The AUDIO ARTIST Sound-Effects Machine

BY JIM BARBARELLO

You can create any of a number of sounds--from a siren's wail to a clock's tick--to enhance your tape recordings

WHETHER you're an amateur recording engineer, electronic musician, or simply a "sound bug" or chronic knob twiddler, the Audio Artist is sure to appeal to you. It's a special-effects generator which can be used to create such sounds as the wail of a siren, the bubbling splash of a rock falling into a pond, the stock Hollywood sound of a flying saucer, the complex whirring generated by some futuristic machine, and much more. The Audio Artist's five controls interact with each other, resulting in a large variety of possible sound effects.

The project can double as a metronome whose rate is variable from less than 1 Hz to more than 250 Hz. Displaying the output of the Audio Artist on an oscilloscope also creates some interesting effects. The project is easily built, and the total cost of construction is less than $25.

About the Circuit. The Audio Artist employs essentially the same circuit as that of the Cabonga Percussion Synthesizer and its Auto Trigger accessory (POPULAR ELECTRONICS, August and September 1977). It is shown schematically in Fig. 1. A comparison of the two reveals that the Cabonga's manual PITCH control has been replaced with a FET to allow voltage control of the output frequency.

That portion of the circuit built around *IC2B* is the triggering and tone-generating section. Field-effect transistor *Q1* is a voltage-sensitive device whose source-to-drain resistance varies with the magnitude of the voltage applied between its gate and source. The signal applied to the gate of *Q1* is a triangle wave which varies the effective channel resistance of the FET at a rate determined by the setting of potentiometer *R20*. Transistor *Q1*, along with op amp *IC2B*, *R11*, *R12*, and *C4* through *C7*, form a twin-T, active bandpass filter which will generate a damped sinusoidal output each time it is triggered by a positive-going pulse. Damping of the output waveform is determined by the setting of *R10*, and can be varied between the extremes of no output at all and sustained oscillation.

Dual operational amplifiers *IC1* and *IC3* each form oscillators. One (*IC1*) is used to generate trigger pulses which stimulate the active filter into oscillation. The other (*IC3*) produces triangle waves which modulate the channel resistance of *Q1* and hence sweeps the filter. In each oscillator, the noninverting stage (*IC1A* or *IC3A*) acts as a comparator and the inverting stage (*IC1B* or *IC3B*) functions as an integrator. Assuming that the output of the comparator is changing state from V− to V+, the resulting positive voltage step is integrated into a ramp with a positive slope. When the amplitude of the ramp reaches V+/2, the comparator again changes state, generating a negative-going step which is integrated into a ramp with a negative slope. The comparator changes state once more when the amplitude of this ramp reaches V−/2.

This process continues cyclically, producing a square wave at the comparator's output and a triangle wave at the output of the integrator. The slope of the ramp (triangle waveform) determines how quickly the comparator changes state and, consequently, the frequency of oscillation. That slope is determined by the current supplied to *C1* (*C8*) via *R3* and *R4* (*R19* and *R20*). Therefore, the frequency of oscillation is governed by the setting of a single control (*R4* or *R19*) over a range of from 0.5 to more than 250 Hz.

This square-wave output of the tempo generator (*IC1*) is shaped into trigger pulses for active filter *IC2B* by the RC network *R7C2C3* and diodes *D1* and *D2*. Triangle waves generated by *IC3B* are applied to the gate of FET *Q1* via DEPTH control *R18* and *R15*, causing *IC2B* to produce a constantly changing pitch. The two generators (*IC1* and *IC3*) oscillate independently of each other, and can thus be adjusted to beat, to run asynchronously, or to run synchronously for different effects. The project's controls can be adjusted to produce some

Fun Projects

continued

very unusual sounds, in addition to a damped, repetitive sine wave whose frequency varies pseudorandomly.

Signals generated by *IC2B* are buffered by *IC2A*, a unity-gain inverting amplifier, and are presented to output jack *J1* for further amplification or recording. The output signals are of line level and should not be applied to microphone or other weak-signal inputs. The bipolar voltages required by the project's op amps can be furnished by either a line-powered supply or batteries. The author's prototype employs batteries for portability. Total current demand is relatively modest, making the use of a battery supply a practical alternative to a line-powered one.

