High Efficiency DC Motor with Generator

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Abstract
A high efficiency multi-phasic type DC motor incorporating brushless electronic switching to phase the attractive and repulsive forces between the permanent magnets in the rotor and wire wound air core coils in the stator. The unequal number of magnets and coils provides a designed imbalance, so that proper energization induces rotation and torque in the motor's dual flywheel rotor. Electronic switching collects inductive kickback and back emf simultaneously during the motor phase and in addition, disconnects the attraction and repulsion phases during regenerative braking, etc. and directs all this generated power back to the power pack where it is stored in batteries and capacitors. The rechargeable batteries and capacitors in the power pack are the source of operating electrical power for the motor. The rotating assembly is designed to have adequate mass so that the kinetic energy of rotation smooths out the pulsing moments introduced by the attraction and repulsion of the coils and magnets and to ensure continuous rotation of the dual flywheel rotor. The combination of electronic switching, the low hysteresis loss in the air core coils, the streamlined configuration of the rotor which reduces windage loss and the recovery of the generated currents in the air core coils contribute to the high efficiency of the electric DC motor.

1. Field of the Invention

This invention is concerned with a high efficiency multi-phasic DC motor with rotor flywheel that operates with generator characteristics that simultaneously captures and stores inductive kickback and back emf, in addition to collecting generated power such as regenerative braking. The motor has an efficiency of about 80% at 100 RPM rising to 95% at 3000 RPM. It is pancake shaped with sufficient mass in the dual rotors to store kinetic energy as a flywheel. Twelve (12) permanent magnets are mounted in the periphery of the dual rotors and fifteen (15) air core coils in the periphery of the stator which is a designed imbalance, that positions adjoining magnets at different degrees of distance from coils ahead and coils behind. The inductive kickback, back emf and other generated power are stored for future use in a power pack of rechargeable batteries and capacitor banks. Torque and RPM are controlled and varied by a microprocessor and algorithm.

2. Description High efficiency DC motor with generator

A Circuitry for Recovering Electrical Energy with an Electric Vehicle DC Propulsion Motor When Braking" describes a DC propulsion motor for a vehicle that becomes a generator by using the motor's kinetic energy when the vehicle is braked "Battery Operated Motor

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With Back EMF Charging" describes a motor driven by electric current from a charged battery during a first time interval. During a second time interval the charged battery is disconnected and a discharged battery is connected to the motor, which is operating as a generator as it winds down "Pulsed Capacitor Discharge Electric Engine" describes a motor that uses stepped-up transformer current from batteries to charge capacitors, which are discharged across a spark gap through stator and rotor coils, generating motion by magnet repulsion. The discharge overshoot (inductive kickback) from collapsing Electrical Energy Efields in the coils is then used to energize (charge) external batteries for conservation of power. nhancement Apparatus" describes a generator device driven by an externally operated motor that uses a flywheel and gyroscope in the motor to store energy "Electric Vehicle Drive System" describes an electric vehicle power system that uses a battery to drive electric drive motors, a flywheel to drive a generator during peak loads and a microprocessor to control the system, with the battery and flywheel recharged during deceleration or braking, or by a charger when idle. DC motors that individually capture, collect, store and use all forms of generated power, inductive kickback, back emf and regenerative braking, etc. are not described in prior art DC motors. Self Starting DC Motor with Permanent Magnets of Varied Magnetic Strength" describes a disk shaped motor with annular magnets in the periphery and a coil in the center with all magnets reacting together as the coil is energized and de-energized Disk Type Brushless Motor" describes a motor with field magnets of two or more poles and loop-like armature windings in quantities of two or more. It is concerned with not overlapping the armature windingsb Single Phase Brushless Motor" describes a motor, with dual rotors that has six magnets and three non-magnets on the peripheries of the rotors, and a stator with nine coils on it's periphery, providing perfect balance between the nine magnets and non-magnets and the nine coils so that all magnets pass over a coil at exactly the same time in perfect balance. A designed imbalance in the number of magnets and coils which positions adjoining magnets at different degrees of distance from coils ahead and coils behind, and which insures that all magnets do not pass over a coil at exactly the same time is not described in prior art DC motors. With a Disk Rotor " describes two groups of "iron-free coils" that are press mounted to the metal casing of the stator, (with insulating foil). However, the conductive metal casing is still subject to hysteresis and eddy currents which are electromagnetically induced when the "iron-free coils" are energized, during operation of the "Motor With a Disk Rotor", unlike the said air core coils of the instant invention that utilizes cores of non-conductive non-magnetic material. Also, if a north pole is induced in the Schmider "iron-free coils" with the same current as required in the said air core coils, the "iron-free coils" will not repel the north poles of strong permanent magnets as efficiently as the said air core coils in the applicants invention. Instead strong neodymium magnets will actually attract any conductive metal casing attached to the "iron-free coils" unless more power is added (inefficiently) to the "iron-free coils". Air core coils with cores that are non-conductive or non-magnetic, or coils that are not attached to conductive or magnetic materials, were not described in prior art DC motors.

