Diodes and integrator brake small motors dynamically

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Alternating-current motors used in position-sensing circuits must be quickly braked and stopped if the system is to retain its positional accuracy. In the case of a small shaded-pole motor, a dc source connected directly to its field winding brakes it dynamically by rapidly dissipating its kinetic energy. But if not turned off in time, the source will overheat the motor.

A safer way is to derive the dc voltage through a silicon controlled rectifier, a diode, and a resistance-capacitance network. Moreover, such a circuit costs less than an electromechanical switch and is simpler than a thermal-delay or momentary-contact switch.

As shown in the figure, the braking unit (within the dotted lines) must be placed in parallel with a manual electronic switch, S_1, that is used to trigger the braking of motor M. With S_1 in the normally closed position, no voltage appears across the braking unit, and R_1 bleeds off any charge being stored in capacitor C_1.

When braking is desired, S_1 is activated and thus opened, so that the positive half-cycle of the line voltage will appear across D_1, C_1, and R_1–R_3 and the SCR will be triggered. This action, in addition to enabling a strong pulse of direct current to flow through the motor windings, partly charges C_1.

When the line current drops through zero and into its negative half-cycle, the SCR turns off and remains in that state until the ac input reaches its positive half-cycle again. The process is repeated until C_1 is charged to near the peak value of the line voltage, at which time direct current will cease to flow. The SCR will not turn on again, because D_1 will be permanently back-biased.

The 150-volt varistor helps to suppress line spikes. The fuse, F, is included as a safety precaution and will open if for some reason the braking unit continues to enable the power line to feed a relatively high direct current through the motor winding. Using the component values shown, the braking unit will enable the line to supply a pulsating dc to the motor for approximately 1 second—more than enough time to completely brake any small motor with a rating of up to ¼ horsepower or so. □

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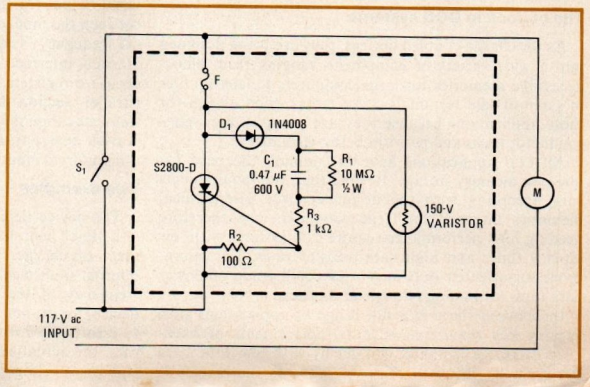

Fast reaction. S_1 initiates motor braking. Positive half-cycle of input voltage appears across D_1, C_1, R_1–R_3, firing SCR and enabling direct current to flow through small shaded-pole motor. C_1 charges to nearly peak value of input voltage during succeeding positive half-cycles, terminating process.