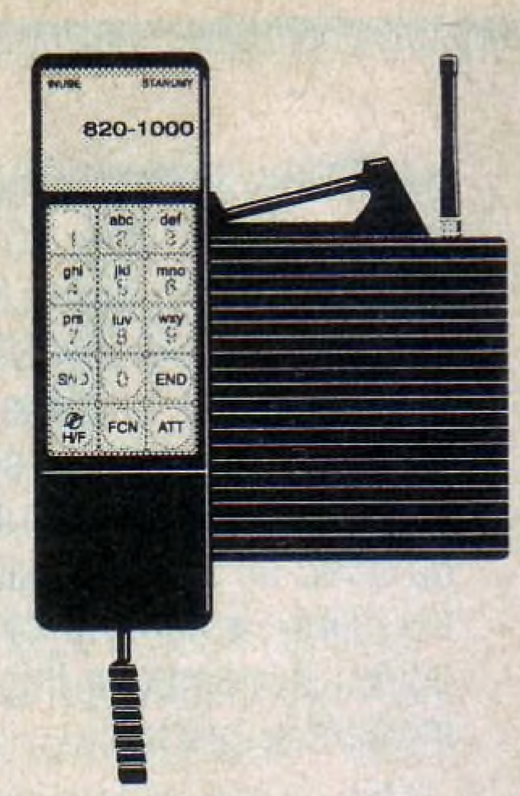


BY DARREN YATES

Simple 2-transistor CW filter

If you're having trouble picking CW signals out of the mud, then try this handy little circuit. It's a 2-transistor CW filter & it's just the shot for beefing up those buried signals.

Deciphering CW signals on a noisy band can often be quite difficult, particularly for novice operators with only basic equipment. Fortunately, there are various techniques that can be used to "clean-up" the signal.

By far the most common technique is to employ a CW filter. A CW (or continuous wave) transmission, as used for Morse code, is essentially an interrupted carrier; ie, the carrier is switched on and off by the Morse key. When you tune your receiver, you tune it close enough to the incoming carrier to give an audible beat.

Most people tune their receiver to give a beat somewhere below 1kHz. This is particularly the case where you have a noisy signal; a lower audible frequency can be somewhat easier to distinguish from the noise and this is where this CW filter comes in. It is essentially a notch filter set at 750Hz which effectively attenuates noise either side of this frequency and thus greatly improves signal reception.

In use, you tune the receiver so that the audible beat is right on 750Hz, at which point the modulated carrier will stand out well above the noise.

