

Envelope generator sets music-box timbre

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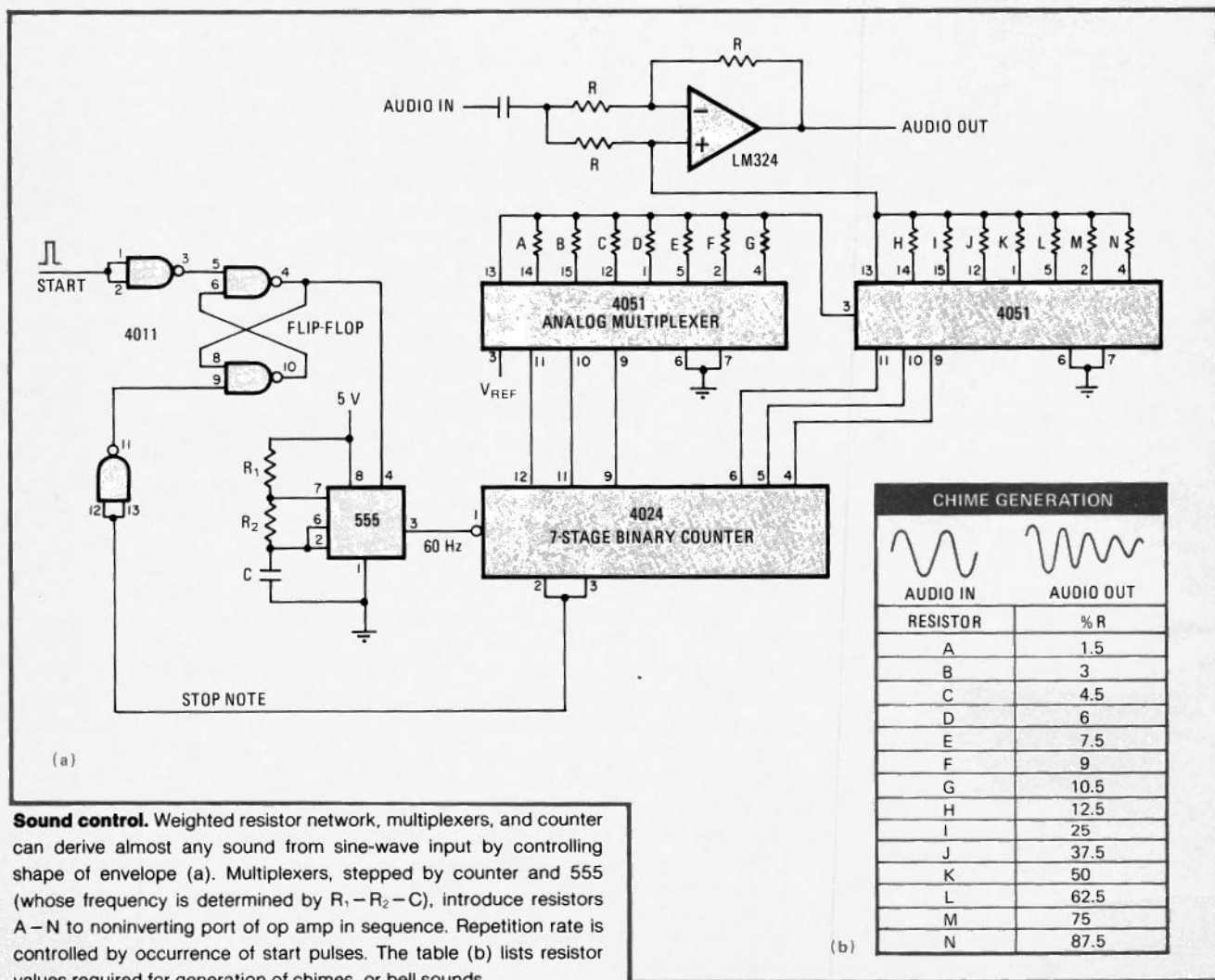
An electronic door bell sounds unlike an electronic music box or telephone ringer because its notes have different attack, sustain, and decay times—in other words, a different envelope. By using just a binary counter and a programmable weighted-resistor network, this simple circuit generates the envelope required to transform a continuous tone into a chime or a signal of almost any other timbre. The circuit can be readily expanded to generate a wave of any complexity.

As shown in (a), the unit is basically an operational amplifier that operates as a subtracter, with the

weighted-resistor network connected to its noninverting port (the switched leg). To generate an envelope, a start pulse sets the flip-flop and fires the 555 timer, which is wired as an astable multivibrator. The timer, which in this case is running at 60 hertz, steps the 4024 counter.

The binary-counter outputs address the 4051 analog multiplexers, and resistors A–N are connected one by one between the noninverting port of the LM324 op amp and ground. Thus the multiplexers control the output envelope, modulating the sine wave so that when the resistance switched into the noninverting port is zero, there is maximum output, but when the resistance is equal to R, there is no audio output. At the end of the sequence, the flip-flop is reset.

Tabulated in (b) are the resistor values needed to generate a chime, or bell sound. The envelope required for a perfect chime is logarithmic (fast attack, no sustain, long delay), but the envelope is approximated by a simple sloping line as shown; otherwise many resistors and multiplexers would be needed. □



Sound control. Weighted resistor network, multiplexers, and counter can derive almost any sound from sine-wave input by controlling shape of envelope (a). Multiplexers, stepped by counter and 555 (whose frequency is determined by R_1 – R_2 – C), introduce resistors A–N to noninverting port of op amp in sequence. Repetition rate is controlled by occurrence of start pulses. The table (b) lists resistor values required for generation of chimes, or bell sounds.