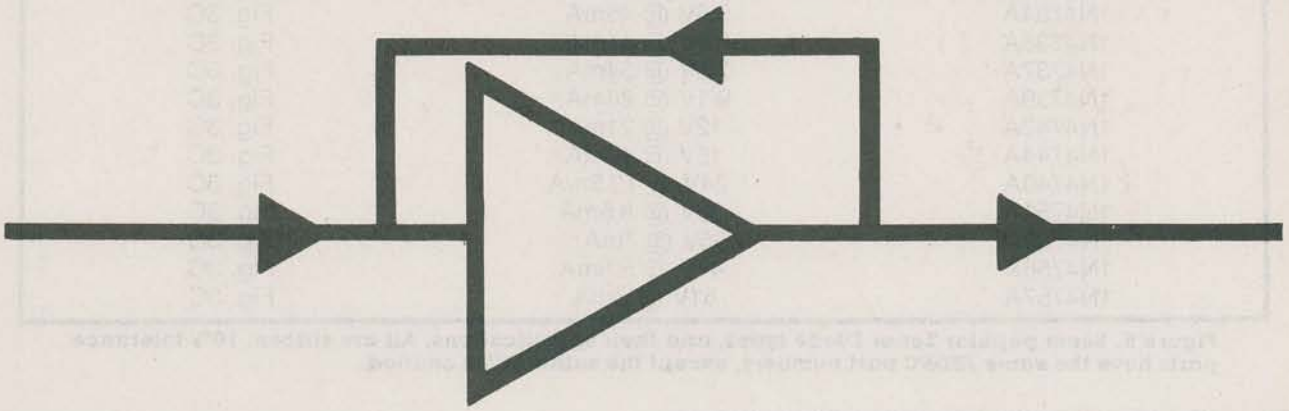
IC TESTBENCH



Of the three projects sections in this issue of **Electronics Handbook** the ones presented here are the most elaborate, and many require more circuit components than the projects in the other two sections. In addition, most of them employ two or more integrated circuits (ICs).

If you haven't already assembled several of the simpler projects, you should probably select one or more projects from our **Circuit Fragments** sections first, since the projects in this section are more advanced than the others. We suggest you study them carefully before deciding which one to put together. Once you've made a choice, copy the circuit onto a new sheet of (larger) paper, and study it until you understand each part of it perfectly. When you've done that, you can finally get all the components together and start the assembly.

TOUCH-SENSITIVE KEYBOARD

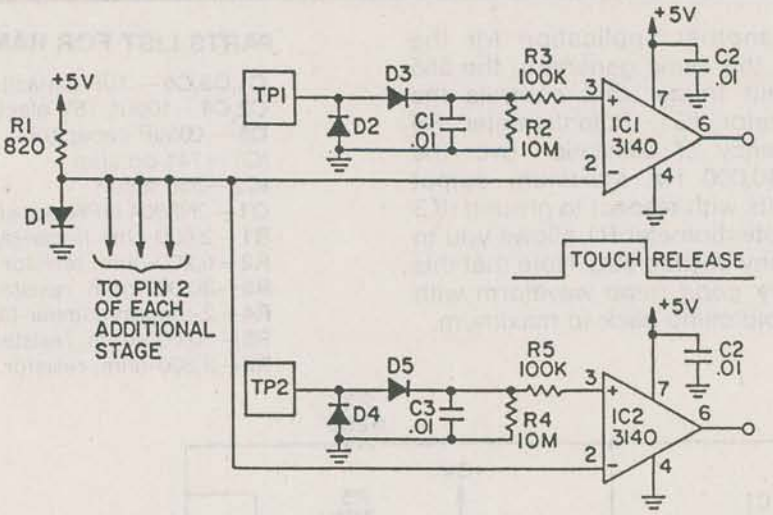
There's no better way to add an exotic touch to a piece of electronic equipment than by employing touch-sensitive switching. The set-up diagrammed here will enable you to employ one, two or however many touch-sensitive switches you need. Electronic musicians, for example, may wish to use 37 units in a 3-octave keyboard.

Each separate unit consists of a touch plate, a silicon-diode detector system, and a 3140 op amp that functions as a voltage comparator. Finger contact with a touch plate feeds 60-Hz power-line radiation from your body, which acts as an antenna, to the detector system. If the rectified AC exceeds 1.2 volts, the 3140's output swings high and remains there for as long as you touch the plate. All stages use the .6-volt drop across D1 as a reference voltage. NOTE: If you're running a battery-operated device in Dogpatch, this touch-switching arrangement may not work. Most homes, however, have sufficient 60-Hz radiation to trigger these sensitive switches.

