strong signals. Other oscillator arrangements were tried but all seemed to suffer from the same problem to one degree or another and so it was back to the Colpitts circuit. Some 455kHz transformers were tried as part of the oscillator circuit but the old problem of thermal drift appeared again particularly when the resonator was pulled off its natural frequency. The only solution was to include an unusually high value capacitor between the base and emitter of the transistor. Despite the relatively small difference in frequency of the two oscillators the values of these capacitors vary quite widely and are fairly critical as are the emitter/ground capacitors if symmetrical waveform and reliable starting are to be maintained.

The Working Circuit

The final circuit shows component values for frequencies of 452kHz (ZTr1) and 455kHz (ZTr2) and these are the b.f.o. frequencies required for the MFL filter. Notes are included at the end of this article for adapting the circuit for other frequencies. The two oscillators are switched into circuit by the FRG-7's MODE switch and diodes ZD1 and 2 ensure that whichever circuit is on, current is still supplied to the buffer amplifier, ZTr3.

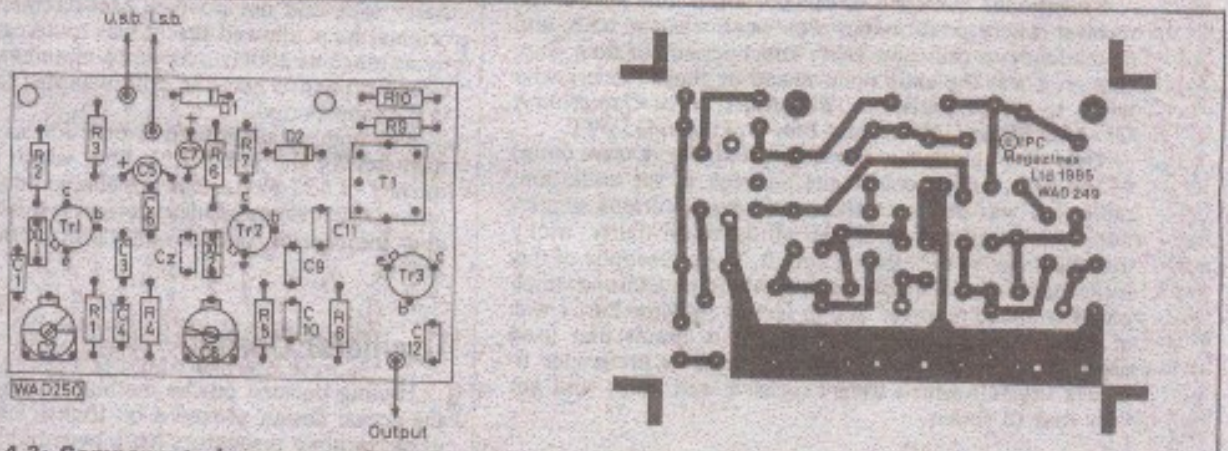

Fig. 4.2: Component placement and p.c.b. track pattern of the ceramic resonator b.f.o., shown full size. Capacitor C_z is not required when using the MFL 453·5kHz filter. Note the prefix letter Z has been omitted for clarity

The circuit based around ZTr1 is for the u.s.b. frequency, 452kHz and ZC1 provides the necessary high capacitance needed to pull the resonator, ZXL1, well off its natural frequency. The trimmer capacitor ZC2, is used to tune the circuit for the exact frequency and capacitor ZC6 couples the output to the transformer, ZT1. The oscillator based on ZTr2 is almost identical except for the values of ZC9 and ZC10 (as already explained). Capacitor C_z is not required when the circuit is used with the MFL filter but may be needed for other frequencies and so provision has been made for it on the p.c.b. layout.

The output from both oscillators goes to the coupling transformer ZT1 which was included to ensure that harmonics were not amplified to any appreciable degree. The transformer used was a second i.f. type salvaged from a portable radio but if a suitable component is not to hand a part number is included on Fig. 4.1.

Harmonics from this circuit are at roughly the same level as those from the set's existing b.f.o. and fitting the circuit board inside a screened case would obviously reduce them even further. Adding de-coupling capacitors back along the switched supply will also make a marginal difference. However, try the unit as it is as in my own case I found harmonics only appeared at low level at two points on the kilohertz tuning dial and were not a nuisance.

Construction and Fitting

Construction is fairly straightforward and the only word of caution concerns the capacitors in the tuned circuits. These should be good quality devices otherwise expect degraded stability. Use of the printed circuit board is advised as materials such as strip board may cause problems because of capacitance between tracks and non-compatibility with the pin-out of the transformer. The p.c.b. also has the advantage of having mounting holes that match existing positions on the FRG-7's chassis.

Once construction is complete the fitting process is fairly easy although the MODE switch will have to be unmounted and pulled out of its hole. Refer to Fig. 4.3 and note the position of the wire that bridges two contacts on the back wafer of the switch and then goes to a pad on the IF/AF board where it feeds to R442. This connection is the power supply feed to the original b.f.o. and the bridge on the wafer switch must be cut and the wire unsoldered from the pad. A second wire is soldered onto the now disconnected switch contact and both the wires now carry the appropriate oscillator supply to the new b.f.o. board.

It is important now that the coupling capacitor in the set's own b.f.o. is removed. It is clearly marked on the board as C439 and must be taken out of circuit otherwise the old b.f.o. will load the new circuit.

The output of the new b.f.o. is fed via a short wire link to the pillar of test point TP405 on the IF/AF board. The only other connection is chassis ground which can be taken to any convenient point.

Once these connections have been made, remove the two screws that hold the IF/AF board to the front right hand side of the chassis and replace them with screws from the underside of the chassis so that 25mm mounting pillars can be screwed onto them from the top. The p.c.b. is now mounted on these pillars and assuming there are no faults it only remains for the correct frequencies to be set up.

Alignment with Instruments

The use of a digital frequency meter and an oscilloscope will make alignment quick and easy but do not worry too much if you do not have access to such instruments. Absolute accuracy of frequency is not as important as