

By Charles D. Rakes

## Take an Electronics Holiday

Seasons greetings circuiters! In keeping with the season, we are going to share a pair of fun circuits. Our first circuit is an animated bell, consisting of several LED's arranged so that they form a three-bell outline. The bell arrangements are electronically controlled so that the lighting sequence gives the

appearance of movement. It's just perfect for the coming holiday.

LED's. As each group of LED's is sequentially switched on and off so that the bell outline appears to shift positions, creating the illusion of movement.

To accomplish the apparent animation, two gates (U1-a and U1-b) of a 4001 CMOS quad 2-input NOR gate are configured as a low-frequency astable oscillator, with its operating frequency set by the values of C2, R13, and R14. The circuit's oscillating frequency can be altered by adjusting R14. The oscillator output at pin 4 of U1-b is fed to the clock input of U2 (a 4017 CMOS decade counter/divider) at pin 14.

Counter U2—which has 10 decoded outputs, but is connected in a count three and recycle configuration—advances one count per pulse, causing pins 3, 2, 4, and 7 (which correspond to outputs 0–3) to sequentially go positive.

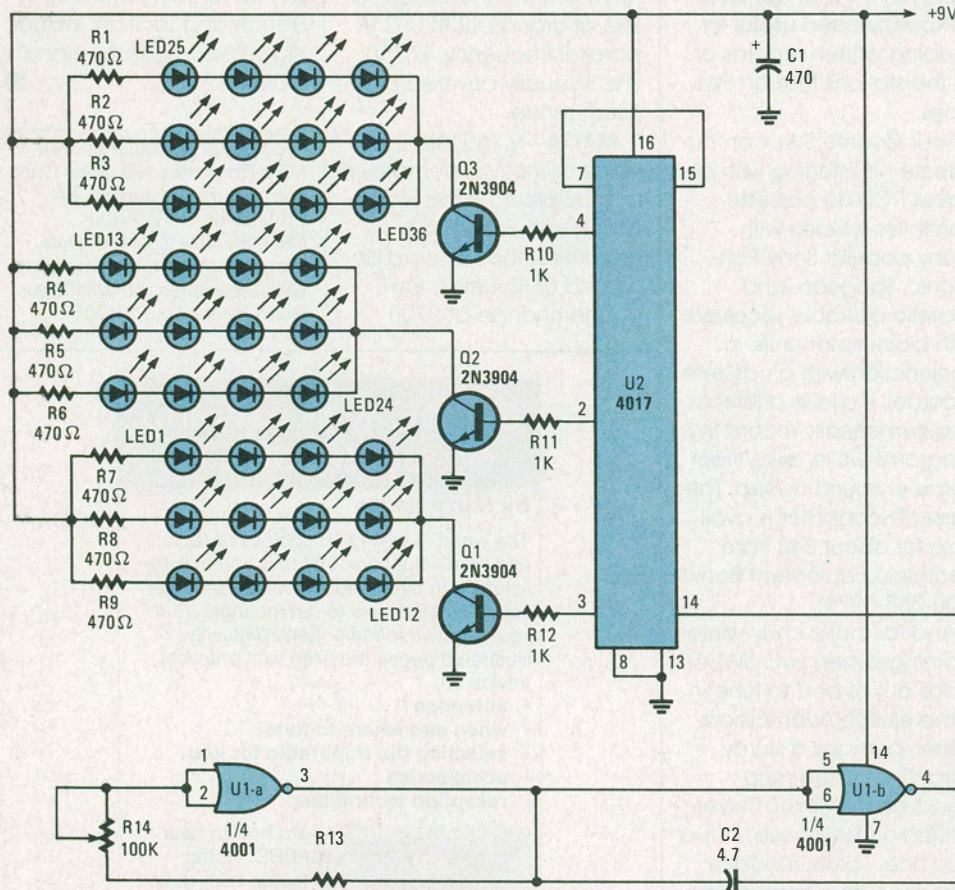
The first clock pulse forces pin 3 of U2 high, turning on Q1. That grounds the cathodes of LED's 1–12, causing them to light, producing the first bell outline. The second pulse forces pin 2 of U2 high (and pin 3 low), which, in turn, causes Q2 to turn on, and Q1 to turn off. With Q2 turned on, the second set of LED's (LED's 13–24) light, causing the bell outline to appear to have shifted positions. The third pulse turns Q2 off and Q3 on, lighting the third set of LED's, and gives the appearance that the bell outline has once again shifted.

On the fourth clock pulse, pin 7 of U2 (which is tied to U2's reset terminal at pin 15) goes high. That causes U2 to reset to zero, once again causing pin 3 to go high, lighting the first bell outline, and the sequence is repeated.

Figure 2 shows the basic overlapping three-bell outline. However, if more bell

puts, connect U2's reset input at pin 15 to the output pin that's one greater than the number of bells that are used in your display.

For instance, if you want to used five bells instead of three, you'd have to connect pin 15 to output 5. (Remember output 0 at pin 3 is the first output to go



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### ANIMATED BELL

Figure 1 is the schematic diagram of the bell animation circuit. Each of the three bell outlines in the circuit consist of twelve

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## PARTS LIST FOR THE ANIMATED BELL

### SEMICONDUCTORS

U1—4001 quad 2-input NOR gate, integrated circuit  
 U2—4017 decade counter/divider, integrated circuit  
 Q1—Q3—2N3904 general-purpose silicon NPN transistor  
 LED1—LED36—Light-emitting diode

### RESISTORS

(All fixed resistors are 1/4-watt, 5% units.)  
 R1—R9—470-ohm  
 R10—R12—1000-ohm  
 R13—47,000-ohm  
 R14—100,000-ohm potentiometer

### ADDITIONAL PARTS AND MATERIALS

C1—470- $\mu$ F, 16-WVDC, electrolytic capacitor  
 C2—4.7- $\mu$ F, 16-WVDC, electrolytic capacitor  
 Perfboard materials, enclosure, IC sockets, 9-volt power source, wire, solder, hardware, etc.