Construction. The Audio Artist can be assembled using either a perforated or a printed-circuit board (Fig. 2). When assembling the circuit board, be sure to employ the minimum amount of heat and solder consistent with the formation of good solder joints. Take care to observe the polarities of electrolytic capacitors and the pin basings of semiconductors. Mounting the ICs in sockets or Molex Soldercons is recommended.

The project's circuit board can be housed in any suitable enclosure. One measuring 6½ " × 3-¾" × 2" (15.9 × 9.5 × 5.1 cm) will provide adequate room for the circuit board, a battery power supply, and the various controls. Mount the board in the enclosure using standoffs and machine hardware. Similarly, install the potentiometers, power switch, and output jack using the hardware supplied with these components. Secure the batteries (if used) to the interior of the enclosure with home-brew or commercial brackets.

Label the various control positions us-

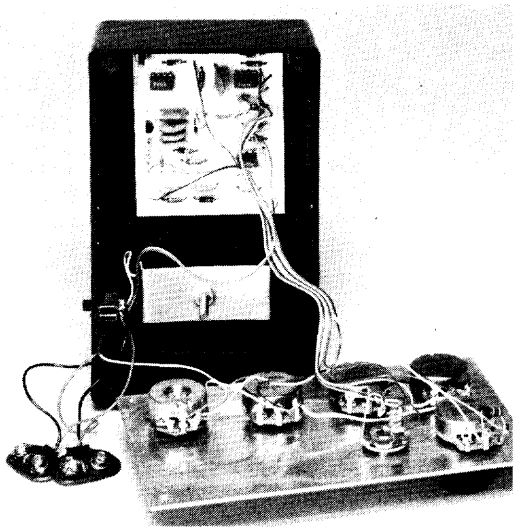


Photo of author's prototype shows pots on front and pc board at rear.

ing dry-transfer lettering. Once the controls, switch and jack have been mounted and identified, interconnect them with the project's circuit board using suitable lengths of flexible hookup wire. Be sure

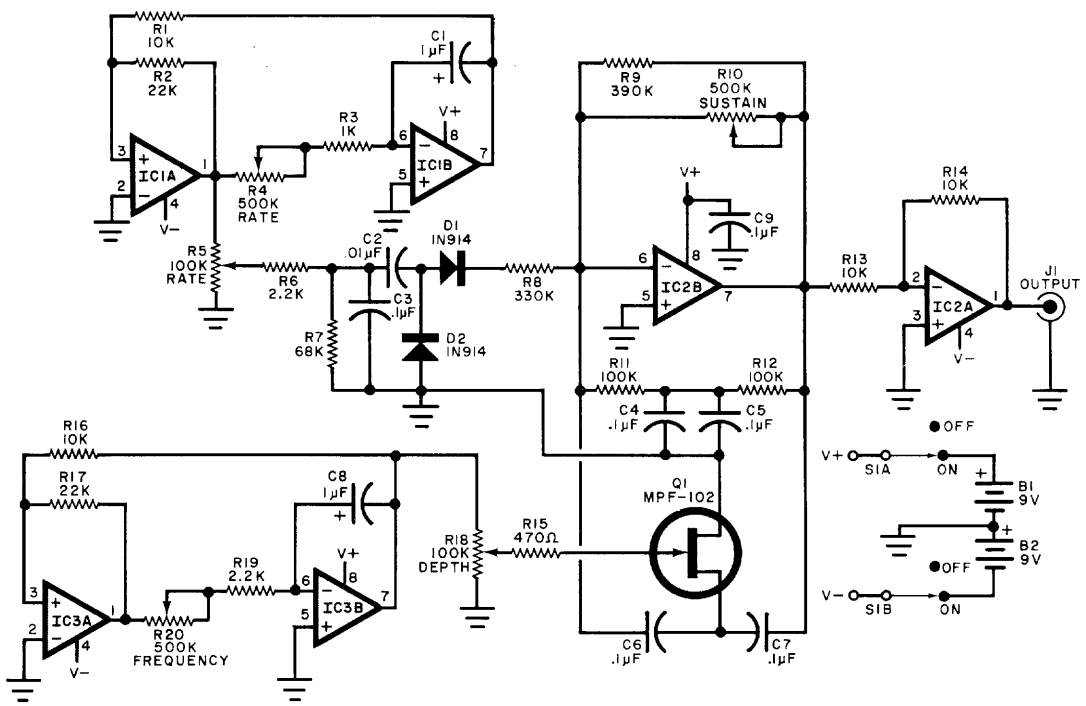
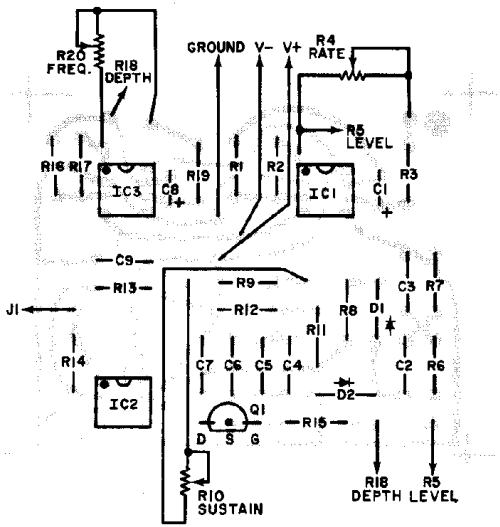


