the best of a bad job. Lots of bipolar oscillator circuits were tried, as were various types of MOSFETs and JFETs. Hartley, rather than Colpitts circuit variations were also put to the test. The one given here with bias for Q9 generated by signal rectification through D21 was the best. I even tried to minimise the noise contribution of the varicap diodes, VC2, by feeding the control voltage from a low impedance voltage source but to no avail.

Commercial Japanese black box manufacturers attempt to get around the problem by tuning very narrow bands so that the contribution of the varicap diode to the total LC product of the oscillator circuit is small. You can get away with this to some extent on amateur gear where the bands are generally narrow and few in number which is why you hear about HF boxes "with nine separate VCOs". Having spent much time studying the problem, I have come to the conclusion that dedicated amateur HF gear is best constructed using the tried method of mixing the output of a switched crystal oscillator (beautifully low noise devices either in their valve or transistor forms) with a narrow band free running VFO. However, neither "nine separate VCOs" or the old method would do what I wanted: a totally general coverage transmitter receiver combination. If I had longer than the 15 months, I would have included both the general coverage VCO shown here, and switched low noise VCOs to cover each of the amateur bands but I thought that 15 months was quite enough for anything.

In the event the performance is good enough for SSB and adequate for the majority of CW working (but not a delight). In fact the noise performance, considering the enormous frequency span, is not significantly worse than the majority of modern solid state amateur gear. I'm waiting for some bright spark to re-invent the valve . . . In fact, I shall make it my next project.

Containing RF

The VCO diecast box was made to fit within a larger diecast box housing the rest of the synthesiser circuitry. The digital parts, and in particular the multiplexed LED readout (**Fig 7**) are immensely dirty in terms of the ammount of RFI they generate. The entire system, including the display, must be housed in an RF tight box using bolt in feedthru capacitors for all supply and signal leads (except the RF output which uses very carefully screened and terminated high quality miniature coax to a flush mounted Belling-Lee socket). As a result of these precautions, interference leakage from the box is not detectable.

The output from the Q10 buffer feeds the prescaler which in turn provides the input signal for IC2, the HEF4751 divider. This IC, like all the other parts of the synthesiser circuitry operates from a 10 volt supply rail. Note that IC3 is bipolar and requires a 5 volt rail. Although all the applications notes always show a voltage regulated supply rail for these circuits, electrically they behave very much like Zenner diodes. The SP8690 draws little current until the supply reaches around 5V where the supply current increases rapidly. The result is that you can use a dropping resistor, 390 ohms, with a high degree of confidence that the chip will run correctly without risk of it going over voltage.

IC2, the programmable Universal divider, is programmed by two sets of multiplexed BCD numbers, the A inputs ($\overline{A0}$ to $\overline{A3}$) and the B inputs ($\overline{B0}$ to $\overline{B3}$). An internal subtractor circuit takes away the B number — the desired IF offset — from the A number — the desired signal frequency. The digit selector outputs, $\overline{D0}$ to $\overline{D6}$, strobe the digits making up the A and B numbers onto the A and B inputs in turn. In the way that

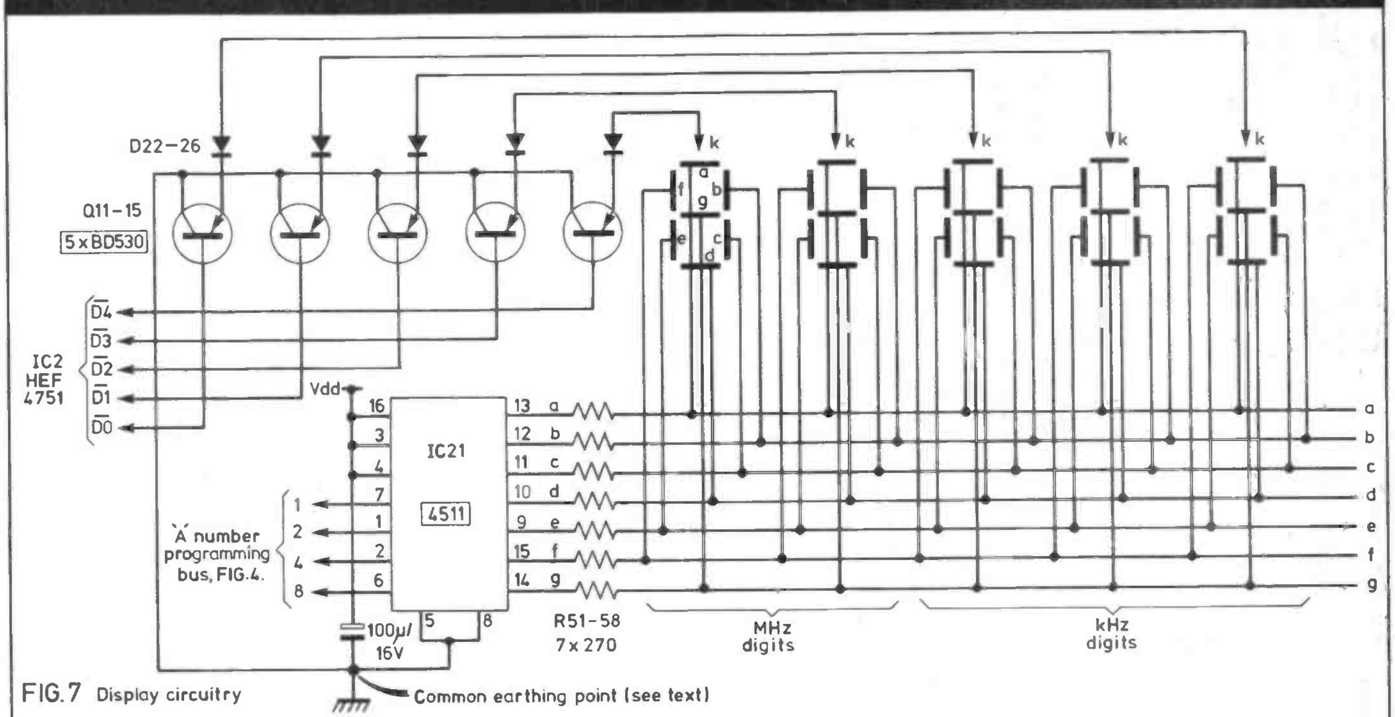

FIG. 7 Display circuitry