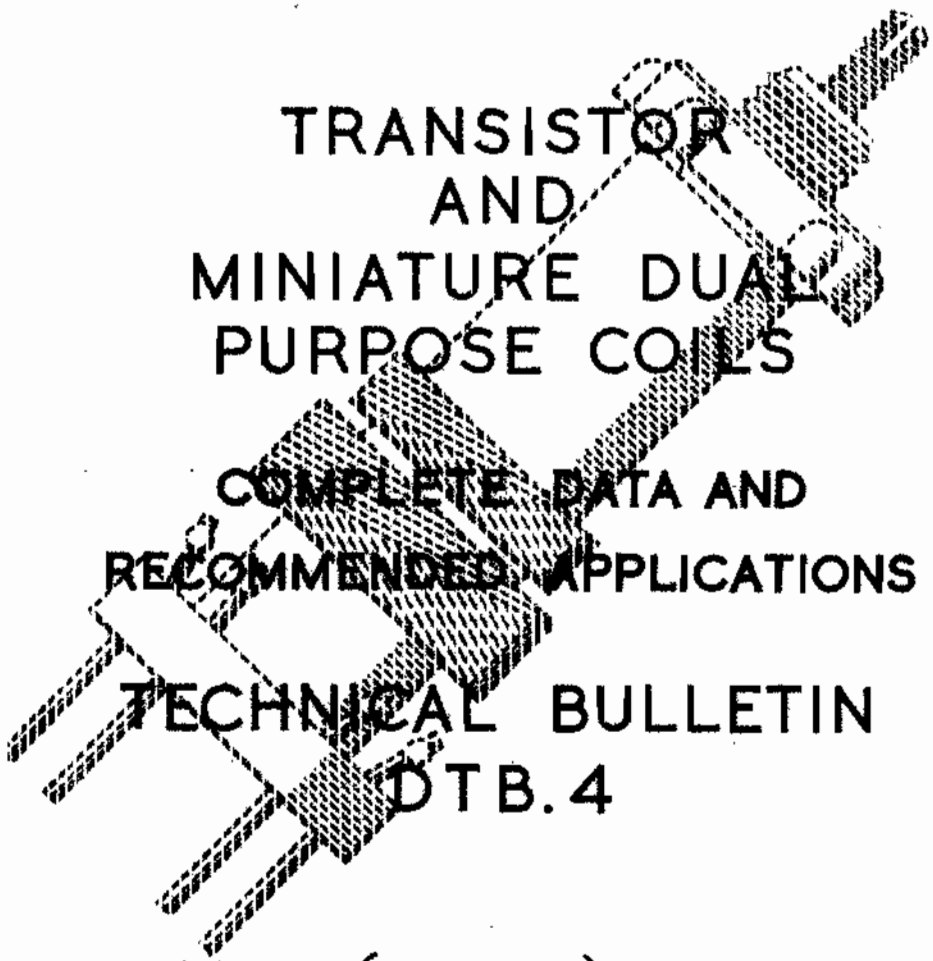
MAXI-Q



TRANSISTOR AND MINIATURE DUAL PURPOSE COILS

COMPLETE DATA AND RECOMMENDED APPLICATIONS

TECHNICAL BULLETIN DTB.4

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1/6d

SECTION 1

TRANSISTOR DUAL PURPOSE COILS

INTRODUCTION... ...

The range of Transistor Dual Purpose Coils has been developed to comply with the modern trend in radio design of making smaller and more compact equipment and the purpose of this section of the Technical Bulletin is to offer suggestions on the use of Transistor Dual Purpose Coils.

Naturally the circuits shown give only a few of the applications that these coils can be put to for instance, they are ideally suitable for incorporating in Signal Generators, Beat Frequency Oscillators, Wavemeters, C.W. Monitors, etc.

TRANSISTOR DUAL PURPOSE COILS ... ...

These coils can be used for quick plug-in insertion in a Noval (B9A) type valveholder or can be used as permanent chassis mounting by assembling to chassis at their opposite end with an O B.A. moulded nut, the valve feet then being used as terminal soldering tags. For highest possible insulation polystyrene formers are used and the threaded portion can be twisted off by excessive locking of the fixing nut and should therefore only be assembled 'finger-tight'.

Every coil is packed in an air-tight aluminium container, the size of which has been calculated to enable you to use it as a screening can for the coil.

These formers are made of pure polystyrene moulded in colour ... Blue, Red, Yellow and White for easy circuit identification.

Complete range for Superhet receivers covering approx. 150 Kc/s - 31.5 Mc/s.

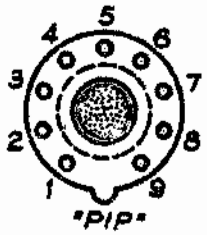
DIMENSIONS ... ...

Former Diameter	.375"
Max. overall height excluding adjusting stem of core and pins	1.250"
Plug-in Base Diameter	.625"
Fixing hole Diameter	.250"

Core .5" long x .250 dia. with 6BA threaded brass insert.

GENERAL DATA
TRANSISTOR DUAL PURPOSE COILS

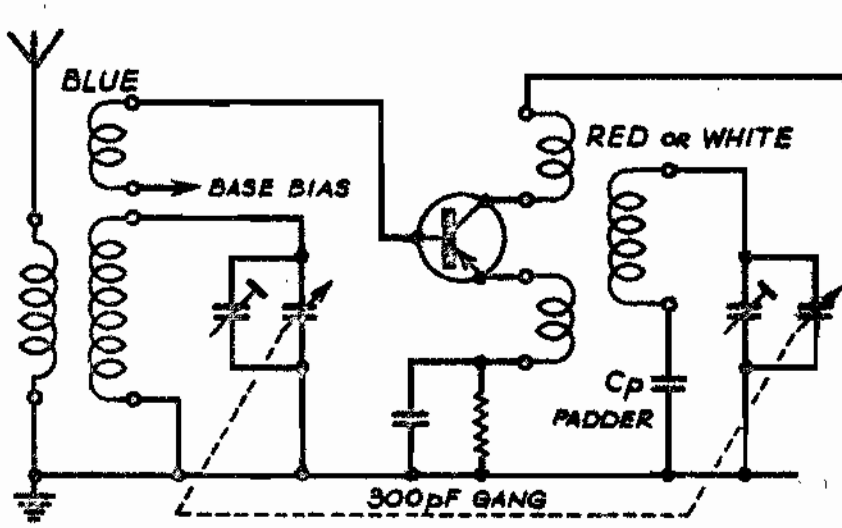
LOOKING AT OPEN END OF FORMER



NUMBERS REFER TO STANDARD NOVAL (B9A) VALVE BASE NUMBERING

PIP ON BASE SIMULATES LOCATOR

COIL COLOUR	PIN CONNECTIONS								
	1	2	3	4	5	6	7	8	9
BLUE	EARTH				BASE	TUNING COND.	BASE/ BIAS	AERIAL	EARTH
YELLOW	EARTH				BASE	TUNING COND.	BASE/ BIAS	COLL. SUPPLY	COLL.
R1 RED & WHITE RANGE 5 WHITE	TUNING COND.				EMITTER	PADDER	EMITTER BIAS	COLL. SUPPLY	COLL.
RANGE 2 RED & WHITE	"	PADDER			"		"	"	"
RANGE 3 RED & WHITE	"		PADDER		"		"	"	"
RANGE 4 RED & WHITE	"			PADDER	"		"	"	"
RANGE 5 RED	"				"	EARTH	"	"	"



SKELETON SUPERHET CIRCUIT

SEE FIGS. 1 & 2 FOR FULL CIRCUITS SHOWING R.F. STAGE.

GENERAL DATA - TABLE A

RANGE	Ls µH	COVERAGE 39/352pF		Cspi	Q_{LS}	465 Kc/s I.F.					1·6 Mc/s I.F.				
		Mc/s	METRES			Lo	Cp	PIN	Cto	Copi	Lo	Cp	PIN	Cto	Copi
1T	303O*	·150/·400	2000/750	10	70	600	110	6	30	20					
1T	235O*	·175/·525	1700/570		60						156	50	6	35	20
2T	271	·515/1·545	580/194		100	129	350	2	0		66	110	2	20	10
3T	27·2	1·67/5·3	180/57		60	20·6	1100	3	6	5	13·6	340	3	11	10
4T	2·9	5·0/15	60/20		90	2·65	3000	4	1·5		2·22	960	4	4·5	
5T	0·65	10·5/31·5	28/9·5		110	2·45		6	0·6		2·35	2000	6	1·5	

* The Range 1T Signal coils are adjustable to both these values.

Ls — Nominal inductive value of signal winding. (Average of ± 15% variation obtainable by core adjustment excepting Range 1 which covers approx. 2250/3500 uH.)

Q_{LS} — Approximate 'Q' of signal winding at mid-point of tuning range.

Lo — Nominal inductive value of Oscillator winding.

Cp — Oscillator padder.

Cto — Oscillator trimming capacitance additional to assumed circuit capacity of 39 pF.

Copi — Fixed capacitance recommended to be wired across main windings of the coils concerned when used in the plug-in application to allow for Cto.

Cspi — Additional fixed capacity across main winding of signal coils on Range 1T with 465 kc/s I.F.

Notes ...

(a) The values in Table A only apply when the recommendations in the following pages are adopted. A tuning condenser capacity of 300pF. nominal has been chosen in preference to the more usual 500pF. (0.0005 mfd) because this lower value allows for less critical tuning on the higher frequency ranges, also for better performance generally.

(b) Where difficulty is experienced in obtaining the specified 0.0003 mfd condensers it is possible to use 0.0005 mfd, provided fixed condensers of 0.001 mfd are connected in series with each section of the gang to reduce the capacity to the value required. These condensers should be of high quality mica insulated type. With this arrangement the recommendations in Table A etc. can still be followed.

The maximum capacity of various makes of nominal 500pF. condensers varies considerably. Those having an actual maximum of 480-490pF. will conform most closely to the data given with the 0.001 mfd series condensers.

(c) It will be noted that there is a slight break in the coverages given in the Table from Range 2, 1.545 Mc/s. to Range 3, 1.67 Mc/s. This avoids I.F. instability when using 1.6 Mc/s I.F. When desired, complete coverage can, however, be obtained by increasing the inductance on Range 3 and Range 4 by core adjustment to allow overlap from Range 2 to 3 and 3 to 4.

COLOUR CODE ...

The following colour code identifies the coils:

BLUE ..... Aerial coil with base input winding.
YELLOW ..... Interstage R.F. coil with coupling.
RED ..... Oscillator coil for I.F. of 465 kc/s.
WHITE ..... Oscillator coil for I.F. of 1.6 Mc/s.

Note that Ranges 1 and 5 Red and White coils require the same padder connections, therefore in the plug-in application only Range 1 or 5 may be directly interchangeable with other ranges.

DESIGN DATA FOR RECEIVERS USING TRANSISTOR DUAL PURPOSE COILS ...

Circuit Diagram Fig. No.1 is suggested as the basis of a receiver suitable for communications purposes covering 150 kc/s - 31.5 Mc/s (465 kc/s I.F.) or 175 kc/s - 31.5 Mc/s (1.6 Mc/s I.F.).

General Notes ... The gang condenser should have a ratio of maximum capacity to minimum capacity of not less than 30:1 and maximum value of 330pF. The stray signal circuit capacities should be approximately as follows. Self capacity of coils according to the range from less than 1pF to 10pF. The wiring should not produce greater capacity than 15pF thus care should be exercised in the use of screened sleeving and all wiring connected with signal and oscillator circuits must be kept as short as practical.

It is recommended that the gang condenser used has a ceramic insulated stator as in the case of some forms of insulation the minimum capacity may be considerably greater than the minimum capacity required of 11pF. Totalling the minimum gang capacity with the stray capacities a 3-30pF trimmer is required to bring the total minimum circuit capacity

up to the required 39pF. It is recommended that for reliability the Philips concentric air-spaced trimmer be used in preference to the compression type trimmer. The measured maximum capacity of a nominal 300pF gang condenser made by a well known manufacturer was found to be 324pF; using a gang condenser of this type gives a maximum tuning capacity of 324pF plus 28pF giving a capacity ratio of 1:9 and frequency tuning ratio of 1:3. The padder and trimmer values to give 3 point tracking have been calculated on the assumption that the above instructions are adhered to.

POINTS TO NOTE ... The oscillator coils are arranged so that the connection for the padder condenser is brought out to a different pin in each range, except Ranges 1 and 5, so that when using the coils as 'plug-in' the padder condensers can be wired permanently to the Noval valve base and whichever range of coils are used the correct value padder is automatically connected when the oscillator coil is plugged-in except that only Range 1 or 5 may be catered for in this way. If it is inconvenient to fit trimmer condensers Cto and Cts may be variable air-spaced condensers with controls brought to the front of the panel, in this case it will be necessary to mark the setting for each range.

When using the coils as chassis mounting the trimmers will normally be connected to a rotating wafer type wavechange switch, one trimmer being used for each range.

Avoid long leads in the oscillator and signal circuits otherwise the inductance and capacity introduced may make it impossible to obtain coverage on the high frequencies, taking particular care that there is direct coupling between the gang and earthy ends of the coil (via padder in the case of the oscillator).

Coil holders should be of low-loss construction.

Make sure that any points to be soldered are clean and that no dry joints are left.

When using the coils for general broadcast work the R.F. stages may be omitted in which case follow the appropriate connections on the circuit and use the Blue coil instead of the Yellow.

When using a 1.6 Mc/s I.F., for better selectivity it is desirable to use an extra I.F. stage, this I.F. gives greater freedom from second channel interference.

It is recommended that the screening cans are used as illustrated or interstage screens employed where an R.F. stage is used, particularly where close spacing of the coils is adopted. This is not always necessary without an R.F. stage but it is a safeguard against instability.

Range 5 oscillator coil operates at one half of the required frequency in the interests of oscillator stability and in order to avoid the necessity of using a transistor of better high frequency performance than the OC170. The second harmonic of this oscillator is then used as the mixer. Alignment of this range is carried out in the normal way; the harmonic being automatically present.

Whilst the main application of 1.6 Mc/s I.F. in connection with these coils will be the 1st. I.F. in a double superhet as illustrated by the converter in Fig.2, a complete 1.6 Mc/s I.F. section may be employed if desired although an additional stage compared with 465 kc/s is recommended in the interests of both sensitivity and selectivity. A typical circuit is shown in Fig.5.

When soldering the leads of transistors a heat shunt should be used between the joint and the transistor. This may be a pair of pliers or tweezers used to firmly grip the wire but a crocodile clip made up with copper jaws is more effective and allows freedom of both hands. It is also advisable to use such a heat shunt when soldering miniature components especially sub-miniature electrolytic condensers.

Continuity testing of components should not be carried out with the transistors in circuit because they can easily be damaged by quite small voltages incorrectly connected to them.

Great care must be taken only to connect the battery the correct way round. Incorrect connection can ruin the transistors.

CIRCUIT ALIGNMENT ... It is almost essential for this to be carried out with a signal generator if the best results are to be obtained.

Keep the signal generator output voltage to the minimum necessary at all times and whilst fair results may be obtained by ear using the loudspeaker and signal generator modulation, a meter is a more sensitive method, as small changes in sound level are difficult to detect.

An A.C. volt-meter (1V. or 5V. range) across the loudspeaker or a D.C. mA meter measuring battery drain (25mA range) are satisfactory methods of meter indication for the circuits given.

The I.F. signal may be fed via a 0.01 mfd capacitor between the base and supply +ve line of each transistor in turn to adjust the I.F.T. in its collector circuit starting with the last I.F. stage.

R.F. Alignment is carried out on the basis of core adjustment first at the low frequency end of the band followed by trimmer adjustment at the high frequency end.

If plug-in coils are in use and only one set of trimmers are fitted start with the highest frequency range in use and set the trimmers on this range.

1. Connect the signal generator to the aerial terminal via a standard dummy aerial or a 400 ohm resistor and set it to the low frequency limit of the range being aligned, e.g. 10.5 Mc/s in the case of Range 5. Fully mesh the tuning condenser.
2. Adjust the core of the oscillator coil to receive the signal. (see note on 'Second Channel' below).
3. Adjust the signal generator to the high frequency limit, e.g. 31.5 Mc/s for Range 5. Fully open the tuning condenser.
4. Adjust the oscillator trimmer to receive the signal.

5. Repeat 1 to 4 until no further adjustment is necessary to set the range.

6. Set the signal generator to the low frequency tracking point e.g. 11.55 Mc/s for Range 5. Tune in the signal with the tuning condenser. (approx 20° from maximum).

7. Adjust the Yellow and/or Blue core for maximum output (see note on 'Pulling' below).

8. Set the signal generator to the high frequency tracking point, e.g. 28.5 Mc/s for Range 5. Tune in the signal with the tuning condenser (approx. 15° from minimum).

9. Adjust the H.F. and/or aerial circuit trimmer for maximum output.

Second Channel ... Note that when setting the oscillator on Short Wave Ranges two responses can usually be found. When both these responses can be found during adjustment of the oscillator trimmer or core the setting of the trimmer or core furthest out is the correct one e.g., the higher of the two oscillator frequencies thus putting the oscillator above the incoming signal.

