low frequency inductor. When used with the bypass circuit shown, the 100n capacitor and inductance of the bead behaves as a parallel tuned circuit across which is connected the negative resistance of the transistor. Result, oscillation in the region of 500kHz to 3MHz or higher modulating the HF (or VHF) signal envelope.

You may think that I am making a little bit too much fuss about nothing in particular. Not a bit of it. I remember one evening about two years ago I was having a long chat on 2m using a home-brew transceiver when I recieved a call from the East Sussex police. Unknown to me, my machine had just this problem with the result that I was putting out three distinct signals: my nominal transmitting frequency, a spurious about 3MHz above and a similar one 3MHz below. The lower one was neatly accessing the East Sussex police repeater six miles away with 5 by 9 reports from the ops room. Since I am a well behaved amateur and always give my call sign, it didn't take them long to trace the source of the interference.

The answer to this particular problem is shown in **Fig 2.** The use of ferrite beads in high power RF circuitry should be judicious to say the least. If you must include the things in a PA section always put them after the low frequency decoupling and never before. As a general rule it is much more satisfactory to use airspaced low value RF chokes than ferrite beads. In the case outlined previously the oscillatory voltage across the bead was sufficient to drive it into magnetic saturation evident by the high temperature that the ferrite bead reached in service.

## Resistive termination

There is another point. Almost every PA circuit that I've ever seen shows a low value resistance in series with the LF discoupling capacitor. The 'lossy' nature of standard aluminium electrolytics is quite enough to damp down even the most recalcitrant of LF parasitic circuits encountered in transistor PA stages providing that it is put in the right place.

There is another place where ferrite beads must be used with care. People invariably stick them in the base circuits of transistor PAs leading to a condition where the transistor sees a low resistance at the operating frequency (if the input matching circuitry is doing its stuff) and a high impedance towards the LF and HF sides of the operating frequency. The HF high impedance state is usually of little importance (but beware, there are special cases) because device gain will be falling off rapidly, typically at 6dB/octave. However, it goes towards the opposite way in the LF direction and it is quite usual to see some sort of negative resistance in the base circuit towards this end of the spectrum. The result is once again robust LF parasitic oscillation with exactly the same results as for the other case. It can also destroy the transistor.

The answer is to use resistive rather than inductive termination in the base circuit. It might appear that the connection of a low value resistance across the base might adversely affect the gain of the circuit at the operating frequency. The actual reduction in gain is marginal and usually undetectable. In most circumstances the actual input resistance of the transistor at the operating frequency will be less than two ohms for the typical 10W 2m case. The insertion loss of the resistance over the usual ferrite bead will amount to fractions of a dB. In other words nothing at all. However, at frequencies away from the operating frequency the maximum excursion will be limited to the value of the resistance rather than the 1000's of ohms which is otherwise the case. Remember too that the input capacitance of this kind of PA transistor will be in the region of 300 or 400pF and when paralleled with an inductance — ie, a ferrite bead — a relatively high 'Q' LF tuned circuit can result. The solution is to think resistors rather than the usual ferrite bead.

All these LF parasitics cannot

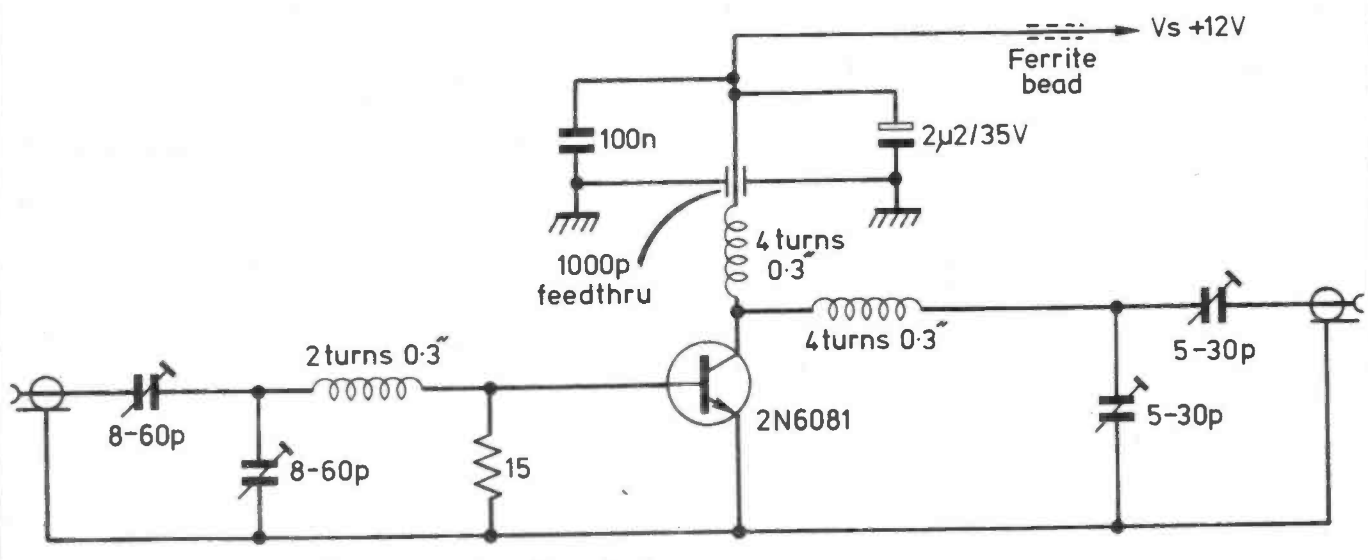


FIG. 2. Almost exactly the same circuit as fig.1, but unconditionally stable