Fig. 1. The circuit around IC2B is the tone-generating section. The five controls react with each other to provide various sound effects.

PARTS LIST

B1, B2—9-volt battery
C1, C8—1-µF, 16-volt upright electrolytic
C2—0.01-µF disc ceramic capacitor
C3 through C7, C9—0.1µF disc ceramic capacitor
D1, D2—1N914 or 1N4148
IC1, IC2, IC3—MC1458N dual op amp
J1—phono jack
Q1—MPF-102 n-channel JFET
The following are ¼-watt, 10% tolerance, carbon-composition resistors unless otherwise noted:
R1, R13, R14, R16—10,000 ohms
R2, R17—22,000 ohms
R3—1000 ohms
R4, R20—500,000-ohm audio-taper pot.
R5, R18—100,000-ohm linear-taper pot.
R6, R19—2200 ohms
R7—68,000 ohms
R8—330,000 ohms
R9—390,000 ohms
R10—500,000-ohm linear-taper pot.
R11, R12—100,000 ohms
R15—470 ohms
S1—Dpdt switch
Misc.—Suitable enclosure, printed circuit or perforated board, IC sockets or Molex Soldercons, battery clips, battery holders, dry-transfer lettering, control knobs, hookup wire, machine hardware, solder, etc.



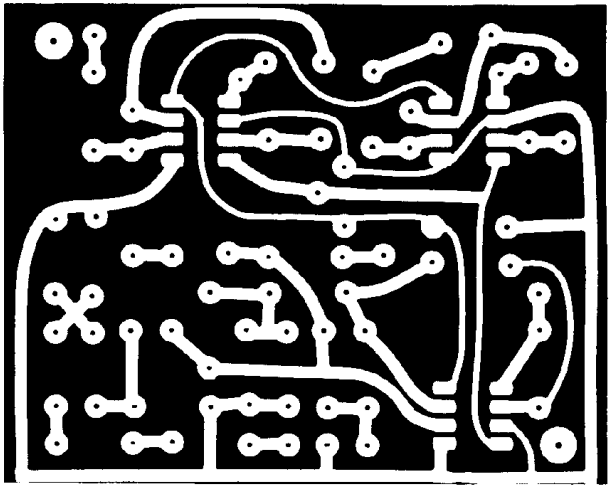


Fig. 2. Foil pattern and component layout for pc board.

to double check your wiring to catch any errors that might have inadvertently been made.

Use. Patch signals from the output jack of the Audio Artist to an audio amplifier which in turn drives a loudspeaker or pair of headphones. Depending on the settings of the Audio Artist's controls, the peak voltage across the output jack can vary from less than one to nine volts. To avoid overloads, apply drive to a line-level input and initially keep the volume low.

Apply power to the Audio Artist and the amplifier and adjust the amplifier's gain control for a comfortable listening level. Setting the SUSTAIN control at its minimum position will reduce the output signal to zero.

Begin to experiment with the Audio Artist by rotating the wiper of the SUSTAIN potentiometer to a maximum of midscale and the wipers of the other controls to their maximum settings. Slowly vary the settings of the RATE and SUSTAIN potentiometers. Vary each control in turn, noting how it affects the sound generated by the project. You will quickly be creating unusual sound effects, and will be surprised to discover how many different sounds the Audio Artist is capable of producing. ◇