



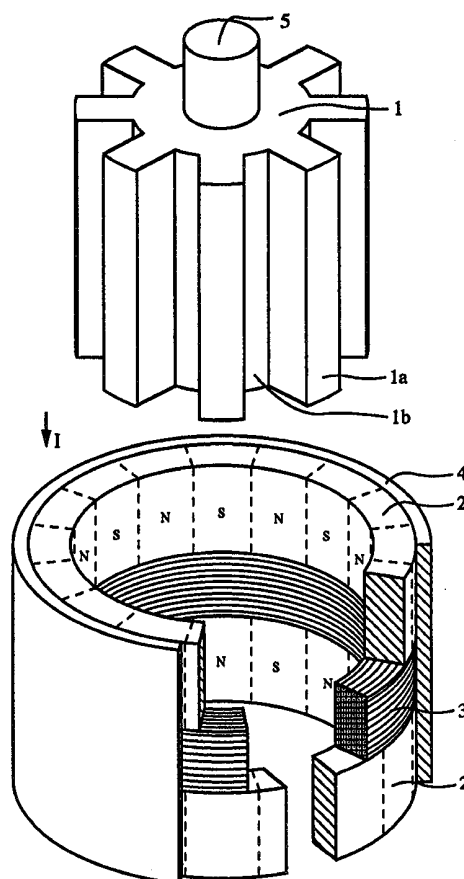
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(54) Title: ONE WAY INTERACTIVE ELECTRIC MOTORS

(57) Abstract

The electric motor of this invention is a reluctance motor with a rotor (1) like a cogwheel made up of ferromagnetic materials having recesses (1b) and salient junctions (1a). Further, a position detector (6, fig. 6) is fixed at the rotor (1) due to control the rotor position. The stator consists of permanent magnets (2) and an additional coil (3) on the ferromagnetic yoke (4). The number of the poles of the stator is identical with the number of the salient junctions (1a) of the rotor (1). Each pole of the stator includes one pair of permanent magnets (2) with a length of one pole pitch (T, fig. 5). The motor is driven by a power source (7, fig. 6) with an electronic part (8, fig. 6) which feed the coil (3) like as a motor during the first and third quarter of each pole pitch (T/4, fig. 5) and get current from the coil (3) like as a generator during the second and fourth quarter of each pole pitch.



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DESCRIPTION

ONE WAY INTERACTIVE ELECTRIC MOTORS

5 It is a known reality that a magnetic field comes into existence around a conductor when electrical current flows on it. With this special future, making dense of magnetic field on a certain area, the electromagnets, and designing the electromagnets in an order and movable continuously, the electrical motors are made.

10 Whenever electrical energy is applied to an electromagnet, at first, the electrical energy, spent because of the induction comes into existence against the current, is stored in electromagnet as magnetic energy. When the electrical energy is interrupted, the magnetic energy, stored in the electromagnet, creates induction on the same direction with the current and
15 turns into electrical energy again.

If we take a DC Electric motor with the magnet on its stator and electromagnet on its rotor, as an example, the functioning of this motor simply becomes true like this: On this motor, the magnetic flux of magnet create circuit passing through the electromagnet. To each of the
20 electromagnet on rotor, electrical energy is applied creating magnetic flux reverse to this pole while flowing through one of the magnet and as approached to the other pole the electrical energy shut off. In this time, the magnetic flux passing through the electromagnet changes the direction. The total variation of magnetic flux is double of the magnetic flux flowing from
25 the electromagnet. The multiplication of the induction, caused by the variation of this magnetic flux, and the current give the electrical energy, spent to get mechanical energy.

The electrical motors, invented, consist of a core, produced from ferromagnetic material having recesses and salients like cogwheel, magnets, established so, one of its pole on the opposite side of recesses of the core and the other pole of it on the opposite side of salients of the core, and
5 electromagnets, designed so its magnetic flux creates circuit while flowing through magnets and the core.

Generally, the pole numbers of rotor and stator on electrical motors are equal. On the invented motor, there are a lot of magnetic poles opposite of an electromagnetic pole. For that reason magnetic flux flowing on electromagnet
10 is as much as the flux difference between the 'N' and 'S' poles of magnets. This difference is the result of magnetic reluctance, caused by recesses and salients of the core.

