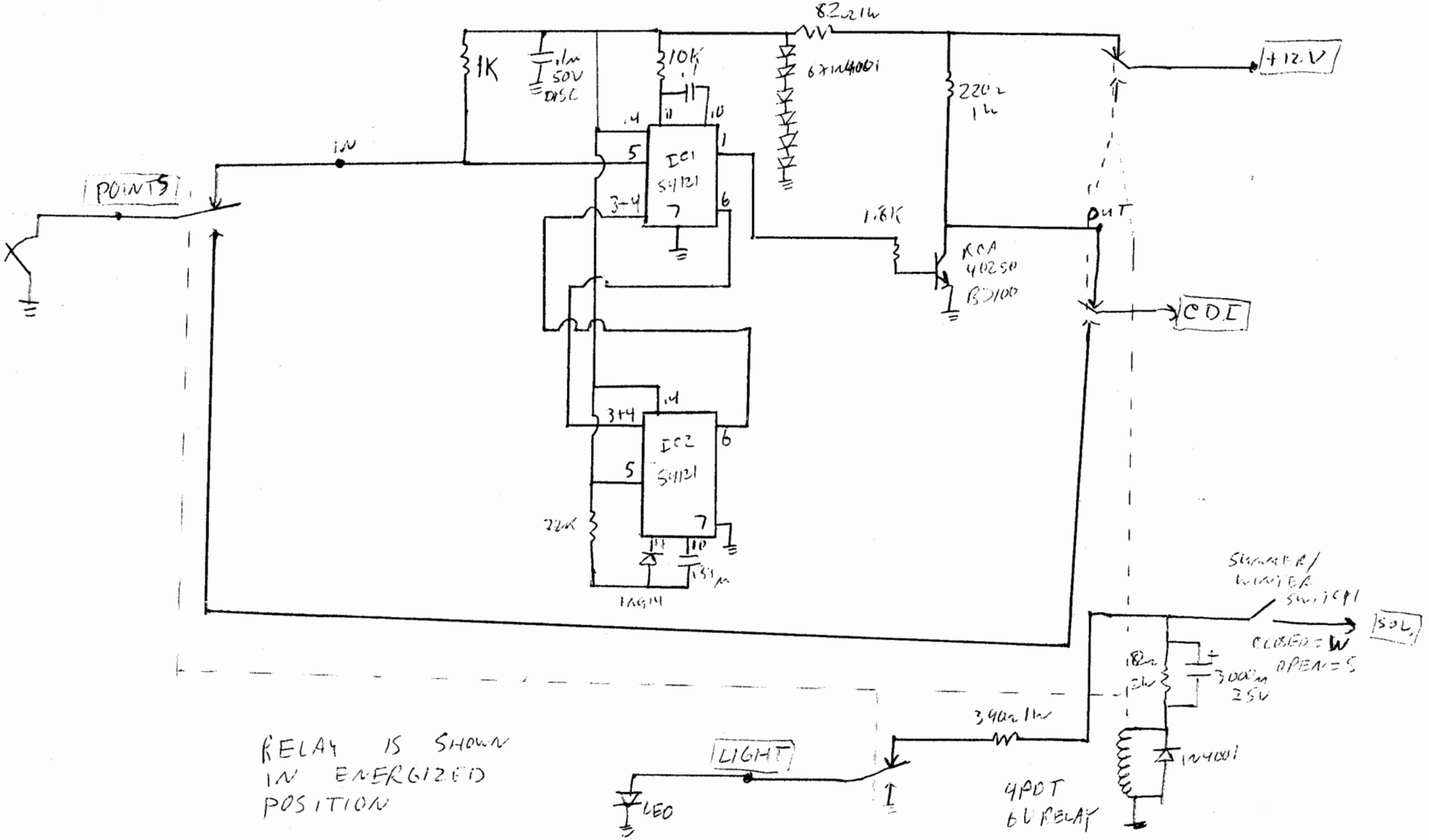
FRASER ELECTRONICS COLD WEATHER CDI BOOSTER



RELAY IS SHOWN IN ENERGIZED POSITION

2) Dec 23/77
D. Fraser

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Original design
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Designer's casebook

IC boosts starting energy for solid-state ignition

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Even in very cold weather, starting need not be a problem in a car with a conventional solid-state ignition system. The addition of a single monolithic integrated circuit and a few discrete devices will keep spark timing accurate and guarantee that six to 10 times more energy than usual reaches the spark plugs.

The circuit is interposed between the ignition points and the solid-state ignition (Fig. 1). Every time the points produce a pulse, the dual monolithic multivibrator IC turns it into a train of pulses by driving a transistor on and off repeatedly. As a result, each spark plug gets many chances to fire with each opening of the points, instead of just one.

