# MAXI-Q

## TRANSISTOR AND MINIATURE DUAL PURPOSE COILS.

COMPLETE DATA and RECOMMENDED APPLICATIONS.

**TECHNICAL BULLETIN DTB.4**

**DENCO (CLACTON) LTD.**

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

# Section 1

## TRANSISTOR TUNING COILS

INTRODUCTION ...

The range of Transistor Tuning 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 Trans - istor Tuning 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 TUNING 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, assembling to chassis at their opposite end with an 0 BA moulded nut, the valve feet then being used as terminal soldering tags. For highest possible insulation polystyrene formers are used. 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 in pur polystyrene moulded in col - our BLUE, RED, YELLOW and WHITE for easy circuit identification.

Complete range for Superhet receiver covering approximately 150 Kc/s. - 31.5 Mc/s..

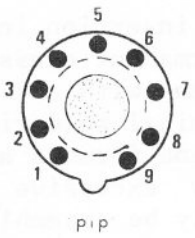
DIMENSIONS ...

| | |
|---|---|
| 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 0.5" long x .250" dia. with 6 BA threaded Brass insert.

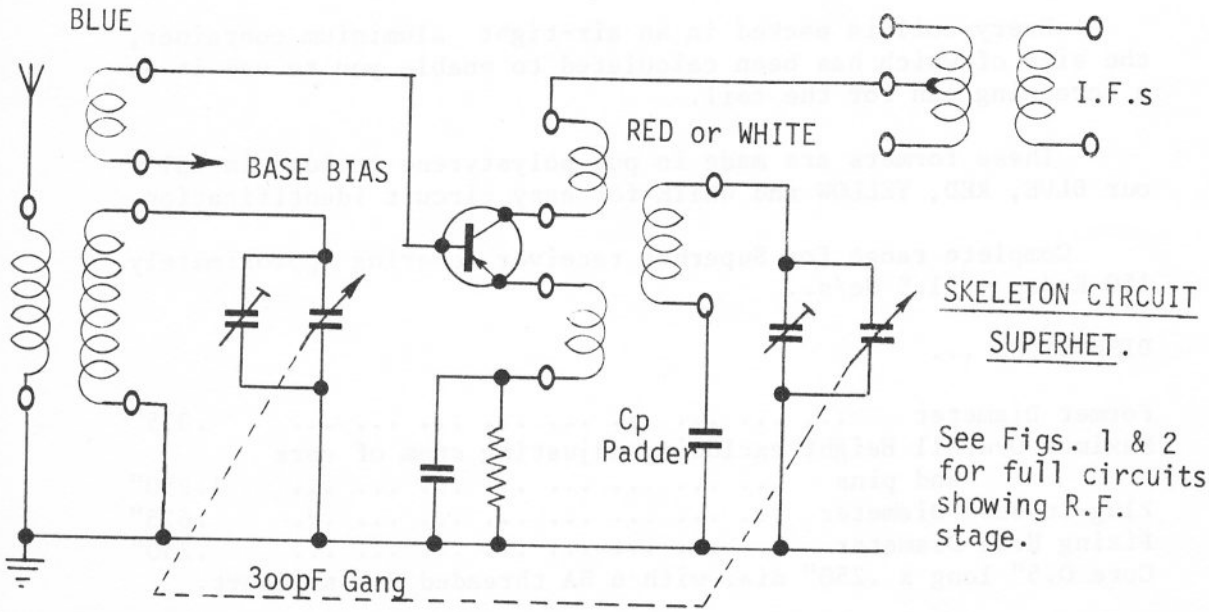
## GENERAL DATA - TRANSISTOR TUNING COILS ..

| 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 | " | " | COLL SUPPLY | COLL |
| R1 RED & WHITE R5 WHITE | TUNING COND. | | | | EMITTER | PADDER | EMITTER BIAS | " | " |
| R2 RED and WHITE | " | PADDER | | | " | | " | " | " |
| R3 RED and WHITE | " | | PADDER | | " | | " | " | " |
| R4 RED and WHITE | " | | | PADDER | " | | " | " | " |
| R5 RED | " | | | | " | EARTH | " | " | " |




LOOKING AT OPEN END OF FORMER

Numbers refer to Standard Noval (B9A) valve base numbering.
PIP on base simulates locator.




SKELETON CIRCUIT
SUPERHET.

See Figs. 1 & 2 for full circuits showing R.F. stage.

