32 in the directions indicated by the arrows A and B. Consequently, the shaft 32 moves alternatively from one operative position to the other following each activation of the coil 30.

The operation of the contactor according to the invention will become clearer by looking at the operating sequence illustrated in Figures 4 to 8.

In the arrangement shown in Figure 4, the contactor is in the open-contact position as the small plate 38 is axially spaced from the fixed contacts 14. The engagement members 56 engage the associated seats 60a, 60b, 60c of the cam profile. The contactor is in a stable configuration as the force of the spring 53 is counteracted by the mechanical contact of the engagement members 56 against the associated seats 60a, 60b 60c of the cam profile 54. In the arrangement of Figure 4, the coil is deactivated. By activating the coil, a biasing force is generated on the ferromagnetic core constituted by the cylindrical member 36, which force causes the shaft 32 to move axially against the action of the spring 53. Figure 5 shows the contactor at the end of its stroke in the direction indicated by the arrow C in Figure 5. The engagement members 56 are at the top of the inclined surfaces 66a, 66b, 66c (Figure 3). The position illustrated in Figure 5 is an unstable position as, when the biasing action of the coil ceases, the shaft 32 tends to move in the opposite direction to that indicated by the arrow C in Figure 5, due to the thrust of the spring 53. The coil is only energised for the time necessary for the shaft 52 to move to the configuration shown in Figure 5. The coil is deenergised immediately afterwards and the shaft 32, due to the thrust of the spring 53, moves into the configuration shown in Figure 6. In this configuration, the engagement members 56 engage the associated seats 62a, 62b, 62c (Figure 3). In this operative position, the contacts are closed. It should be noted that the small plate 38 is urged against the fixed contacts 14 by the spring 42. The position shown in Figure 6 is stable in that the force of the spring 53 is counteracted by the mechanical abutment of the engagement members 56 against the seats 62a, 62b, 62c of the cam profile 54.

Starting from the closed-contact configuration illustrated in Figure 6, the coil is re-energised in order to move the contactor into the open-contact configuration, thus returning the shaft 32 downwards to the configuration of Figure 7. Thereafter, as soon as the supply to the coil has been interrupted, the shaft 32 moves upwards under the thrust of the spring 53, bringing it into the open-contact configuration illustrated in Figure 8, which is identical to the starting configuration illustrated in Figure 4.

Claims

1. A contactor intended in particular for use as a battery isolator in an electrical installation on board a vehicle, comprising:

   - a static base (12, 18) carrying at least one fixed contact (14);
   - a shaft (32) which is movable with respect to the base (12, 18) in the direction of its own longitudinal axis, and which carries at least one movable contact (38) for face-to-face cooperation with the said fixed contact (14);
   - resilient means (53) tending to urge the shaft (32) towards a first operative position; and
   - an electromagnetic control device (30, 36) capable of generating a force which urges the shaft (32) into a second operative position against the action of the said resilient means (53),

   characterised in that it includes a retaining device (54, 56) operatively associated with the shaft (32) and the base (18, 12), and having two stable retaining positions corresponding to

the first and second operative positions of the shaft (32), the retaining device (54, 56) being adapted to pass from one to the other of the said stable retaining positions each time the said electromagnetic control device (30, 36) is activated.

2. A contactor according to Claim 1, characterised in that the said fixing device includes a cylindrical member (36) axially fixed to and freely rotatable about the shaft (32), the cylindrical surface of the cylindrical member (36) having a cam profile (54) which cooperates with at least one stationary engagement member (56) carried by the base (18).

3. A contactor according to Claim 2, characterised in that the cam profile (54) has at least first (60a, 60b, 60c) and second (62a, 62b, 62c) associated stable engagement seats between the cam profile (54) and the engagement member (56), the said first and second seats being axially and circumferentially spaced from each other.

4. A contactor according to Claim 3, characterised in that the said first and second engagement seats (60a, 60b, 60c, 62a, 62b, 62c) are connected to each other by a branch having a cam profile including inclined surfaces (64a, 64b, 64c, 66a, 66b, 66c, 68a, 68b, 68c) capable of rotating the said cylindrical member (36) by an amount equal to the angular displacement of the said seats in correspondence with each axial movement of the shaft (32) following the activation of the said control device.

5. A contactor according to Claim 4, characterised in that the said retaining device includes two or more engagement members (56), and in that the cam profile has two or more identical sections (58a, 58b, 58c) in series with each other, each of which extends along a portion of the surface of the cylindrical member having an angular extent equal to 360°/n, where n is the number of engagement members.