However it is recommended that after each operation above for Short Wave ranges the signal generator is tuned above and below its setting (approx 1 Mc/s with 465 kc/s I.F.'s and approx 3 Mc/s with 1.6 Mc/s I.F.'s). When this is done a second response (second channel), at lower strength when the signal circuits have been adjusted, should be found. This should be higher in frequency than the one on which adjustment was made.

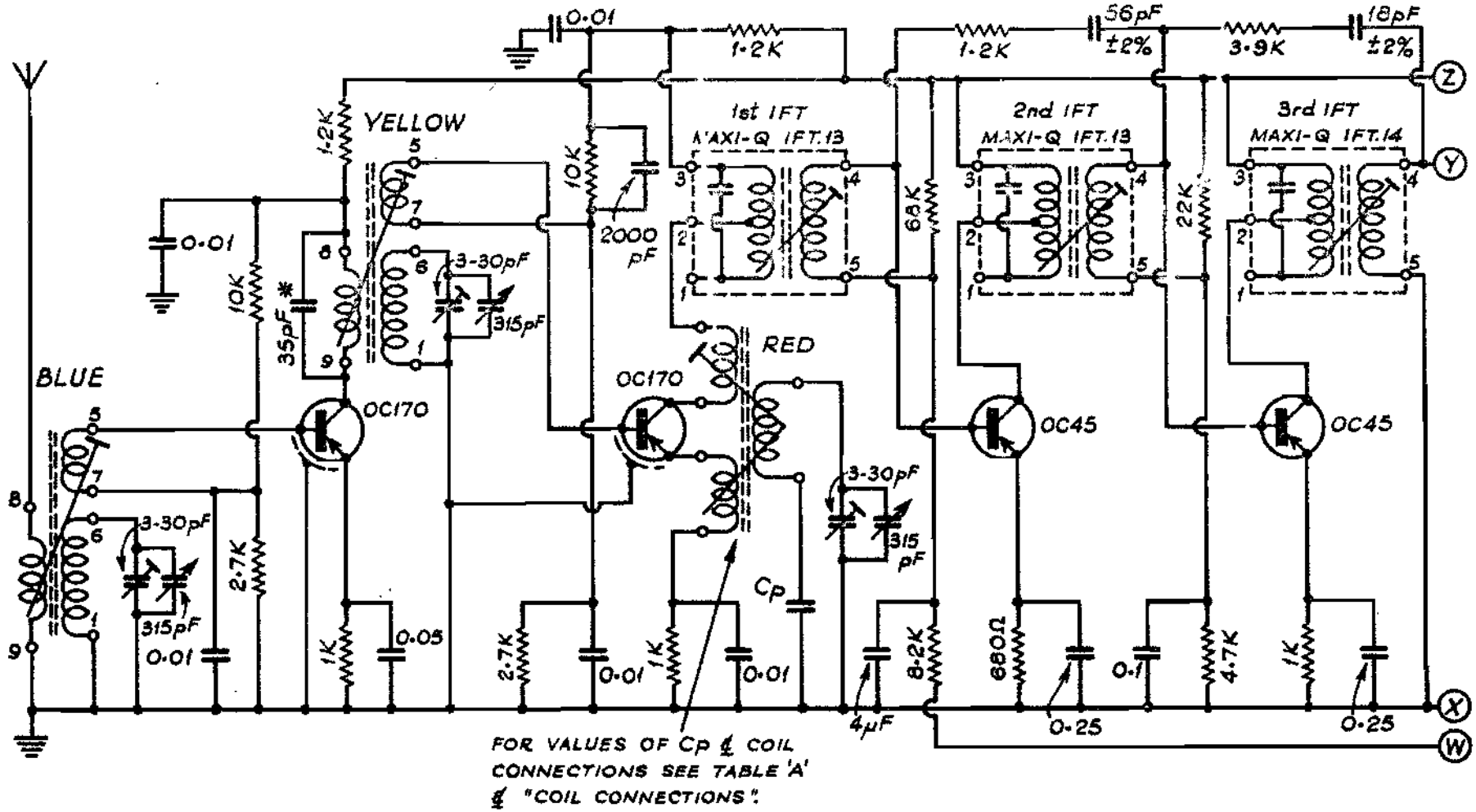
If the signal generator shows the second response to be lower in frequency, then the incorrect response was selected and the operation concerned should be repeated finding a response with the core or trimmer further out than previously.

Pulling ... When adjusting the signal circuits on Short Wave ranges some slight detuning of the oscillator can occur (pulling) and in order to prevent this effect giving a false peak, the signal generator or tuning condenser should be slightly rocked to and fro when carrying out operations (7) and (9) above.

T A B L E B

Alignment and Tracking Points

Range	L.F. Band end	L.F. Tracking Point	H.F. Tracking Point	H.F. Band end
1 (465 kc/s IF)	150 kc/s	165 kc/s	370 kc/s	400 kc/s.
1 (1.6 Mc/s IF)	175 kc/s	192 kc/s	472 kc/s	525 kc/s.
2	515 kc/s	566 kc/s	1390 kc/s	1545 kc/s.
3	1.67 Mc/s	1.83 Mc/s	4.5 Mc/s	5.3 Mc/s.
4	5.0 Mc/s	5.5 Mc/s	13.5 Mc/s	15 Mc/s.
5	10.5 Mc/s	11.5 Mc/s	28.5 Mc/s	31.5 Mc/s.



NOTES.

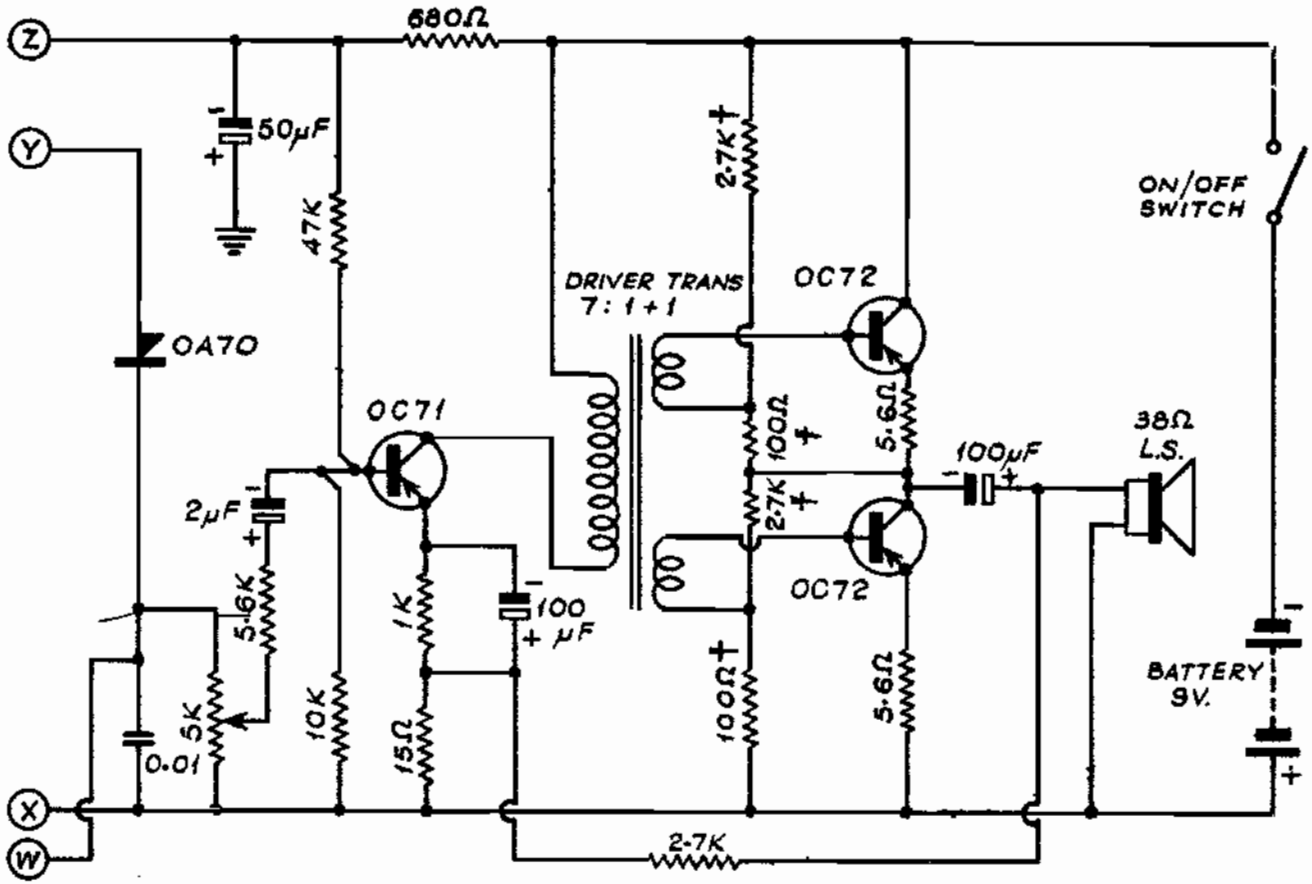
CAPACITOR MARKED * IS REQUIRED FOR RANGE 1T COILS WITH 465 KC/S I.F., BUT MAY BE LEFT IN CIRCUIT ON OTHER RANGES EXCEPTING RANGE 5T.

TOLERANCE OF RESISTORS MARKED † SHOULD BE 5%. TOLERANCE OF ALL OTHER RESISTORS SHOULD BE 10%.

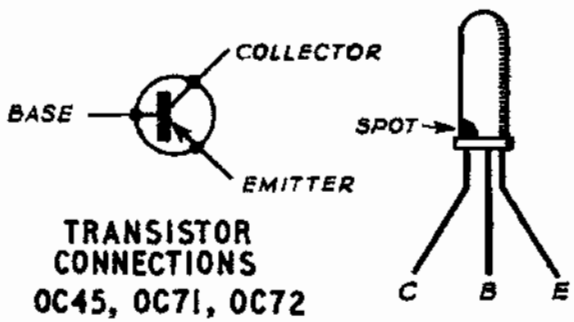
ALL RESISTOR VALUES ARE IN OHMS. ALL CAPACITOR VALUES ARE IN MICROFARADS UNLESS OTHERWISE STATED.

SUGGESTED SUPERHET CIRCUIT USING TRANSISTOR MINIATURE DUAL PURPOSE COILS.
SHEET 1 CONTINUED ON SHEET 2

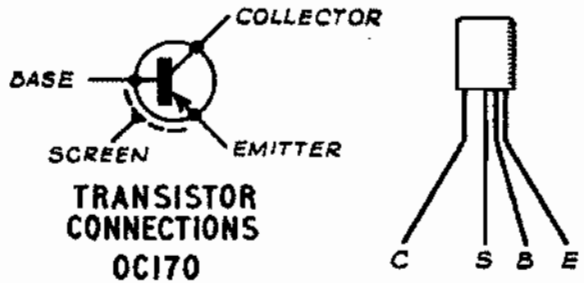
FIG. 1a



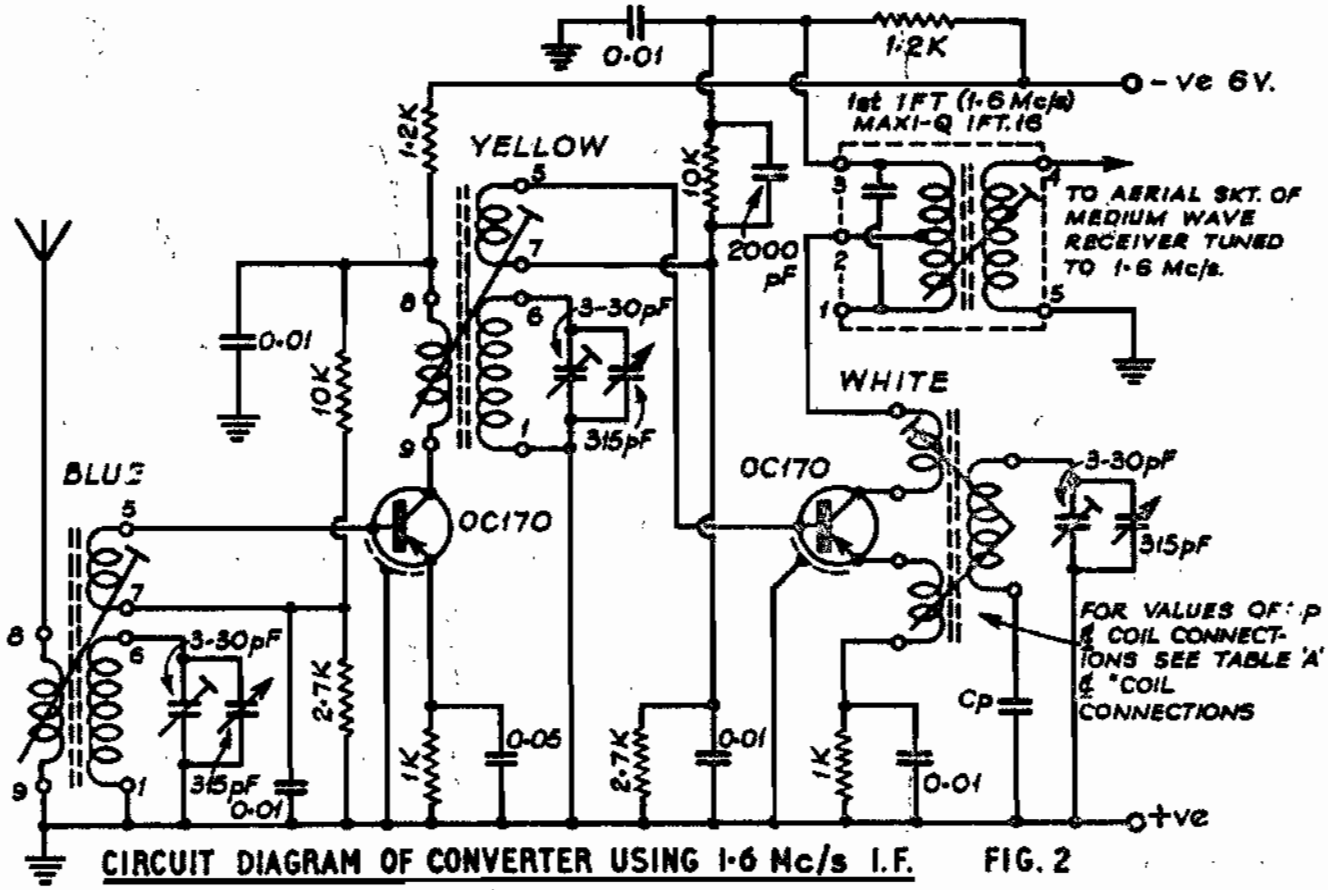
SUGGESTED SUPERHET CIRCUIT, SHEET 2
CONTINUED FROM SHEET 1
FIG. 1b