PARTS LIST FOR TOUCH-SENSITIVE KEYBOARD

C1—C4-.01-uF capacitor
D1-D5—1N914 diode
IC1-IC2—3140 FET-input op amp
R1—820-ohm, resistor
R2,R4—10,000,000-ohm, resistor
R3,R5—100,000-ohm,resistor
TP1,TP2—touch plates (small, aluminum or copper)

TOUCH-SENSITIVE KEYBOARD



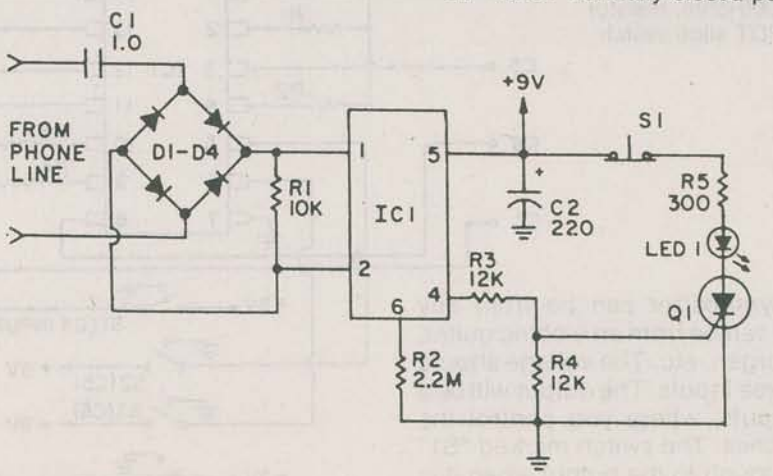
PHONE-CALL LOGGER

This inexpensive circuit is designed to let you know if a telephone call was received in your absence. Of course, it won't answer the phone or take a message, but when you consider that the necessary cash outlay is about 5% of the cost of a typical answering machine, this phone-call logger begings to look appealing.

Diodes D1 through D4 rectify the 20-Hz phone-ringing signal and feed it to the LED inside optocoupler IC1. Light from the LED actuates a phototransistor inside IC1. The phototransistor conducts and causes a pulse of current to flow to the gate of Q1, a silicon-controlled rectifier. Upon receiving the gate pulse, Q1 latches in a conducting state and lights up LED1. When you return home, you'll know that cousin Clem called. Pressing S1 extinguishes LED1 until the next call comes in. Please note that if you are hooked into a multi-party line, you will log not just your own calls, but those of everyone else on the line as well.

PARTS LIST FOR PHONE-CALL LOGGER

C1—1.0uF, 200V Capacitor
C2—220uF, 25V capacitor
D1 thru D4—1N4003 1A, 200PIV rectifier diode
IC1—MCT-2 optocoupler
LED1—light-emitting diode
Q1—2N5060 sensitive-gate SCR
R1—10,000-ohm, resistor
R2—2.2 Megohm, resistor
R3, R4—12,000-ohm, resistor
R5—300-ohm, resistor
S1—SPST normally closed pushbutton switch

