August 1965

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Brief 65-10237

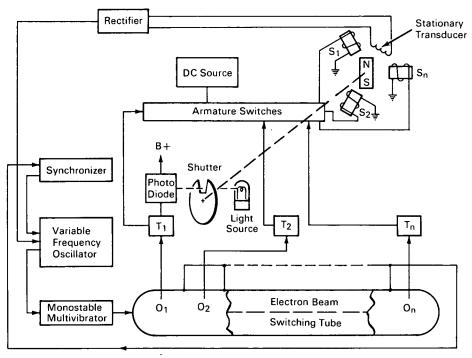


NASA TECH BRIEF



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Brushless DC Motor Uses Electron Beam Switching Tube as Commutator





The problem: To design a self-starting brushless dc motor in which there is no physical contact between rotor and stator. Experience has shown that efficient motor operation may be obtained by using a number of stator windings that are sequentially energized and a permanently magnetized rotor that rotates to reduce the torque angle between the stator rotating field and and the rotor field. Relative positions of rotor and stator must be sensed so that the stator windings can be energized at a rate proportional to rotor angular velocity. **The solution:** An electron beam switching tube and associated circuitry that control the output of a dc source to sequentially energize the motor stator windings. The tube is driven by a pulsed input that is responsive both to rotor position for proper sequencing and to rotor angular velocity for smooth acceleration during self-start.

How it's done: The beam in the electron beam switching tube is sequentially switched through succeeding outputs $(O_1 \text{ through } O_n)$ in response to pulses

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Precise sequencing is achieved by means of a light source acting on a photodiode through a shutter that revolves with the rotor. Whenever the light beam is interrupted by the shutter, output of the electron beam tube is routed to the synchronizing feedback loop. The synchronizer then inhibits the variable frequency oscillator, and stops triggering of the pulse input of the monostable multivibrator until the photodiode is again illuminated. When the photodiode is energized, the monostable is again triggered as output to the synchronizing feedback is removed.

Notes:

- 1. This invention uses a standard electron tube and standard related components to accurately commutate a brushless dc motor and can be applied to any size rotating equipment including motorgenerator sets.
- 2. Inquiries concerning this invention may be directed to:

Technology Utilization Officer Goddard Space Flight Center Greenbelt, Maryland, 20771 Reference: B65-10237

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