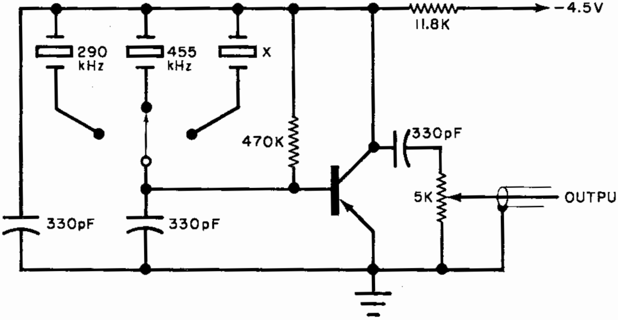
TWO-WAY SECOND I-F SPOTTER

This circuit was built to check 2-way mobile radios having 290- or 455-kHz intermediate frequencies. Two crystals, one at 455 kHz and the other at 290 kHz, determine the frequency of oscillation. The switch is set to select the appropriate crystal. The output level of the oscillator is adjusted by the setting of the 5000-ohm potentiometer. The output level is sufficient for use in adjusting the rig's second i-f. A third crystal can be included for a marker or other fixed frequency output.—*Bob Goff*



technical topics

Four off-beat circuit applications you can use. Most unusual is the multivibrator-type i.f. sweep gen.

by ROBERT F. SCOTT
TECHNICAL EDITOR

SELECTING MATERIAL FOR THIS COLUMN can be frustrating. We never know whether the material selected will interest most of you. Some months back, you indicated that you like *Technical Topics* and want to see it more often. I have a constant fear of saturating you with material that turns you off. This is your column so why make me play guessing games? Drop me a line and tell me just what subjects interest you and what type of material you'd like to see.

We gather our material from application notes and limited-circulation and foreign magazines so it may take a while to work up material on *your* pet subject. If enough of you tell me what you want, we'll be able to get it and even tell you when it will appear. Meanwhile, here are a few circuits that you may want to adapt for your own needs.

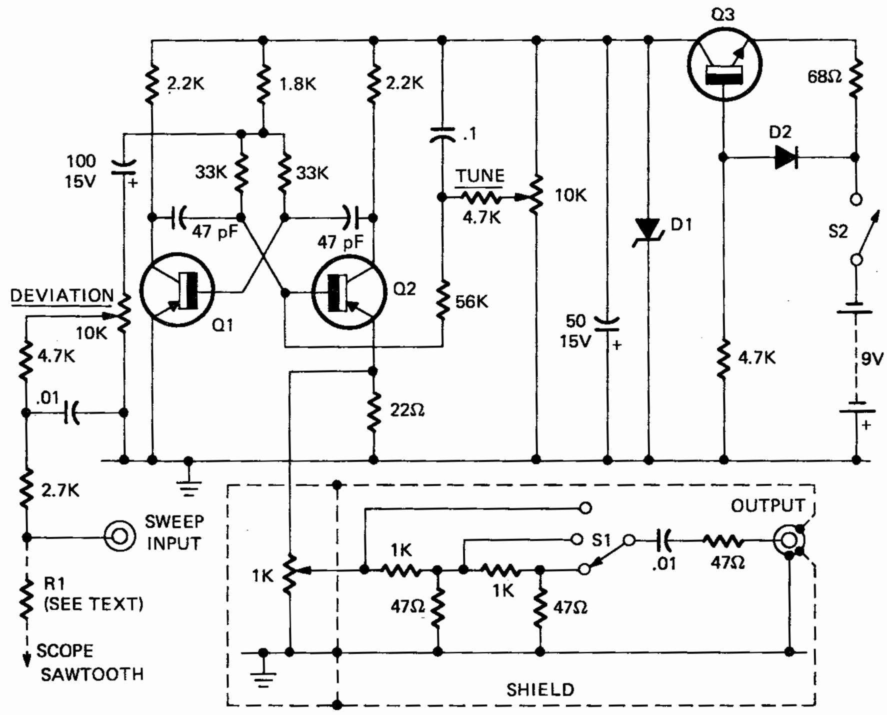
Unusual i.f. sweep generator

The response of i.f. strips, bandpass filters and various forms of FM detectors can be checked and corrected, if necessary, by using a sweep generator and a scope. Most sweep generators consist of an rf *sinewave* oscillator whose frequency is swept about a center point by a reactance tube, an Increductor (voltage-variable inductor) or a variable-capacitance diode.