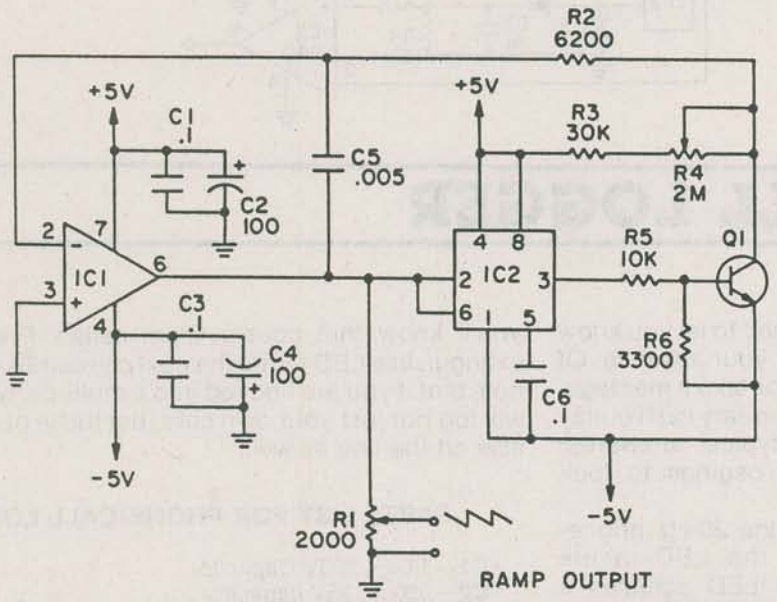


RAMP GENERATOR

We present here another application for the versatile 555 timer. In this ramp generator, the 555 functions as a Schmitt trigger that controls the current fed to integrator IC1. Potentiometer R4 determines the frequency of oscillation over the range from 150 to 10,000 Hz. Maximum output amplitude is ± 1.67 volts with respect to ground (3.3 volts peak-to-peak). Potentiometer R1 allows you to trim the amplitude to any desired size. Note that this circuit produces a *very good* ramp waveform with slow descent and a rapid climb back to maximum.

PARTS LIST FOR RAMP GENERATOR

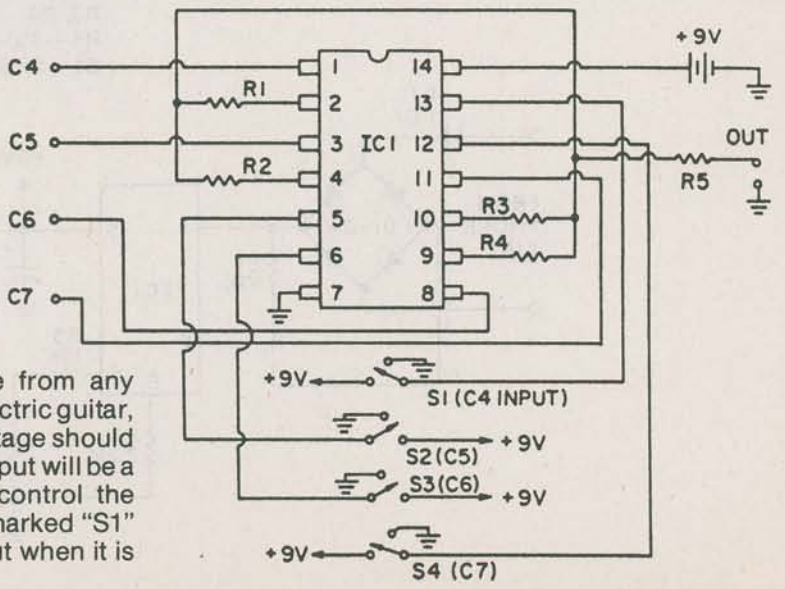
C1,C3,C6—.1uF capacitor
C2,C4—100uf, 16V electrolytic capacitor
C5—.005uF capacitor
IC1—741 op amp
IC2—555 timer
Q1—2N3904 NPN transistor
R1—2,000-ohm linear-taper potentiometer
R2—6,200-ohm, resistor
R3—30,000-ohm, resistor
R4—2-megohm linear-taper potentiometer
R5—10,000-ohm, resistor
R6—3,300-ohm, resistor



MULTI-INPUT MUSIC SYNTHESIZER

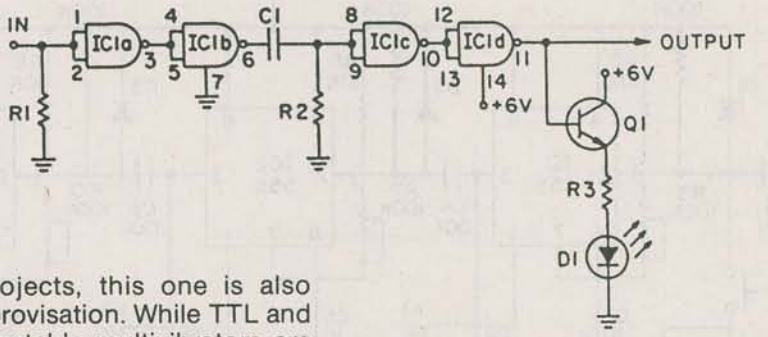
PARTS LIST FOR MULTI-INPUT MUSIC SYNTHESIZER

IC1—4016 quad bilateral switch
R1 through R5—1,000-ohm, resistor
S1 through S4—SPDT slide switch



The input to this synthesizer can be from any musical instrument. C4 can be from an electric guitar, C5 from an electronic organ, etc. The voltage should not exceed 9 volts at these inputs. The output will be a combination of the inputs, where you control the combining via the switches. The switch marked "S1" will put the C4 input through to the output when it is switched to the down position.