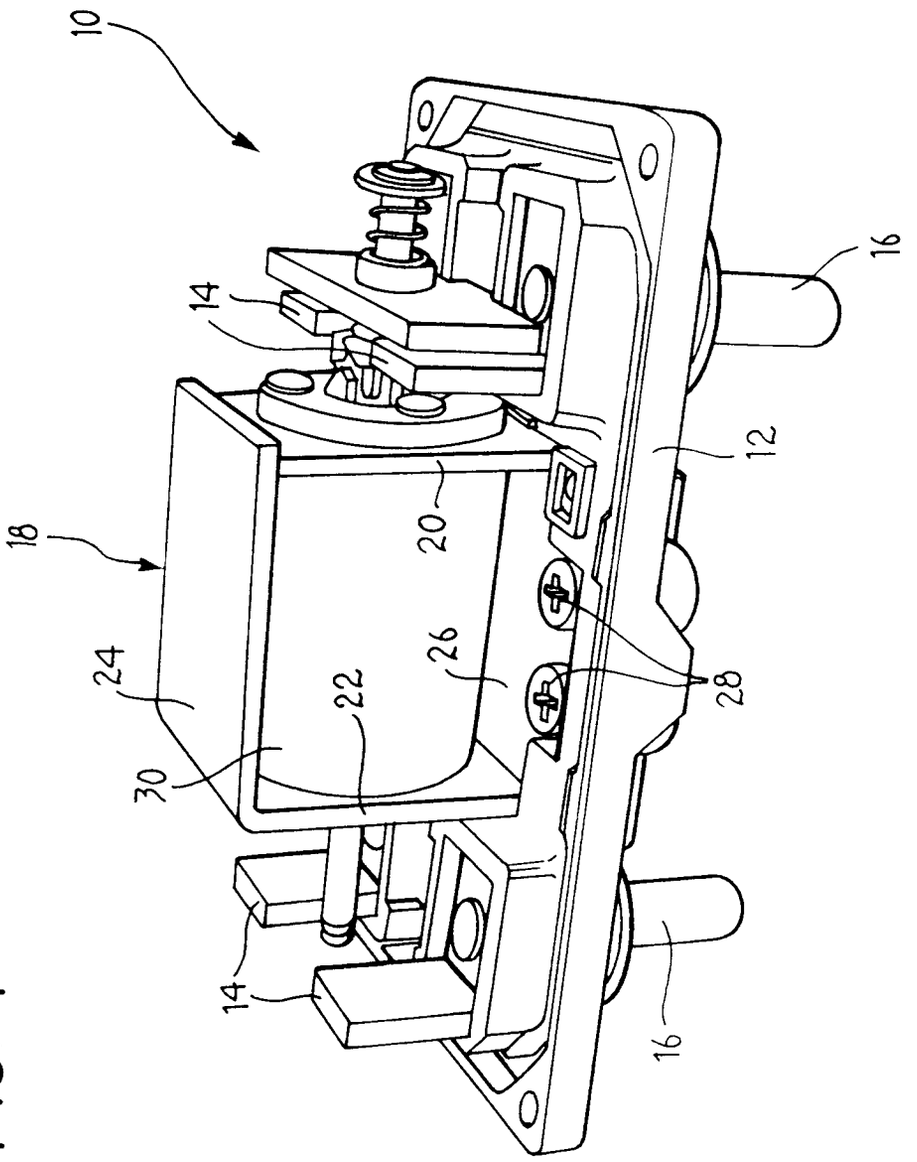
