for specifically broadband RF circuits to show resonnce but that is another story!

Given the symptoms outlined in 1), the cause could be very different if you have designed and built the thing from scratch. Assuming once again that the DC circuit conditions are OK (all the resistors are of the correct value to bias the transistor into what should be a working condition) then failure to function correctly will once again be due to lack of resonance.

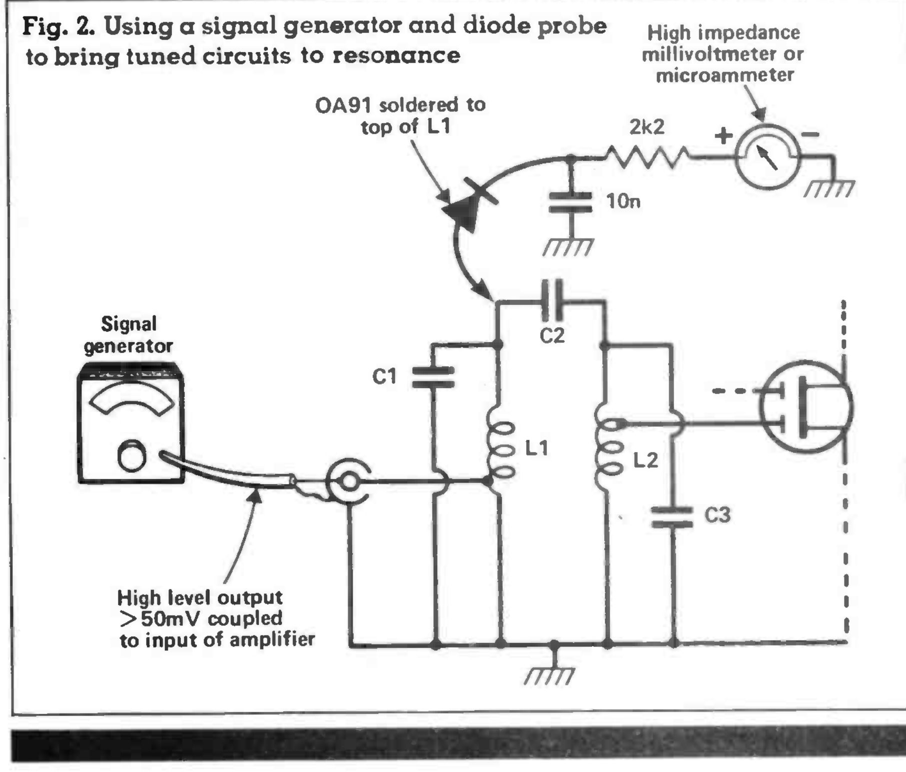
In this case, you must work through the circuit methodically checking that tuned circuits are capable of resonance at the operating frequency. At this point, the standard textbooks would suggest "that a GDO (grid dip oscillator) should be loosely coupled to the circuit under inspection and the frequency noted at which the GDO produces the maximum dip". With modern miniature components and circuits this kind of advice is seldom practical or even possible. Even worse, every GDO that I have come across has been less than accurate in its calibration. Just to blackball the traditional methods completely, you are just as likely to measure the resonant frequency of the coupling loop rather than the circuit under inspection. **Fig. 2** shows the effective way of bringing tuned circuits to resonance. With the amplifier connected to the supply inject a high level signal — greater than 50mV — directly into the first tuned circuit. At the same time, temporarily solder an OA91 germanium diode (it must be this type of device as any other will be hopelessly insensitive/or impose a severe circuit loading with both resistance and capacitance) to the hot end of the tuned circuit under inspection. The other end of the diode connects to a grounded 10n capacitor and a microampmeter via a low value series resistor. The frequency of the signal generator is then swung about until a reading is obtained on the meter. Although tuning will be much broader than without the diode probe connected, a distinct hump in the reading will show the precise resonant frequency without ambiguity. Having adjusted L1 into the resonance ballpark, the probe is then moved to the top end of L2 and the performance repeated.

This time, the maximum of the hump will be much less although still readily discernable. This is because the value of C2 will have been chosen for optimum coupling between the tuned circuits without taking the loading of the diode probe into account.

By the time that the two input tuned circuits have been brought close to resonance, some action should be evident at the output of the pre-amplifier. The next thing to do is to tune L1 and L2 for maximum smoke. The tuned circuit L3 can also be adjusted by switching the generator signal source from the input to the output socket. However, beware. The application of supply volts to the amplifier is necessary for this kind of cold tuning exercise. Without them, the transistor appears as a low value resistance effectively connected directly across the L3 tuned circuit as far as RF is concerned. It only goes to a high resistance state when passing its normal operating current. Furthermore, the earth return on the measuring meter will have to be made to the cold end of L3.

When designing from scratch some curious tuning anomalies may be noted in the behaviour of L1 and L2. This is most likely due to overcoupling. If a very pronounced double tuning hump is noted then the value of C2 is probably too high. Dropping its value or removing it altogether may effect an improvement.

Fig. 2. Using a signal generator and diode probe to bring tuned circuits to resonance



Instability

2) "The circuit seems to work but every time I attempt to adjust the inductors for maximum signal output, the wretched thing bursts into oscillation".

A common problem. What you need to know is the type of instability which the circuit exhibits. There are basically two kinds. That which occurs in the region of signal frequency (perhaps not so common with dual gate MOSFETs) and the other where oscillation occurs at a far removed frequency (either higher or lower but more usually higher).

Let's examine the simple case first. The pre-amp bursts into uncontrollable oscillation as the inductors approach optimum setting. You measure the frequency of oscillation (assuming that some kind of counter or absorption meter is to hand — see *Technicalities* in the July issue) and find that it goes off within a few MHz of signal frequency. There is only one explanation: you have built an amplifier but inadvertently coupled the output back to the input.

There are three kinds of RF feedback loops: capacitive, inductive and resistive. You may count a combination of loops as a fourth condition. The most usual cause of instability is through capacitive feedback. The top ends of L1, L2 and L3 are at very high impedance — several thousands of ohms when at resonance. Very little capacitive reactance between them is required to provide a feedback path sufficient for oscillation. At 144MHz the effective stage gain will be around