IMPROVISED MONOSTABLE



Like the preceding projects, this one is also dedicated to the art of improvisation. While TTL and CMOS prepackaged monostable multivibrators are available, one may not be at hand when such a useful device is called for. Once again, two very common gates, the 4001 quad NOR and the 4011 quad NAND will equally fill the bill. In operation, when the input is made high, the output of the first inverter goes low, forcing the output of the second high, charging the capacitor C1 through resistor R2. For a while, the output of the third gate is driven low, causing the output stage to go high, activating the LED indicator. In this elementary circuit, it is only necessary that the turn-on signal remain high for at least the duration of the timed interval.

PARTS LIST FOR IMPROVISED MONOSTABLE

C1—0.1-uF ceramic capacitor, 15VDC
D1—small LED
IC1—4001A or 4011A quad NAND gate
Q1—2N4401
R1, R2—47,000-ohm, ½-watt resistor
R3—470-ohm, ½-watt resistor

SEQUENTIAL TIMER

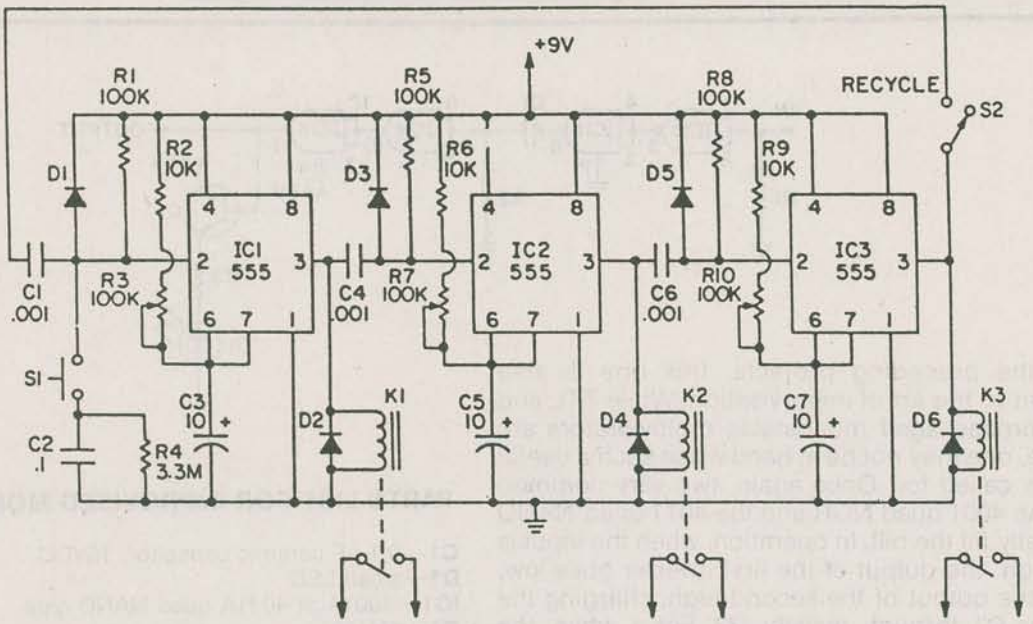
Press S1, and relay K1 pulls in for a time interval determined by the setting of R3. When IC1 times out and K1 opens once again, IC2 gets triggered. This causes K2 to pull in for an interval determined by R7's setting. Finally IC2 will time out and trigger IC3, thereby causing K3 now to pull in. Once IC3 times out and K3's contacts open, action ceases if S2 is flipped to the right. However, if S2 had been flipped to the left, IC1 would have once again been triggered as IC3 timed out, thus starting the whole cycle over again.

With the values shown, each timer can be adjusted for times from .1 to 1 second. If your application demands longer timing intervals, simply increase the size of the timing capacitors (C3, C5 and C7) and/or the timing resistors (R2-R3, R6-R7, and R9-R10). One application of the circuit that comes to mind is in flash photography. Let each relay fire a separate, cheap flash unit. With the timers adjusted for rapid fire, you'll be able to take stroboscope-like pictures that you couldn't take with a single conventional flash unit because re-cycle times (.3-.5 seconds) are too long. With three units each flash has ample time to re-cycle while the others are firing. You might also try using color film and putting a separate colored filter over each flash tube.

