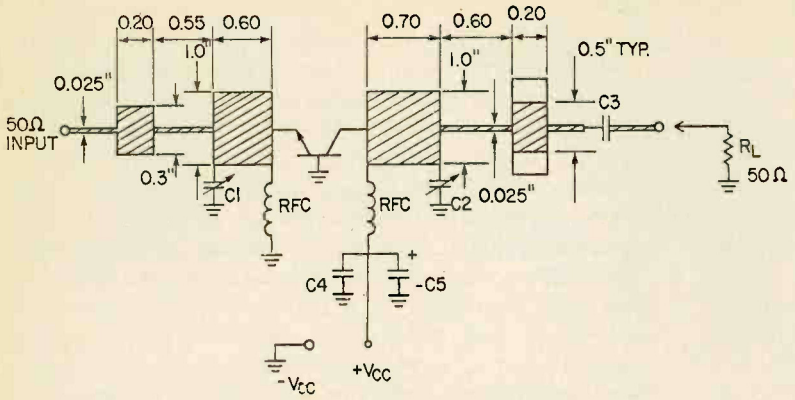

Fig. 2. A microstrip microwave amplifier test circuit.

As you increase your knowledge of microwave technology, you may want to start working with resonant cavities. These are circuit elements which are fabricated using the skills of a precision machinist rather than those of an electronics technician. At the beginning, however, you'll probably confine your projects to those using *stripline* or *microstrip* circuitry. A stripline is essentially a single conductor transmission line supported above a fixed ground plane. In its simplest form, it is a thin conductor etched on one side of a double-clad circuit board, with the unetched side serving as the ground plane. By varying the width of the line at different points, one can create effective circuit elements and match impedances.

A representative stripline microwave amplifier circuit layout is shown in Fig. 2. Suggested as a test amplifier for their DME375 and TSP400 microwave transistors by the Communications Transistor Corporation (301 Industrial Way, San Carlos, CA 94070), the circuit is assembled on a Duroid microstrip line with a 10-mil dielectric, type D-5880. Either the DME375 or the TSP400 may be used in the circuit without modification. Capacitors *C1* and *C2* are 0.6-to-6-pF variable units, *C3* and *C4* are 82-pF chip capacitors, and C5 is a 200-μF, 50-volt electrolytic. The circuit is designed for operation on a 50-volt dc power supply. The nominal operating frequency is 1090 MHz (or 1.09 GHz), although it can be used as low as 1.02 GHz and up to 1.15 GHz with the DME375. If operated as a pulse amplifier (10 μsec at a 1% duty cycle), the circuit can deliver a peak output of nearly 400 watts to a 50-ohm load.

So, if you're bored with computer technology, turned off by the popularity of CB, and have achieved near perfection in your audio designs, try the microwaves for *a real challenge*.

Reader's Circuit. You may have been intrigued by Harold Wright's *Model Railroad Sound Synthesizer* in last December's issue but would rather tackle something a little simpler for a start. If so, you might like to try the inexpensive model train steam whistle circuit shown in Fig. 3. Submitted by reader Ralph O. Bentley (606 Lake View, South Milwaukee, WI 53172), the circuit requires only two active devices, an LM389 IC and a small general-purpose npn transistor, *Q1*. Designed for operation on a standard 12-volt dc source, the circuit can be assembled on perf board. The LM389 was described in our September, 1976 "Solid State" column. Manufactured by the National Semiconductor Corporation (2900 Semiconductor Drive, Santa Clara, CA 95051), the device comprises three uncommitted general-purpose transistors and a ten-transistor low-power audio amplifier in an 18-pin DIP.

Ralph has used two of the IC's uncommitted transistors as RC phase-shift audio oscillators, coupling their outputs to the input of the audio amplifier section at pin 16. The remaining transistor is diode-connected and used as a white-noise generator, with its output applied to external transistor *Q1*, where the noise signal is amplified and applied back to the audio amplifier section through another capacitor. Each phase-shift oscillator can be individually "tuned" with a 50k potentiometer, with a common 100k potentiometer serving to establish tonal balance. The amplifier's gain is controlled by a potentiometer connected between pins 4 and 12. Capable of delivering up to 500 nW to a 16-ohm PM loudspeaker, the amplifier provides ample output for most uses.

