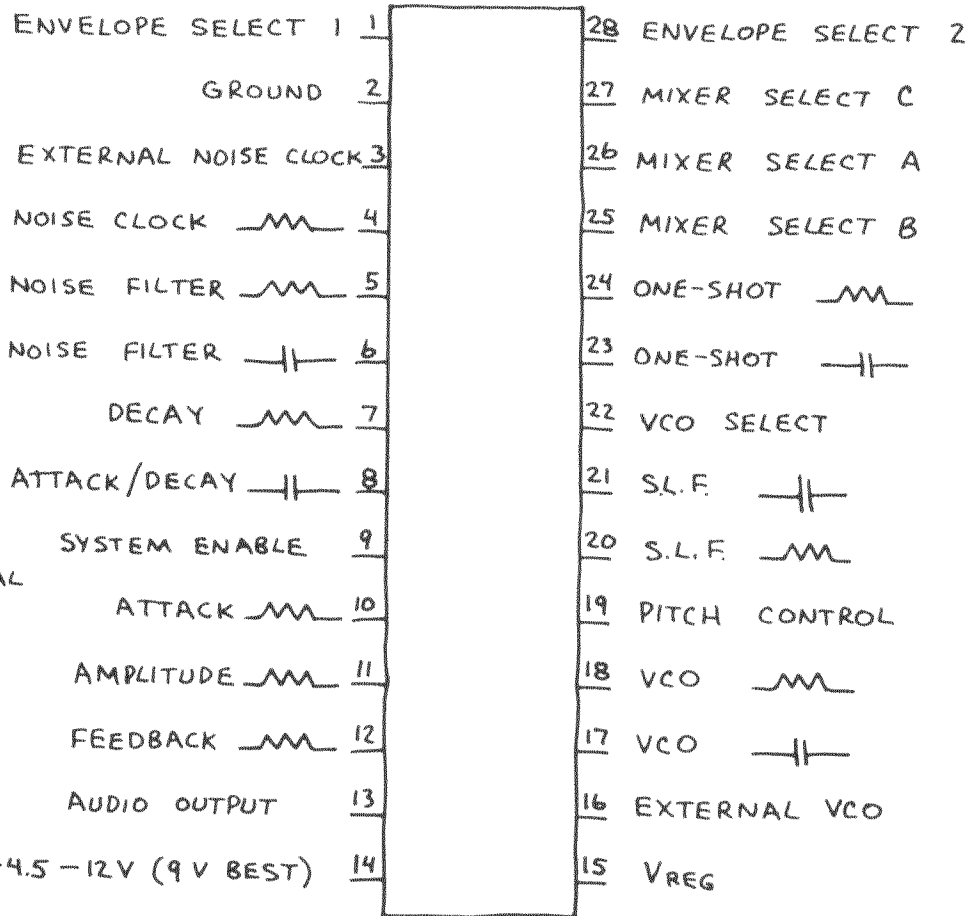


COMPLEX SOUND GENERATOR

SN76477N

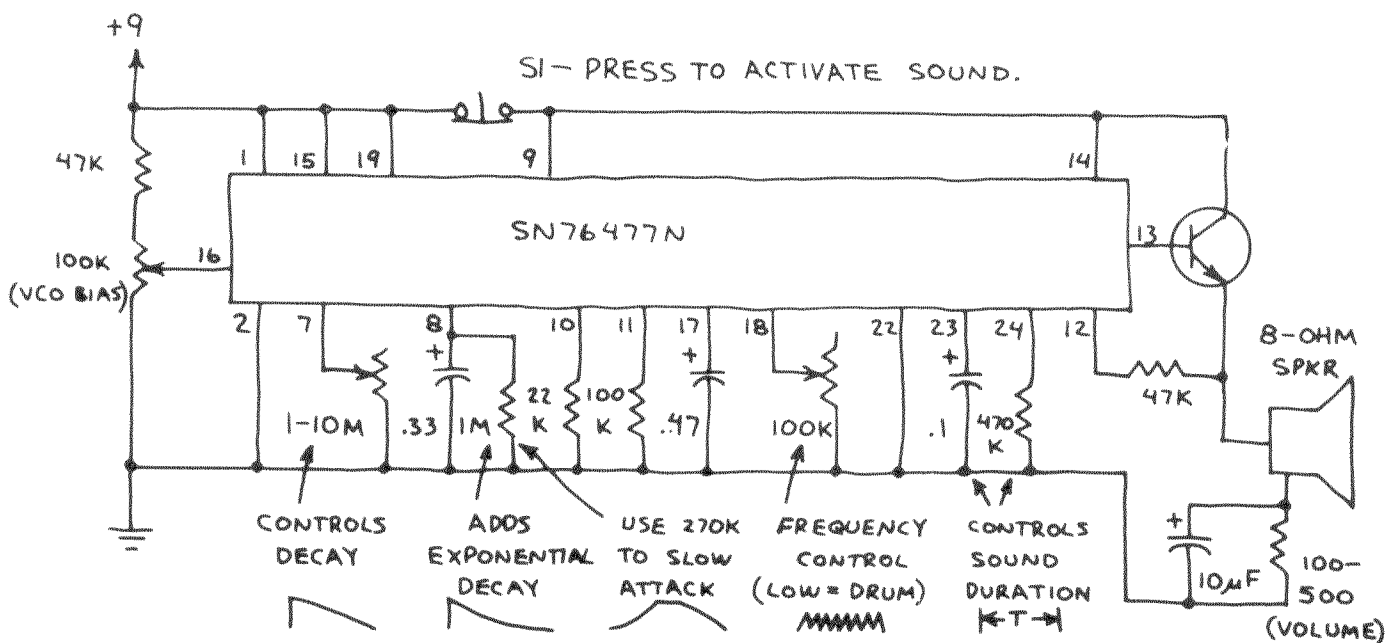
NOTE: THE SN76488 INCLUDES BUILT-IN SPEAKER AMPLIFIER. THE SN76477 DOES NOT.