The most important special feature of this invention is that instead of electromagnet and magnetic flux of magnet unites, creating a more powerful
15 flux and a large amount of power between the ferromagnetic core and magnets, thanks to using of multi-poled magnets, the effect of rotating rotor to the magnetic flux of the electromagnet lessens. The name of the invention is given because of this special feature. 'One way interactive' concept in the name of the invention emphasises, one way of the interaction is reduced
20 greatly and turned into effect.

The construction, the function and the other advantages of the invention are explained in the following paragraphs with the aid of attached figures. These figures are given as samples and does not set a limit.

25 **Figure 1:** The appearance from one angle of the rotor and the stator of a motor put in order as eight couple-poled according to the invention. Ferromagnetic core has been put in order as rotor. There are two magnet groups that wraps the rotor from lower and upper part and in the middle part

are electromagnetic coil. Some crosscut of the stator has been taken to make the detail seen and rotor is drawn over the stator. On this figure, the known technical parts of the motor are not drawn.

5 **Figure 2, 3 and 4:** The view from the direction of arrow ' I ' of the smallest section (a couple-pole of magnets and salient of the core) with some features with the motor illustrated on Figure 1. The representative drawn of three different position of tracking way of magnetic flux in 'An Energy Loop' which described below.

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Figure 5: Variance graphs within 'Energy Loop' of the electric and mechanical values being subject to the invention.

15 **Figure 6.** It is the diagram of the optical position detector and electronic power source to feed a motor with eight couple-poled which belongs to the invention. This power source controls the electrical current, direction and timing according to the information comes from position detector that perceives the position of rotor as optically, depending on the opaque and transparency parts of a disk, connected to the rotor.

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The motor system belongs to the invention consists of those parts: on a surface, the core like cogwheel or cores (1) made up of ferromagnetic materials having recesses (1b) and salients (1a) one after another; a magnet or a group of magnet (2) accross of each salient (1a), there is a pole of magnet (N,S) and accross of each recesse (1b) of core there is an opposite pole of magnet (S,N), creating a plane at an appropriate position of rotor; core like cogwheel (1) that its magnetic flux flows through the magnet and cogwheel type core, creating a circuit or one or more electromagnet coil (3) wrapped on

the auxiliary ferromagnetic material (4); Auxiliary ferromagnetic material (4) causing of magnetic flux of magnet and electromagnet to create circuit; position detector (6) controls the direction and timing of energy, applied to the motor and position of rotor (1) with the motion taken from rotor axle; 5 power source (7) that able to apply energy to the motor in double way with the information taken from position detector and electronic part (8) that provides the magnetic energy stored in electromagnets be gained back as electrical energy.

One of them of ferromagnetic core (1) like cogwheel and magnet group 10 (2) is arranged as rotor, the other one as stator and electromagnet coil (3) preferably stays at the stator.

The other parts of the motor, in part of the technics, known, are the bearing that enable the rotor to rotate on an axle or plane, similar seatings and the coverage of motor.

15 The parts of the motor, explained generally above, provides the invention to be designed as many models.

The rotor and stator parts of the invention, with the easiest usage and top model (Fig.1), are explained below.

Rotor (1) is like a long and cylindrical bar having salients (1a) like 20 cogwheel from center toward out side on the outer surface. On the opposite side of this recesses (1b) and salients (1a) of the core like cogwheel, there is a stator, wraps the core completely, and air distance between the core and the stator. This stator consists of three parts. In the middle part of the stator there is a conductor coil (3) that wraps the core. This coil (3) and the core of rotor 25 (1) form an electromagnet. Stator consists of two magnet groups that they are established on the upper and lower part of stator, wrapping the rotor and on the opposite of the each salient of rotor at the upper part, there is one pole (N,S) of magnet and at the lower part the opposite pole (S,N) on each of the

magnet group, opposite of the recesses and salients there is a magnet pole. The outer part of stator, covered with ferromagnetic conductor (4) that makes the magnetic flux flow easily and takes the whole stator inside.

The motors, belong to the invention, function like step motors. The magnetic flux, come into existence when energy is applied to the electromagnet coils (3) strengthen the magnet magnetic flux in the same direction and weaken the magnet magnetic flux in the opposite direction.