## GENERAL DATA — TABLE A

| RANGE | Ls uH | COVERAGE 39/352pF Mc/s | Metres | Cspi | Q1s | Lo | Cp | PIN | Cto | Copi | Lo | Cp | PIN | Cto | Copi |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 465 Kc/s I.F. | | | | | 1.6 Mc/s. I.F. | | | | |
| 1T | 3030* | .150/.400 | 2000/750 | 10 | 70 | 600 | 110 | 6 | 30 | 20 | | | | | |
| 1T | 2350* | .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 1T which covers approximately 2290/3150 uH.).

Q1s 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 the main winding of the coils concerned when used in 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 (0.005 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 0.001mfd 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 the 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 0.001mfd series condensers.

(c) It will be noticed that there is a slight break in the coverages given in the Table from Range 2, 1.545MHz to Range 3, 1.67MHz This avoids IF instability when using 1.6MHz IF. 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 and 3 and 3 to 4.

COLOUR CODE:

The following colour code identifies the coils:

BLUE..... Aerial coil with base input windings.
YELLOW ..... Interstage RF coil with couplings.
RED ..... Oscillator coil for IF of 465 KHz.
WHITE ..... Oscillator coil for IF of 1.6 MHz.

Note 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 TUNING COILS:

Circuit diagram Fig. No. 1 is suggested as the basis of a receiver suitable for communications purposes covering 150 KHz - 31.5 MHz (465KHz I.F.) or 175 KHz - 31.5 MHz (1.6 MHz 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 taken 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 min. capacity required of 11pF. Totalling the minimum gang capacity with the stray capacities a 3-30pF trimmer is required to bring the total min. circuit capacity

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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 min. capacity required of 11pF. Totalling the minimum gang capacity with the stray capacities a 3-30pF trimmer is required to bring the total min. circuit capacity

up to the required 39pF. It is recommended that for reliability the Phillips 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 three 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 and 'plug-in' the padder condensers can be wired permanently to the Noval base and which ever range of coils are used the correct padder value is automatically connected when the oscillator coil is plugged in, except than only Range 1 or 5 may be catered for in this way. If it is inconvenient to fit trimmer condensers to each range variable airspaced condensers with controls brought to the front of the panel may be used for Cto and Cts, in which case, it will be necessary to mark the setting for each range on the panel.

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 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 point 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 1.6MHz 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 transistor of better high frequency performance that the OC17. 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 1.6MHz I.F in connection with these coils will be the ist IF. in a double superhet as illustrated by the converter in Fig. 2, a complete 1.6MHz IF. section may be employed if desired, although an additional stage compared with 465KHz 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 for greater freedom of both hands. It is also advisable to use such a heat shunt when soldering miniature components, especially subminiature electrolytic condensers.

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

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

CIRCUIT ALIGNMENT: It is most 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 more sensitive as small changes in sound level are difficult to detect.

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

The I.F. signal may be fed via the 0.01 mfd capacitor between the base and supply +ve line of each transistor in turn to adjust the IFT in its collector circuit starting with the last IF 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 hgih 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 400ohm resistor and set it to low frequency limit of the range being aligned, eg. 10.5 MHz 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')
3. Adjust the signal generator to the high frequency limit, eg. 31.5 MHz 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 MHz for Range 5. Tune the signal with the tuning condenser (approximately 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 MHz for Range 5, tune in the signal with the tuning condenser (approximately 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 alignment of the oscillator trimmer or core, 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 MHz with 465 KHz I.F.s and approx. 3 MHz with 1.6 MHz 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.

