

Switching to Save

Low-cost, variable-speed motor ideal for residential HVAC blowers.



Variable speed (VS) motors for circulating blowers provide increased comfort, better air quality, and electric energy savings of up to 70 percent when used with a modulated heating/cooling source, compared with single-speed on/off motors. However, in spite of these attractive benefits, only 5 percent of the residential HVAC systems installed each year utilize VS motors, in contrast with their regular use in commercial systems.

The reason is cost. Currently available single-phase VS motors cost four to five times as much as conventional single speed PSC motors so the typical savings of 500 kWhs per year does not provide an attractive payback. Consequently VS motors are used almost exclusively in high end, feature laden systems to provide constant airflow and better filtration, reduce drafts and noise, and improve humidity control.

Because of the huge potential savings in energy and air pollution on a national scale, the US Department of Energy (DOE) is eager to stimulate much greater use of VS motors. To help achieve this goal, the DOE awarded a grant to DynaMotors Inc. (DMI) to

develop a VS motor based on its innovative technology that would reduce the price level by 35 percent. DMI is on track to meet that target.

The DynaMotor is constructed like an ordinary universal motor with wound salient stator poles and a wound armature but it differs in having no commutator or brushes. Instead each armature coil is connected to a solid-state switch. The motor does not rely on a rotating field for operation. When the motor stator is energized and an armature switch is closed, the stator magnetic field induces current in the armature coil. The armature current in turn creates an opposing magnetic field that is offset from the stator field. This proximity of like poles in each field produces torque. Naturally, when the armature switches are open, no current can flow and no torque is produced.

Closing the switches for a longer arc produces greater torque and increases speed. The rotating switches are turned on and off at the appropriate angle and time in their rotation by optical or RF

devices located on the stator. Any kind of remote sensor or signal can control the motor. Shorting the armature coils on the other side of the stator pole provides reverse rotation.

Since the DynaMotor uses conventional motor parts and tolerances, costs are kept low. Electronic parts count is lower than conventional technologies which cuts costs, improves reliability and reduces maintenance. The DynaMotor has operated without a failure in accelerated testing for the equivalent of 60 years of normal usage. This testing continues.

Unlike other variable speed motors, the DynaMotor's stator connects directly to the AC line. Switching occurs at 100 to 400 Hz reducing dramatically radiated electro-magnetic interference (EMI) and power line noise compared to conventional VS motors that switch at frequencies in excess of 10 kHz. Since switching occurs only on the armature, the stator acts as a filter further reducing EMI and power line noise. The motors line current is sinusoidal, which eliminates the problems associated with the discontinuous line current generated by other VS motors.

MOTORS, FANS, BLOWERS & PUMPS

DynaMotor Electronic Circuitry

The DynaMotor's efficiency far exceeds that of the typical PSC motor and approaches that of the more expensive permanent magnet designs. There are other relatively inexpensive electronic devices available that can vary the speed of PSC motors but these typically do not save power when running at reduced speeds.

With completely integrated electronic controls, the DynaMotor is an exact replacement for a standard PSC motor. The 48 frame DynaMotor is available up to one horsepower and speeds from 300 to 2000 RPM.

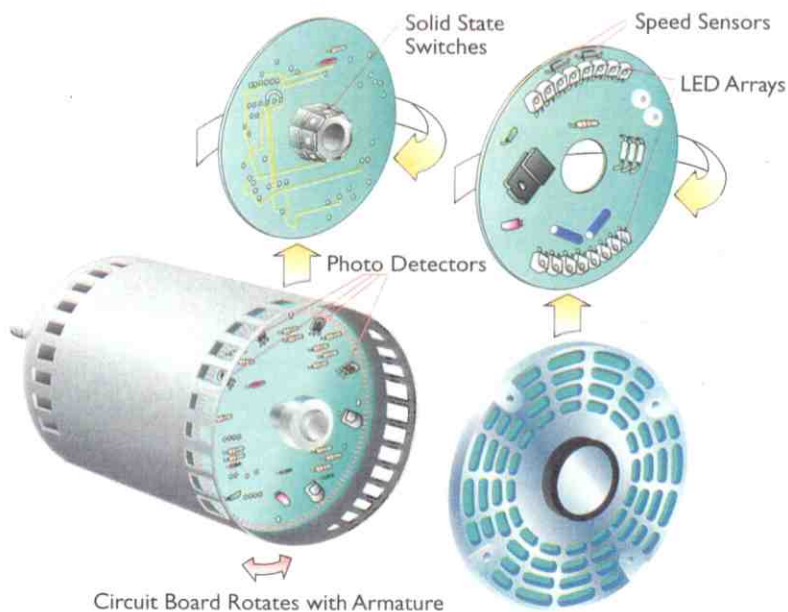
The DynaMotor offers a choice of control functions. The standard version provides precise speed control over a wide speed range with ramped start, stop and speed changes. Systems requiring greater capability and flexibility can use a microprocessor-based control. In either case a simple internal optical encoder can provide speed feedback for accurate closed-loop speed control.

The DynaMotor concept is covered by seven basic patents and was recently selected to participate in the 2004 World's Best Technologies Showcase in Dallas, Texas. **AM**

—Doug Toman

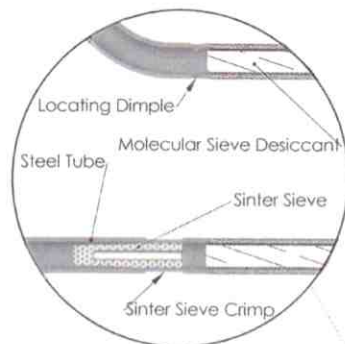
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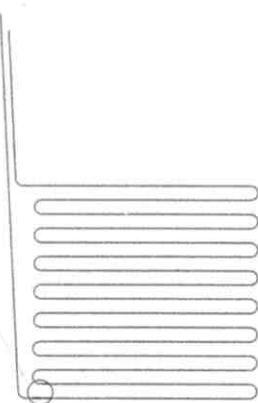
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