developed in the early 'sixties by Christopher Henn-Collins, GU5ZC. This has reminded him that while doing consulting work in Chicago in the 'fifties, he worked with an American engineer called Dwight Sinninger who described to him a device termed a "QRM device" capable of providing directional reception by adjusting the phase and amplitude of the output from two fixed antennas, and similarly able to "phase out" an unwanted signal. Basically, the idea behind the device was to improve reception in the hf range by using two antennas of any type and then coupling them in an optimum way to the receiver: Fig 4.

GU5ZC writes: "The device as I remember it consisted simply of a helix about 10 or 12in long and about 0·5in diameter wound at about two-wire-diameter spacing on an insulating tube. The coupling coil could be moved over the length of the main coil by means of a conventional string drive. In use, the coupling coil was simply adjusted for strongest signal or for optimum nulling of interference as desired. The two potentiometers served to adjust the overall antenna pattern by adjusting the relative outputs, and in practice it may be desirable to balance the outputs by backing off the 'pot' associated with the 'best' antenna a bit."

GU5ZC seems to recall that the coupling coil consisted of about 20 turns, but clearly some experimentation may be needed to obtain optimum coupling, depending on the impedance step-down provided by the cathode followers or their semiconductor equivalents.

Power oscillator transmitters

Many of the pioneering contacts in the very early days of hf were made using single-stage power oscillators, initially in the form of rather unstable variable-frequency master oscillators but later more often crystal controlled. Then during the 1939–45 period they were used by both sides in a number of wartime clandestine transmitter-receivers, including the excellent AP4 sets designed and built by Polish engineers in England (keyed 6L6 co with small superhet receiver) and the Whaddon Mk7 (also known as the "Paraset") which consisted of a metal 6V6 with two 6SK7 valves as a "straight" receiver: Figs 5, 6. A feature of the Mk7 was the complete absence of metering but, instead, two small pilot bulbs were used for tuning the oscillator and antenna; a technique still valid provided you do not absorb too much of the limited rf output (about 4 or 5W) in the process. The transmitter section of such rigs proved very effective over distances of several hundreds of miles even with the makeshift antennas used in the field. It is perhaps only fair to add that the users encountered a particular hazard when using the Mk7 in urban areas; the regenerative receiver oscillator was directly coupled to the antenna and could be detected by the skilled German df teams. As a result the later Mk15 receiver with an extra 6SK7 used to isolate the antenna from the detector, or the "rival" A3 (the so-called B2 Minor) built by Marconi for SOE with a superhet receiver, was often preferred by those working in the field.

Power oscillators are inherently less efficient than a power amplifier stage, but for QRP operation the overall efficiency can actually be higher, particularly with valves. Even with solidstate it is still possible to obtain good results on 3·5 and 7MHz (and 10·15MHz) with a single-stage cw rig, at least if you are satisfied with crystal control. *TT* April 1981, p332, provided details of a 10MHz vmos power fet oscillator capable of providing

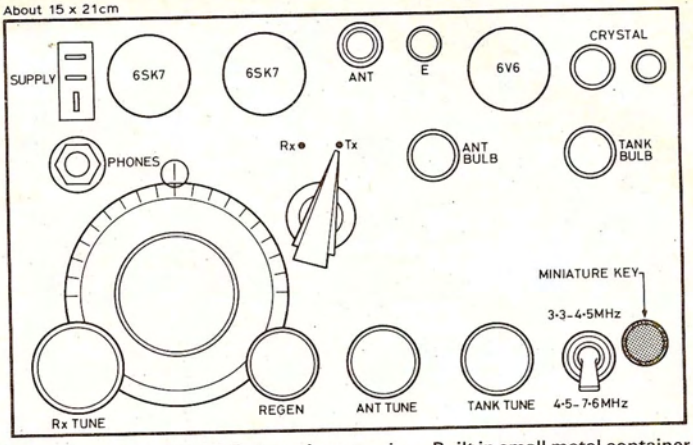
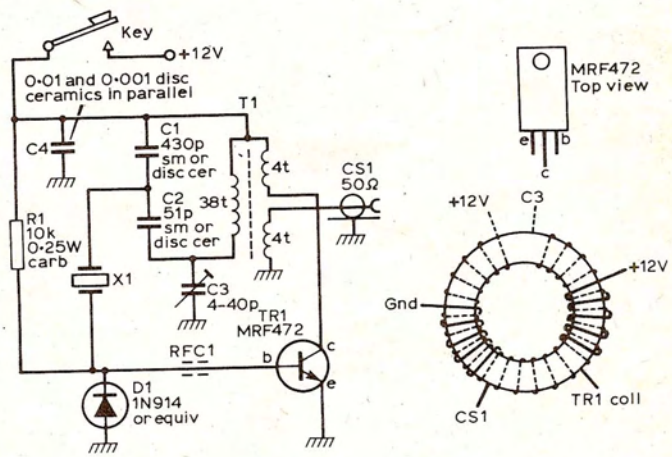