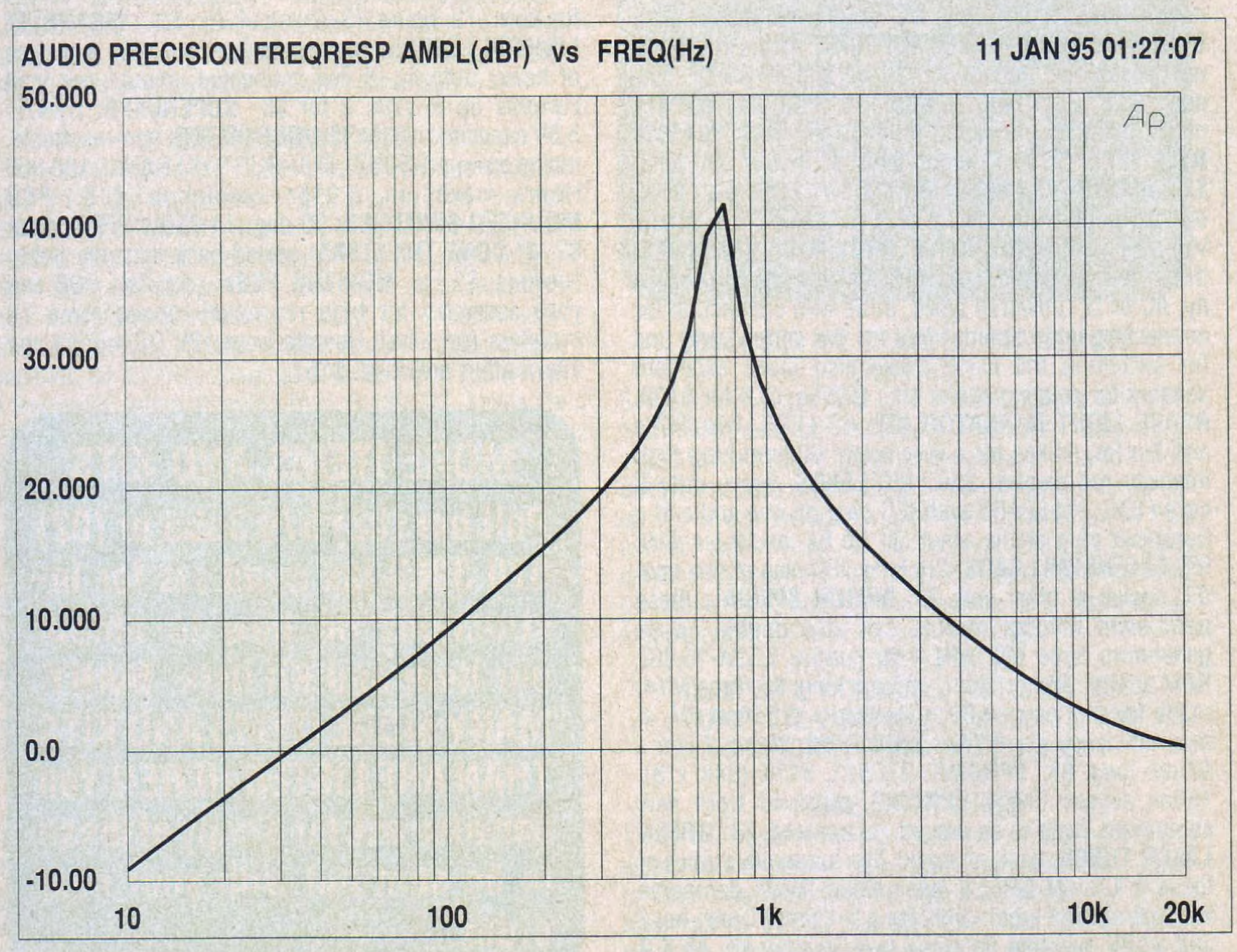


Fig.1: the frequency response of the filter. The passband is centred on 750Hz.

The circuit itself uses just two transistors and a handful of passive components. It is built on a PC board measuring just 46 x 36mm, which should be small enough to fit inside most receivers. The power supply requirements are a 9-12V DC at just a few milliamps and this can easily be derived from an existing supply rail.

Fig.1 shows the frequency response of the filter, as measured on an Audio Precision audio test set. As can be seen, it effectively provides around 40dB of gain at 750Hz.

Circuit details

Refer now to Fig.2 for the circuit details of the CW Filter. It is basically a 2-transistor amplifier with a twin-T filter in the feedback path.

In greater detail, transistors Q1 and Q2 make up a DC feedback pair, with negative feedback applied from Q2's collector to Q1's emitter via the twin-T filter network. The input signal is applied via a 0.1μF capacitor to Q1's base, while the 120kΩ and 150kΩ resistors set the bias for this stage.

The 330Ω resistor and series 1μF capacitor roll off the low-frequency response of this first stage, to make the overall filtering more effective. The resulting amplified output on Q1's collector is then fed directly into base of PNP transistor Q2. Note the 33kΩ load resistor on Q1's collector. This is not strictly necessary but has been included since it significantly reduces distortion.

Finally, the amplified signal on Q2's collector is coupled to the output via a 10μF capacitor.

Twin-T filter

Six components are used in the twin-T filter network: two 2.2kΩ resistors, a 1.1kΩ resistor, two 0.1μF capacitors and a 0.22μF capacitor. Its

