TABLE 1

VFO characteristics required for all band operation 160m through to 10m. 10.7 MHz if assumed.

Band	Signal frequency MHz	LO frequency MHz	% Swing
160m	1.8 to 2.0	12.5 to 12.7	1.6
80m	3.5 to 4.0	14.2 to 14.7	3.5
40m	7.0 to 7.3	17.7 to 18.0	1.7
30m	10.1. to 10.15	20.8 to 20.95	0.3
20m	14.0 to 14.35	24.7 to 25.05	1.4
17m	18.67 to 18.77	29.37 to 29.47	0.4
15m	21.0 to 21.45	31.7 to 32.15	1.4
10m	28 to 29.7	38.7 to 40.4	4.3

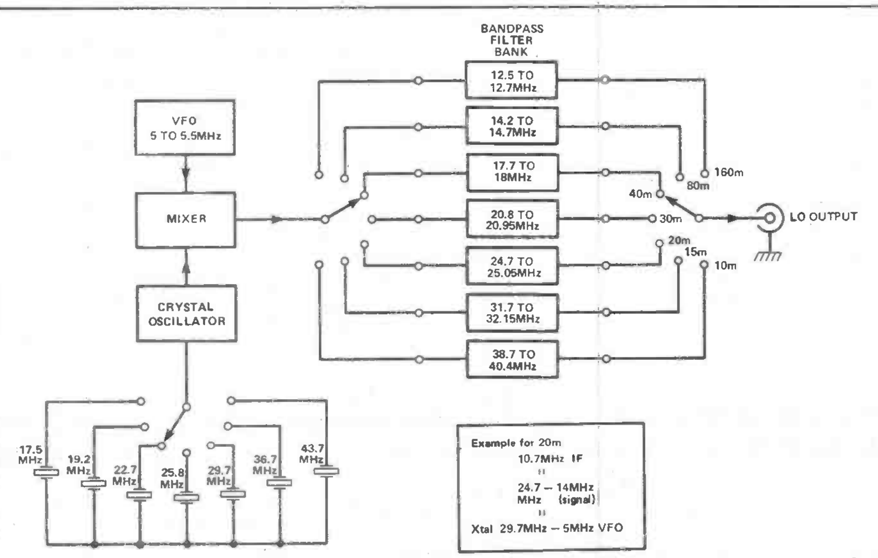

Fig. 4. The traditional method of generating the local oscillator signal from a VFO and crystal bank

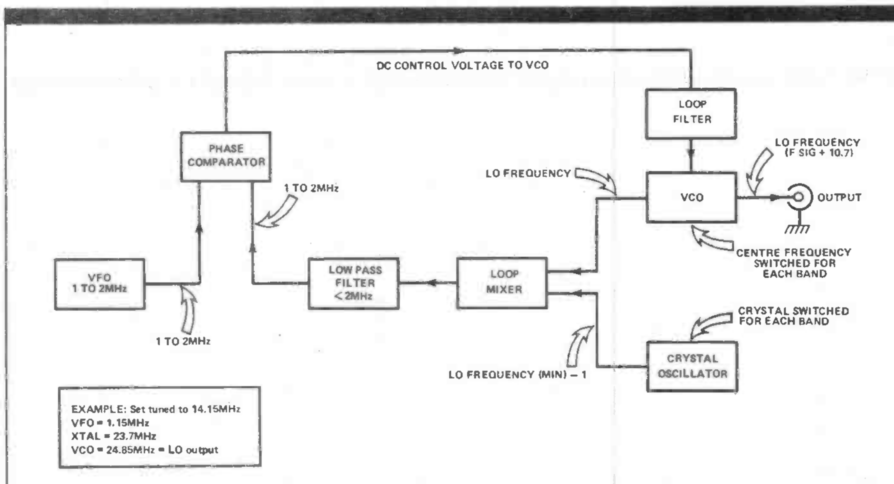

Fig. 5. Block diagram of the proposed single loop synthesised VFO

manufactured during the mid-Seventies. It often works demonstrably better than the latest gear although it has its own problems. In particular, this type of *direct synthesis* system is prone to spurious signals because of the image products formed during the mixing process. It is also noisier than the basic VFO but not nearly as noisy as digital circuits. Furthermore the bandpass filter bank required to filter out the unwanted mixing products is a fairly cumbersome piece of circuitry. However the stability (from a frequency point of view) is virtually that of the basic VFO.

The design pursued as the basis for the HRT transceiver combines the best aspects of direct and digital synthesis to produce a VFO with little compromise between the two. I confess that the concept is not original, but very few these days are. **Fig. 5** shows how the system fits together. The main tuning control – the box marked VFO/1 to 2MHz – is analogue and represents a free running oscillator operating over this range.

I don't propose to offer a discourse on closed loop synthesisers. You must therefore take me at my word when I say that the VFO subsystem, schematic **Fig. 6**, operates as the reference oscillator of a conventional PLL system. Anything it does makes everything else do the same. Therefore the LO output to the TX/RX mixer will be shifted by a constant increment proportional to the crystal oscillator depicted in **Fig. 5**, added to the frequency of the VFO. If the VFO shifts by 100kHz, then the LO output, driven from the VCO, will do the same. If the VFO drifts by 100Hz, then the output will do the same.

The advantages of the system should be apparent. It is a relatively easy task to design a VFO which will provide a stable output in the region of 1 to 2MHz. It should be possible to obtain rather higher stability over a complete MHz of coverage than is possible from the standard 5MHz system covering just half that span. The VCO runs at the output frequency so that it should contain virtually nothing in the way of sproggies provided that the loop filter does its job satisfactorily.

Noise

But what about VCO and synthesiser noise ... wasn't there something about these devices being impossibly dreadful and fit only for use