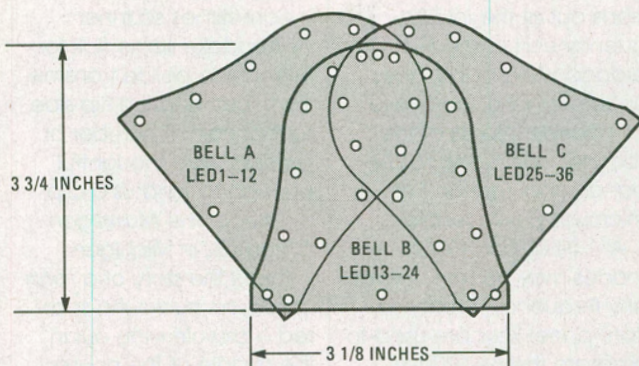


Fig. 2. The 36 LED's of the bell animation circuit are grouped by 12 and arranged to form three bell outlines. Here is the layout of the basic overlapping three-bell outline.

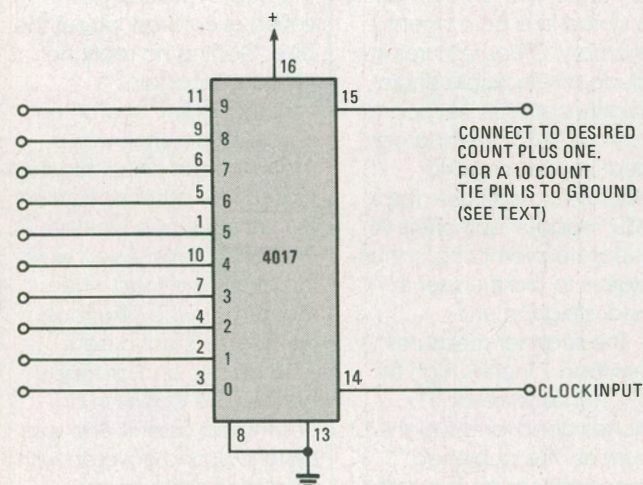


Fig. 3. Additional LED-bell outlines can be added to the circuit using this diagram as a guide. Simply connect pin 15 of the counter to the output that corresponds to the number of bells plus one. See the text for more information.

high, which in this instance is considered as the first output.) If you want to use all 10 of U2's outputs, tie pin

15 to ground. Of course, any increase in LED strings, must be accompanied by a corresponding increase

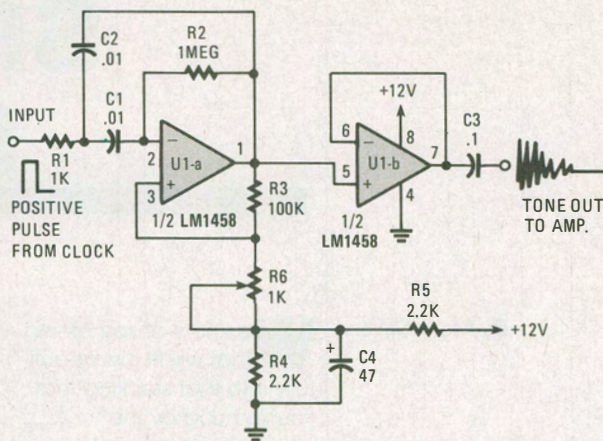


Fig. 4. The tone chime circuit shown here can be added to the animated bell to give the original circuit that extra flare.

## PARTS LIST FOR THE MUSICAL CHIME

### RESISTORS

(All fixed resistors are 1/4-watt, 5% units.)  
 R1—1000-ohm  
 R2—1-megohm  
 R3—100,000-ohm  
 R4, R5—2200-ohm  
 R6—1000-ohm potentiometer

### CAPACITORS

C1, C2—.01- $\mu$ F, ceramic-disc  
 C3—0.1- $\mu$ F, ceramic-disc  
 C4—47- $\mu$ F, 16-WVDC, electrolytic

### ADDITIONAL PARTS AND MATERIALS

U1—LM1458 dual op-amp, integrated circuit  
 Perfboard materials, enclosure, IC socket, 12-volt power source, wire, solder, hardware, etc.

in driver transistors. You can also use the basic circuit to animate other objects, such as a star, a ball, or even a Christmas tree.

### tone CHIME

Our second circuit for this month is a simple add-on musical-chime. You can add the chime circuit to the animated bell circuit in Fig. 1 to jazz up the project, making the bell appear to ring as it swings.

In Fig. 4, half of an LM1458 dual op-amp (U1-a) is configured as a modified active filter whose gain is controlled by R6. If the gain is set too high the circuit will go into oscillation at the filter's resonant frequency. By adjusting the gain to just below the point of oscilla-

tion, the circuit can be triggered with a positive pulse, causing it to give out a short ringing signal at the filter's resonant frequency.

The chime-oscillator's output is buffered from external loading by the second op-amp, U1-b, which is configured as a voltage follower. The input of the chime-oscillator circuit can be activated by the output of the clock generator or any of the 4017's outputs in the animated bell circuit. Connect the chime's input to the desired trigger source and set R6 for a ringing output. The chime oscillator's frequency may be increased by lowering the values of C1 and C2, or decreased by increasing the values.