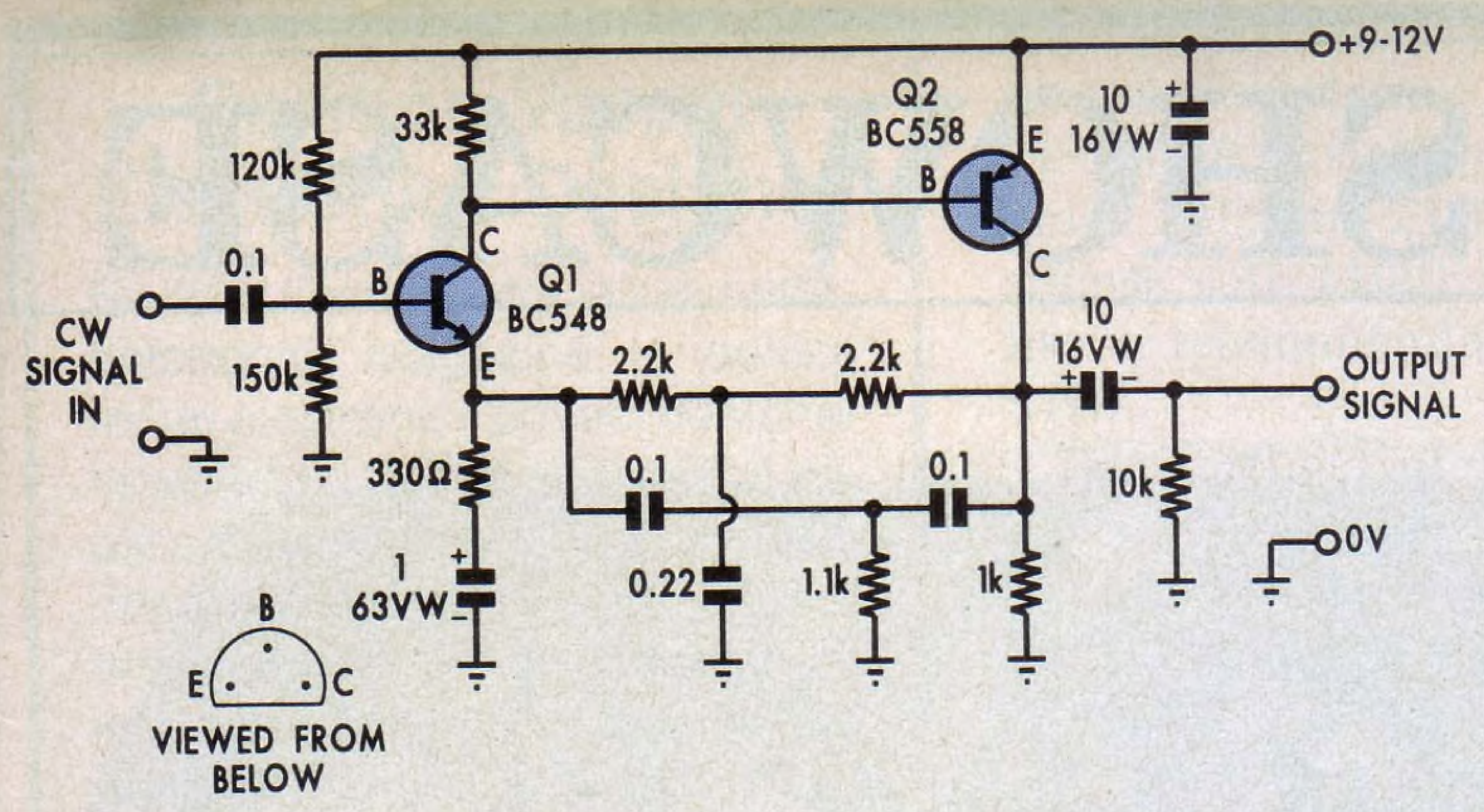


Fig.2: Q1 & Q2 make up a DC feedback pair, with negative feedback applied from Q2's collector to Q1's emitter via a twin-T filter network.

