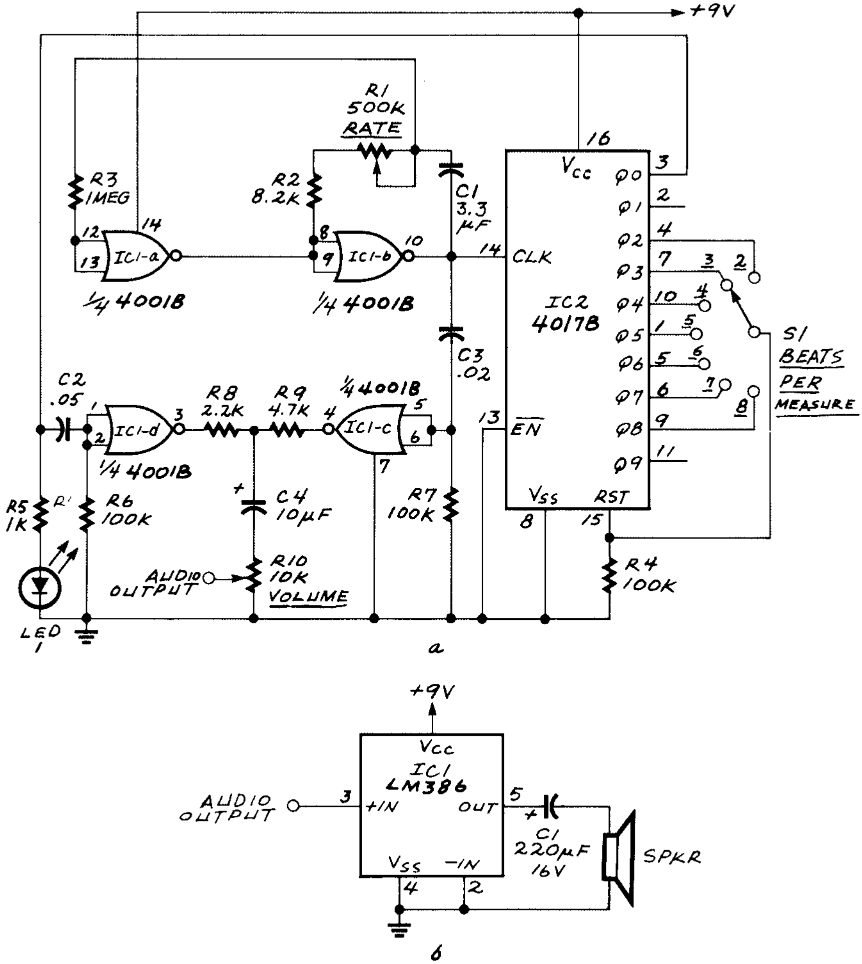

FIG. 1

ELECTRONIC METRONOMES HAVE LONG been popular with both electronics experimenters and musicians with a practical bent. All metronomes provide a steady stream of pulses, but few accent the first beat of the measure—the downbeat. The metronome presented here does, and it allows you to vary the counting rate from about 1 to 200 beats per minute. A rotary switch allows you to select an emphasized beat every other beat, every third beat, etc., all the way to once every nine beats.

As shown in Fig. 1-*a*, IC1-a and IC1-b form an astable multivibrator whose period of oscillation is approximately equal to 1/(2.2 × C1 (R1 + R2)). The astable's signal is fed to IC1-c, which buffers the signal for further amplification. The astable's output is also fed to the CLOCK input of IC2, a 4017B (a 4017A is also suitable) decade counter. That IC's Q0 through Q9 outputs go high one at a time for each successive clock pulse received at pin 14. Switch S1 feeds one of those outputs to the 4017B's RESET input; whenever the selected output goes high, the 4017B restarts its counting cycle. That is what deter-

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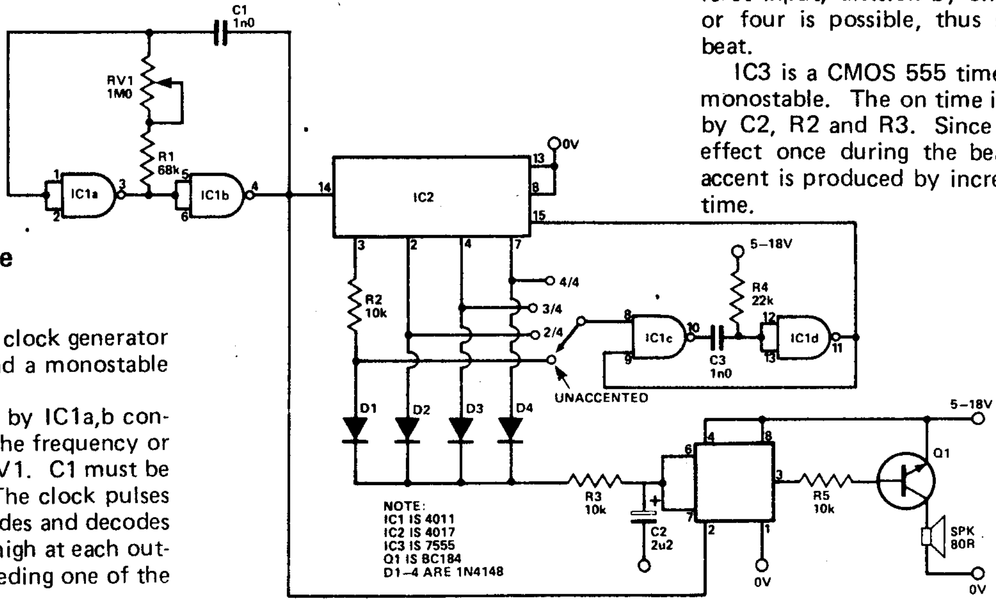
Accenting Metronome