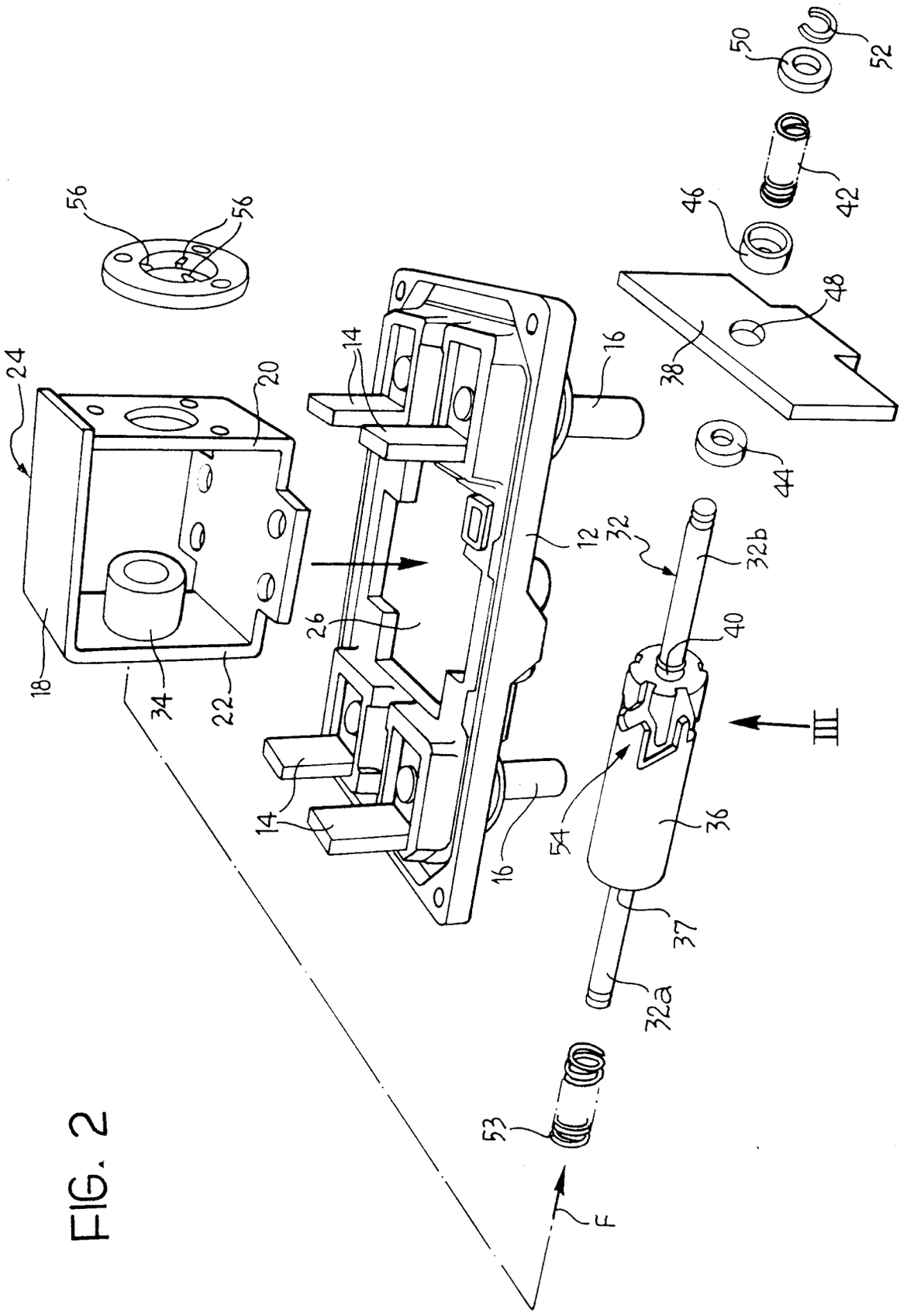


