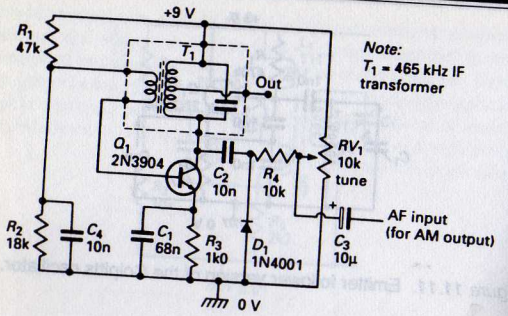

Figure 11.13. 465kHz B.F.O. with varactor tuning and FM facility.

Figure 11.14 shows a wide-range crystal oscillator designed for use with a parallel-mode crystal. This is actually a Pierce oscillator circuit, and can be used with virtually any good 100kHz to 5MHz parallel-mode crystal without need for circuit modification.

Alternatively, *Figure 11.15* shows a 100kHz Colpitts oscillator designed for use with a series-mode crystal. Note that the L_1–$C1$–C_2 tuned circuit is designed to resonate at the same frequency as the crystal, and that its component values must be changed if other crystal frequencies are used.

Finally, *Figure 11.16* shows an exceptionally useful two-transistor oscillator that can be used with any 50kHz to 10MHz series-resonant crystal. Q_1 is wired as a common-base amplifier and Q_2 is an emitter follower, and the output signal (from Q_2 emitter) is fed back to the input (Q_1 emitter) via C_2 and the series-resonant crystal. This excellent circuit will oscillate with any crystal that shows the slightest sign of life.

White noise generator

One useful 'linear' but non-sinusoidal waveform is that known as 'white noise', which contains a full spectrum of randomly generated frequencies, each with equal mean power when averaged over a unit of

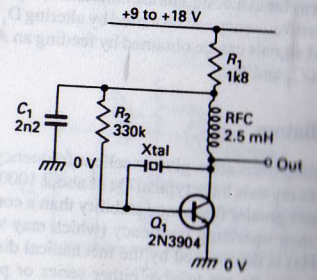

Figure 11.14. Wide-range Pierce oscillator uses parallel-mode crystal.

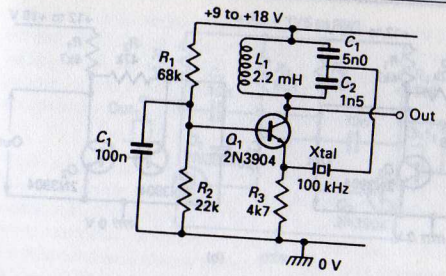

Figure 11.15. 100kHz Colpitts oscillator uses series-mode crystal.

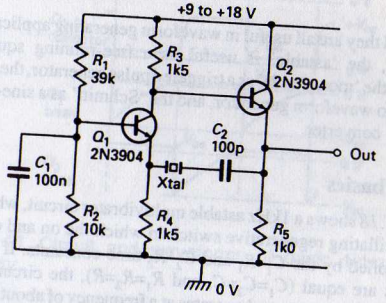

Figure 11.16. Wide-range (50kHz–10MHz oscillator can be used with almost any series-mode crystal.

time. White noise is of value in testing AF and RF amplifiers, and is widely used in special-effects sound generator systems.

Figure 11.17(a) shows a simple white noise generator that relies on the fact that all Zener diodes generate substantial white noise when operated at a low current. R_2 and ZD_1 are wired in a negative-feedback loop between the collector and base of common-emitter amplifier Q_1, thus stabilising the circuits d.c. working levels, and the loop is a.c.-decoupled via C_1. ZD_1 thus acts as a white noise source that is wired in series with the base of Q_1, which amplifies the noise to a useful level of about 1V0 peak-to-peak. Any 5V6 to 12V Zener diode can be used in this circuit.

Figure 11.17(b) is a simple variation of the above design, with the reverse-biased base-emitter junction of a 2N3904 transistor (which 'zeners' at about 6V) used as the noise-generating Zener diode.

Multivibrator circuits

Multivibrators are two-state circuits that can be switched between one state and the other via a suitable trigger signal, which may be generated either internally or externally. There are four basic types of 'multi'