The poles of the magnet that its magnetic flux is strengthened, are named 'Active' the others are named 'Passive' Active poles pull the attract the salients of the ferromagnetic core more powerfully compared to passive poles. Attractive force cause the rotor to move as the salients of the ferromagnetic core and active poles come across of each other. When this motion is ended the energy applied to the electromagnet, is shuts off and with the application of energy on the reverse direction, active and passive poles change the place and so the continuous movement of the rotor is provided.

The time, from the application of energy to the electromagnet and till the current becomes zero after energy is shut off, is called 'An Energy Loop'. The equivalent meaning of this definition in mechanic; the position of the salients of ferromagnetic core on the opposite of a magnet's pole '0', the position on the opposite of neighbour pole 'T/2', this is the movement from '0' position to 'T/2' position and it is the half of a period. To understand how the motor function, it is enough to examine an energy loop.

The function of these motors, can be examined in details with the aid of figure 2,3 and 4. Rotor is at '0' position, whenever energy is not applied to the electromagnet (Fig. 2), the magnetic flux, flowing through the magnet pole opposite of the salient of rotor (1a), is little bit more compared to the other pole. When a little movement of rotor from '0' to 'T/2' position occurs, the position detector (6) feels this and arouse the power source to cuse it to

apply energy to the electromagnetic coil (3) to activate the poles opposite of the recesses (1b) of ferromagnetic core (T1 or T2 becomes conductive). Active poles attract the salients of ferromagnetic core and create a force to make the rotor to move towards the 'T/2' position. With the effect of this force the rotor increases its speed and whenever passed the 'T/4' position (Figure 4) the energy, applied, is shut off (T1 and T2 don't cause the current to flow). The magnetic energy, stored in the electromagnets, flows through the diodes (D1 or D2) for some time and turns back to the power source as electrical current. When the rotor comes the 'T/2' position an energy loop is over and the above mentioned actions continue with the current, applied to the electromagnet coils of the power source, in the reverse direction. In this way, motor produces mechanical energy with the continuous movement.

The energy traffic of motor and the other specifications can be examined in details with the graphics in figure 5.

Graphic 'A', when the rotor rotated the induction comes into existence on electromagnet coils (3) and this caused by the more magnetic flux flows through the magnet pole, close to the salients of the ferromagnetic core (1a). To become little of this difference of magnetic flux, the dimension of the magnet poles in the motion direction, should not be so much bigger than the thickness of magnet.

Graphic 'B' shows the total electrical tension at the tip of motor coils.

Graphic 'C' shows the current flowing through these coils. The electrical energy, applied to the motor coils is shut off when T/4 position is passed. With the recuction of the magnetic field of electromagnet, the magnetic flux difference on the active and passive poles and the amount of magnetic flux, flowing through the electromagnet is reduced (Fig. 3, Fig. 4). This change of

magnetic flux creates induction on electromagnet coils and cause the flowing current through the coil to last for some more time.

Graphic 'D' shows the magnetic attraction force between the rotor and stator. This force is the difference of magnetic attraction forces between the active and passive poles. Magnetic attraction force is proportional with the magnetic flux square. This ratio cause the difference of magnetic attraction force to become larger even if the difference of magnetic flux is smaller between two poles.

Graphic 'E' shows the mechanical energy taken from motor, Graphic 'F' shows the electrical energy applied to the motor. Some part of the electrical energy is taken back after the T/4 position but the mechanical energy, taken back from motor, lasts after the T/4 position. The electric energy supplied to the motor is the energy consumed for the heat energy caused by the resistance of electromagnet coils, ferromagnetic material losses and induction created by the rotor motion.

In the case of other electric motors, usually the magnetic current going out of the magnet poles forms a circuit by passing through the electromagnets; whereas by this invention, the circuit is formed by a major part of the magnetic current of magnet poles passing through these poles and by a minor part passing through the electromagnet. As a result of this, the magnetic current difference caused by the rotor rotation and induction are less in this motor system being the subject matter of the invention.

Due to the structure of multiple poles in the invention, generally motors can be constructed, which have high torque and less rotor speed. By high frequency, it is possible to construct very high performance motors by increasing the rotor speed. For the high frequency motor, it is recommended

to use ferrite as ferromagnetic core and to have a structure with more poles by decreasing the dimensions of the magnet pole in the movement direction.

5 An industrial application of this invention might be, depending on the design, the range of electric motors with various tension and current values, in various sizes and types. Such motors might be constructed as motors having circular motion on an axis as well as linear motors moving on a line.

