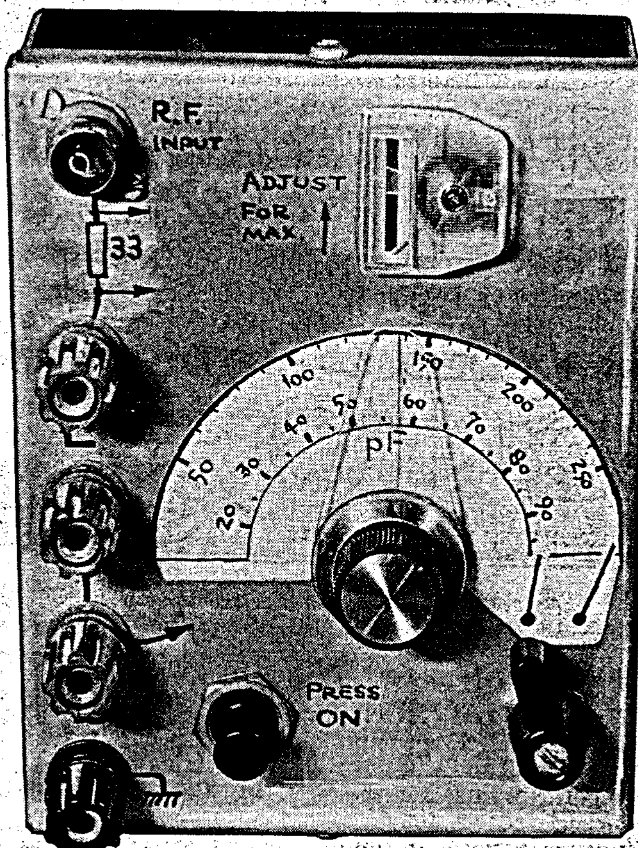
R.F. RESONANCE INDICATOR

D.H.E.KING G3TQN

When designing, building or servicing RF equipment it is sometimes necessary to know the frequency at which a particular coil resonates or tunes. A recent example involved a radio IF stage with very low gain; one of the IFTs seemed suspect and this was removed from the printed circuit and dismantled to expose a small ferrite-enclosed coil and an even smaller capacitor with unreadable markings. Using an RF signal generator and the apparatus described here it was found that a 470pF capacitor tuned the coil to the correct IF; an 'outboard' capacitor was then fitted across the IFT, bringing the radio back to 100 per cent performance, and the test apparatus was returned to the shelf to await the next emergency.

This resonance indicator is not intended to replace more accurate (and more expensive!) apparatus, but rather to provide a rapid method of checking unknown tuned circuits in the range 100kHz to 28MHz. With a given inductor in circuit, the values of unknown capacitors may be found within the range of VC1a and b by resonating the inductor at the same frequency, first with and then without the unknown capacitor between terminals N and M. The change in the value of VC1a or VC1b needed to re-establish resonance is therefore the value of the unknown capacitor.



Circuit operation

In a series tuned circuit **maximum** current flows at resonance and in **Fig. 1** this current through R1 feeds the emitter of Tr1 with an increased RF voltage compared with the voltage at other frequencies. The emitter and base of Tr1, just biased on by R2, VR1, form a detector circuit and the boosted RF thus acts to increase the emitter-base current. The resulting increase in collector current is indicated by the meter so that the resonance of a particular coil with a selected capacitance and frequency is now known.

Construction

Because a variable capacitor usually has the frame earthed, this has to be fitted at the 'bottom' of the circuit and the operational electronics are therefore at the 'live RF' end, as is the push-button on-off switch. All components apart from R1, S1, S2, VC1 and M1 may be fitted to a piece of Veroboard; VR1 is adjusted to give a small (about 20 per cent) pointer deflection when S1 is closed. R1, a carbon type, is fitted directly from the coaxial RF input socket to terminal O to limit excess inductance; the circuit board could be attached across R1 by short stiff wires if one wishes to avoid making additional fixings to the chassis or panel. See **Figs. 2 and 3.**