In a recent issue of *Radio Communication*, G8CGA points out that a sinewave source is not necessary when checking the response of high-Q tuned circuits. The prime requisite is a signal whose amplitude is constant over the swept range. Fig. 1 is the circuit of a sweep generator using a saturating-type multivibrator oscillator. The frequency is varied about the center point by applying a sawtooth voltage as bias to the base of Q2. The sawtooth excitation voltage is tapped off the scope's sweep oscillator and fed to the common base circuit through the DEVIATION control. The value of resistor R1 is determined by the magnitude of the sawtooth from the scope. It should be about 40,000 ohms for each 10 volts peak-to-peak of sweep voltage. The output signal level is controlled by a 3-step attenuator and a 1000-ohm pot for smooth control.

With the values shown, the multivibrator can be tuned from about 440 to 550 kHz. Frequencies as high as 20–30 MHz can be covered using adequate transistors and adjustments in circuit constants.

When using the sweep generator, set the scope sweep-speed control for the lowest rate that can be used without objectionable flicker on the trace. In any event, the response curve will be distorted if the sweep rate is too high. Start with a very slow sweep and increase it to the point where the trace starts to distort and then back off a hair.



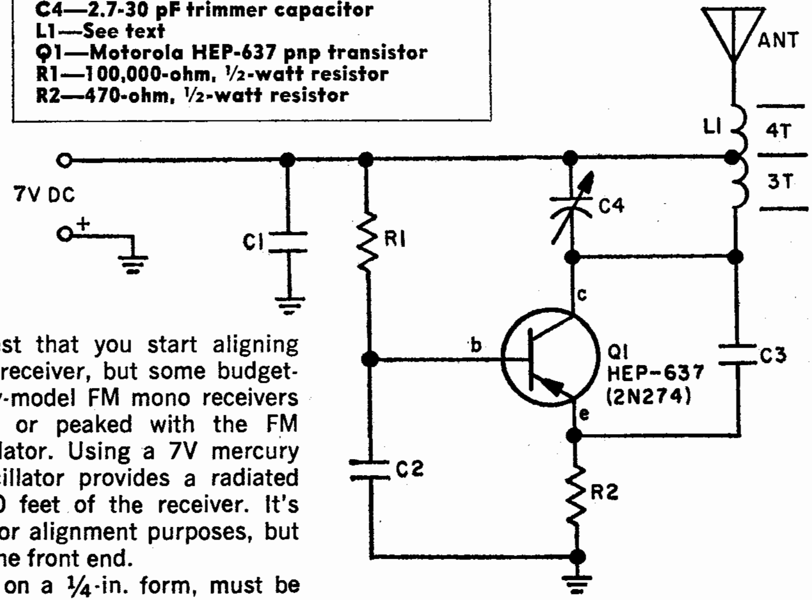
Q1, Q2 = BFX12, GE-12, HEP-52, ETC.
Q3 = GE-7, HEP-641, ETC.
D1 = 6.1V ZENER
D2 = GE-504A, HEP-156, ETC.

FIG. 1—MULTIVIBRATOR SIGNAL GENERATOR delivers sweep signal for i.f. circuit alignment.

56 FM Alignment Oscillator

PARTS LIST FOR FM ALIGNMENT OSCILLATOR

C1, C2—500-pF, 100-VDC capacitor
C3—5-pF silver mica capacitor
C4—2.7-30 pF trimmer capacitor
L1—See text
Q1—Motorola HEP-637 pnp transistor
R1—100,000-ohm, ½-watt resistor
R2—470-ohm, ½-watt resistor



We don't suggest that you start aligning your stereo FM receiver, but some budget-priced and early-model FM mono receivers can be aligned or peaked with the FM Alignment Oscillator. Using a 7V mercury battery, the oscillator provides a radiated signal within 10 feet of the receiver. It's strong enough for alignment purposes, but won't overload the front end.