10 On the basis of this invention, prototypes of three different types have been manufactured and test data was obtained in accordance with the indicated specifications. One of these, the type illustrated in figure 1 is the motor prototype with highest performance and energy efficiency. On the prototypes are used sheet iron with silicone as the ferromagnetic material and anisotropic ceramic magnet as the magnet.

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CLAIMS

Claims 1: It is an electrical motor system. This motor system consists of those parts: on a surface, the core like cogwheel or cores (1) made up of ferromagnetic materials having recesses (1b) and salients (1a) one after another; a magnet or a group of magnet (2) accross of each salient (1a), there is a pole of magnet (N,S) and accross of each recesse (1b) of core there is an opposite pole of magnet (S,N), creating a plane at an appropriate position of rotor; core like cogwheel (1) that its magnetic flux flows through the magnet and cogwheel type core, creating a circuit or one or more electromagnet coil (3) wrapped on the auxiliary ferromagnetic material (4); Auxiliary ferromagnetic material (4) causing of magnetic flux of magnet and electromagnet to create circuit; position detector (6) controls the direction and timing of energy, applied to the motor and position of rotor (1) with the motion taken from rotor axle; power source (7) that able to apply energy to the motor in double way with the information taken from position detector and electronic part (8) that provides the magnetic energy stored in electromagnets be gained back as electrical energy.

These are the motors, applied to the industry with using these parts and there are ferromagnetic core like cogwheel and magnet group, one of them stays on the rotor and the latter on the stator.

Claims 2: This is a motor system according to Claim 1, the specifications, gained to this motor system are; although the magnetic fluxes, coming out of electromagnet, creates circuit passing through many magnet poles (N,S), the big part of the magnet magnetic fluxes, passing through their own poles (N,S) and a little part passing through electromagnet, create

circuit. This feature cause the induction, been because of the rotor movement,, to become lesser.

Claims 3: The feature added to the motor system in Claims 1 is; the
5 magnetic flux, com into existence when energy is appied, make the magnet
magnetic flux (active pole) more powerful in the same direction and weaken
the magnet magnetic flux (passive pole) in the reverse direction. The
magnetic flux, flowing through the active poles, is the total of the magnetic
fluxes, flowing through the electromagnet and passive poles. This feature
10 cause the magnetic attraction force between the rotor and stator to become
bigger than the attraciton force, come into existence by the magnetic flux of
electromagnet, by itself.

Claims 4: The feature added to the motor system in Claims 1 is; the large
15 amount of electrical energy, applied to electromagnet coil (3), is stored in
ferromagnetic core and magnets because of the features, defined in Claims 2
and 3. After the energy, applied to the energy coil (3) is shut off, creates
induction on the points of coil and is sent back to the power source by
electronic part (8). The mechanical energy is gained during the period in that
20 electrical energy is applied and some part of it taken back.