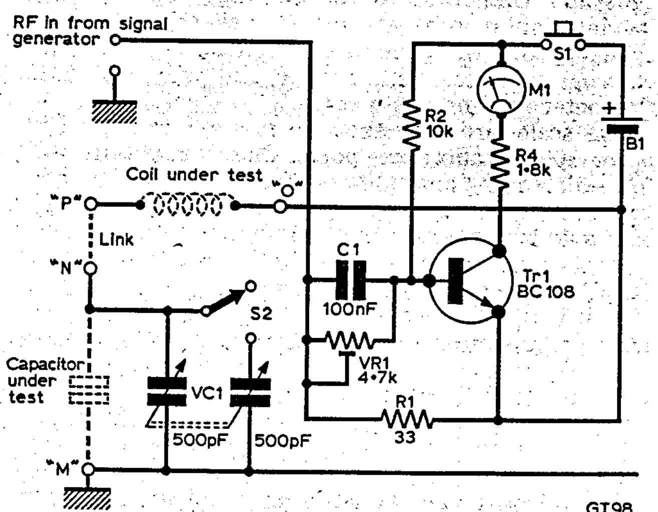


Fig. 1: The circuit diagram of the RF Resonance Indicator.

VC1 is bolted direct to the case. A metal case is recommended rather than a plastic one. A short pointer on the shaft traverses over a card scale glued to the outside of the box. During construction ensure that the link between terminal N and P is easily removed for ease of calibration.

The single Mallory cell (in its holder) may be glued into place, and should last for several years.

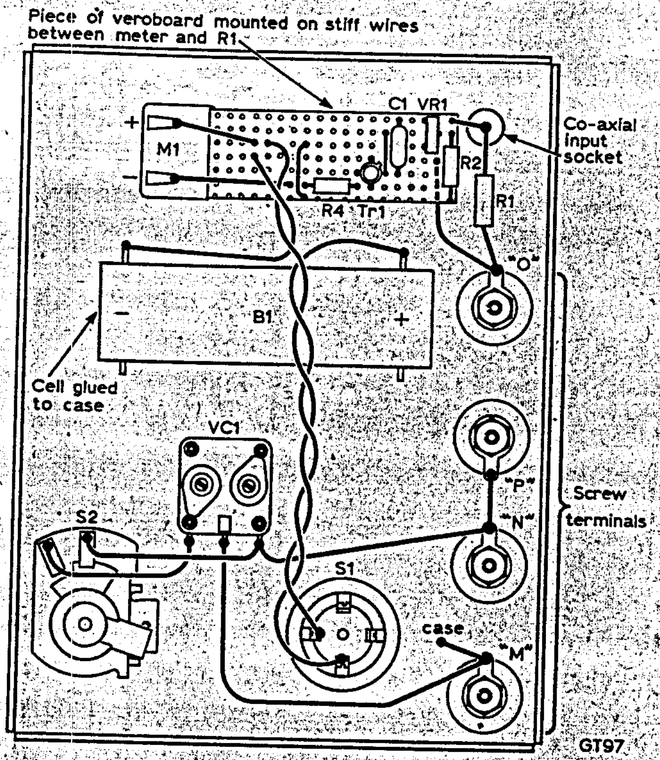


Fig. 2: General wiring inside the aluminium case.

★ components

Resistors: R1 33Ω, R2 10kΩ, R4 1·8kΩ, VR1, 4·7kΩ preset.

Capacitors: C1 100nF polycarbonate, VC1, 500/500pF gang capacitor

Transistor: BC108

Switches: S1, push-to-make switch. S2, SPDT wafer

Miscellaneous: Screw-type terminals. Co-axial socket. Metal case, 5½" × 4¼" × 1¾" (140mm × 105mm × 45mm). (AB10) B1: 1·2V to 1·5V cell (mercury). Piece of Veroboard, 2" × 1" (50mm × 25mm).