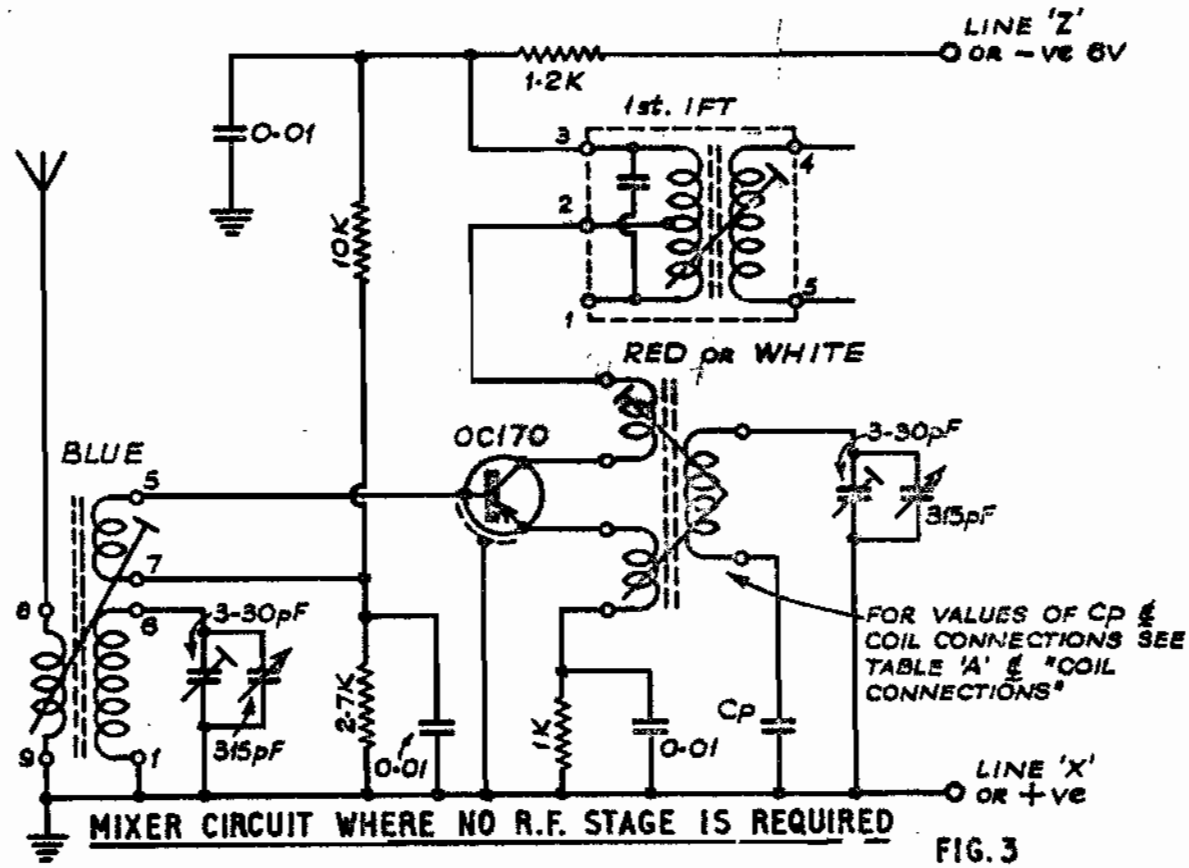
TRANSISTOR CONNECTIONS
OC45, OC71, OC72



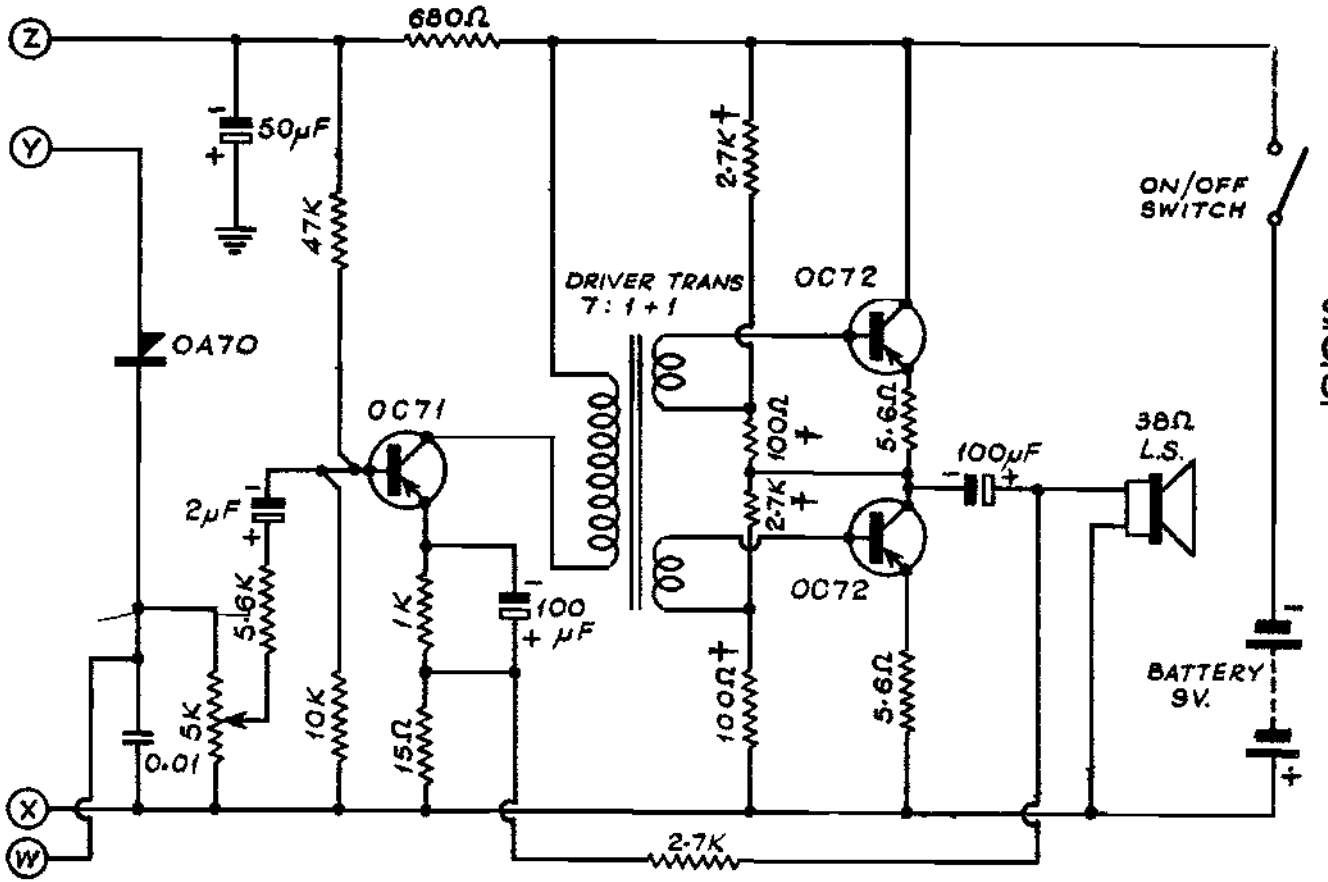
TRANSISTOR CONNECTIONS
OC170



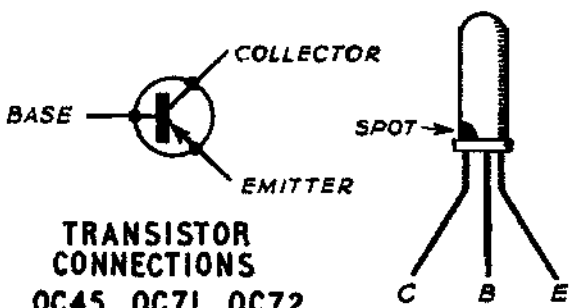
CIRCUIT DIAGRAM OF CONVERTER USING 1·6 Mc/s I.F. FIG. 2



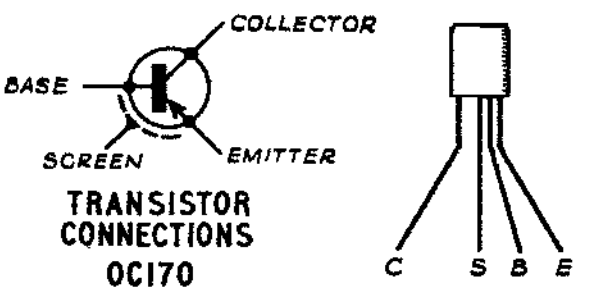
MIXER CIRCUIT WHERE NO R.F. STAGE IS REQUIRED FIG. 3



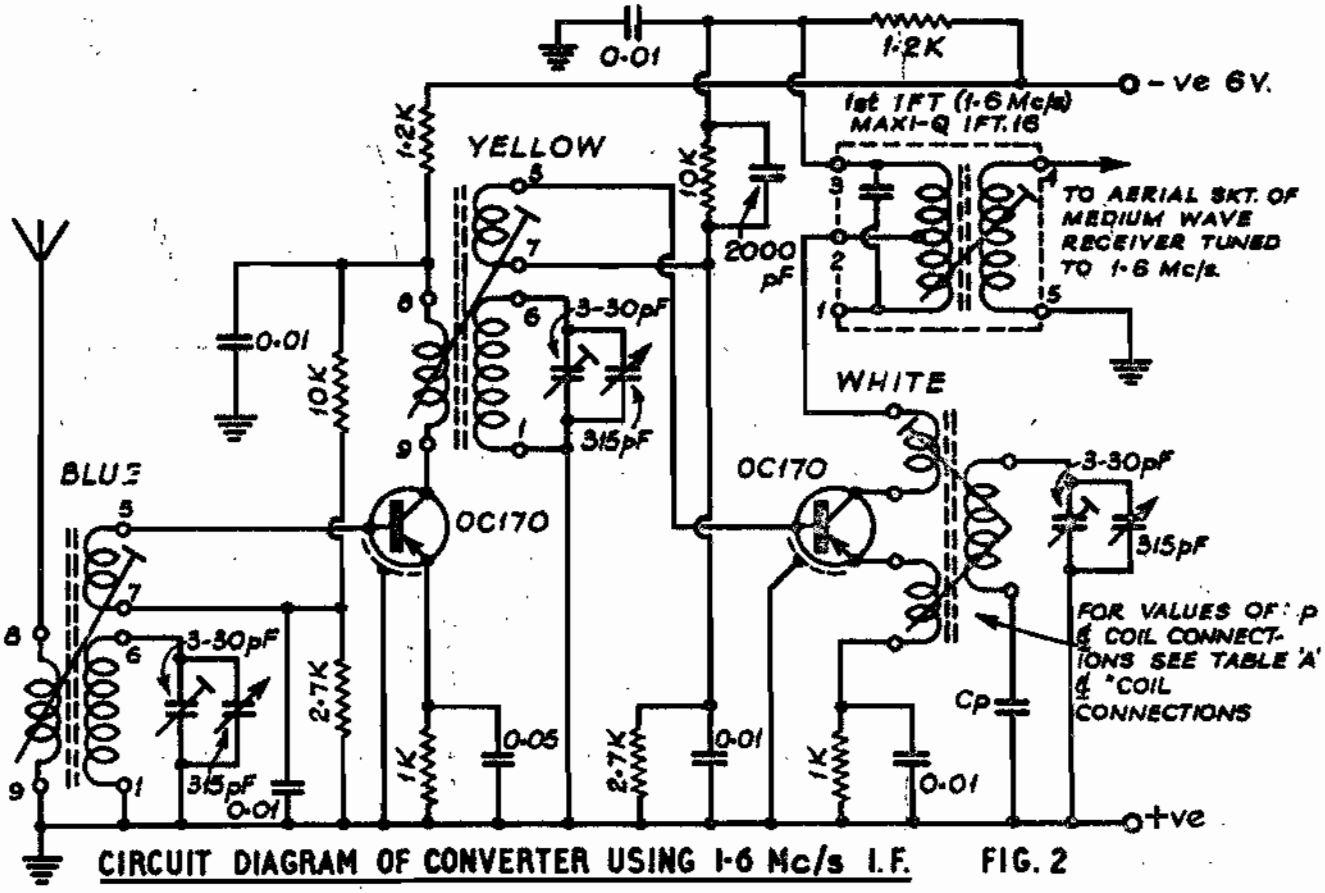
SUGGESTED SUPERHET CIRCUIT, SHEET 2
CONTINUED FROM SHEET 1
FIG. 1b