Coil L1, wound on a ¼-in. form, must be

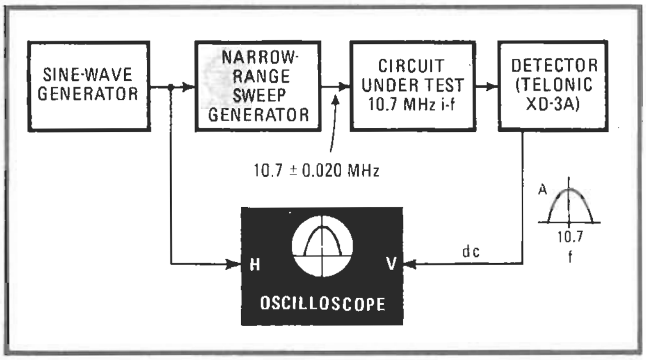
Narrow-band sweep source reduces incidental fm

by James Isbell Jr.
Radio Astronomy Department, University of Texas, Austin, Texas

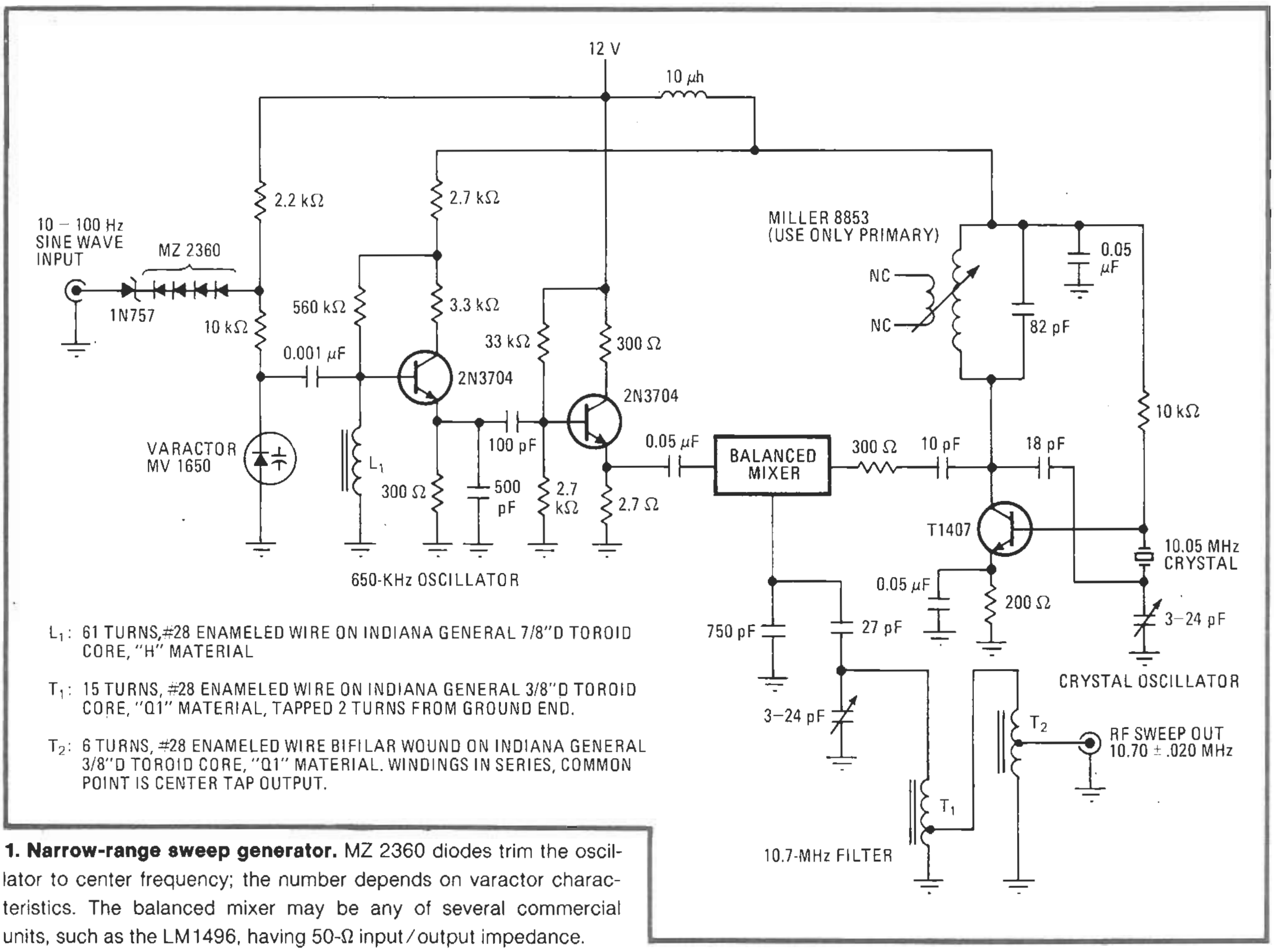
A low-frequency oscillator and balanced modulator can generate a 40-kilohertz sweep range centered at 10.7 megahertz, which is suitable for aligning the intermediate-frequency amplifiers in a standard frequency-modulation receiver. The narrow sweep-source is advantageous when observing the test-circuit response on an oscilloscope because the scope pattern is stable, a condition not possible when a wide-band sweep generator is used. The sweep width of the circuit is 2½ times less than that of a commercial sweep source, thus reducing the incidental fm generation to a point where it is not troublesome.