INCORPORATES S.L.F. (SUPER LOW FREQUENCY OSCILLATOR), VCO (VOLTAGE CONTROLLED OSCILLATOR), NOISE GENERATOR AND A MIXER THAT ALLOWS THE OUTPUTS FROM ONE OR MORE OF THE ABOVE TO BE COMBINED. CAN BE OPERATED TOGETHER WITH APPROPRIATE RESISTORS AND CAPACITORS TO PRODUCE MANY KINDS OF SOUNDS. CAN BE CONTROLLED BY EXTERNAL LOGIC. SEE DATA SUPPLIED WITH CHIP FOR MORE INFO.



THIS CHIP IS EASY TO USE IF YOU FOLLOW DATA SHEET INSTRUCTIONS. +4.5-12V (9V BEST)

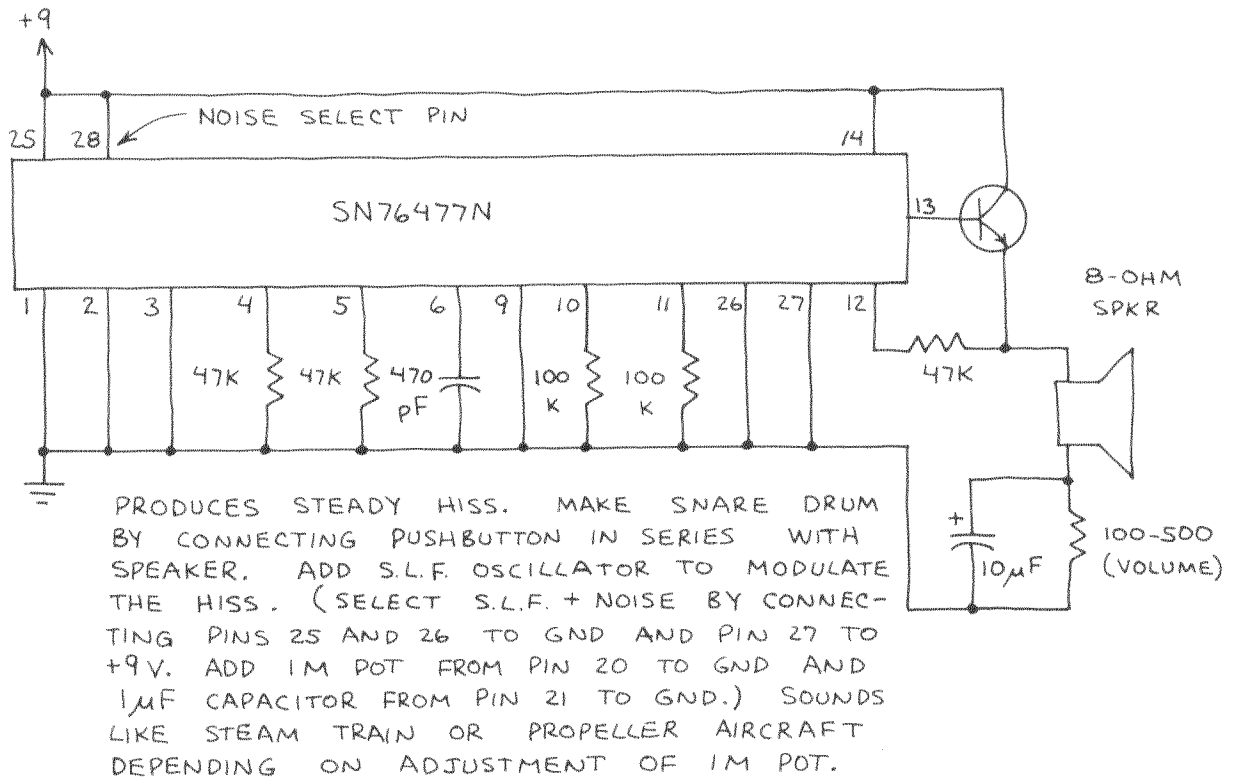
PERCUSSION SYNTHESIZER



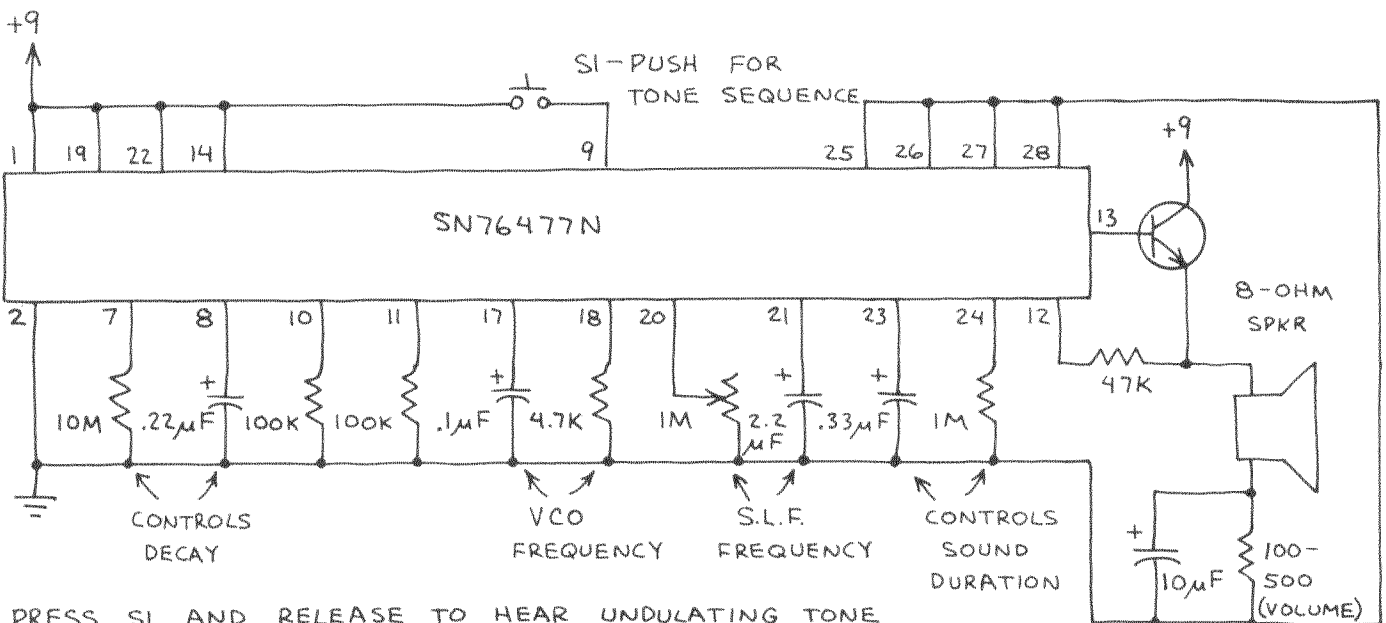
COMPLEX SOUND GENERATOR (CONTINUED)

SN76477N /

NOISE GENERATOR



UNIVERSAL UP-DOWN TONE GENERATOR



the frequency and reducing the capacitance will raise it.

The entire circuit should be self-contained and complete with battery and miniature acoustic transducer.

The LM3909 can even be powered by a single 1.5-volt silver-oxide cell of the type used to power digital watches. This will allow you to assemble a miniature unit. The audio output could be

provided by a miniature earphone salvaged from a discarded hearing aid. Alternatively, you can use a midget transistor-radio earphone. ■

14. Steam Engine and Whistle Sound Synthesizer

Originated at Texas Instruments, the circuit is designed around the SN76477 sound-effects chip. In operation, the output of the chip's noise generator is switched on and off by its super-low-frequency (SLF) oscillator. Potentiometer *R2* controls the switching rate, hence the speed of the engine sound.

When *R2*'s resistance is high, the sound resembles that of a stopped train whose engine is idling. As the potentiometer's effective resistance is reduced, the sound speeds up and resembles that produced by an accelerating train.