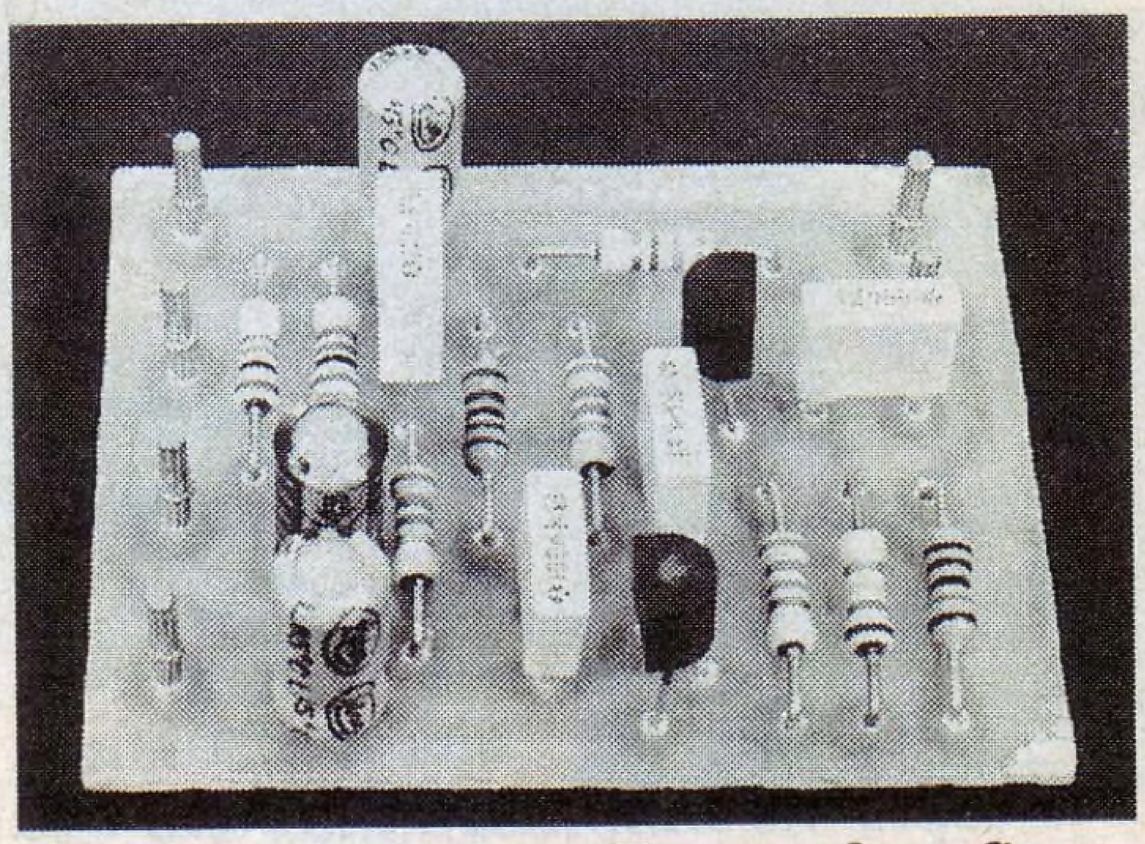
ACTIVE FILTER FOR CW RECEPTION

notch frequency is determined by the formula F= 1/(2πRC).

Since the impedance of the twin-T network is a maximum at this frequency (in this case, 750Hz), this corresponds to minimum negative feedback and the maximum gain. Note that because the circuit has considerable gain at the notch frequency, the input signal needs to be below 20mV in order to prevent clipping at the output. If you have too much signal, just wind back the volume control or use a resistive attenuator to reduce the input level.

Construction

All the components for the CW filter are installed a PC board coded 06104951. Fig.3 shows the details.



The PC board is small enough to fit inside most receivers.

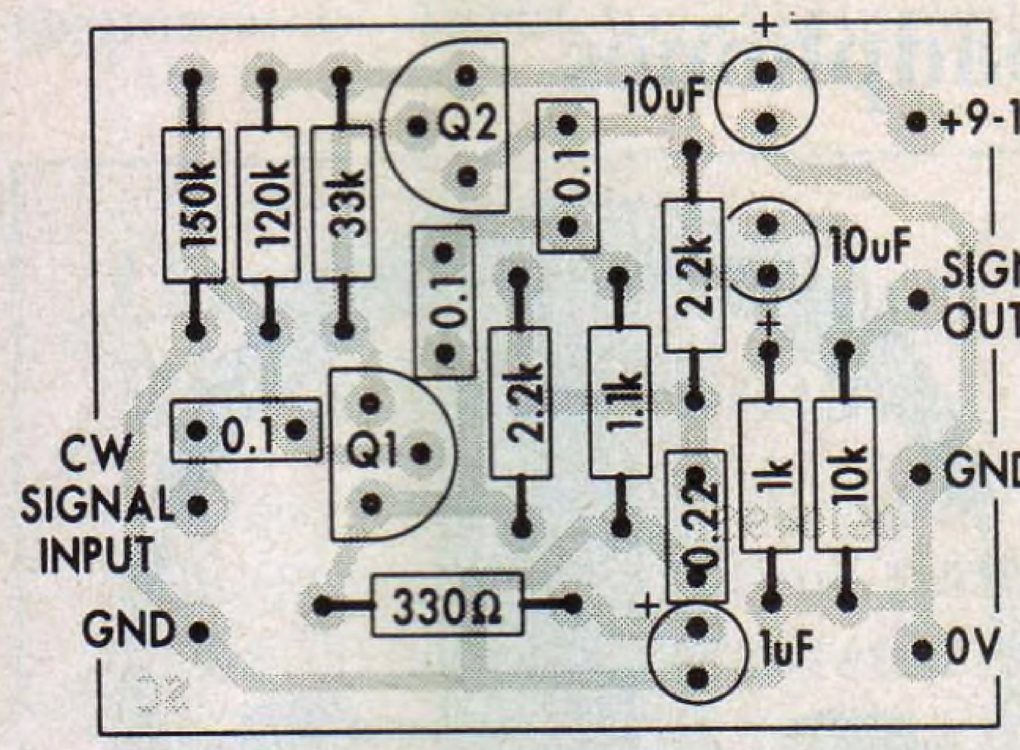
Begin construction by installing PC stakes at the external wiring points, then install the resistors and capacitors. Table 1 lists the resistor colour codes but it is also a good idea to check them on your multimeter, as some colours can be difficult to decipher. Be sure to install the electrolytic capacitors with the correct polarity.