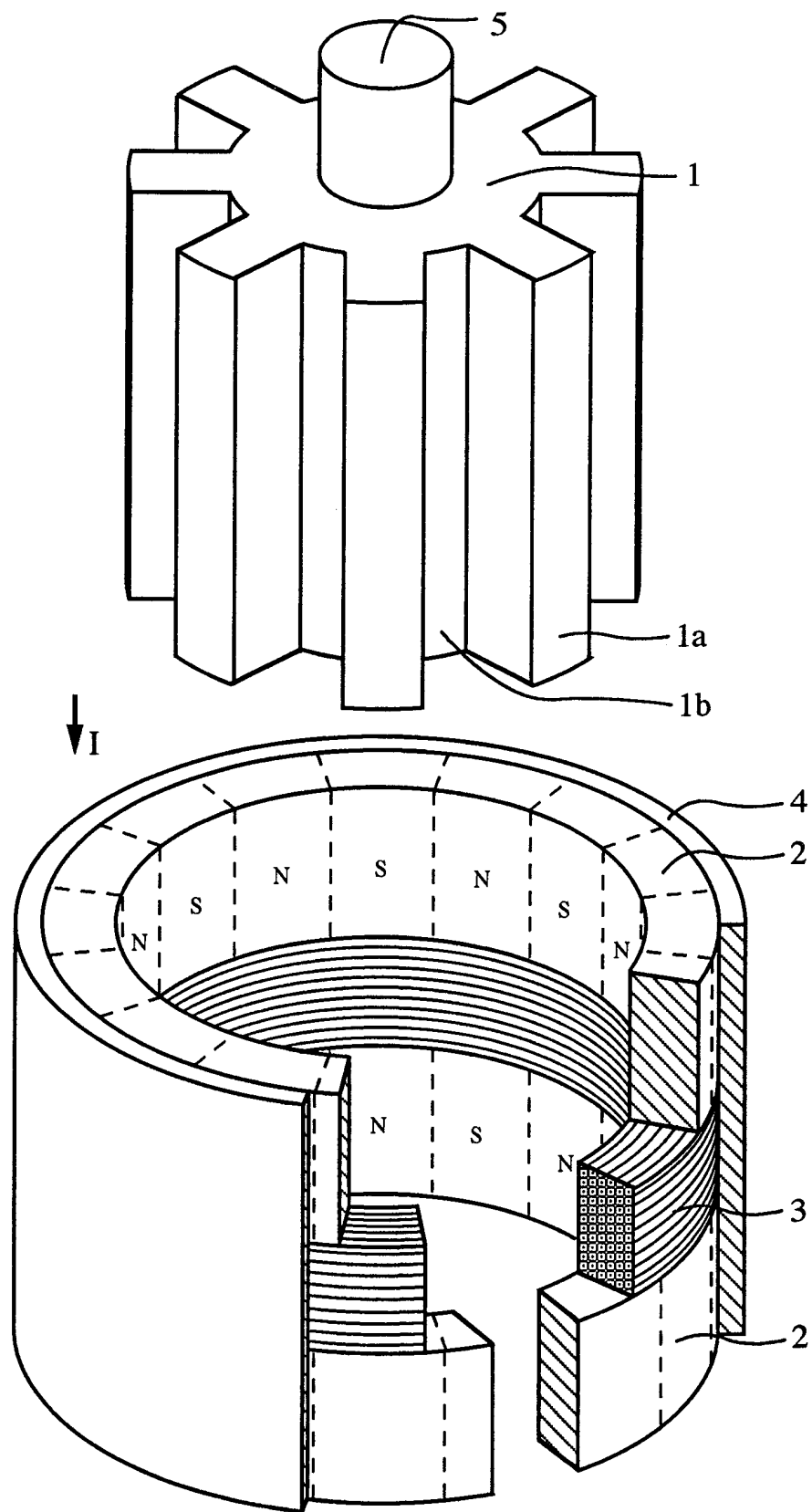


FIGURE 1

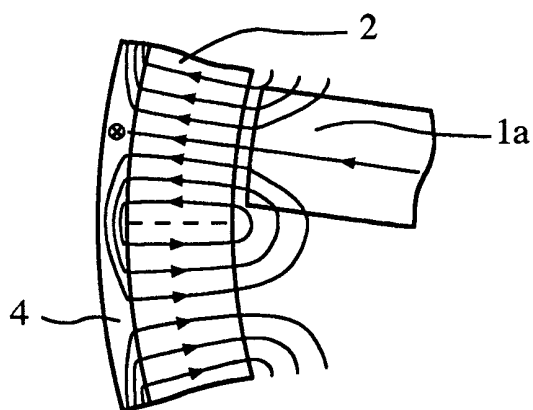


FIGURE 2

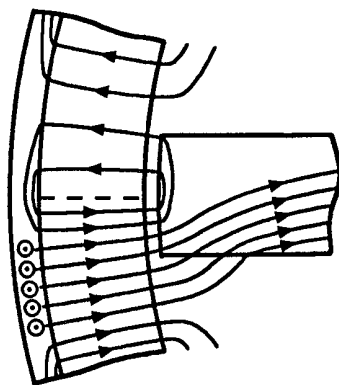


FIGURE 3

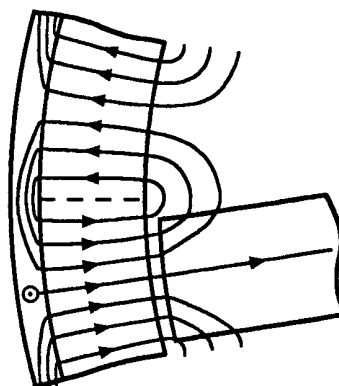


FIGURE 4

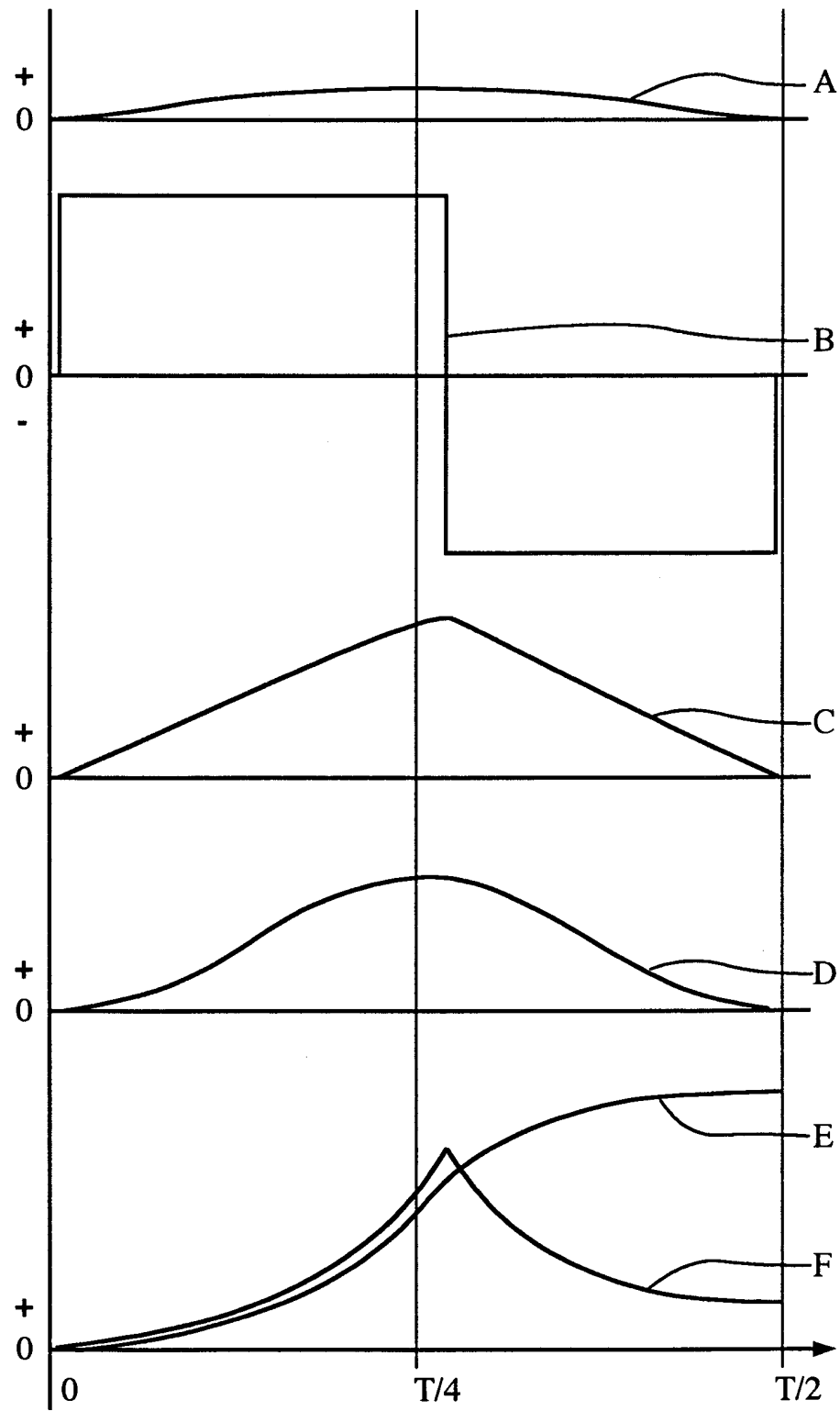


FIGURE 5

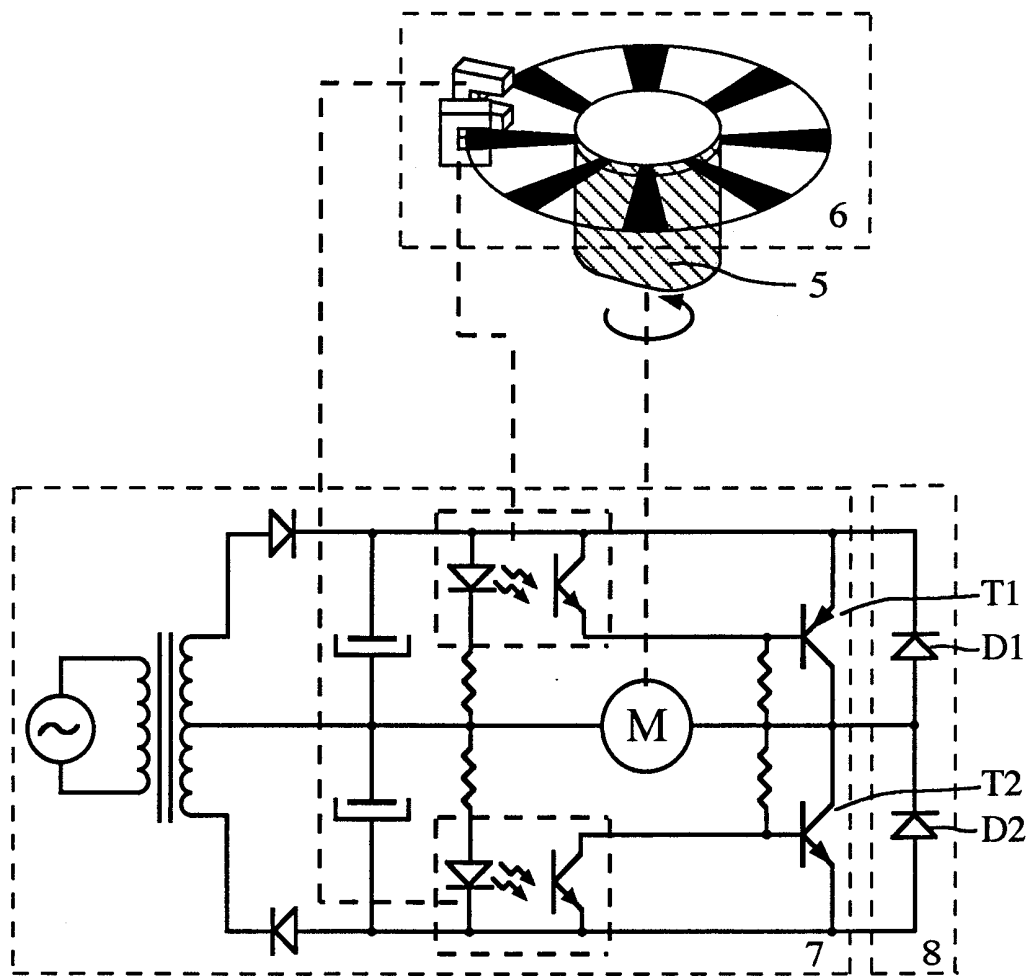


FIGURE 6

INTERNATIONAL SEARCH REPORT

International application No.

PCT/TR 97/00013

A. CLASSIFICATION OF SUBJECT MATTER

IPC⁶: H 02 K 21/04, 19/24, 53/00; H 02 P 7/05

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC⁶: H 02 K; H 02 P

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, PAJ, WPI, TXTUS1, TXTUS2

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Soviet Inventions Illustrated, Section E1: Electrical, week E05, Derwent Publications Ltd., SU 824-380 A (MOSC AVIATION) 17 March 1982 (17.03.82), & SU 824-380 A (MOSC AVIATION) 23 April 1981 (23.04.81), fig.2.	1-3
A	WO 94/19 855 A1 (ELECTRIC POWER) 01 September 1994 (01.09.94), claims 1,15,16,33.	1,3
A	DE 26 06 438 A1 (OHLMANN) 25 August 1977 (25.08.77), page 3.	1,4
A	GB 2 179 803 A (MATSUSHITA) 11 March 1987 (11.03.87), page 3.	1

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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Date of the actual completion of the international search

31 July 1998 (31.07.98)

Date of mailing of the international search report

24 August 1998 (24.08.98)

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/TR 97/00013

Im Recherchenbericht angeführtes Patentdokument Patent document cited in search report Document de brevet cité dans le rapport de recherche	Datum der Veröffentlichung Publication date Date de publication	Mitglied(er) der Patentfamilie Patent family member(s) Membre(s) de la famille de brevets	Datum der Veröffentlichung Publication date Date de publication
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