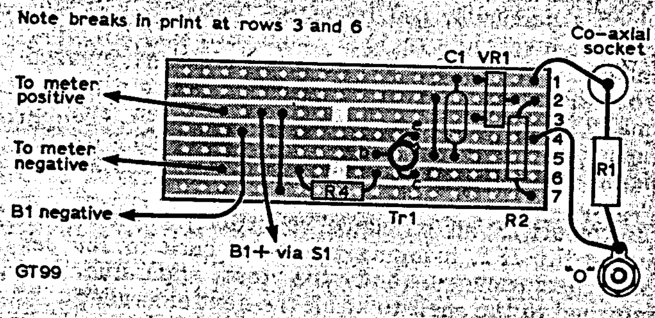
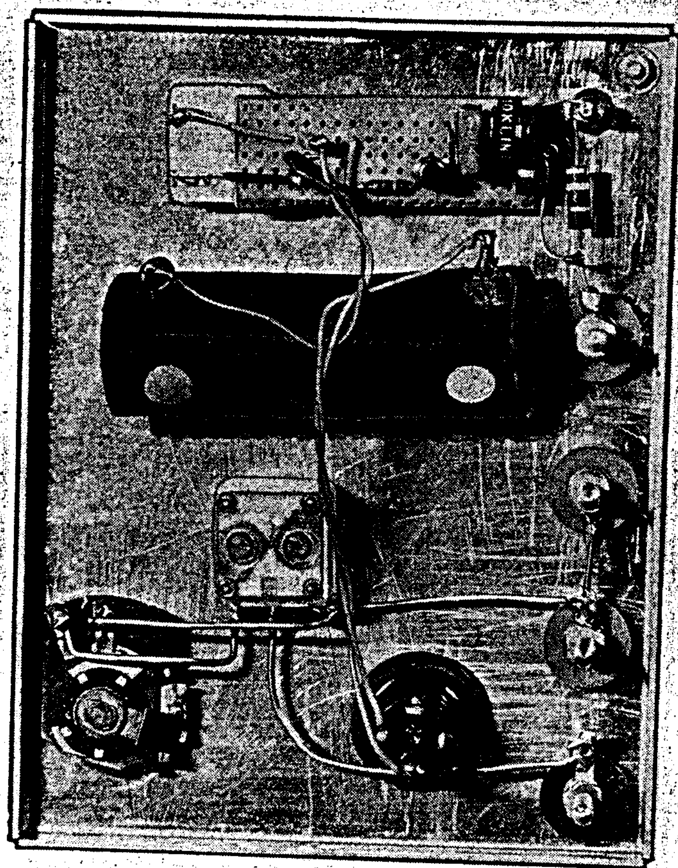


Fig. 3: Showing the component positions on the Veroboard, and meter and battery interconnections.



Calibration

Connect a coil (fifteen turns of plastic or enamel covered wire close-wound and taped securely to a ferrite aerial rod will do) between terminals P and O. Temporarily unsolder the link N-P. Connect a close-tolerance 50 or 100pF silver mica or polystyrene capacitor between terminals N and M, keeping S1 closed. Then vary the tuning of the RF signal generator connected to the RF input socket while looking for a peak in meter deflection. Without changing the RF generator frequency, remove the external capacitor, connect N-P and vary VC1 until the meter reading again peaks.

The scale-card may then be marked with its first 50 or 100pF calibration point. Close S2, retune VC1 for peak reading and calibrate the other scale. Depending upon the particular type of variable capacitor available it is possible that the minimum capacitance of both gangs in parallel is more than 50pF and that 100pF will be the first calibration.

Now with VC1 set to the 50pF calibration point, add the external capacitor and vary the input frequency to obtain a peak meter reading. Remove the external capacitor and increase the value of VC1 to regain the peak meter reading, marking this new calibration point on the scale. In this way calibration points may be located at 50 or 100pF intervals around the scales.

It will also be possible to confirm the basic frequency formula that if the 15-turn coil resonates at about 5 to 6 MHz with 50pF, then at 450pF, **nine times** the original capacitance, the resonant frequency becomes **one-third** of its value at about 1·8MHz. This is because resonance is proportional to the **square root** of the ratio of capacitance change. ●