Finally, complete the assembly by installing the two transistors.

The finished PC board can be mounted inside the receiver or installed in a plastic case and run off batteries or a DC plugpack. If you elect to mount the unit separately, then you will need to fit an on/off switch.

The filter can be driven from the volume control, from the headphone output, or from the "record" output of most receivers. In fact, by using the record output, which allows the loudspeaker to operate in normal fashion, it is possible to compare the filtered and unfiltered signals. You will be amazed at the difference.

Finally, note that careful tuning of the receiver will be necessary to ensure that the beat frequency is centred within the narrow filter passband. This is not as difficult as it sounds and is readily done by ear. **SC**



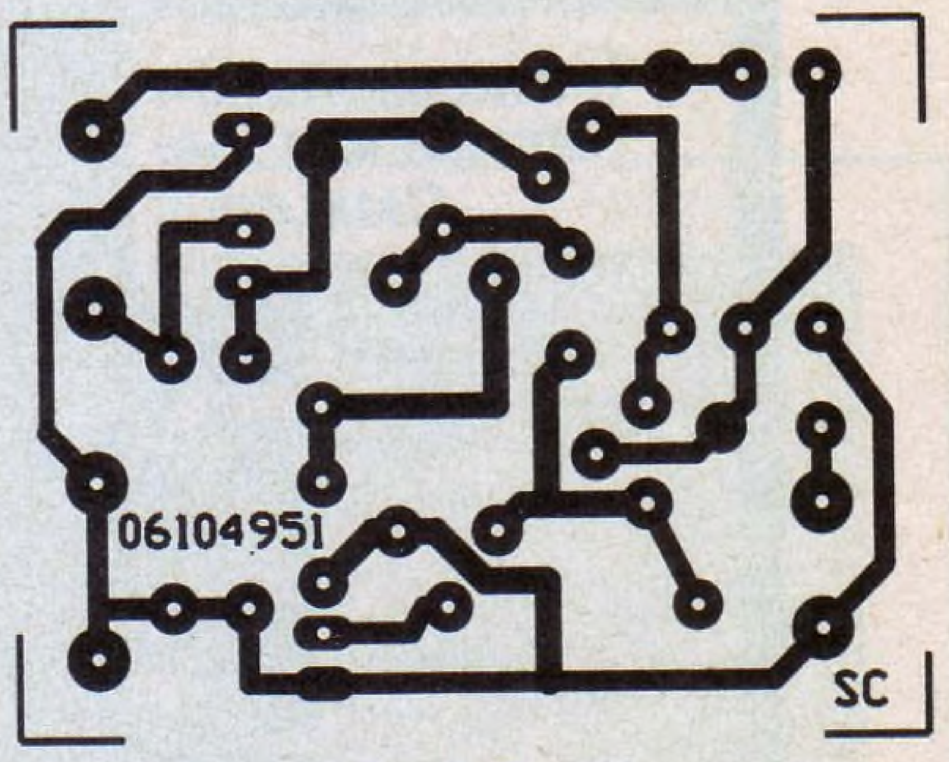


Fig.3 (left) shows how the parts are installed on the PC board while Fig.4 (right) shows the full-size etching pattern.

PARTS LIST

1 PC board, code 06104951, 46 x 36mm
6 PC stakes

Semiconductors
1 BC548 NPN transistor (Q1)
1 BC558 PNP transistor (Q2)

Capacitors
2 10µF 16VW electrolytic
1 1µF 16VW electrolytic
1 0.22µF MKT polyester
3 0.1µF MKT polyester

Resistors (0.25W, 1%)

1 150kΩ	2 2.2kΩ
1 120kΩ	1 1.1kΩ
1 33kΩ	1 1kΩ
1 10kΩ	1 330Ω

TABLE 1: RESISTOR COLOUR CODES

	No.	Value	4-Band Code (1%)	5-Band Code (1%)
❑	1	150kΩ	brown green yellow brown	brown green black orange brown
❑	1	120kΩ	brown red yellow brown	brown red black orange brown
❑	1	33kΩ	orange orange orange brown	orange orange black red brown
❑	1	10kΩ	brown black orange brown	brown black black red brown
❑	2	2.2kΩ	red red red brown	red red black brown brown
❑	1	1.1kΩ	brown brown red brown	brown brown black brown brown
❑	1	1kΩ	brown black red brown	brown black black brown brown
❑	1	330Ω	orange orange brown brown	orange orange black black brown