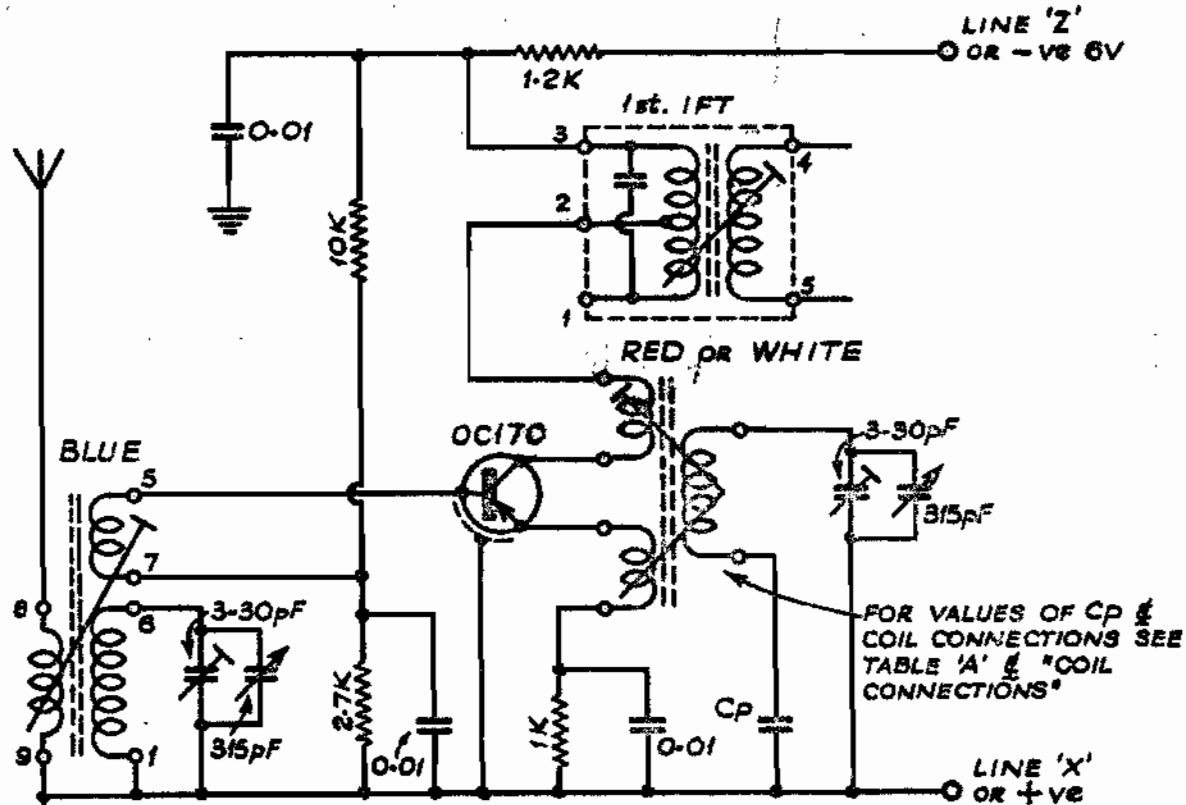
TRANSISTOR CONNECTIONS
OC45, OC71, OC72



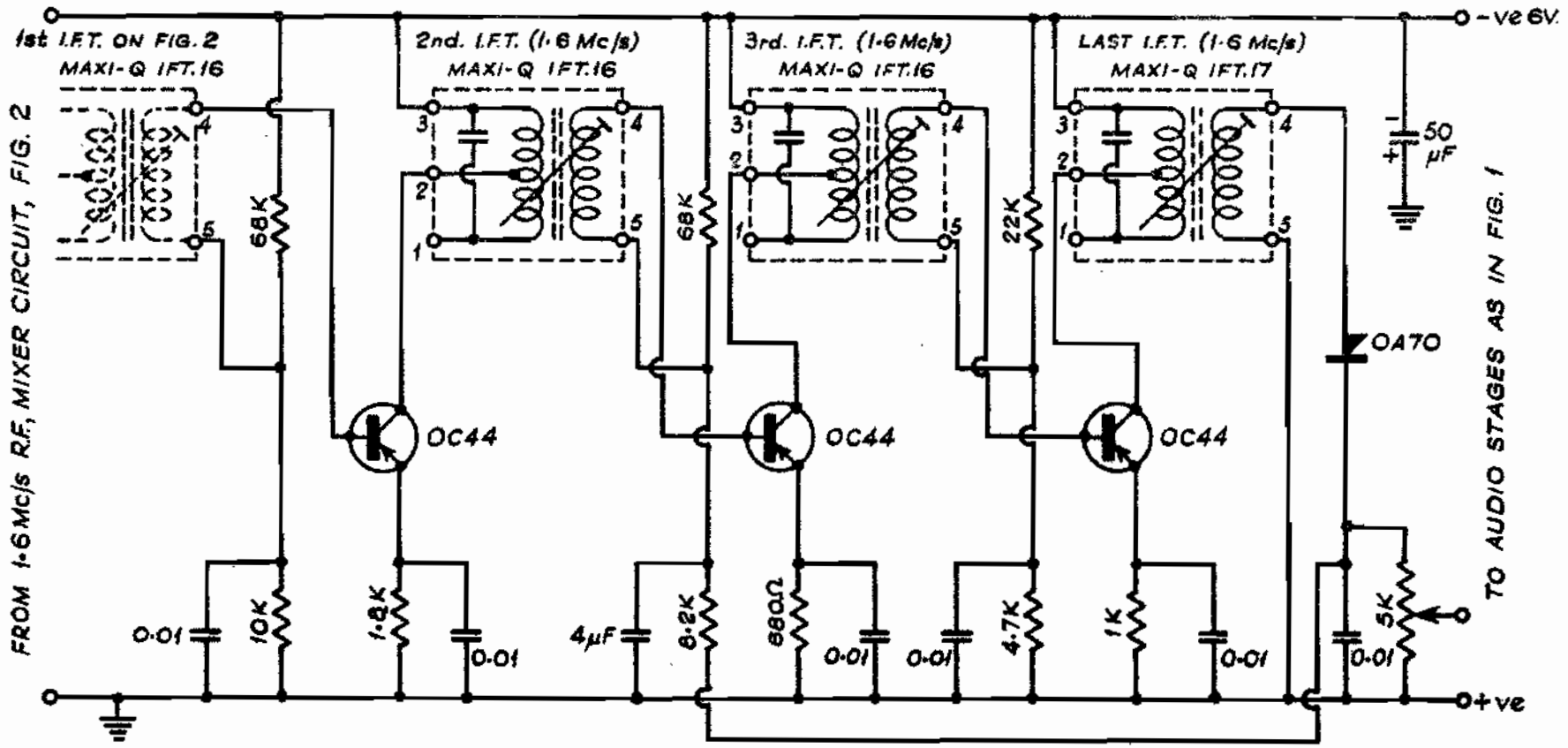
TRANSISTOR CONNECTIONS
OC170



CIRCUIT DIAGRAM OF CONVERTER USING 1·6 Mc/s I.F. FIG. 2



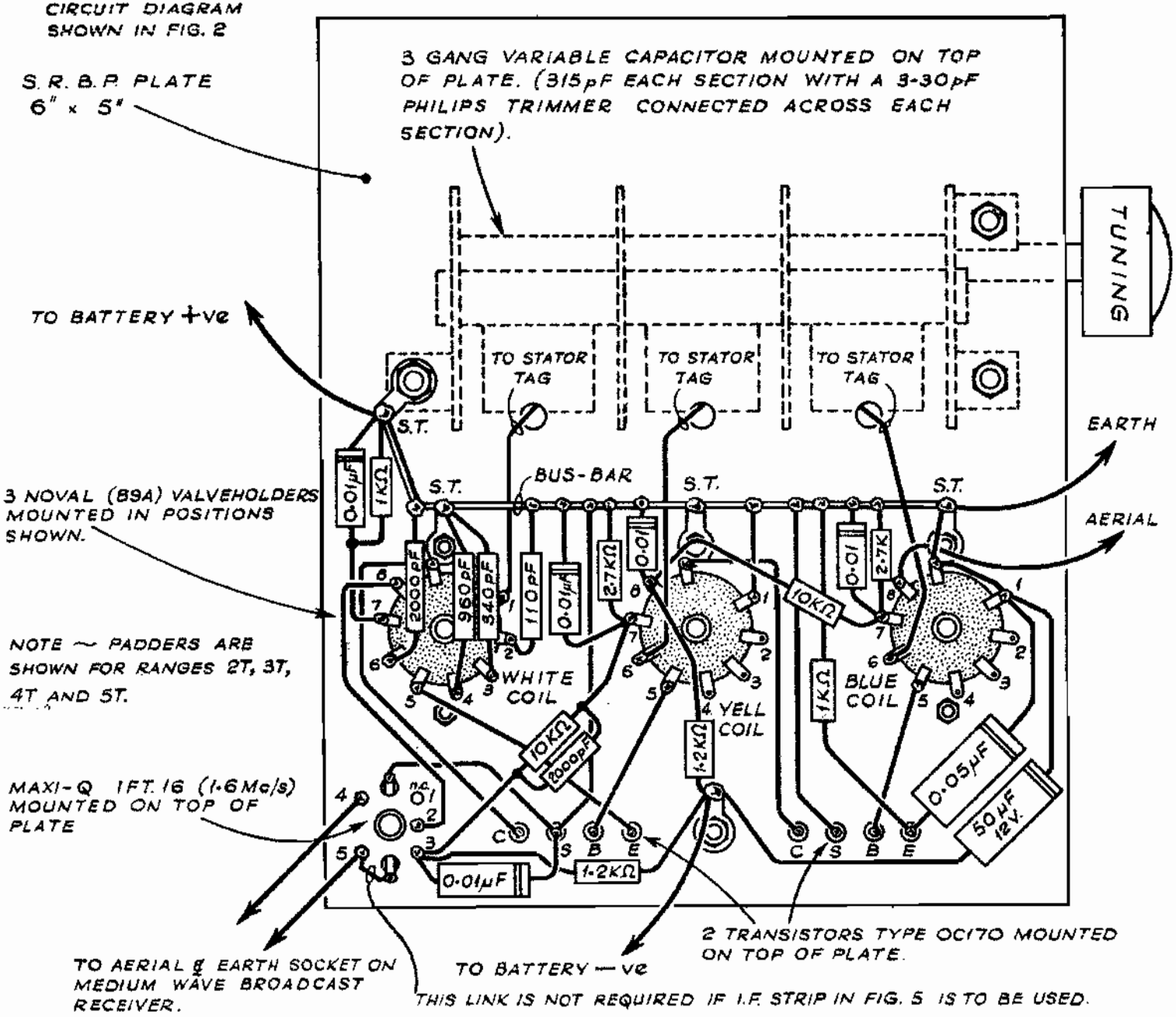
MIXER CIRCUIT WHERE NO R.F. STAGE IS REQUIRED FIG. 3

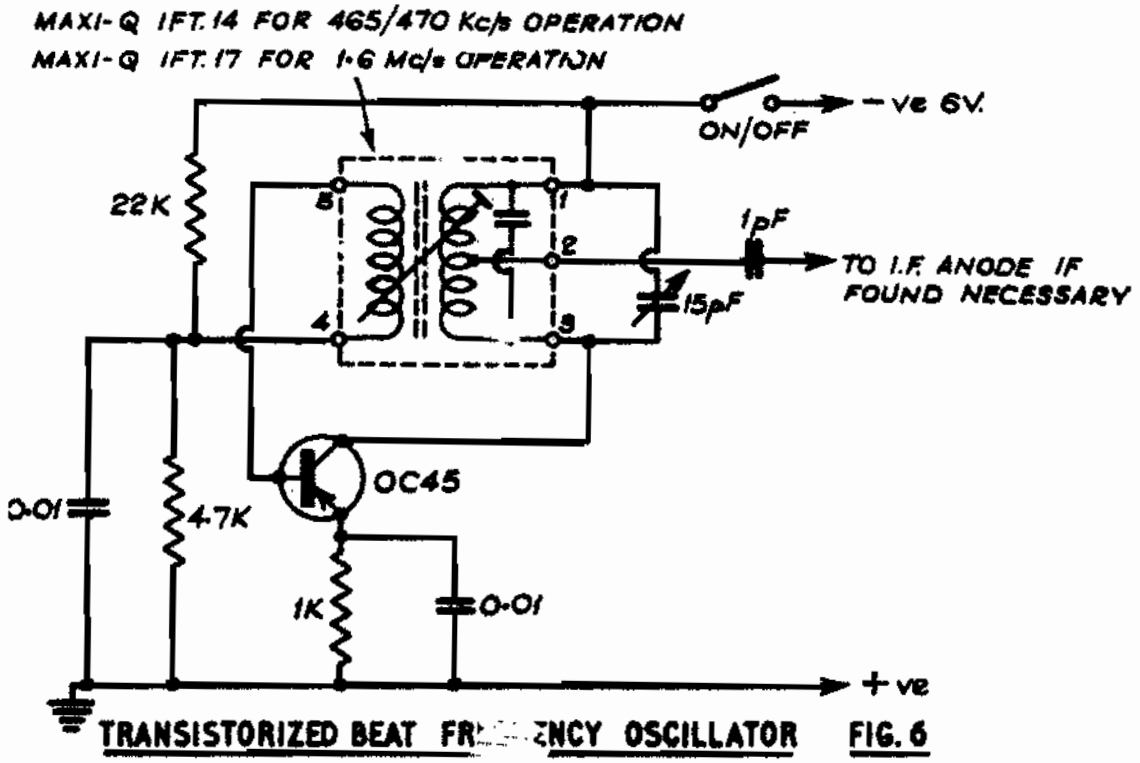


1·6 Mc/s I.F. STRIP FIG. 5

LAYOUT OF CONVERTER (1·6 Mc/s I.F.) USING TRANSISTOR DUAL PURPOSE COILS

FIG. 4





TRANSISTORIZED BEAT FREQUENCY OSCILLATOR FIG. 6

SECTION 2

MINIATURE DUAL PURPOSE COILS

INTRODUCTION... ...

The range of Miniature Dual Purpose Coils has been developed to comply with the modern trend in radio design of making smaller and more compact equipment and the purpose of this Technical Bulletin is to offer suggestions on the use of the Miniature Dual Purpose Coils.

Naturally the circuits shown give only a few of the applications that these coils can be put to for instance, they are ideally suitable for incorporating in Signal Generators, Beat Frequency Oscillators, Wavemeters, C.W. Monitors, etc. It will be appreciated that we cannot undertake to carry out design work for individual constructors and technical queries should be limited generally to apply to our particular components and circuits.

MINIATURE DUAL PURPOSE COILS ... ...

These coils can be used for quick change chassis mounting by insertion in a Noval (B9A) type of valveholder or can be used as a permanent fixture by assembling to chassis at opposite end with an 0 B.A. moulded nut, the valve feet then being used as terminal soldering tags. It should be noted that for highest possible insulation the formers are moulded in polystyrene and the threaded portion can be twisted off. The moulded fixing nut should therefore only be assembled 'finger-tight'.

Every coil is provided in an airtight aluminium container, the size of which has been calculated to enable you to use it as screening can for the coil.

These formers are made of pure polystyrene moulded in colour Blue, Red, Yellow, Green and White for easy circuit identification.

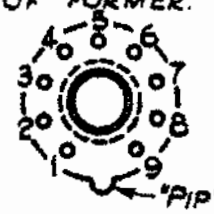
Complete range for Superhet or Straight receivers covering ex. 150 kc/s. to 80 Mc/s.

DIMENSIONS ... ...

Former Diameter	.375"
Maximum overall height excluding adjusting stem of core and pins	1.250"
Plug-in Base Diameter	.625"
Fixing hole Diameter	.250"

Core .50" long x.250" dia (6 B.A. Threaded Brass insert).

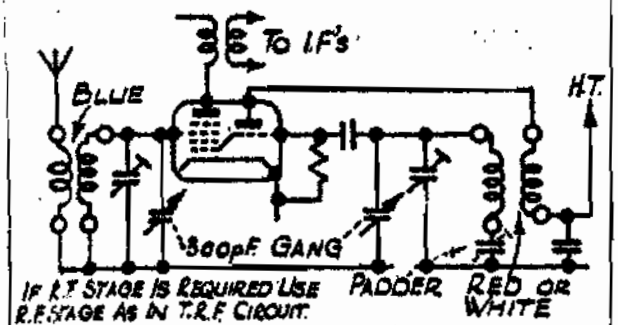
GENERAL DATA



NUMBERS REFER TO STANDARD NOVAL VALVE BASE NUMBERING.

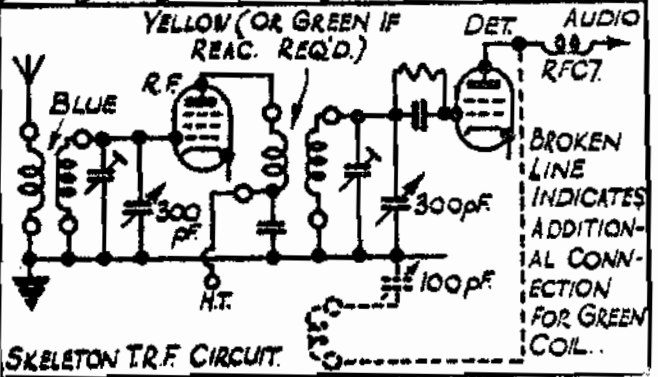
PIP ON BASE SIMULATES LOCATOR.

COIL COLOUR	PIN CONNECTIONS. 1	2	3	4	5	6	7	8	9
BLUE.	EARTH A.V.C.					GRID		AERIAL	EARTH
YELLOW	EARTH A.V.C.					GRID		H.T.	R.F. ANODE
GREEN		EARTH A.V.C.	ANODE REAC.	REAC.	GRID			AERIAL OR R.F	EARTH OR H.T.
RED EXCEPTING RANGE 1.	GRID	PADDER OR EARTH				PADDER OR EARTH		OSC. ANODE	H.T.
WHITE EXCEPTING RANGE 1	GRID	PADDER OR EARTH						ANODE	H.T.
RANGE 1 RED AND WHITE.					PADDER		GRID	ANODE	H.T.



IF R.F. STAGE IS REQUIRED USE R.F. STAGE AS IN T.R.F. CIRCUIT.

SKELETON SUPERHET CIRCUIT.



SKELETON T.R.F. CIRCUIT.

GENERAL DATA — TABLE 1

RANGE	Ls µH.	COVERAGE 39/352 pF Mc/s.	METRES.	'Q' Ls	465 Kcs. Lo µH.	Cp pF.	Z pF.	Cto pF.	1·6 Mcs Lo µH.	Cp pF	Z pF.	Cto pF.
1	2350	0·150/0·500	2000/750	65	535	110	5	30	156	50	5	21·5
2	271	0·515/1·545	580/194	115	129	350	2	0	66	110	2	20
3	27·2	1·67/5·3	180/57	100	20·6	1100	3	6	13·6	340	3	11
4	2·9	5·0/15	60/20	95	2·65	3000	4	1·5	2·22	960	4	4·5
5	0·65	10·5/31·5	28/9·5	140	0·6		6	0·6	0·58	2000	6	1·5
6	0·4	30/50	10/6		0·33	TUNED WITH NOMINAL 50pF. CIRCUIT CAPACITY 23·5pF. INCLUDING TRIMMER. THESE RANGES HAVE I.F. OF APPROX. 5 Mc. ONLY. OSC. COILS RED.						
7	0·18	45/78	6·6/3·8		0·15							

NOTE: 50pF. TO BE ACROSS GRID WINDING OF RANGE 1 BLUE AND YELLOW COIL. WHEN USING A 1·6 Mc. I.F. RANGE 1 COVERS ·175/·525 Mc. — 1700/570 METRES.

Ls: NOMINAL INDUCTANCE MAIN WINDING (AVERAGE OF ±15% VARIATION OBTAINABLE BY CORE ADJUSTMENT).

QLs: 'Q' OF MAIN WINDING AT MID POINT OF TUNING RANGE.

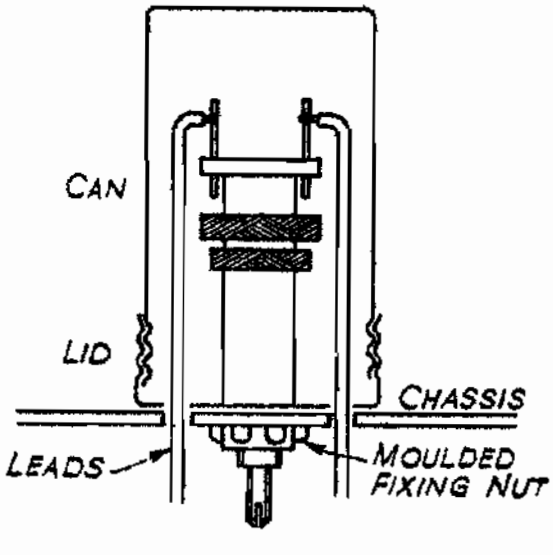
Lo: NOMINAL INDUCTANCE OF OSCILLATOR WINDINGS. Cp: PADDER.

Cto: OSCILLATOR TRIMMER (N.B. OVER AND ABOVE AN ASSUMED CIRCUIT CAPACITY OF 39pF).

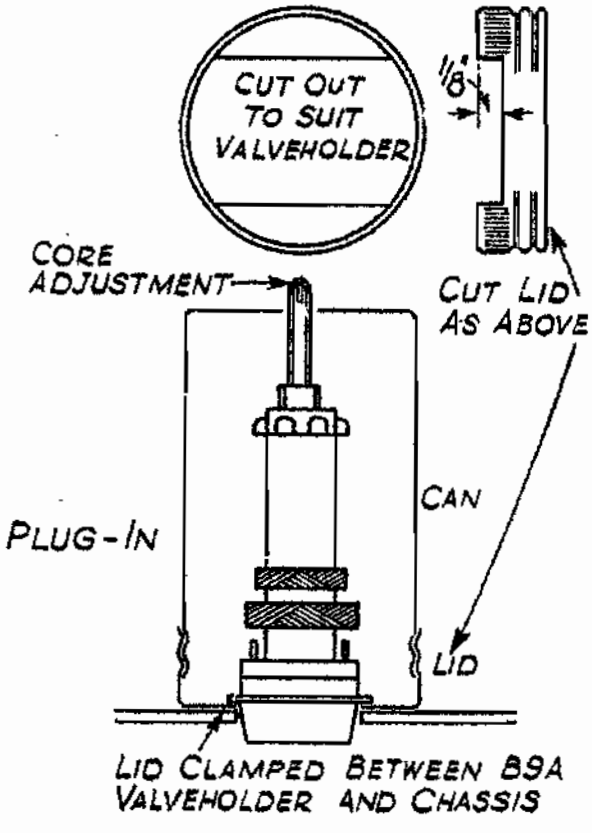
THE APPROXIMATE FIXED CAPACITORS REQUIRED TO TUNE "MINIATURE DUAL PURPOSE COILS" TO THE PRINCIPLE BROADCASTING STATIONS.

STATION	WAVE-LENGTH METRES	FREQ. Kc/s.	SIGNAL BLUE, YELL. GREEN	OSC. FOR 465 Kc/s. I.F. RED	STATION	WAVE-LENGTH METRES	FREQ. Kc/s.	SIGNAL BLUE, YELL GREEN	OSC. FOR 465 Kc/s. I.F. - RED
RANGE 1					BERLIN	303	989	85 pF	70 pF
B.B.C. LIGHT	1500	200	260 pF	80 pF	HILVERSUM II	298	1007	80	65
RANGE 2					B.B.C. WEST	285	1052	75	60
B.B.C. THIRD	464	647	215	130	B.B.C. MIDLAND	276	1088	70	60
B.B.C. NORTH	434	692	185	120	B.B.C. NORTH & N.I.	261	1151	65	55
HILVERSUM I	402	746	160	110	B.B.C. LIGHT	247	1214	55	50
B.B.C. SCOTTISH	371	809	135	100	LUXEMBOURG II	208	1439	35	30
PARIS I	348	863	120	90	B.B.C. WEST	206	1457	35	30
B.B.C. WELSH	341	881	110	85	B.B.C. THIRD	194	1546	30	25
B.B.C. LONDON	330	908	105	80					

— METHOD OF USING PACKING CAN FOR SCREENING PURPOSES —



CHASSIS MOUNTING



Notes ...