P. Hill

The circuit consists of a clock generator determining the beat and a monostable producing the accent.

The clock is formed by IC1a,b configured as an astable. The frequency or tempo is adjusted by RV1. C1 must be a non-polarised type. The clock pulses are fed to IC2. This divides and decodes the clock to produce a high at each output in succession. By feeding one of the outputs via monostable IC1c,d to the reset input, division by one, two, three or four is possible, thus selecting the beat.

IC3 is a CMOS 555 timer, forming a monostable. The on time is determined by C2, R2 and R3. Since R2 only has effect once during the beat cycle, the accent is produced by increasing the on time.



Reader's Circuit. In the majority of metronome circuits using simple R-C timing networks, the tempo (frequency) adjustment has most of its control "squeezed" near one end of the operating range. Seeking to minimize this problem, reader Richard K. Brush (1965 East 3375 South, Salt Lake City, UT 84106) decided to develop his own design for a metronome. His circuit (Fig. 2) features a nearly linear tempo control, loudspeaker output, and, interestingly, discrete devices rather than an IC.

Richard's major improvement is a shift from a voltage variable to a current-controlled charging source for the timing capacitor. Transistor *Q1A* provides temperature compensation for a voltage divider network consisting of *R2*, tempo control *R3* and *R4*. The tempo control's adjustment determines the base bias applied to *Q1B* which, in conjunction with limiting resistor *R1*, serves as a current source for timing capacitor *C1* in the UJT relaxation oscillator. The pulse oscillator's output, developed across base load *R6*, drives the power amplifier, *Q2*, which, in turn, delivers an output signal to a PM loudspeaker. The loudspeaker's voice coil is shunted by *D1*, to dissipate transient voltage peaks developed by sharp current pulses.

To keep costs low, inexpensive components are used. Dual transistor *Q1* is a Poly Paks type 14A 653 or type 2N1132, the UJT is type TIS43, and the output amplifier is a general-purpose npn power transistor, (Radio Shack No. 276-636 or similar). The damping diode, *D1*, is a general-purpose rectifier with a 1-A rating. Timing capacitor *C1* is a 15- or 20-volt electrolytic. An 8-ohm, 3" PM loudspeaker

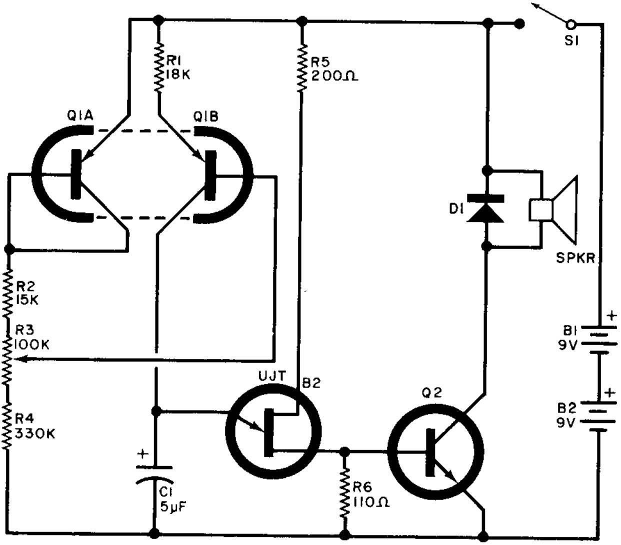


Fig. 2. Metronome circuit has a nearly linear tempo control and loudspeaker output.

was used in the original model, but larger units can be used if preferred. Finally, *B1* and *B2* are standard 9-volt transistor batteries.

Any construction technique can be used for duplicating the circuit. The completed unit, after check-out, can be calibrated using another metronome or a stopwatch.

Richard writes that his original model has a range of 30 to 220 beats per minute, but this may vary with component tolerances. The range can be shifted by using different values for *R1* and *R2*. Current limiting resistor *R1's* value determines the overall tempo, while *R2's* value establishes the minimum-to-maximum ratio. The use of a UJT type other than the one specified may require different values for *R5* and *R6*.