stability and that latter quality is virtually guaranteed by the ceramic resonators. Assuming the instruments are available, allow half an hour for the set to warm up, disconnect the antenna and find any tuning point where there is no signal of any kind. Switch to u.s.b. and monitor the circuit output. Tune ZC2 for 452kHz and adjust the core of the transformer for a good symmetrical waveform. Note that this adjustment may well affect the frequency of the oscillator slightly but don't worry about that at this stage. Now switch to l.s.b. and trim ZC8 for 455kHz. If the oscillator won't start, you will need to adjust the core of the transformer until it does. With the oscillators running at roughly the required frequencies it is now necessary to find a setting of the transformer's slug where the output level from each is roughly equal. Once this has been achieved, do not touch the transformer any further and now make final adjustments to obtain exact frequencies by using the trimming capacitors.

Trial and Error Alignment

If trial and error must be used then start by turning the core of ZT1 until it is fully out and set ZC8 for maximum capacitance. Connect an antenna to the set, switch in the WIDE filter and find a good strong a.m. broadcast transmission. Tune it as accurately as possible using the S-meter and then switch to l.s.b. Now trim ZC8 until you hear the b.f.o. zero beat with the transmission (if this does not happen try screwing in ZT1's slug until it does). Once you have the zero beat, screw in the transformer slug and at some point the oscillator should switch off (if it does not, just leave the slug set at the mid-way position). Bring the slug back by a slight turn, switch to a.m. and then back to l.s.b. and the oscillator should start again. Zero beat will probably have been lost but bring it back by slight adjustment of ZC8. That completes the alignment for l.s.b. and the transformer setting.

Now find an amateur s.s.b. station on any of the bands above 10MHz, switch in the NARROW filter, tune for maximum S-meter deflection and trim ZC2 until the signal is resolved. If needs be keep repeating this procedure with different stations until you are happy with the results.

Performance Tests

Performance can now be checked on the various bands and if a d.f.m. has been used the b.f.o. frequencies can be monitored for drift. On the two prototypes built the worst case variation was on the u.s.b. oscillator and this is no doubt due to the relatively high value of capacitor ZC1. If variations greater than 20Hz are encountered then it may be a good idea to change ZC1 for a better quality device. If ZT1 has been salvaged from the junk box it is a good idea to check that it is not coupling an excessive amount of signal to the buffer amplifier. This can be done by monitoring the set's a.g.c. voltage and ensuring that under no-signal conditions it does not alter when either b.f.o. signal is switched in.

Other Sets and IF Frequencies

There is no reason why this circuit should not be used with other sets, particularly those with standard 455kHz i.f. stages. The b.f.o. frequencies for 455kHz will be at 453·5kHz and 456·5kHz. For the lower frequency, the component values around ZTr1 should work although ZC1 may need to be reduced. For the higher frequency, it is advisable to use a 460kHz resonator and pull it down in frequency as pulling a 455kHz resonator up can lead to unreliable starting. Using the 460kHz version (CRM460) for ZXL2, C_x will need to be included (try about 100pF) and the values of ZC9/10 will need to be juggled although start by trying different values for ZC10 only.

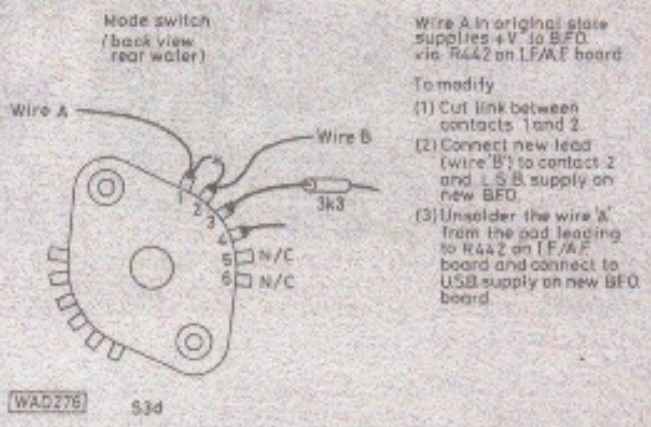

Fig. 4.3: Details of the modifications to the MODE switch wiring

Back to Battery Packs

Apart from b.f.o.s the other main query raised by readers concerned the battery pack. My brain was obviously not fully engaged when I suggested in the first article that NiCads could be used, U2 versions of these cells are rated at 1·2 volts and multiplied by 8 that comes to only 9·6 volts which is 0·4 volts less than the output of the set's regulator. Reader John Hunt picked me up on this point and offered a solution. John is currently working in Iran and has great difficulty in obtaining U2 dry cells and so has opted for NiCads. He suggests fitting an L-shaped bracket to the back of the battery pack and mounting a dual (side-by-side) U2 holder on it. This unit is then merely wired in series with the existing holder to give 12 volts from the 10 cells. I have not actually fitted this modification to my own set but have measured the available space and confirmed that John is quite right, the extra cells are positioned in the space above the audio amplifier i.c.

This modification is worth considering even for normal dry cell use because as reader Bob Marshall pointed out even 12 volts is going to leave the regulator struggling the moment the battery voltage starts to sag. Using ten cells will give 15 volts and the set will happily cope with this.

Bob Marshall came up with one final simple trick that improves the audio quality of the set. The FRG-7 and many sets like it suffer from poor loudspeaker performance particularly when receiving broadcast stations. Bob tried sealing up all the ventilation holes and slots and found there was a noticeable improvement. He pointed out that as the set only consumes around 15 watts of power these slots are really quite unnecessary and it is quite easy to carry out this modification using sticky tape.

Finally, thank you to everyone who wrote in with ideas and I am pleased to say that from the correspondence it is clear that this series has provided solutions to these shortcomings that could be tackled at reasonable cost. I hope owners who fit circuits get as much enjoyment from their "new" FRG-7 as I do from mine. ●