(a) The values in Table 1 only apply when the recommendations in the following pages are adopted. A tuning condenser capacity of 300pF. nominal has been chosen in preference to the more usual 500pF. (0.0005 mfd.) because this lower value allows for less critical tuning on the higher frequency ranges, also for better performance generally.

(b) Where difficulty is experienced in obtaining the specified 0.0003 mfd condensers it is possible to use 0.0005 mfd, provided fixed condensers of 0.001 mfd. are connected in series with each section of the gang to reduce the capacity to the value required. These condensers should be of high quality mica insulated type. With this arrangement the recommendations in Table 1 etc., can still be followed.

The maximum capacity of various makes of nominal 500pF. condensers varies considerably. Those having an actual maximum of 480-490pF. will conform most closely to the data given with the 0.001 mfd series condensers.

(c) It will be noted that there is a slight break in the coverages given in the Table from Range 2, 1.545 Mc/s. to Range 3, 1.67 Mc/s. This avoids I.F. instability when using 1.6 Mc/s I.F. When desired, complete coverage can, however, be obtained by increasing the inductance on Range 3 and Range 4 by core adjustment to allow for overlap from Range 2 to 3 and 3 to 4.

(d) Range 5 oscillator is the same coil for 465 kc/s and 1.6 Mc/s I.F.

(e) Ranges 6 and 7 are not normally supplied with cores but where desired for special purposes these can be supplied.

COLOUR CODE ...

The following colour code identifies the coils:

BLUE ..... Signal grid coil with aerial coupling winding.
YELLOW ... Signal grid coil with intervalve coupling winding.
GREEN .... Grid coil with Reaction and Coupling windings (6 pin). These coils are available for Ranges 1-5 only.
RED ..... Superhet Oscillator for I.F. of 465 kc/s.
WHITE .... Superhet Oscillator for I.F. of 1.6 Mc/s.

Note - Ranges 6 and 7 RED can be used for various I.F.'s: no WHITE coils are made for these ranges.

DESIGN DATA FOR RECEIVERS USING MINIATURE DUAL PURPOSE COILS ...

Circuit Diagram Fig.No.2 is suggested as the basis of a receiver suitable for communications purposes covering 150 kc/s - 31.5 Mc/s (465 kc/s I.F.) or 175 kc/s - 31.5 Mc/s (1.6 Mc/s I.F.). The recommended valves are Mullard using the B8A base.

General Notes ... The gang condenser should have a ratio of maximum capacity to minimum capacity of not less than 30:1 and maximum value of 330pF. The stray signal circuit capacities should be approximately as follows. Self-capacity of coils according to the range from less than 1pF. to 10pF. The wiring should not produce greater capacity than 15pF thus care should be exercised in the use of screened

sleeving and all wiring connected with signal and oscillator circuits must be kept as short as practical.

It is recommended that the gang condenser used has a ceramic insulated stator as in the cases of some forms of insulation the minimum capacity may be considerably greater than the minimum capacity required of 11pF. Totalling the minimum gang capacity with the stray capacities a 3/30pF trimmer is required to bring the total minimum circuit capacity up to the required 39pF. It is recommended that for reliability the Philips concentric air-spaced trimmer be used in preference to the compression type trimmer. The measured maximum capacity of a nominal 300pF gang condenser made by a well known manufacturer was found to be 324pF; using a gang condenser of this type gives a maximum tuning capacity of 324pF plus 28pF giving a capacity ratio of 1:9 and frequency tuning ratio of 1:3. The padder and trimmer values to give 3 point tracking have been calculated on the assumption that the above instructions are adhered to.

POINTS TO NOTE ... The oscillator coils are arranged so that the connection for the padder condenser is brought out to a different pin in each range so that when using the coils as "plug-in" the padder condenser can be wired permanently to the Noval valve base and whichever range of coils are used the correct value padder is automatically connected when the oscillator coil is plugged in. If it is inconvenient to fit trimmer condensers Cto and Cts may be variable air spaced condensers with controls brought to the front of the panel, in this case it will be necessary to mark the setting for each range.

When using the coils as chassis mounting the trimmers will normally be connected to the rotating wafer type wavechange switch, one trimmer being used for each range.

A series fed coupling winding is recommended to provide adequate oscillator voltage at high frequencies and low damping at low frequencies.

Avoid long leads in the oscillator and signal circuits otherwise the inductance and capacity introduced may make it impossible to obtain coverage on the high frequencies taking particular care that there is direct coupling between the gang and earthy ends of the coils (via padder in the case of the oscillator).

Valve and coil holders should be of low-loss construction.

Make sure that any points to be soldered are clean and that no dry joints are left.

When using the coils for general broadcast work the R.F. stages may be omitted in which case follow the appropriate connections on the circuit and use the Blue coil instead of the Yellow.

When using a 1.6 mc/s I.F., for better selectivity it is desirable to use an extra I.F. stage, this I.F. gives greater freedom from second channel interference.

CIRCUIT ALIGNMENT (Oscillator and Mixer) ...

It is almost essential that this be carried out with a signal generator, preferably modulated, and with controlled output.

Having previously aligned the I.F. stages to the correct frequency -

(1) Inject into mixer grid via a 0.1 mfd condenser and, with tuning condenser at maximum, adjust the core of Lo to give the lower frequency (Table 1) of the band selected. With tuning condenser at minimum, adjust Ct. for higher frequency, ensuring that the higher of the two possible oscillator circuit frequencies is selected (i.e., the oscillator is higher in frequency than the signal circuit). This is important when using 465 kc/s I.F. as the image frequency can be quite easily selected by mistake. Repeat this alignment at both the L.F. and H.F. ends until no further adjustment is required to set the range.

(2) Inject into the aerial coupling coil, via either a standard dummy aerial or a 400 ohm resistor. Set signal generator to lowest frequency of the range in use, as shown in Table 2. Tune the receiver to this signal and adjust Ls for maximum output. Work with the smallest possible signal. Set signal generator to highest frequency shown in Table 2, for the range in use, tune receiver, and adjust Cts for maximum output. Repeat this until no further increase in output can be obtained at either frequency.

If the receiver is tracking correctly, no appreciably greater output will be obtained at middle frequency (Table 2) by adjusting the trimmer or coil slug.

Example ... Suppose it is desired to align range 5. From Table 1 it will seen that the lowest frequency of the band is 10.5 Mc/s. Therefore set signal generator to the frequency, inject as in para. 1 and adjust Lo with tuning condenser at maximum. Set signal generator to 31.5 Mc/s (highest frequency, Table 1), or, if this is unobtainable, use the second harmonic of 15.75 Mc/s and adjust Cto. Two responses will be obtained and the higher, i.e., the one with the trimmer farthest out should be selected. Repeat this process as detailed in para. 1.

With signal generator set to 11.55 Mc/s (Table 2) inject into aerial as stated, tune receiver, and adjust Ls for maximum output. With signal generator at 28.35 Mc/s tune receiver to correct beat (highest) and adjust Cts. at the same time gently 'rocking' tuning control to eliminate 'pulling' between oscillator and signal circuits. (It is possible to 'pull' the oscillator by varying Cts and the correct adjustment is with Cts near maximum). Set signal generator to 16.65 Mc/s., tune receiver and observe the intensity of the received signal. If tracking is perfect no increase of signal strength can be obtained. After this check, reset as above.

Perfect Tracking Points ... These are the three points on each range where the signal and oscillator circuits are exactly the I.F. apart:-

TABLE 2

Range 1 ...	192.5	277.5	472.5	kc/s.
Range 2 ...	566.5	817	1390.5	kc/s.
Range 3 ...	1.835	2.64	4.5	Mc/s.
Range 4 ...	5.5	7.93	13.5	Mc/s.
Range 5 ...	11.55	16.65	28.36	Mc/s.

R.F. STAGE ... Where an R.F. stage is used the Yellow series of coils must be used in the mixer grid circuit and the Blue coils used in the aerial circuit. A 3 gang condenser will, of course, be necessary and the extra trimmers will be 3-30pF. A valve of the EF41, 6K7, EF39, KTW61, etc., class will be suitable. To prevent coupling and, hence instability between the R.F. grid circuit and the R.F. anode-mixer grid circuit, suitable layout and screening should be used.

ALIGNMENT ... After setting frequency coverages (Table 1) by oscillator padder, trimmer and core adjustment as already described, inject into the R.F. grid via a 0.1 condenser, align mixer grid coil (Yellow) at end tracking points. Then inject into the aerial terminal via dummy aerial and align input circuit as per 'Circuit Alignment (2)'.

BAND SPREAD ... Where required, band spreading can be carried out by the use of small variable ganged condensers of 3-15pF connected in parallel with the main tuning condenser.

Alignment should then be carried out as already described with the Band Spread condenser at the 'half way' position and reducing the trimming capacity sufficiently to allow for added tuning capacity. At 'half way' position the Band Spread will have a capacity of 9pF., i.e. 3pF minimum plus 6pF). Care should be taken to make the connections to the B.S. condenser as short as possible, so that the circuit capacity is not increased, otherwise correct alignment would not be possible.

On the amateur bands the following spreading would be obtained using the 15pF suggested.

Centre frequency in Band.	Band Spread coverage.
3.65 Mc/s.	150 kc/s.
7.15 Mc/s.	125 kc/s.
14.2 Mc/s.	970 kc/s.
29.0 Mc/s.	1.87 Mc/s.

Alternatively of course, mechanical bandspread, by the use of a good quality dial and reduction drive direct to the main condenser, is quite effective provided there is no back-lash in the drive.

V.H.F. CONVERTER (Fig. 3) ...

The converter employs one R.F. stage, mixer and separate oscillator using easily obtainable valves, namely EF54, EF50 and EC52.

The wave range is from 30 - 78 Mc/s. covered in two bands called 6 and 7 (i.e., Miniature Dual Purpose Coils ranges 6 and 7 are used).

The complete coverage is:-
Range 6 ... 30 - 52 Mc/s. Range 7 ... 45 - 78 Mc/s.

The alignment points are:-
Range 6 ... 33 and 46.8 Mc/s. Range 7 ... 49.5 and 70.2 Mc/s.

The I.F.T. used is for 5 Mc/s and has a low impedance output (600 ohms) for connecting to the input of the receiver. If perfect tracking is to be obtained, padders should be used, and these might well be fitted to the oscillator coils, soldered one end to the coil base and the other to the tuning condenser. However, for use on comparatively narrow bands, such as the amateur 5 metre band padding will not be necessary.

The padder values are:-
Range 6 ... 500pF. Range 7 ... 750pF.

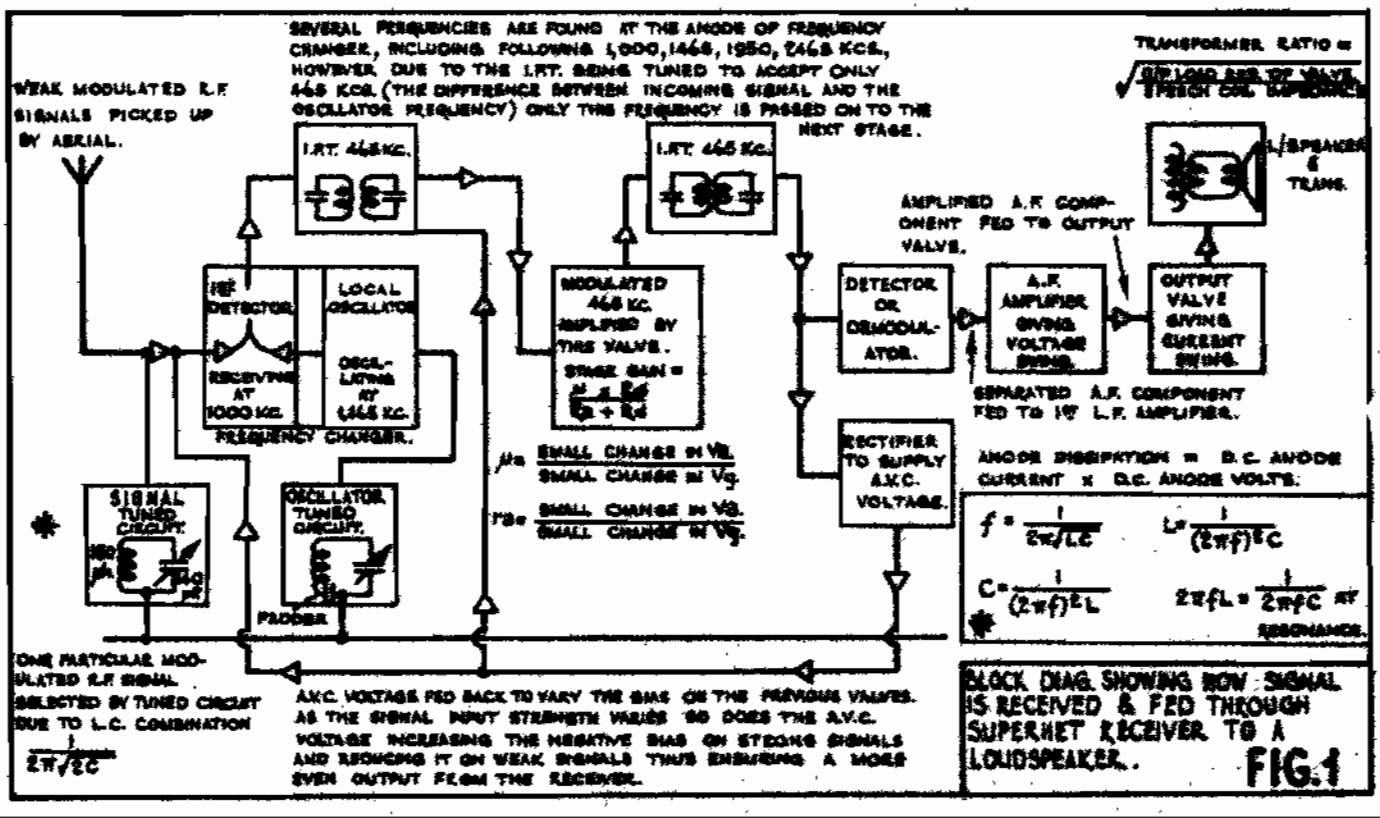
The alignment procedure is the same as for the 5 Band Superhet receiver, the adjustment at the L.F. end, if necessary, being achieved by spacing of coil turns.

Important Electrical Features ... The EF50 valve used as a mixer, fed by a separate oscillator, although advantageous in many respects, has a low input resistance (G1-K) at frequencies greater than 30 Mc/s. (e.g., 5000 ohms at 40 Mc/s to 1250 ohms at 80 Mc/s). This being so, the anode circuit of the R.F. valve is tuned and the mixer grid coupled to it to reduce the damping on the tuned circuit. The input stage does not suffer from this disadvantage as the input resistance of an EF54 (RL7) is 16,000 ohms at 40 Mc/s. to 4,000 ohms at 80 Mc/s., and the grid circuit is tuned with the aerial input (approx. 80 ohms) coupled to it.