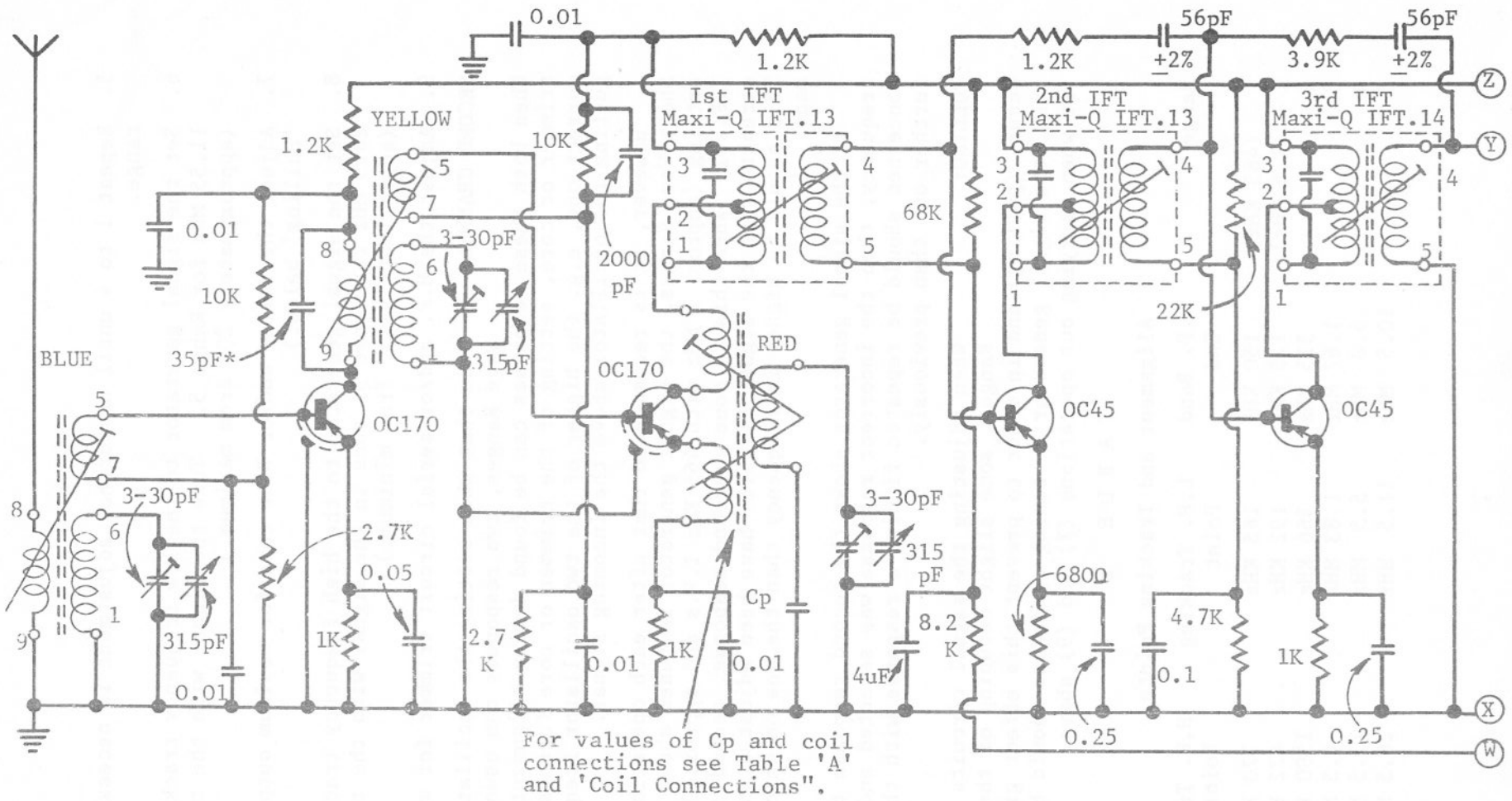
If the signal generator shows the second response to be lower in frequency, then the incorrect response was selected and the operation concerned should be repeated finding a response with the core or trimmer further out than previously.

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 rocked too 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 KHz) | 150 KHz | 165 KHz | 370 KHz | 400 KHz |
| 1 (1.6 MHz) | 175 KHz | 192 KHz | 472 KHz | 525 KHz |
| 2 | 515 KHz | 566 KHz | 1390 KHz | 1545 KHz |
| 3 | 1.67 MHz | 1.83 MHz | 4.5 MHz | 5.3 MHz |
| 4 | 5.0 MHz | 5.5 MHz | 13.5 MHz | 15 MHz |
| 5 | 10.5 MHz | 11.5 MHz | 28.5 MHz | 31.5 MHz |




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.