PARTS LIST FOR RE-CYCLING SEQUENTIAL TIMER

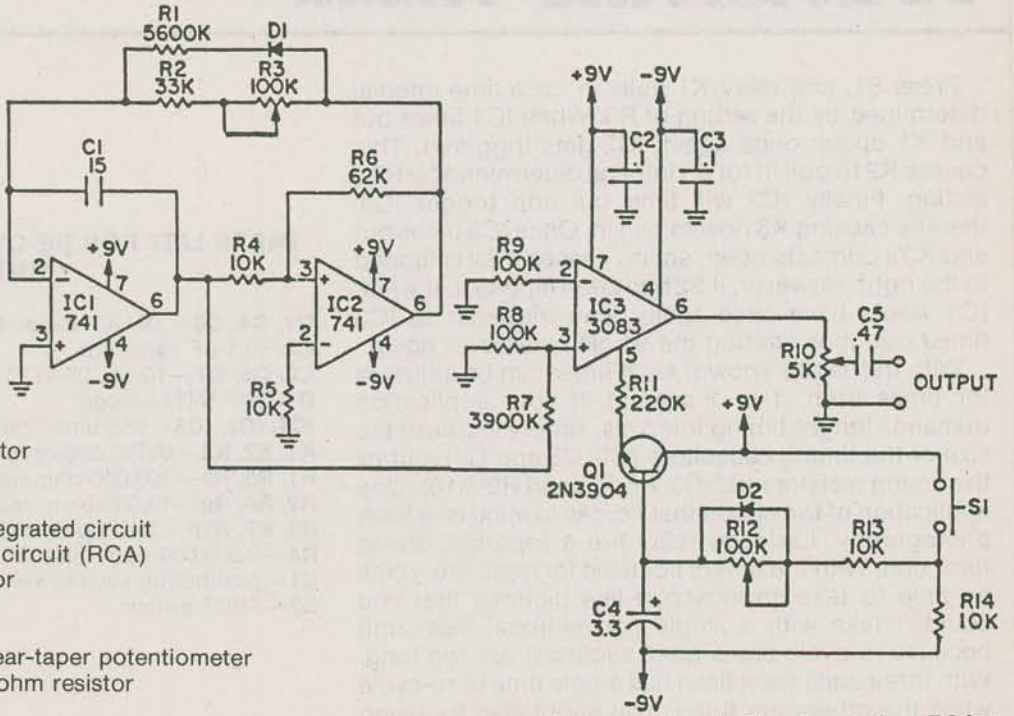
C1, C4, C6—.001-uF capacitor
C2—0.1-uF capacitor
C3, C5, C7—10-uF, 25-VDC capacitor
D1-D6—1N914 diode
IC1, IC2, IC3—555 timer integrated circuit
K1, K2, K3—6VDC,500-ohm relay
R1, R5, R8—100,000-ohm,resistor
R2, R6, R9—10,000-ohm, resistor
R3, R7, R10—100,000-ohm, linear-taper potentiometer
R4—3,300,000-ohm resistor
S1—pushbutton switch, normally open
S2—SPDT switch

SEQUENTIAL TIMER



SLIDE TROMBONE

This is a novel little instrument that can be played through your stereo system. IC1 and IC2 comprise a ramp generator, the frequency of which is adjusted by R3. The range of adjustments spans two octaves from 150 to 600 Hz. The ramp signal is fed to modulator IC3, which imparts a natural-sounding attack and decay to the note that sounds when S1 is pressed. R12 allows adjustment of the note's decay interval, and R10 controls the volume. Maximum signal amplitude at the output is 500 mV peak to-peak (sufficient to drive an amp's high-level input). To play, adjust R3 for a particular note; press S1; slide R3; then release S1. You can make things easy by calibrating R3 in terms of musical notes. Either a slide or rotating pot can be used for R3, depending on your playing preferences.



PARTS LIST FOR SLIDE TROMBONE

C1—0.15-uF capacitor
C2, C3—0.1-uF capacitor
C4—3.3-uF, 25VDC capacitor
C5—0.47-uF capacitor
D1, D2—1N914 diode
IC1, IC2,—741 op amp integrated circuit
IC3—3080 amp integrated circuit (RCA)
Q1—2N3904 NPN transistor
R1—5,600-ohm resistor
R2—33,000-ohm resistor
R3, R12—100,000-ohm linear-taper potentiometer
R4, R5, R13, R14—10,000-ohm resistor
R6—62,000-ohm resistor
R7—3,9000-ohm resistor
R8, R9—100-ohm resistor
R10—5,000-ohm audio-taper potentiometer
R11—220,000-ohm resistor
S1—pushbutton switch, normally open