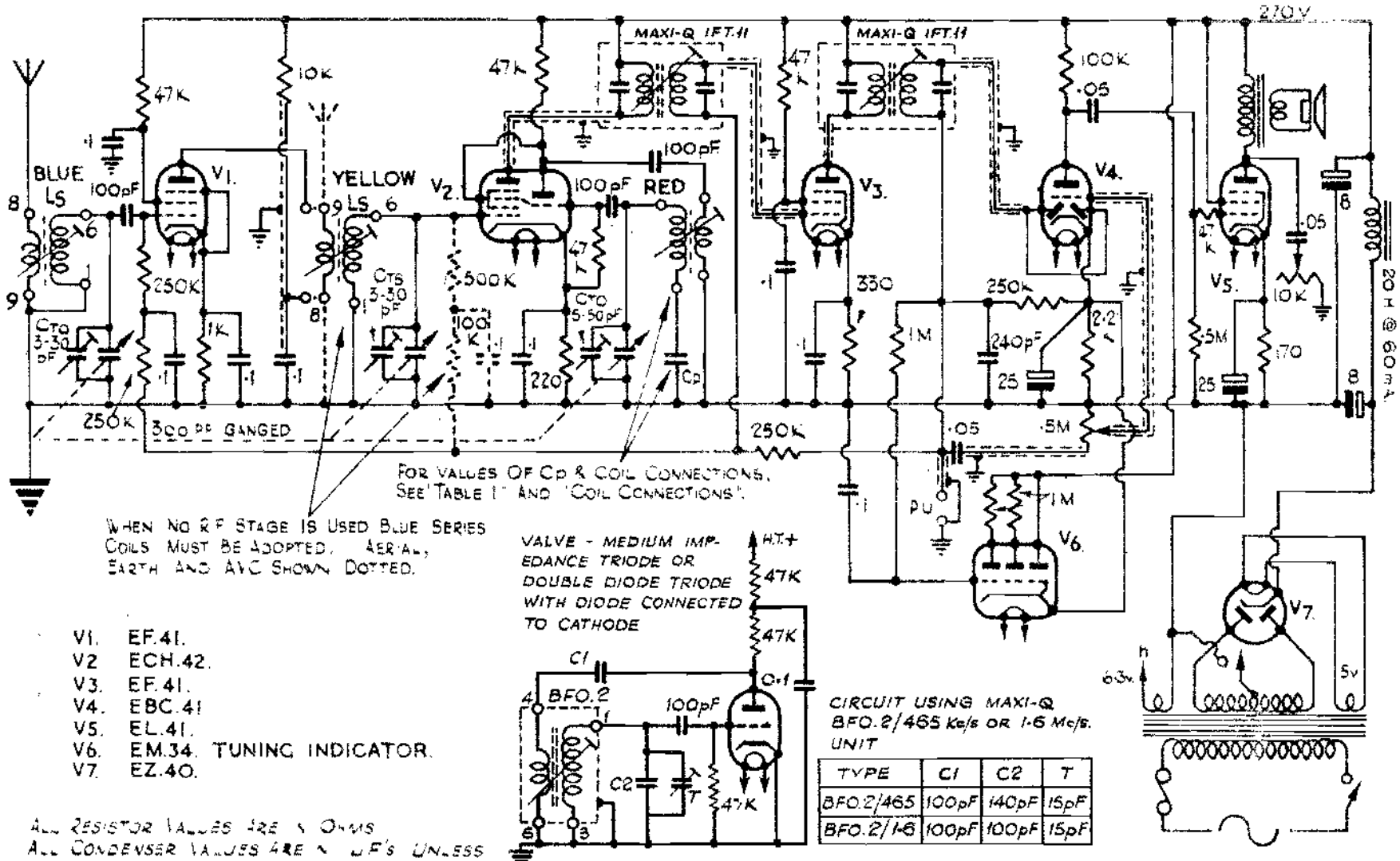
Important Mechanical Features ... Perhaps the most important point in the design of this type of converter is the mechanical layout, and the following suggestions must be adhered to:-

(1) All leads from coil to tuning condenser must not exceed 1".
(2) All earthings of components associated with one stage should be taken to the same earth point.
(3) All leads from tuned circuits to valves must be as short as possible. Use insulated coupling bushes between variable condensers.

A suggested mechanical layout is also given, and although it is not claimed as being the best possible arrangement, it is hoped that it will give some idea of the shortness of connection necessary.



BLOCK DIAG. SHOWING HOW SIGNAL IS RECEIVED & FED THROUGH SUPERHET RECEIVER TO A LOUDSPEAKER. FIG.1



V1. EF.41.
V2 ECH.42.
V3. EF.41.
V4. EBC.41
V5. EL.41.
V6. EM.34. TUNING INDICATOR.
V7 EZ.40.

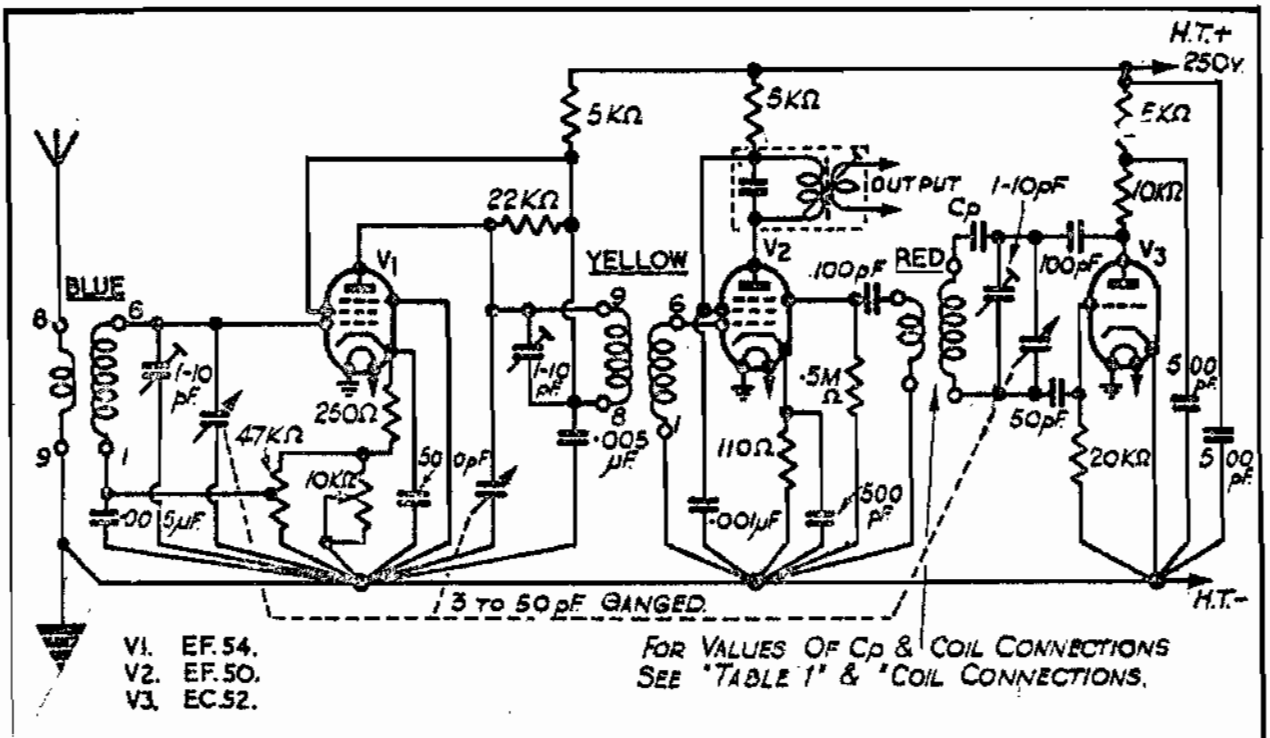
ALL RESISTOR VALUES ARE IN OHMS
ALL CONDENSER VALUES ARE IN μF's UNLESS OTHERWISE STATED.

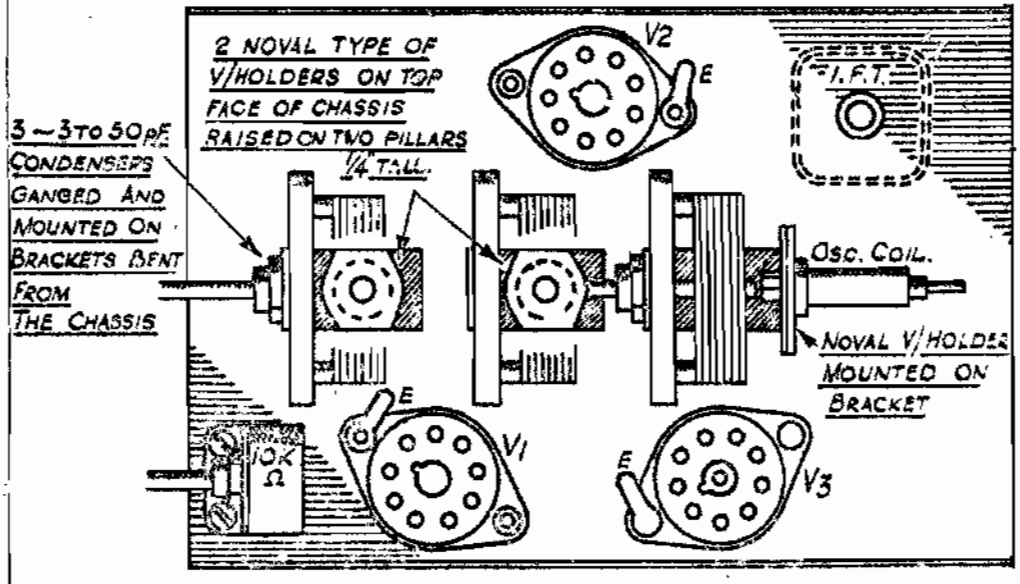
CIRCUIT USING MAXI-Q BFO.2/465 Kc/s OR 1·6 Mc/s. UNIT

TYPE	C1	C2	T
BFO.2/465	100pF	140pF	15pF
BFO.2/1·6	100pF	100pF	15pF

GENERAL PURPOSE SUPERHET FOR USE WITH MINIATURE DUAL PURPOSE COILS

FIG. 2

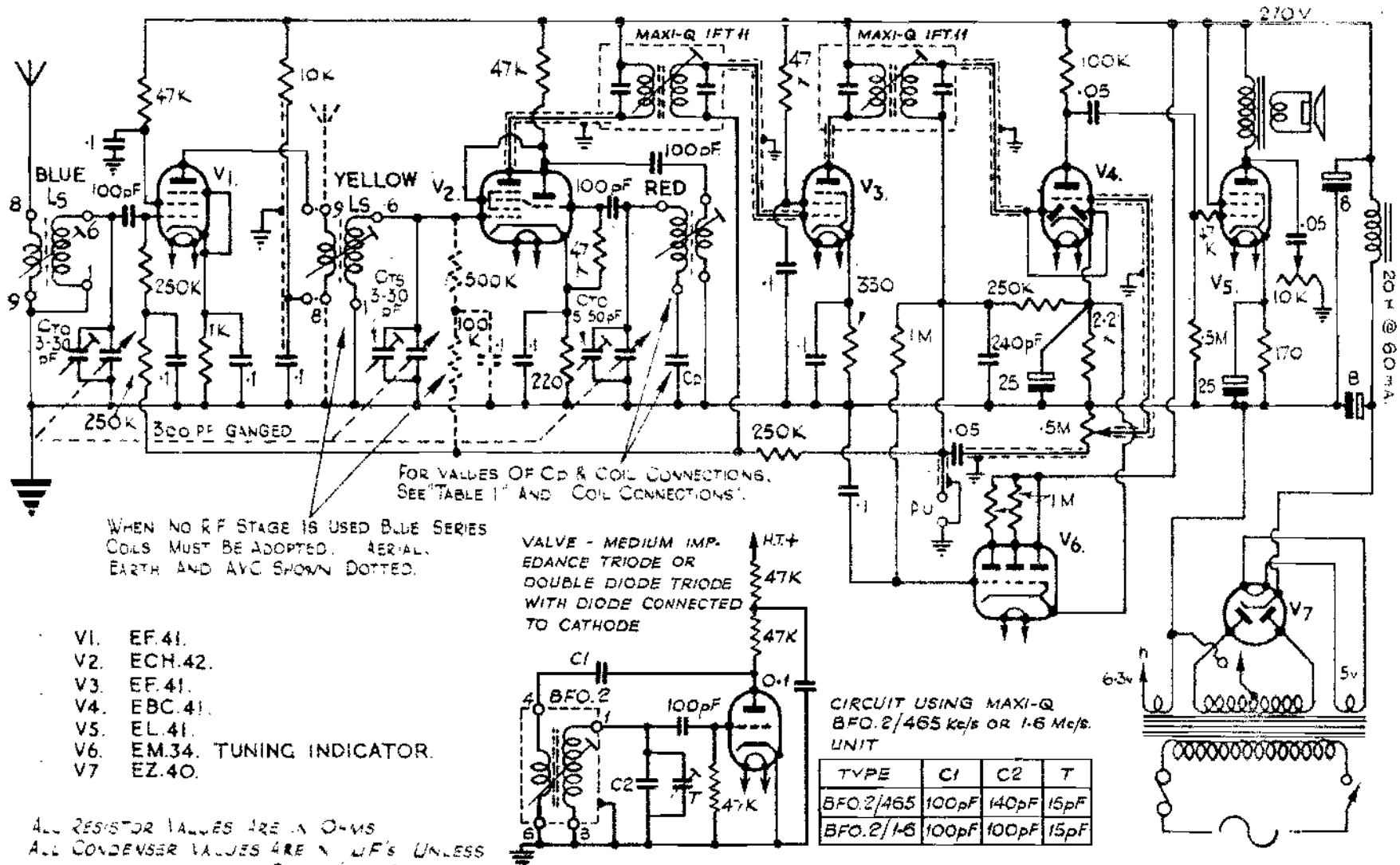




UNDERCHASSIS VIEW.

V.H.F. CONVERTOR FOR USE WITH MINIATURE MAXI-"Q" COILS.

FIG.3



V1. EF.41.
V2. ECH.42.
V3. EF.41.
V4. EBC.41.
V5. EL.41.
V6. EM.34. TUNING INDICATOR.
V7 EZ.40.

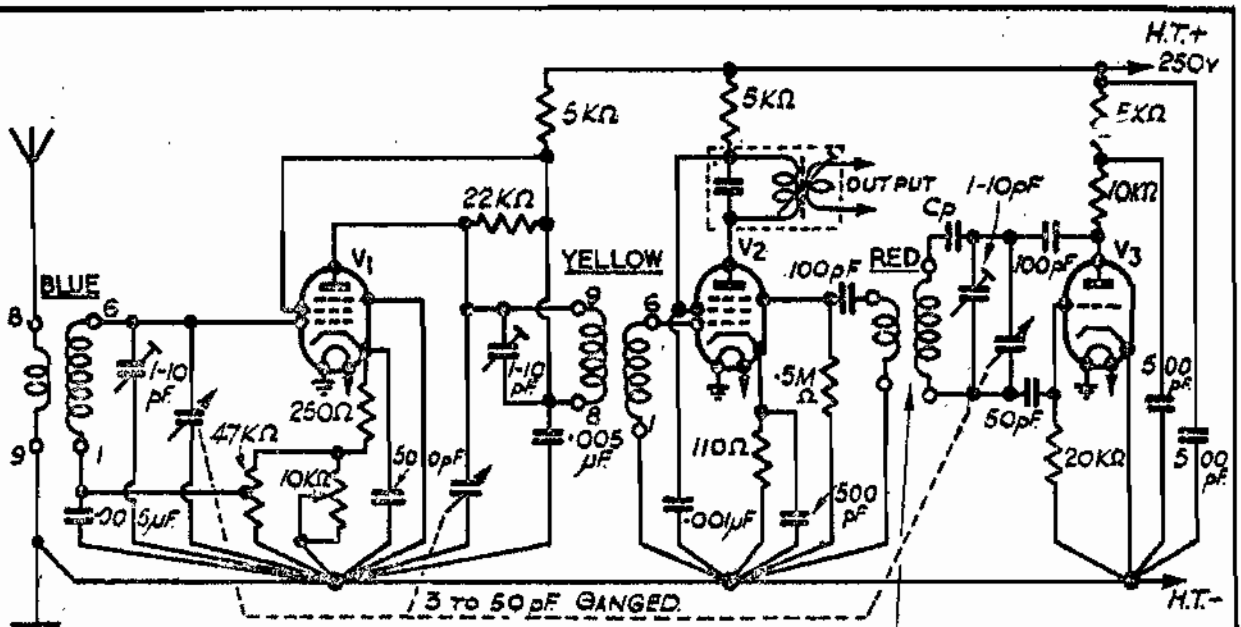
ALL RESISTOR VALUES ARE IN OHMS
ALL CONDENSER VALUES ARE IN MF's UNLESS OTHERWISE STATED.