3. Regenerative Electric Motor

Regenerative Electric Motor" describes a brush type DC motor that uses the voltage from collapsing electromagnetic fields around the armature (inductive kickback) to charge the batteries. "Battery Operated Motor Switch Back EMF" describes the

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use of inductive kickback to charge the batteries. Electrical Energy Enhancement Apparatus" describes an apparatus that uses capacitors connected to electromagnets as alternate power sources. As resonance occurs in the energy flow between the capacitors and electromagnets, energy fed back from the electromagnets assists in driving the apparatus. describes a motor that uses storage batteries and a capacitor bank. The batteries charge the capacitor bank, which discharge through oppositely polled coils to drive (repel) the rotor. Secondary batteries are charged by inductive kickback and with the primary batteries appear to be the power source for the "engine". However, the directing of power through the coils to both pull and push the permanent magnets in the rotors in the same direction is not described in prior art DC motors.

The applicant's DC motor is multi-phasic as 1) it is designed and built with (t) (an integer equal to 2 or greater) multiple phases and 2) while operating it can utilize one or more of the multiple phases, depending on the load requirements, and as directed by the specially designed microprocessor with proprietary algorithm. Multi-phasic DC motors are not described in prior art DC motors.

SUMMARY OF THE INVENTION

The subject invention describes a highly efficient pancake shaped multi-phasic DC motor with dual flywheel rotors that operates with generator characteristics that simultaneously captures and stores inductive kickback and back emf, in addition to collecting generated power (regenerative braking, etc). RPM, torque, regenerative braking, inductive kickback and back emf are all variable and controlled by a microprocessor and algorithm. Batteries and capacitor banks are used as a rechargeable power pack. At 100 RPM to 3,000 RPM, this high efficiency DC motor with generator and flywheel characteristics has an efficiency of about 80% to 95%. The prototype is about 14 inches in diameter by 3 inches in height with twelve permanent magnets mounted in the periphery of two outer rotor disks and fifteen air core coils in the periphery of an inner stator disk. The magnets are mounted with north and south poles reversed for every other magnet. The air core coils are activated in equilateral positioned groups of three, while pairs of magnets in the outer rotors rotate past the coils. The flywheel rotors operate together as a single parallel unit secured to the central shaft with the stator fixed and sandwiched between the two rotors. The high efficiency multi-phasic DC motor, using power from the power pack, is controlled by the specially designed microprocessor, which sequentially pulses the coils in equilateral groups. The dual flywheel rotors develop and store sufficient kinetic energy to provide a smooth output without any torque ripple.

With the designed imbalance of 12 magnets and 15 air core coils, some coils are being energized during their motor phase, while simultaneously inductive kickback and back emf are conserved through the intelligent control of the power pack, in addition to which, generated power such as regenerative braking, inductive kickback and emf are intelligently collected and stored in the power pack at their times of induction. This designed numerical imbalance of 12 magnets and 15 coils insures that adjoining magnets are at different degrees of distance from the coils ahead and the coils behind, and also insures that all magnets do not pass over coils simultaneously. Full wave bridge rectifiers and power switching electronics assist in collecting generated power, such as regenerative braking power, back emf and inductive kickback,

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which are intelligently stored in the power pack for future use.

High efficiency in the DC motor is achieved by the imbalance in the number of permanent magnets 12 (pairs) and air core coils 15; the control of the pulling and pushing (attraction and repulsion) of the magnets; the simultaneous conservation of energy by collecting generative power such as inductive kickback and back emf; the multiphasic operation; the dual flywheel rotors, the power pack and the intelligent control provided by the specially designed microprocessor and proprietary algorithm.

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