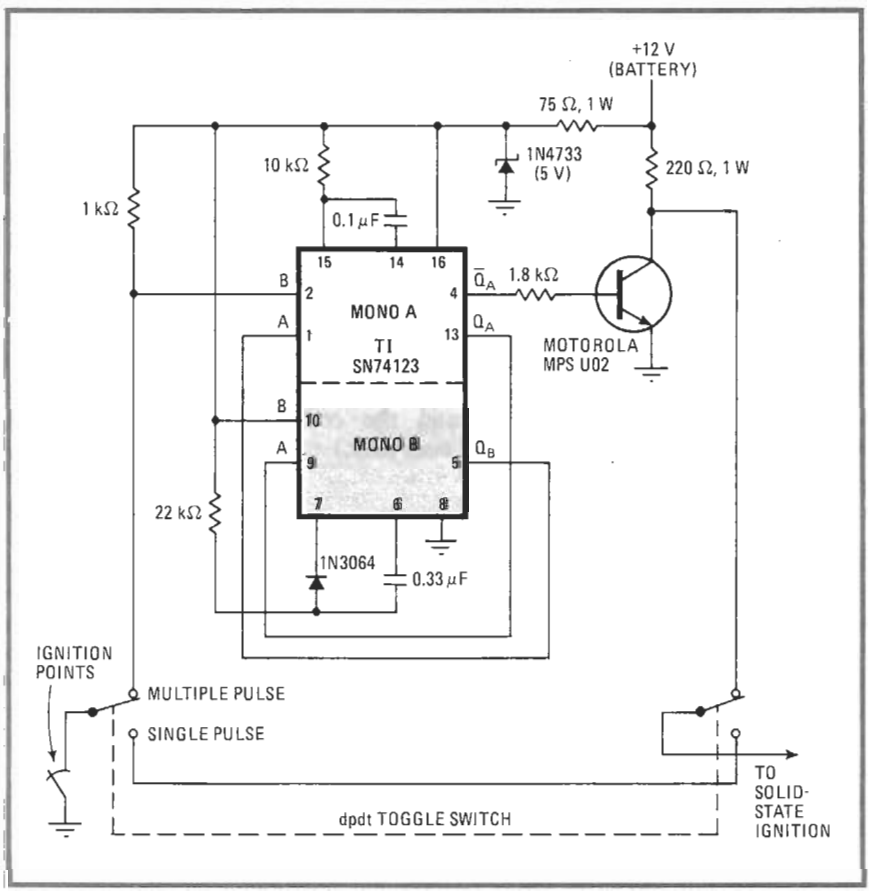
A Texas Instruments SN74123 multivibrator is shown in the figure, but for operation at very low temperatures (to −55°C) the SN54123 package can be used in exactly the same way. When the points open, a rising edge at the B input to mono A occurs, making Q_A go high and $\overline{Q}_A$ go low for 500 microseconds. The falling edge of the Q_A output, applied to the A input of mono B, turns on a Q_B pulse 7 milliseconds long.

The Q_B output from mono B is connected to the A input of mono A. If the B input from the points remains high (in other words, the points remain open), mono A is triggered from Q_B, causing a second pulse of 500 μs to occur 7.5 ms after the first pulse. This second pulse again triggers mono B. This process is repeated over and over, thereby producing a train of pulses. When the points close, mono A is inhibited, and the pulse train is terminated.

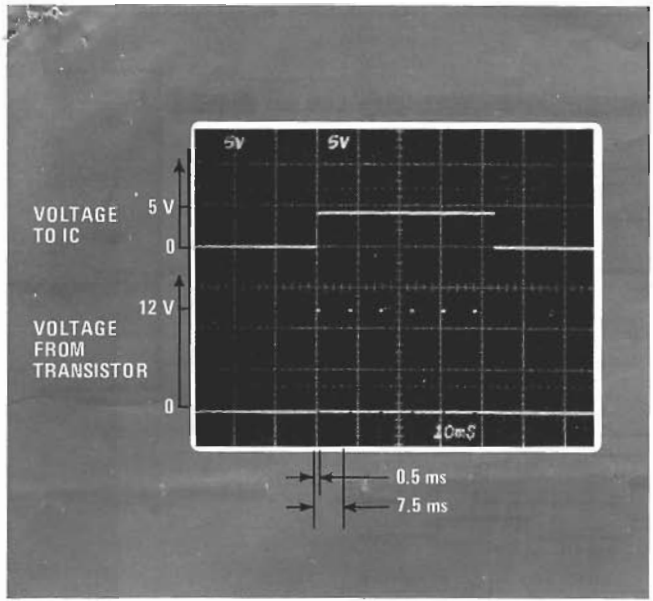
The pulse train from the $\overline{Q}_A$ output of mono A is applied to the base of the transistor, which then acts in an identical fashion to the points, insofar as the solid-state ignition is concerned. Thus, when the points open as shown in Fig. 2, a train of pulses is applied to the solid-state ignition, rather than just one pulse as would be the case in normal operation, causing the spark plug to fire many times.

The interpulse spacing provided by mono B is not critical. A lower boundary is determined only by the maximum rate at which the solid-state ignition operates. This is typically 2.5 to 3 ms.

The upper boundary is related to the desired number



1. Extra sparks for better starts. When the toggle switch is set for the multiple-pulse starting mode, the multivibrator IC and transistor send a series of pulses to the ignition every time the points open. After starting, the switch is simply flipped for normal triggering to the solid-state ignition. The zener diode provides 5-V regulation for the IC down to a battery voltage of about 7 V.



2. Pulses to ignition. Upper trace shows voltage waveform at B input of mono A due to points opening. Lower trace shows the resulting train of pulses, which triggers the solid-state ignition six times. The train of pulses is terminated when the points close.

of pulses that are produced while the points are open. For a V-8 engine with a cranking speed of one revolution per second and a dwell angle of 30°, the 7.5-ms interpulse spacing produces about 10 pulses spaced at 3° intervals while the points are open. Slower cranking speed provides more pulses with a smaller interval in degrees between pulses.

This technique was tested several times in January 1976 on a 1967 Mustang equipped with a solid-state ignition that refused to start in −10°F temperatures and high humidity. After several attempts to start the car had failed, the multiple-pulse circuit was switched in by using the toggle switch. The engine then started almost immediately. For normal driving, the toggle switch is returned to the single-pulse position. □