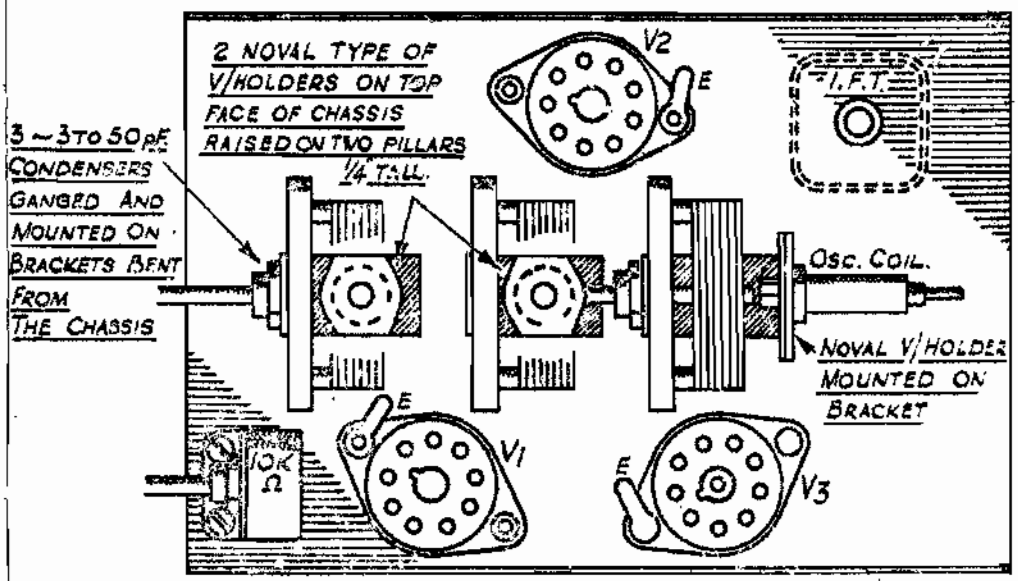
CIRCUIT USING MAXI-Q BFO.2/465 kc/s OR 1·6 Mc/s. UNIT

TYPE	C1	C2	T
BFO.2/465	100pF	140pF	15pF
BFO.2/1·6	100pF	100pF	15pF

GENERAL PURPOSE SUPERHET FOR USE WITH MINIATURE DUAL PURPOSE COILS

FIG. 2

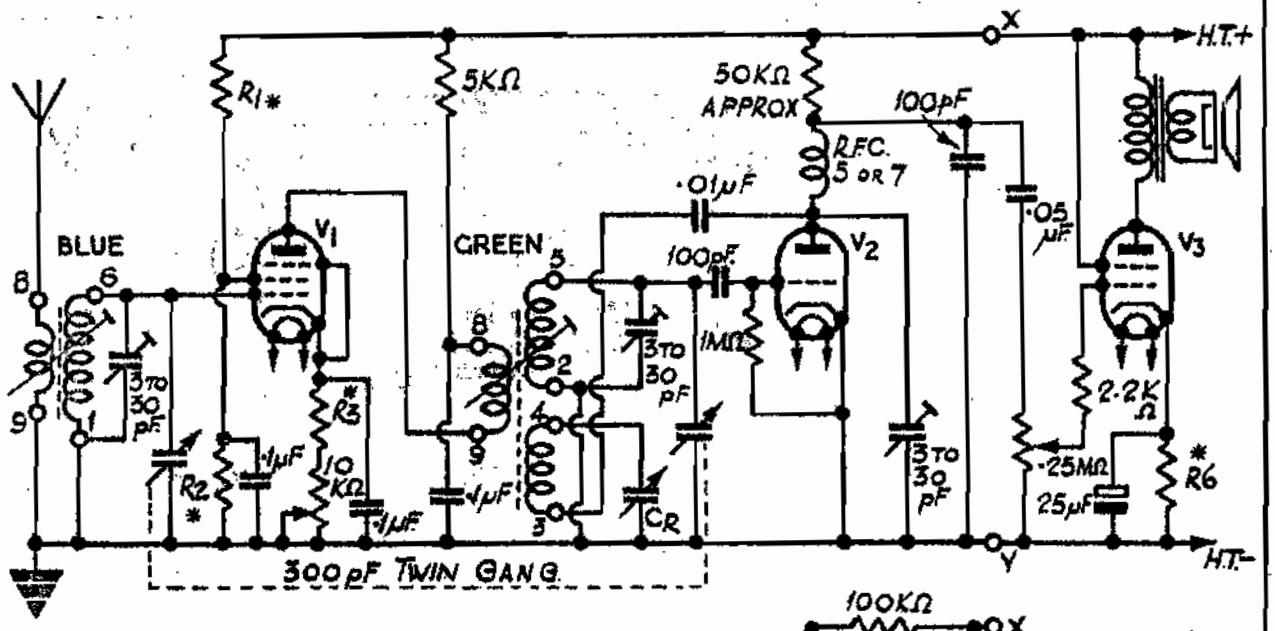




UNDERCHASSIS VIEW.

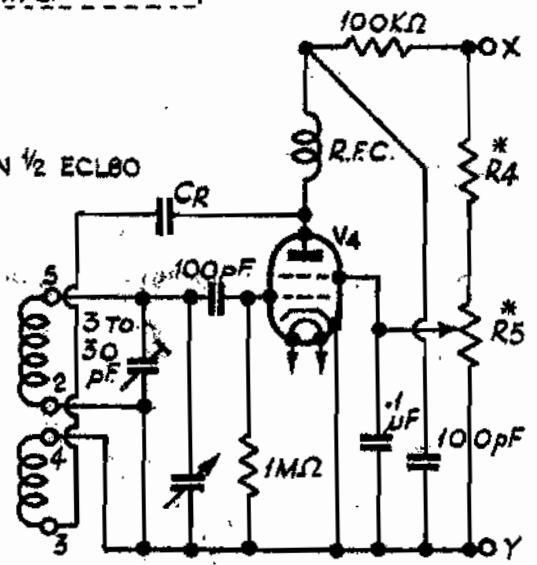
V.H.F. CONVERTOR FOR USE WITH MINIATURE MAXI-"Q" COILS.

FIG.3



V1. KTW61 – EF39 – 6K7 – EF41.
V2. H63 – 6C5. – TRIODE ½ ECL80
V3. KT61 – EL33 – 6V6G – EL41 – PEN ½ ECL80
V4. KTZ63 – 6J7.

* USING VALVES 6K7, H63, 6V6G & 6J7 RESISTOR VALUES ARE R1 – 15KΩ, R2 – 10KΩ, R3 – 330Ω, R4 – 50KΩ, R5 – 50KΩ, R6 – 250Ω. SUITABLE RESISTORS MUST BE CHOSEN TO SUIT ALTERNATIVE VALVES.



ALTERNATIVE DETECTOR CIRCUIT WHEN USING A TETRODE OR PENTODE VALVE.

NOTES

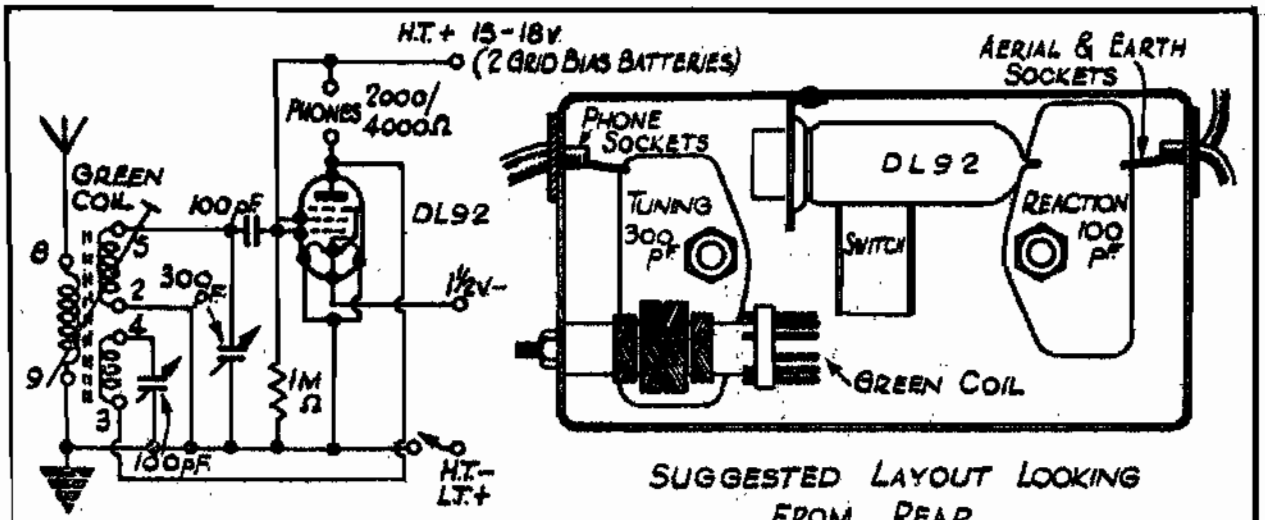
The receiver circuit shown above uses the BLUE and GREEN series of Coils and comprises one R.F., detector and output stage. The R.F. stage is essentially the same as in the superhet receiver, but with provision for biasing the stage to prevent overloading the detector on high levels of input.

If a triode is used as detector, then the reaction condenser CR will, depending on the type of valve used, have a value of about a 100pF. If a tetrode valve is used, then CR can be fixed and the feedback controlled by means of a screen potentiometer R5.

In order to avoid instability the R.F. stage grid circuit should be carefully screened from the following detector grid circuit. The R.F. valve should be metalised or mounted in a metal screening can.

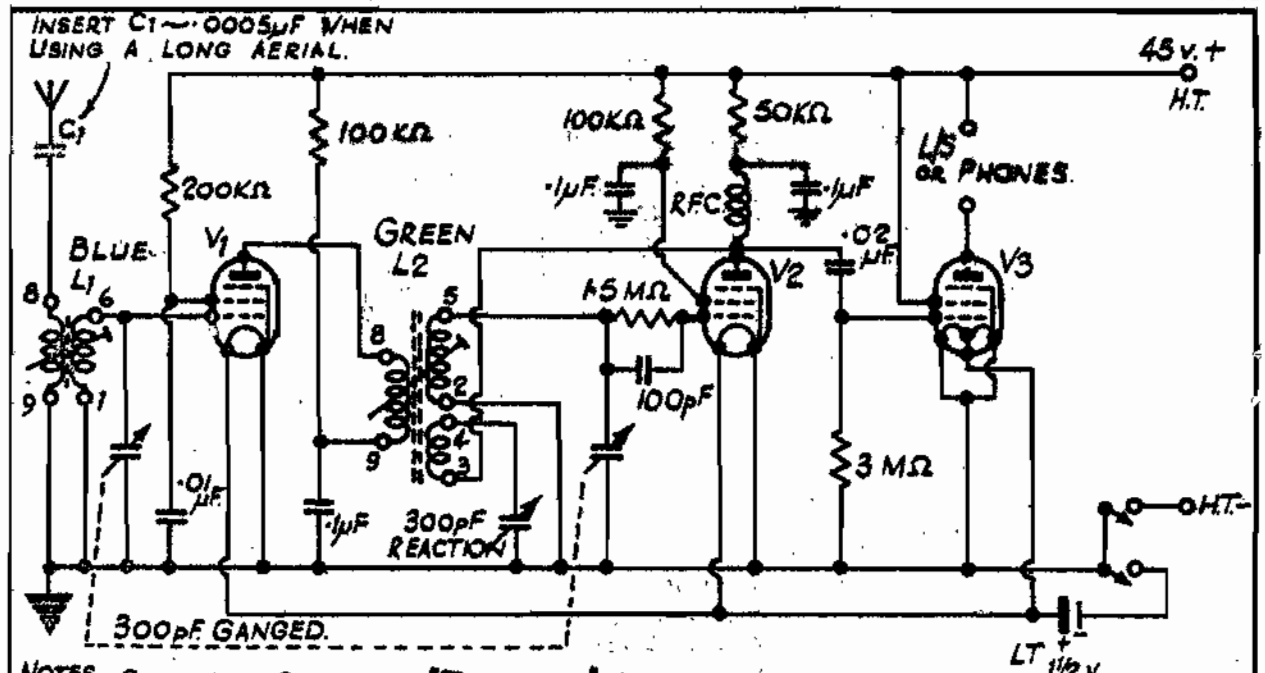
T.R.F. RECEIVER CIRCUIT DIAGRAM FOR USE WITH MAXI-Q MINIATURE DUAL PURPOSE COILS

FIG. 4



SUGGESTED CIRCUIT FOR A SIMPLE ONE VALVE BATTERY RECEIVER.

FIG. 5

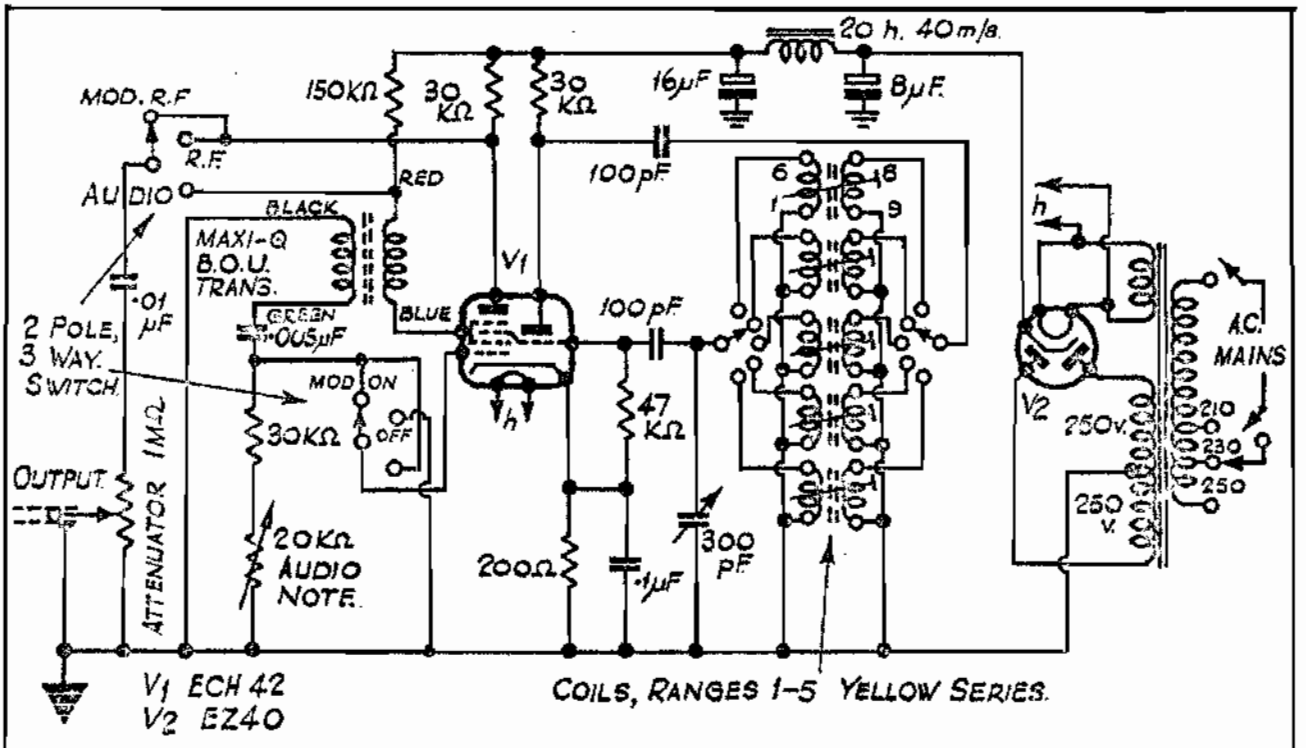


NOTES. SHOULDER STRAP OR "THROWOUT" AERIAL CAN BE USED.
FRAME AERIALS CAN BE SUPPLIED TO REPLACE L1 IF REQUIRED.

V1. DF91
V2. DF91
V3. DL92.

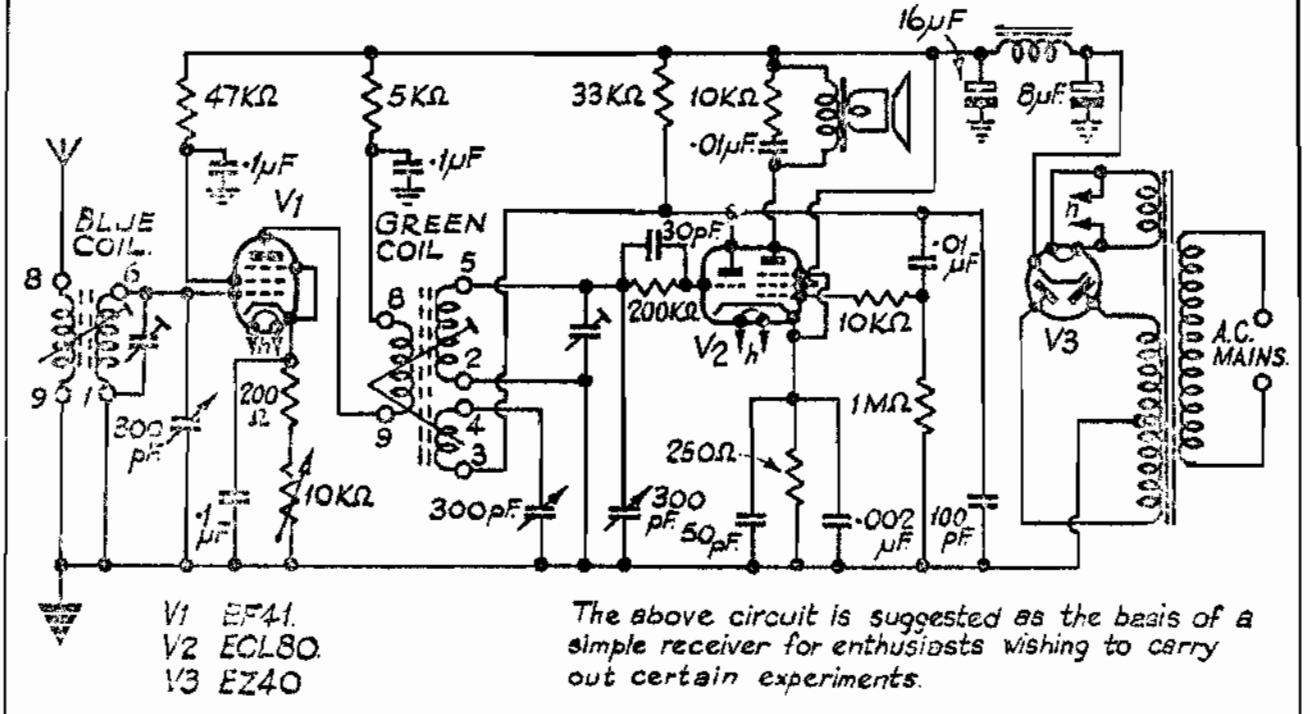
SUGGESTED CIRCUIT FOR A PORTABLE RECEIVER.