FIG. 1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12
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32b
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III
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36
37
32a
53
F

FIG. 2

FIG. 7

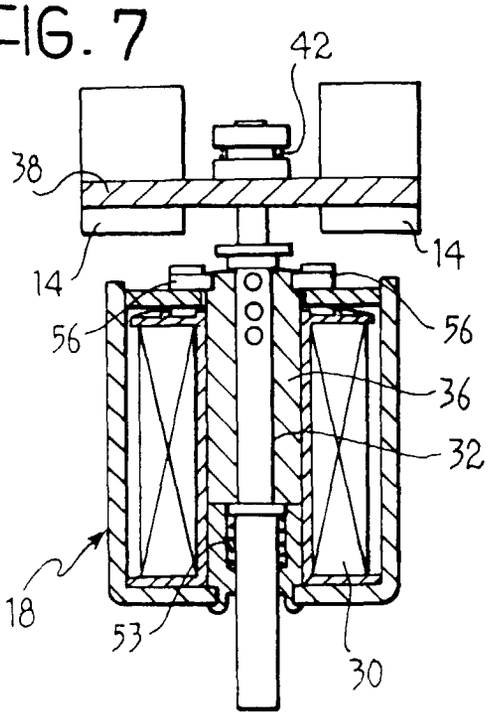


FIG. 8

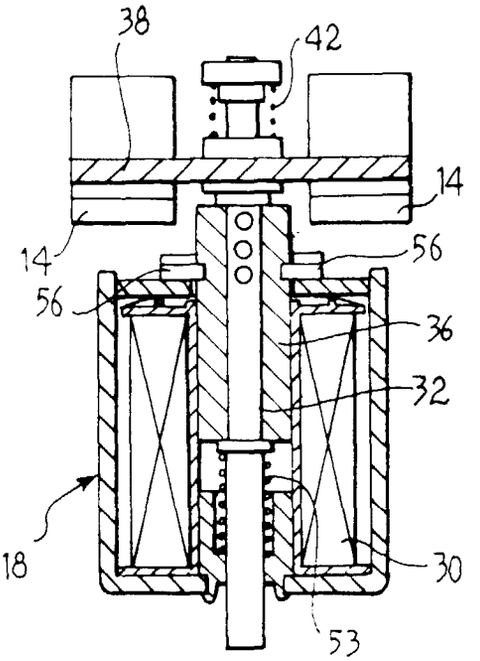


FIG. 3

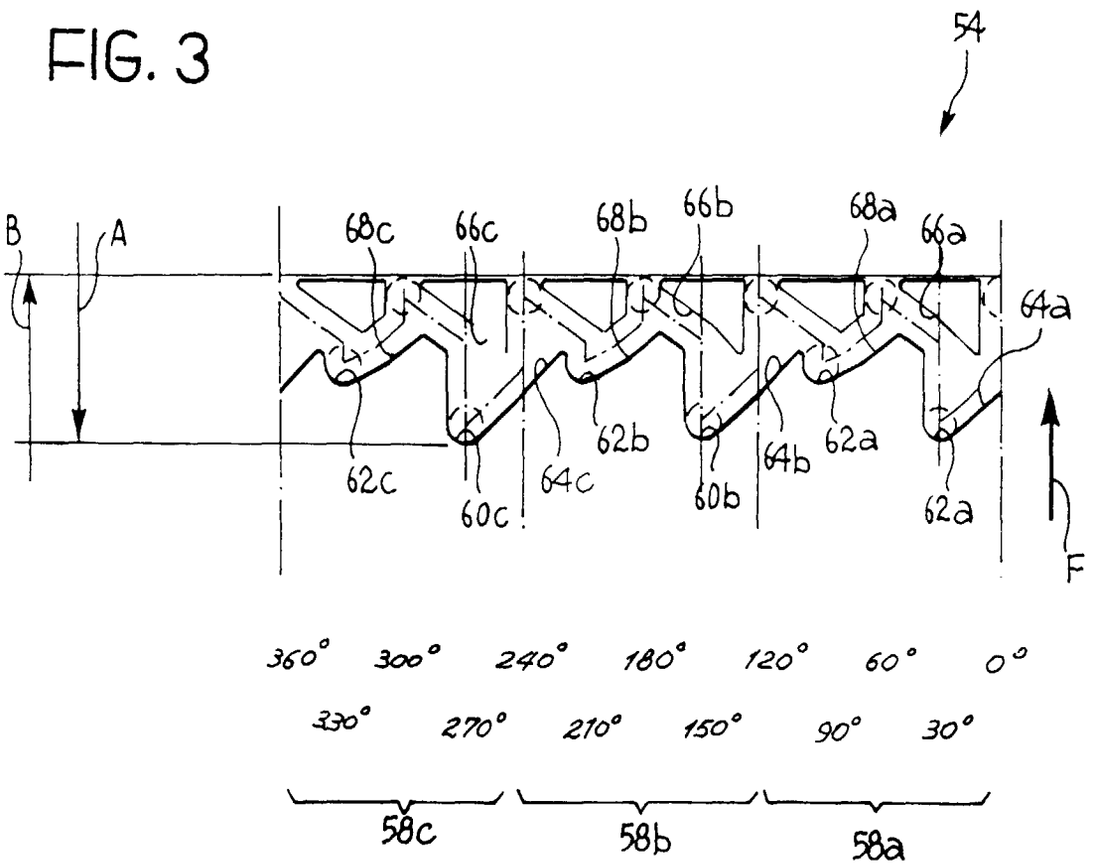


FIG. 6

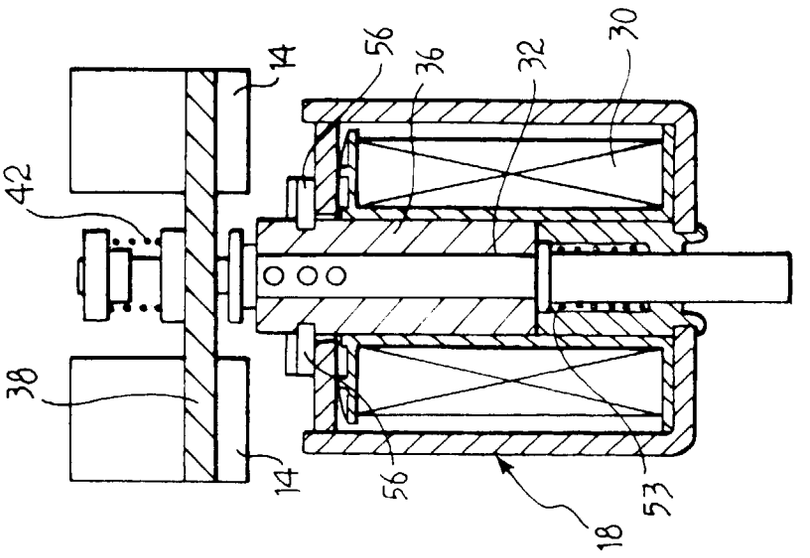


FIG. 5

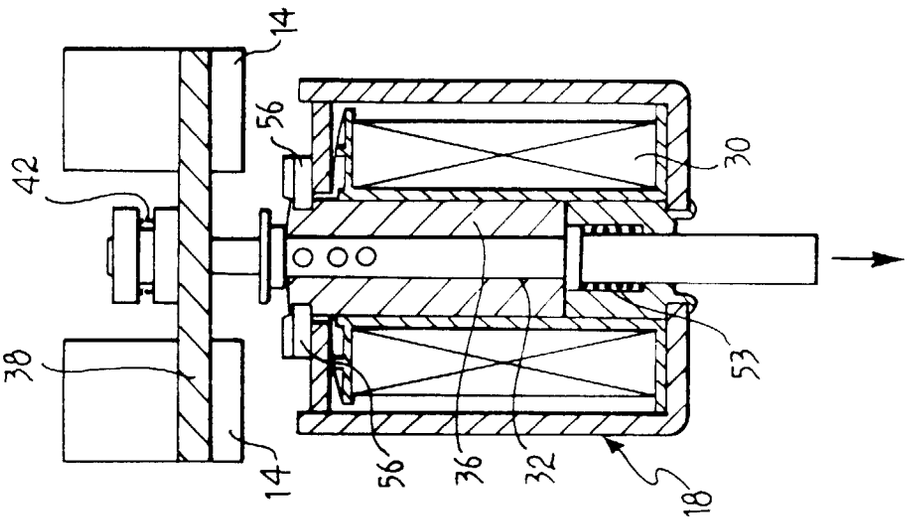
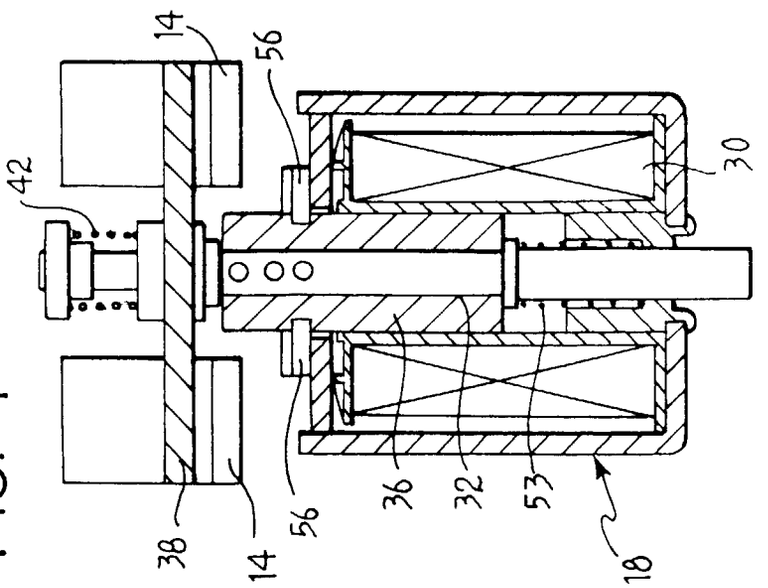


FIG. 4



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EUROPEAN SEARCH REPORT

Application Number
EP 97 12 2618

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y	FR 1 277 250 A (SAPENA PRIETO) 23 March 1962	1	H01H51/08
A	* the whole document *	2-5	
Y	US 2 703 348 A (OSWALD E.KNAPP) 1 March 1955	1	
	* claims; figures *		
A	US 3 290 631 A (VICTOR BEDGGOOD) 6 December 1966	1-5	
	* claims; figures *		
A	US 4 725 801 A (SNYDER JOHN L) 16 February 1988	1-5	
	* abstract; claims; figures *		
A	DE 879 726 C (HANS SAUER)	1-5	
	* the whole document *		

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

H01H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	12 June 1998	Durand, F

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