As shown in Fig. 1, a 10.05-MHz crystal-controlled oscillator is mixed with a low-frequency sweep oscillator centered at 650 KHz. The setup produces an output frequency at 10.7 MHz, which is varied 20 KHz to either side of the center by tuning the 650-KHz oscillator. This method is preferable to controlling the high-frequency oscillator because of stability considerations.

The tuned-input sweep oscillator uses a varactor diode



2. Performance second to none. Sine-wave generator output is approximately 0 – 2 V at frequencies below 100 Hz. Lower sweep rates produce a more stable scope pattern, because circuit response rings less. The detector may be any general peak-detecting type.



1. Narrow-range sweep generator. MZ 2360 diodes trim the oscillator to center frequency; the number depends on varactor characteristics. The balanced mixer may be any of several commercial units, such as the LM1496, having 50-Ω input/output impedance.

controlled by the amplitude of a sine-wave generator to vary its frequency. The sinusoidal control signal is approximately 2 volts rms at a frequency of 10 hertz. This frequency may be increased, but if it is higher than 100 Hz, the settling-time of the circuit under test can create difficulty in observing its response. While reducing the sine-wave amplitude will reduce the 40-kHz sweep width, it will produce only an infinitesimal reduction because the normal sine-wave amplitude is enough to swamp the varactor.

The output of the balanced mixer is 10.7 ± 0.020 MHz. Other components produced by the modulation process (mostly harmonics) may cause difficulty in obtaining a stable scope pattern. A 10.7-MHz bandpass filter removes these components, and then the signal is presented to the circuit under test (Fig. 2).

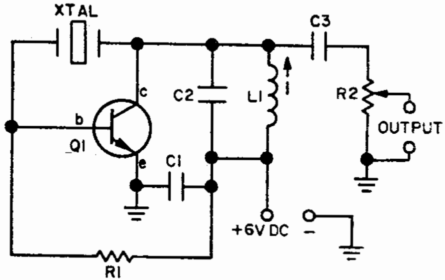
The peak output voltage of the i-f amplifiers (which make up the test circuit) is a function of the input frequency. It must be converted to dc if the circuit's bandpass response is to be observed accurately. A peak-detecting circuit, essentially a rectifier and integrating network, is used for the conversion; in this case, it is a commercial unit, the Telonic XD-3A. The dc signal produced is then applied to the vertical input of the oscilloscope, while the horizontal input is driven by the sine-wave oscillator.

The frequency-response curve is thereby traced out. The pattern remains stable and accurate, because the frequency modulation produced by the narrow-range generator is minimal, and consequently the detector response is not changing with each sweep cycle. □

Engineer's notebook is a regular feature in *Electronics*. We invite readers to submit original design shortcuts, calculation aids, measurement and test techniques, and other ideas for saving engineering time or cost. We'll pay $50 for each item published.

Calculator notes

18 Simple IF Signal Generator



PARTS LIST FOR SIMPLE IF SIGNAL GENERATOR
C1—0.05-uF, 25-VDC capacitor
C2—50-pF silver mica capacitor
C3—15-pF silver mica capacitor
L1—3.4-5.8 mH RF coil (J.W. Miller 21A473RB1)
Q1—GE-5 npn transistor
R1—330,000-ohm, ½-watt resistor
R2—5000-ohm, potentiometer
XTL—455-kHz crystal

Using a 455-kHz crystal, this generator provides a signal for testing and aligning radio IF circuits. The unit is built on a perf-board or some other rigid mounting to achieve good circuit stability. A metal cabinet reduces radiation so the signal fed to the receiver will be primarily determined by level control R2.

To align the completed circuit, adjust L1's slug for maximum S-meter reading in a receiver or connect R2 to an oscilloscope and adjust L1 for maximum output.

Turn the power supply *on* and *off* several times to make certain the oscillator starts consistently. If the oscillator fails to start every time, adjust L1's slug *slightly* until you obtain immediate and consistent starting each time the power is applied.