FIG. 6



SUGGESTED CIRCUIT FOR A SIMPLE SIGNAL GENERATOR 175 KCS. — 28 MCS.

FIG. 7



SUGGESTED CIRCUIT FOR A SIMPLE 3 VALVE RECEIVER.

FIG. 8

BEGINNERS SIMPLE SHORT-WAVE RECEIVER USING MINIATURE DUAL PURPOSE GREEN COILS ... ...

This design has been kept as simple as possible, consistent with good 'one valve' performance, in the interests of the beginner. To this end the 'plug-in' method has been adopted for the tuning coils, thus eliminating coil switching. It requires only one coil at the start but allows for further ranges to be added as required. It is basically intended for short wave operation using 'Maxi-Q' Miniature Dual Purpose Green Coils ranges 3,4 and 5, giving coverages from approximately 1.6 to 30 Mc/s or 10 to 180 metres. Ranges 1 and 2 coils may however also be used covering the long and medium wave broadcast bands.

The circuit is a straightforward grid leak detector using a battery pentode valve type 1T4. The coil is tuned by C1 using the smaller band-spread condenser C2 for fine tuning. C3 controls reaction.

The receiver may conveniently be built on a 'Maxi-Q' blank chassis type CH.8. The hole sizes required for mounting the main components are listed on the layout diagram.

Mount the main components on the chassis and then commence soldering in the small components, carefully following the layout. Care must be taken to avoid dry joints, i.e., where the solder forms a 'blob' round the joint but does not adhere to or 'run' on the metal. To avoid such joints, which would spoil the performance of the receiver, ensure that both parts of the joint, i.e., the tag and the wire are clean, (scrape if necessary) before attempting to solder. In the case of valveholder tags and tuning condenser connections (which are usually either silver plated or hot tinned) and with clean tinned copper wire, scraping should not be necessary. However some tags and connections may become oxidized with age or may be nickel plated or electro tinned in which case scraping is recommended. Allow the soldering iron to become thoroughly heated before use and apply a clean tinned face of the bit so as to make contact with both parts of the joint and below the joint if possible. After two or three seconds apply a good quality resin cored solder to the top of the joint, whereupon the surplus solder should flow round the joint onto the iron. Remove the iron from the joint and shake off the surplus before proceeding with the next joint. After a little practice the amount of solder applied can be controlled so as to avoid having appreciable surplus to shake off and thus eliminating waste.

It cannot be over emphasized that to obtain the best results from a simple receiver a good aerial is essential. This should be erected as high as possible and as far clear of surrounding objects as practicable.

The earth connection should be made either to a buried metal plate or stake or to the incoming water (not gas) main.

Carefully recheck the wiring before inserting the valve and connecting the supplies. At first connect only the L.T. leads and ensure that the filament glows before connecting the H.T. lead.

In operation the reaction control should be kept just below the point at which oscillation occurs. This is the point at which a whistle occurs behind each station. This varies in pitch from a high note, down to zero and up to inaudibility again as the set is tuned through the station. This should not be confused with the 'thresh-hold howl' which is sometimes set up if the reaction control is turned too far and is present on or off a station. It will be necessary to adjust the reaction control in step with the tuning control if this condition, at which the receiver is most sensitive, is to be maintained. Although this is difficult at first it comes readily with a little practice. If it is required to listen to c.w. morse signals the reaction control should be advanced to the point of oscillation and the bandspread condenser used to adjust the note to a suitable pitch.

COMPONENTS REQUIRED

R1 ... 2 Meg ohm, 1/8 watt Resistor. R2 ... 10,000 ohm, ½ watt Resistor.
R3 ... 22,000 ohm, ½ watt Resistor. C1 ... 310 pF Variable Condenser, Jackson type 'E', price 9/-. C2 ... 15 pF Variable Condenser, Jackson type C804/15, price 6/6d.
C3 ... 100 pF Variable Condenser, Jackson type C804/100, price 7/-.
C4 ... 100 pF Ceramic Condenser. C5 ... 0.1 mfd Condenser.

Battery ... Ever-Ready type B103. Headphones .... 2,000 ohms.
Maxi-Q Miniature Dual Purpose Coils, Ranges 1 to 5 Green, price 4/9d each.
1 ... B9A Valveholder (for coils) price 1/-.
1 ... B7G Valveholder (for valve) price 1/-. 1 ... 1T4 Valve.
1 ... Maxi-Q Blank Aluminium Chassis, type CH.8, price 6/-.
1 ... Front Panel. 3 ... Knobs type 'E', price 1/1d each.
1 ... Aerial/Earth Socket. 1 ... Headphones Socket.
3 ... Wander Plugs (for battery connection), price 6d. each.
1 ... Grommet, ½". 1 ... 6BA Solder Tag. 1 ... 4BA Solder Tag.

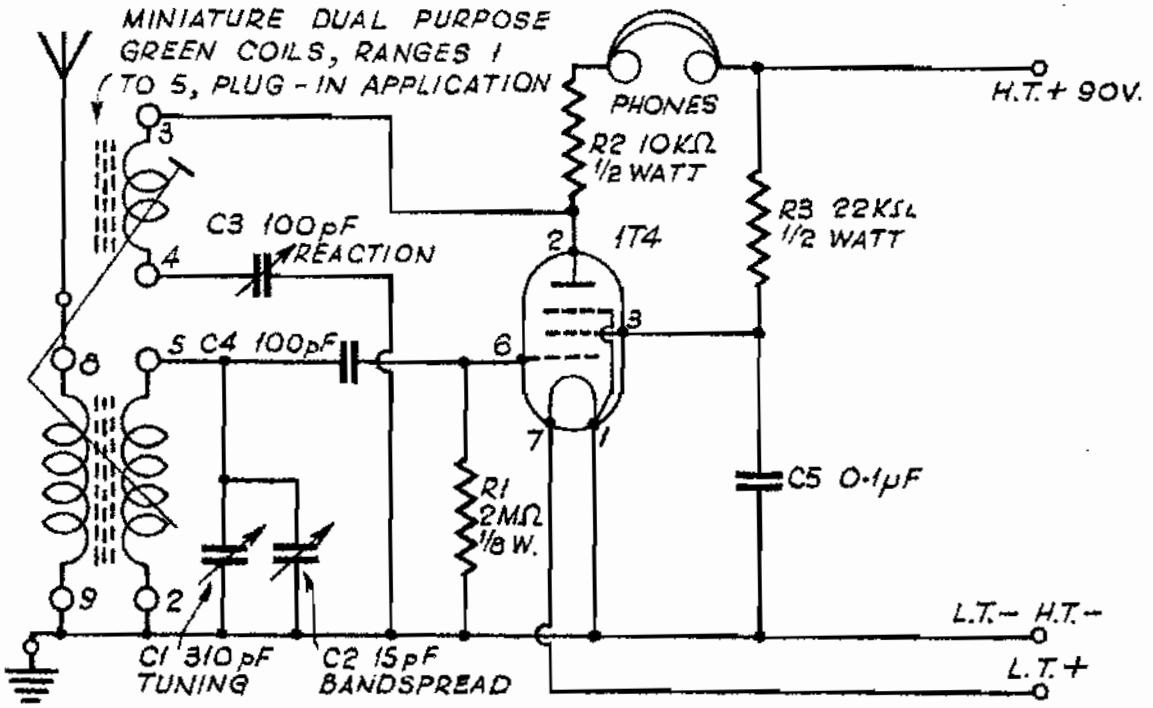
Wire, Screws, Nuts, Solder, Sleeving ... as required.

All components marked with a price are obtainable from -

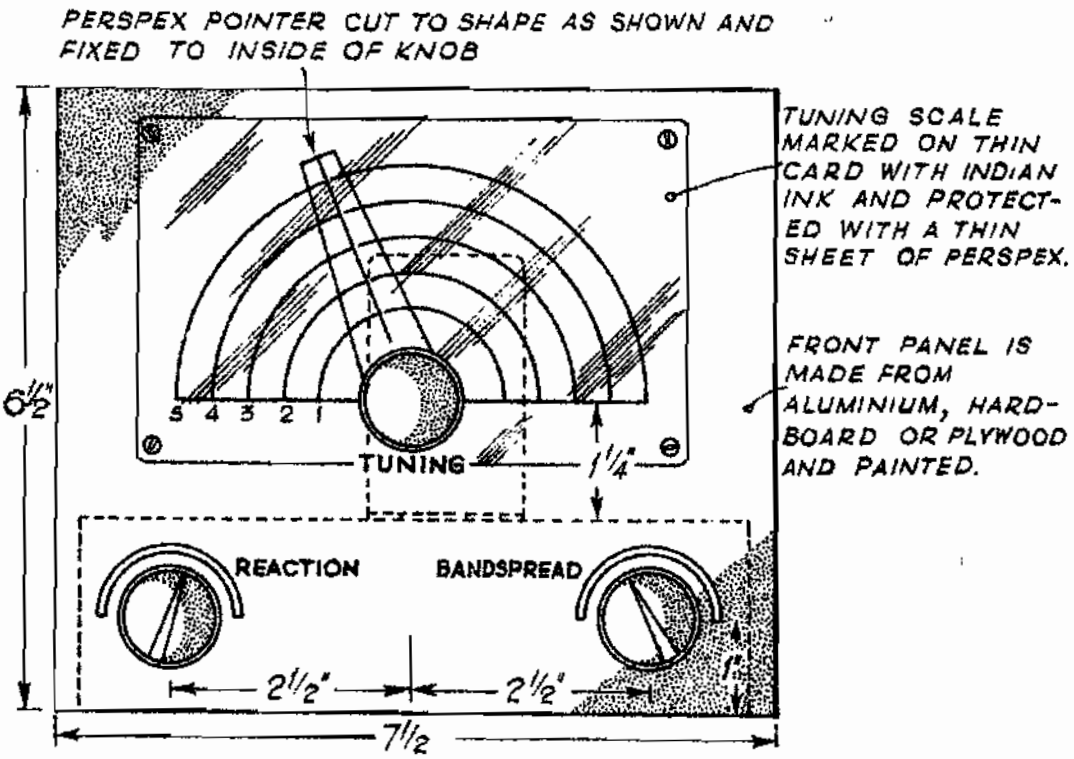
DEMCO (CLACTON) LIMITED,

357/9 Old Road, Clacton-on-Sea, Essex.

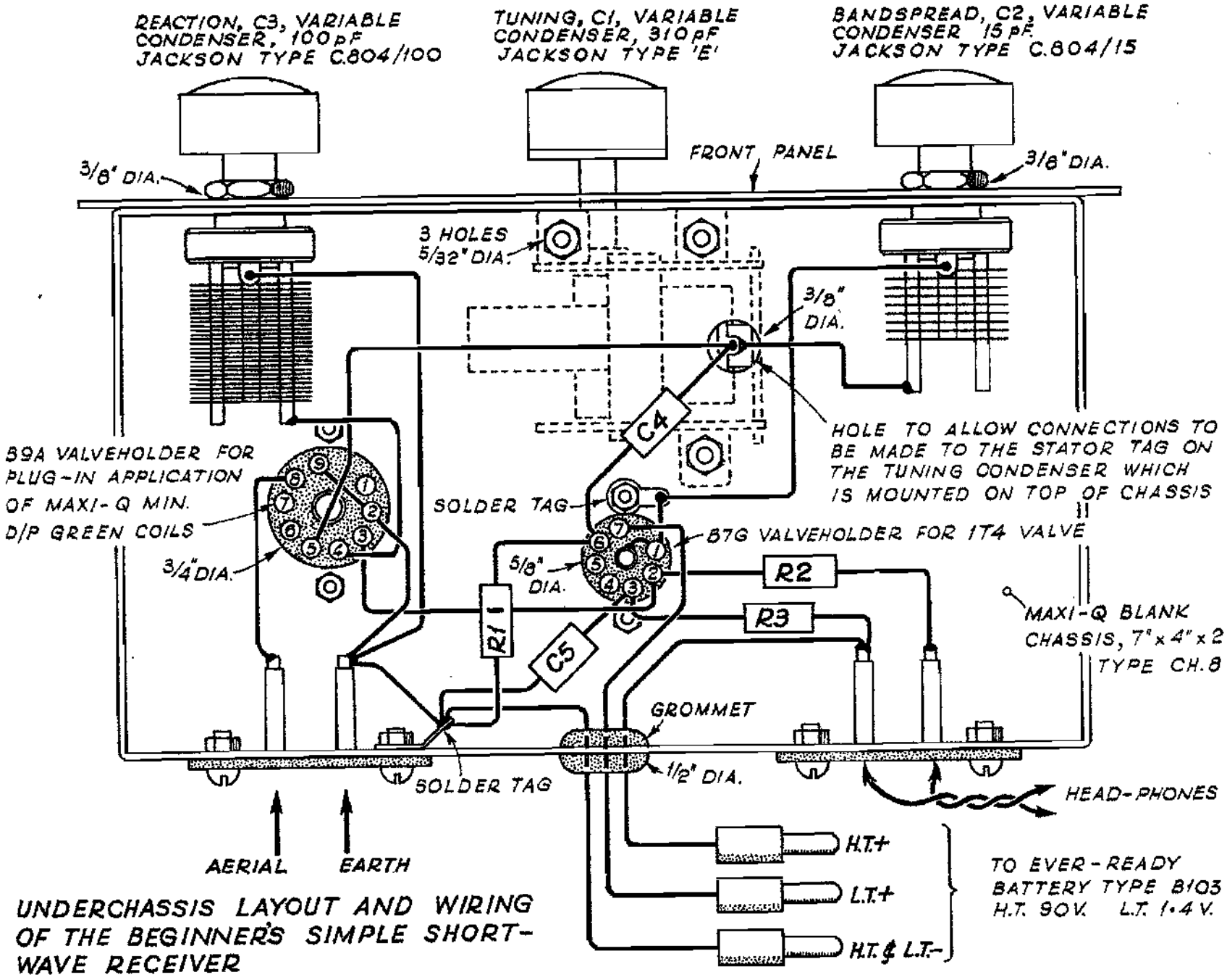
BEGINNERS SIMPLE SHORT-WAVE RECEIVER
USING MINIATURE DUAL PURPOSE GREEN COILS



SCHEMATIC CIRCUIT DIAGRAM



FRONT PANEL LAYOUT



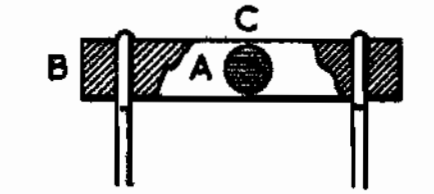
UNDERCHASSIS LAYOUT AND WIRING OF THE BEGINNER'S SIMPLE SHORT-WAVE RECEIVER

RESISTOR COLOUR CODE

CARBON RESISTORS ARE COLOUR CODED IN ONE OF TWO WAYS TO INDICATE THE NOMINAL RESISTANCE IN OHMS AND THE TOLERANCE FROM THIS NOMINAL: THE FIRST METHOD IS AS FOLLOWS: THE BODY COLOUR INDICATES THE FIRST DIGIT (A), THE TIP (COLOURED OTHER THAN SILVER OR GOLD) INDICATES THE SECOND DIGIT (B). THE MULTIPLIER (OR NOUGHTS AFTER THE SECOND DIGIT) IS INDICATED BY THE SPOT PAINTED ON THE BODY (C). IF THE FREE TIP IS PAINTED GOLD OR SILVER THIS INDICATES A TOLERANCE WITHIN 20% (D). NO ADDITIONAL COLOUR INDICATES 20% TOLERANCE FROM NOMINAL.

THE SECOND METHOD IS INDICATED BY FOUR RINGS PAINTED AROUND THE BODY STARTING AT ONE END. THE FIRST RING INDICATES THE FIRST DIGIT (A), THE SECOND INDICATES THE SECOND DIGIT (B). THE THIRD RING INDICATES THE MULTIPLIER WHILST THE FOURTH INDICATES THE TOLERANCE FROM NOMINAL.

COLOUR	DIGITS	MULTIPLIER	TOLERANCE
BLACK	0	1	–
BROWN	1	10	–
RED	2	100	–
ORANGE	3	1000	–
YELLOW	4	10000	–
GREEN	5	100000	–
BLUE	6	1000000	–
VIOLET	7	10000000	–
GREY	8	100000000	–
WHITE	9	1000000000	–
GOLD	–	·1	5%
SILVER	–	·01	10%



PRINCIPLE BROADCASTING STATIONS

STATION	METRES	KC/S.
LONG WAVE:		
BBC LIGHT PROG.	1500	200
MEDIUM WAVE:		
BBC THIRD PROG.	464	647
BBC NORTH	434	692
HILVERSUM I	402	746
BBC SCOTTISH	371	809
PARIS I	348	863
BBC WELSH	341	881
BBC LONDON	330	908
BERLIN	303	989
HILVERSUM II	298	1007
BBC WEST	285	1052
BBC MIDLAND	276	1088
BBC NORTH AND N. IRELAND	261	1151
BBC LIGHT PROG.	247	1214
LUXEMBOURG II	208	1439
BBC WEST	206	1457
BBC THIRD		