The sound of the train's whistle is derived from the output of the voltage controlled oscillator (vco) in the SN76477. The values of *C2* and *R3* control the whistle's pitch. Pressing *S1* activates the whistle.

The output of the SN76477 is amplified by *Q1*, which in turn drives a small 8-ohm speaker. Resistor *R11* controls the amplitude of the sound from the speaker. If you prefer, you can drive an external audio power amplifier with the signal voltage appearing between pin 13 of the IC and ground.

For a little more money, you can buy the SN76488. This chip has everything that the SN76477 has, as well as a built-in amplifier, but it has a different pinout. If you use this chip, omit *Q1* from the circuit in Fig. 1 and connect pin 13 directly to one terminal of the speaker. Connect the second speaker terminal to ground through *C4*. Resistors *R10* and *R11* should be omitted.

A drawback of the circuit in Fig. 1 is that the steam-engine sound generator is disabled when the whistle is activated. This problem can be remedied by adding a simple whistle-multiplexer circuit (Fig. 2) and by removing *S1* from the circuit of Fig. 1.

When activated, the whistle multiplexer, which was also suggested by Texas Instruments, switches the whistle on and off at a rate of 26 kHz. Even though the steam-engine sound is turned off when the whistle is on, the switching rate is far too fast for the ear to detect. Consequently, the whistle seems to be superimposed on

the sound of the engine. The only audible effect of the whistle multiplexer on the steam-engine sound is a slight reduction in volume when the whistle

is activated.

Model railroaders might want to modify this circuit so that the engine sound speeds up *automatically* when a model train is accelerating. This can be done with the help of a homemade optoisolator made from a small lamp and a cadmium-sulfide photocell. Use black electrical tape or heat-shrinkable tubing to mount the lamp adjacent to the photocell and to block ambient light.

Connect the lamp in the optoisolator to the train's transformer. Remove *R2* from the circuit of Fig. 1 and connect the photocell in its place. As the train's speed is increased, the lamp will glow more brightly. This will reduce the resistance of the photocell and increase the rate at which the sound-effects generator is switched on and off by the SLF oscillator.

It might be necessary to add a series resistor between the photocell and the circuit to match the sound of the engine with the speed of the train. You can achieve the same result by blacking out part of the photocell's window. ■

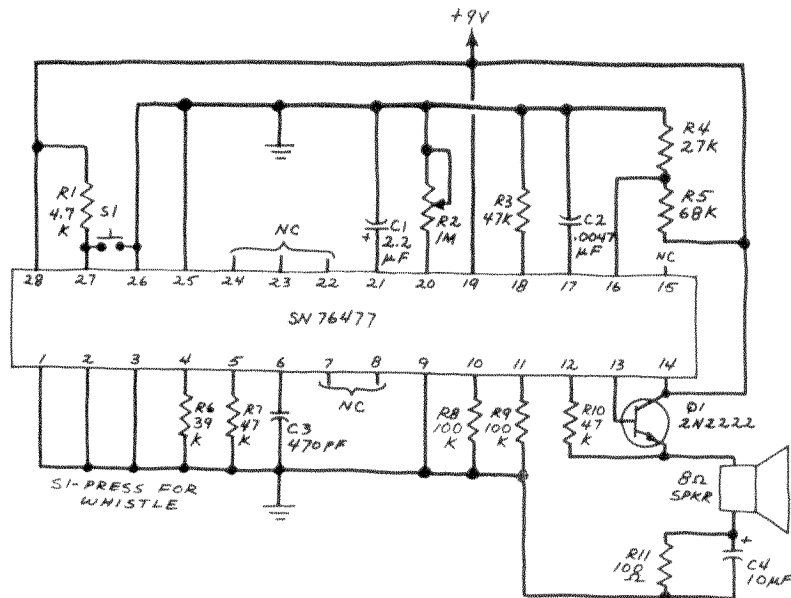


Fig. 1. Schematic using the SN76477 sound-effects chip to generate sounds of a steam locomotive.

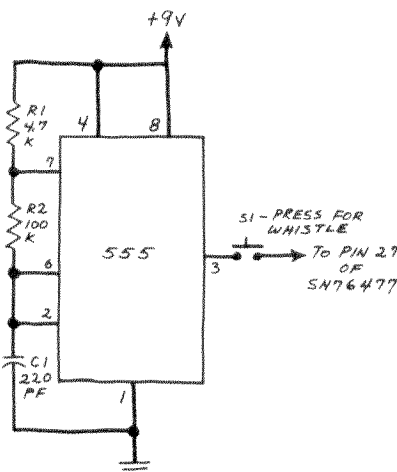


Fig. 2. Whistle multiplexer for steam-engine simulator.