Fig 6. Panel layout of Mk7 transmitter-receiver. Built in small metal container with separate psu

5W output with a 28V power supply. A miniature 7MHz rig using a low-cost Motorola MRF472 npn medium-power bipolar transistor is fully described by Dennis Monticelli, AE6C, in *QST* July 1982, pp34–6: Fig 7. With a 12V supply (about 300mA load) this "one-cubic-inch" rig can produce a useful 2·1W of rf output with a total dc input of 3·6W, or an overall conversion efficiency of some 58 per cent—a better efficiency than is achieved in most multi-stage rigs! The home-made heatsink is made from 0·062in aluminium or brass 1·375 by 0·625in (bent into a square-U shape). Such a rig can produce a fair amount of harmonic output, and AE6C recommends it should be connected to the antenna via a low-pass filter and atu.



▲ **Fig 7. The 7MHz "Cubic Incher" miniature transmitter with about 2W rf output. RFC1, ferrite bead (FB 43·101 or equivalent). T1, toroidal transformer wound with No 26 enamelled wire on T50-2 iron-dust core, 38t primary, 4t each secondary. Fundamental FT243 or HC-6/U type crystal**

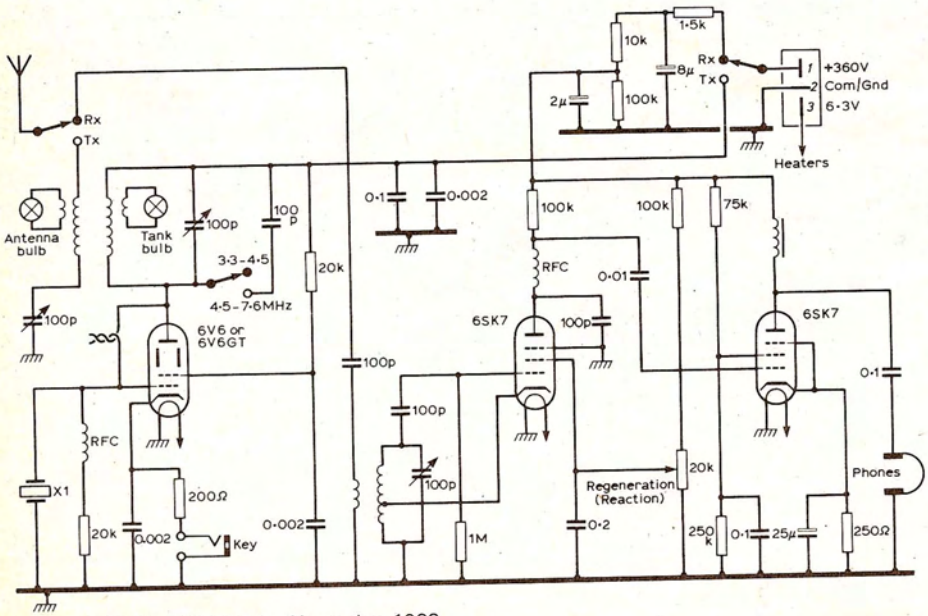


Fig 5. Circuit diagram of the Special Communications Mk7/B transmitter-receiver used in 1943-4 for clandestine links. Also known as the "Paraset"