Standard components are used in the design. Except for the potentiometers, all resistors can be either one-quarter or one-half watt types, at the builder's option. The electrolytic, which

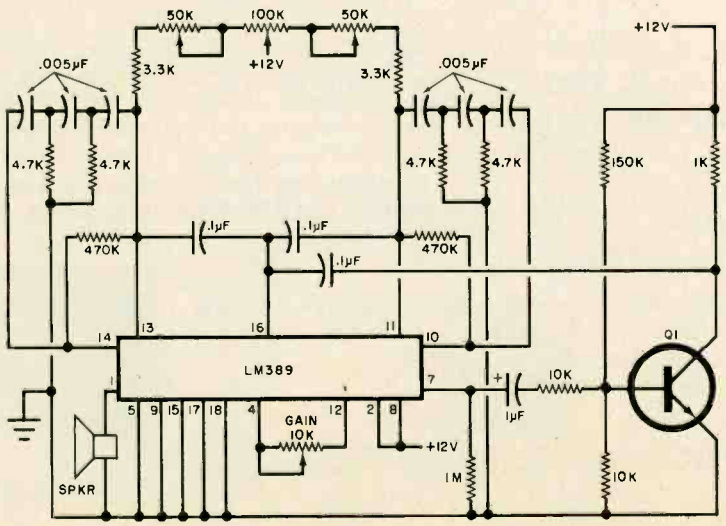

Fig. 3. Inexpensive circuit for a model train steam whistle sent in by a reader.

should be a 15-volt unit, is identified by a polarity sign, while all other capacitors can be either low-voltage ceramics, tubular paper, or plastic-film types. A spst pushbutton control switch should be connected in series with one of the power leads.

After assembly and the customary check for possible wiring errors or accidental shorts, one minor adjustment is required before the unit is ready for use. With the power on, advance the 100k potentiometer until the signals from both oscillators can be heard through the loudspeaker, readjusting the gain control if necessary. Adjust the individual 50k pots until zero beat is achieved or until a single low-frequency tone can be heard. Afterwards, adjust for the desired tonal balance using the 100k pot alone.

Device/Product News. If you're in to high-power projects and price is no object, RCA's Electro-Optics and Devices group (Route 202, Somerville, NJ 08876) has a new family of silicon power devices that should really turn you on. Dubbed *Transcalent* devices, the new units have heat pipes bonded directly to the semiconductor wafers, and feature high current capabilites, high blocking voltages, light weight and small size. The *Transcalent* family currently comprises three series of devices: the P95000EB 250-A rectifiers with blocking voltages to 1200 V, the P95200EE4 100-A npn transistors, and the P95400EB 400-A thyristors (SCR's) with blocking voltages to 1200 V. Potential commercial applications for the devices include welding control, induction heating, electroplating, vehicular drives, heavy-duty power supplies, and motor speed control—wherever high voltages and high currents must be controlled.

Motorola Semiconductor Products, Inc., (P.O. Box 20912, Phoenix, AZ 20912) has introduced a new breed of transistors with improved power handling capabilities. Identified as *Powerbase* devices, the transistors feature a unique "base spreading resistance ring" which produces more uniform current flow through the epitaxial-base region, thus reducing destructive "hot spots." Offered in standard TO-3 packages, the new *Powerbase* units include the 2N3055H, the MJ5015, the 2N3773, and the 2N6609, with the latter two devices an npn/pnp complementary pair.

Motorola also has announced a new quad linear IC which combines two different functions in a single package. Designated type MC3405/3505, the unit comprises two operational amplifiers similar to type MC3403/3503 with a pair of dc comparators similar to type LM339/139. Supplied in 14-pin DIP's, the MC3405 has a specified operating temperature range of 0°C to +70°C, while the identical (electrically) MC3505 is specified for −55°C to +125°C.

National Semiconductor Corporation has developed a series of 2.5-volt reference IC's that perform as if they were zener shunt regulators. The result is a 2.5-volt reference diode that can be used as either a positive or negative reference device and which features an adjustable breakdown voltage and temperature coefficient. Identified as the LM136/236/336 series, the units operate over an input current range of 300 μA to 10mA. When trimmed to operate with a minimum temperature coefficient, the LM336, typically, has a variation of only 2.5 mV over the commercial temperature range, and is guaranteed 6 mV, maximum. The dynamic impedance of the LM136 series is a low 0.6 ohms, maximum. Although basically 2-terminal devices, the series includes an optional third terminal for trimming to precise application requirements. The devices are supplied in 3-lead TO-46 metal packages, with the LM336 also available in a TO-92 plastic package. ◇