To reduce station cramping at higher frequencies the recommended dual-gang variable capacitor is an "H" law, broadcast band component by Jackson Brothers. Trimming is necessary to limit h.f. range at 1630kHz, and this is done by twisting together two 50mm lengths of 32 s.w.g. enamelled copper wire, soldered one each to the tuning capacitor fixed vanes. The J B dual-ratio dial drive eases tuning and provides space for dry transfer scale markings. See Table 1 for "H" law tuning calibration using the manufacturers 0 to 100 dial scale.

A brief mathematical comparison illustrates the performance relative to that of the standard 1016mm square 7 turn design. Since

$$\text{Loop Voltage} \propto \frac{\text{Area} \times \text{Turns} \times \sqrt{(\text{Inductance}/\text{Capacitance})}}{\text{Effective Resistance}}$$

then

$$V_W = C \times \left(\frac{2{\cdot}8 \times 10^5 \times 18 \times \sqrt{340/260}}{0{\cdot}4\Omega + 635\text{mm loss resistance}}\right)$$

and

$$V_{\square} = C \times \left(\frac{1{\cdot}03 \times 10^6 \times 7 \times \sqrt{170/520}}{1{\cdot}2\Omega + 1016\text{mm loss resistance}}\right)$$

C being determined by field strength and frequency. With its much reduced losses the "W" loop has a sensitivity advantage. Higher inductance to capacitance ratio with lower effective resistance confers improved selectivity, while an increased product of wound area and Q with lower ohmic resistance enhances signal to noise ratio.

Dial	kHz	m
0	1630	184
7·5	1500	200
13	1400	
19	1300	
26	1200	250
32·5	1100	
40	1000	300
48	900	
52·5		350
58	800	
63		400
68·5	700	
72·5		450
82	600	500
91		550
100	510	588

Table 1. Tuning Calibration

On a personal note, I had been chasing DX using either a 1524mm 8 turn, roof space mounted spiral, or a free standing, 889mm, 13 turn spiral-solenoid-spiral mix. These were dismantled however when weak carrier listening tests showed that although the larger loops developed increased terminal voltage their overall signal to noise ratios were not better.

Amplifier Design

Work with differential matching amplifier and Q-multiplier circuits showed individual advantages and prompted a design that combined their good points. The resulting Q-amplifier compensates for some winding losses by using field effect transistor capacitance to generate minute amounts of stable positive feedback.

During development the following points were listed:

1) input devices must not have any deleterious effect upon winding characteristics, especially at higher frequencies,
2) with a "W" loop the input stage need not be differential but must be symmetrical and gain balanced,
3) gain at 500kHz should be higher than at 1·5MHz to compensate for loss in Q as tuning capacitance increases,
4) to prevent reactive loads from overloading output devices amplifier output should be 75Ω resistive.
5) to minimise harmonic distortion the output stage should operate in Class A push-pull,
6) there must be sufficient dynamic range to cover any signal between background noise levels and powerful local stations,
7) a variable output attenuator would prevent strong-signal receiver overload,
8) performance should be repeatable and independent of device tolerances.

The Circuit

The symmetrical circuit employed is shown in Fig. 3. Oppositely phased signals are amplified by separate but identical stages and then combined at the push-pull output transformer. Here resistance coupling avoids reactive shunting of output devices by transformer, coaxial cable or load.

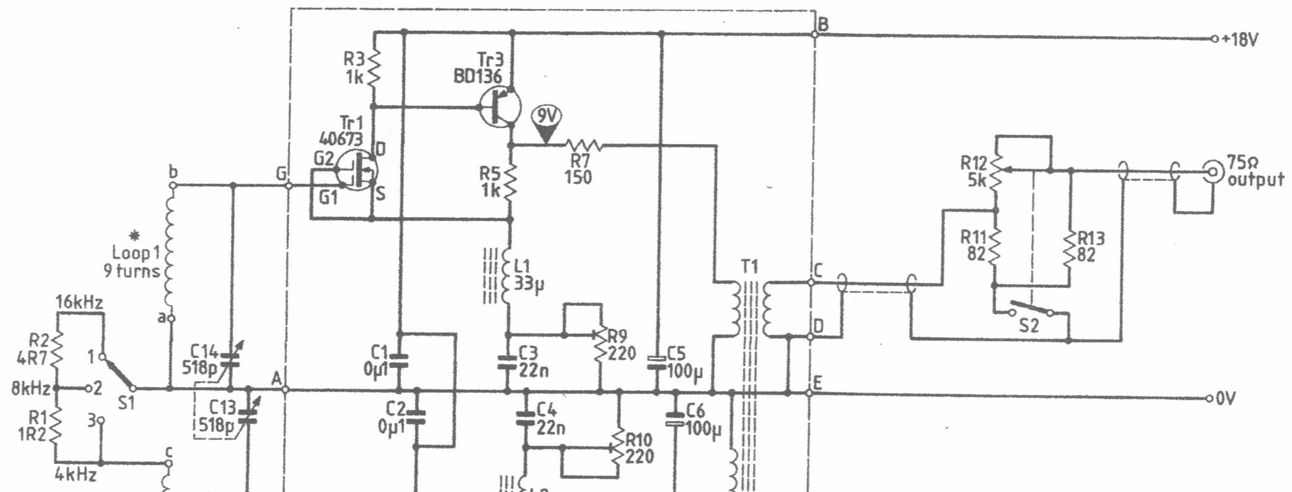

Fig. 3: The complete circuit diagram of the amplifier used with the W-Q MW Loop antenna

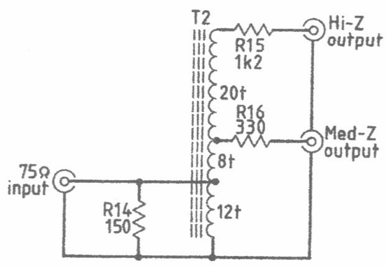

Fig. 4: This circuit may be used with high input impedance receivers. Details are given in the text