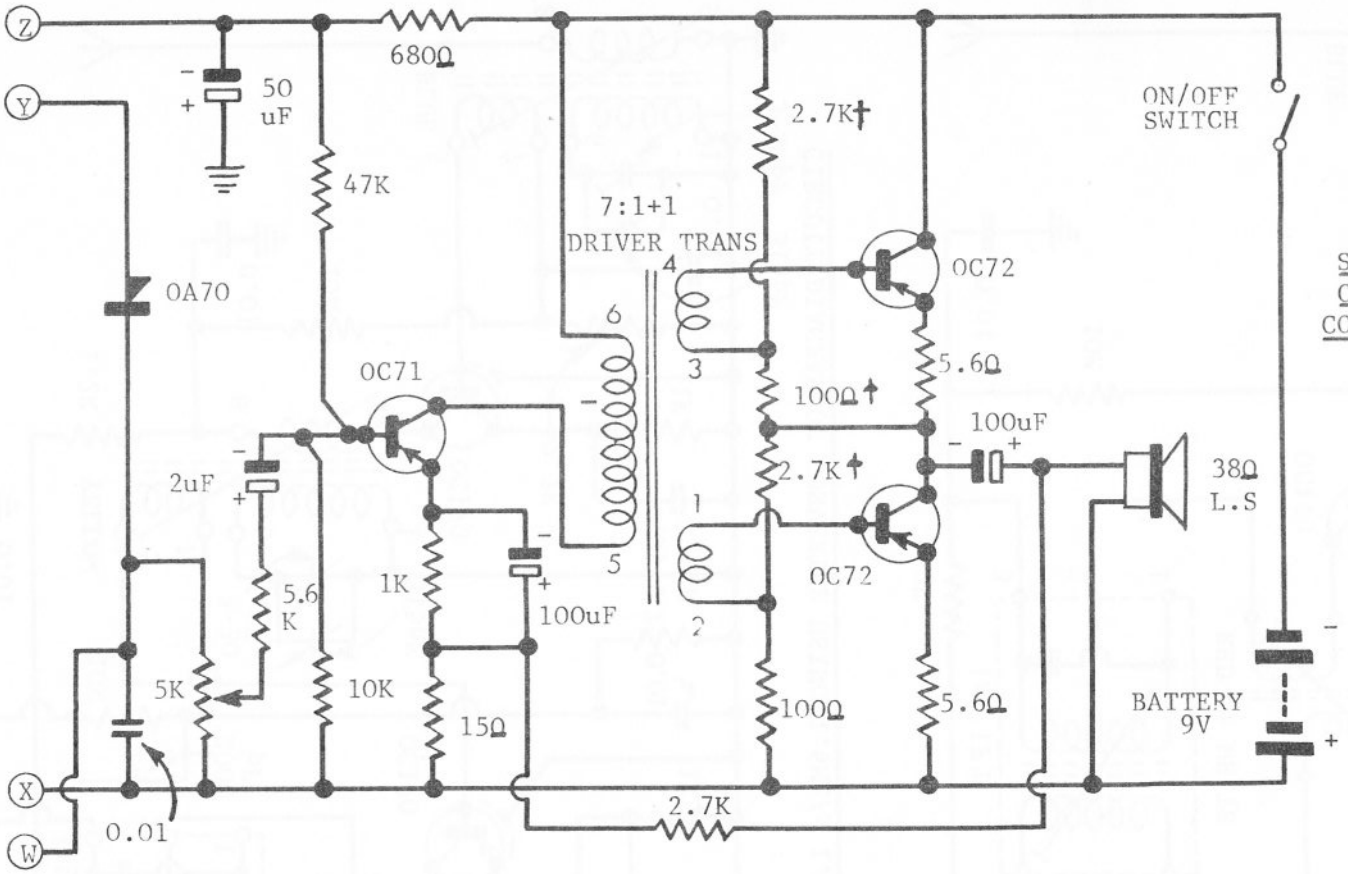
Tolerance of resistors marked † should be 5%. Tolerance of all other resistors should be 10%

All resistor values are in ohms. All capacitor values are in microfarads unless otherwise stated.

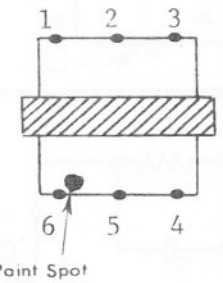
SUGGESTED SUPERHET CIRCUIT USING TRANSISTOR TUNING COILS

FIG. 1a

SHEET 1 CONTINUED ON SHEET 2

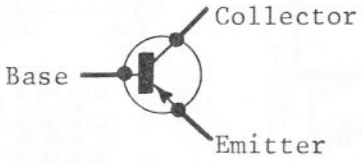


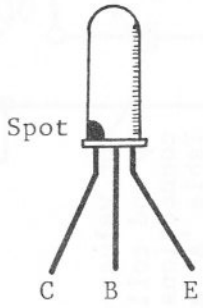

SUGGESTED SUPERHET CIRCUIT. SHEET 2
CONTINUED FROM SHEET 1
FIG. 1b



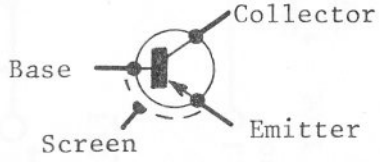

DRIVER TRANSFORMER UNDERSIDE.

NOTE: Driver Transformer ref. No.T5803/1 7:1+1 is available direct from us.

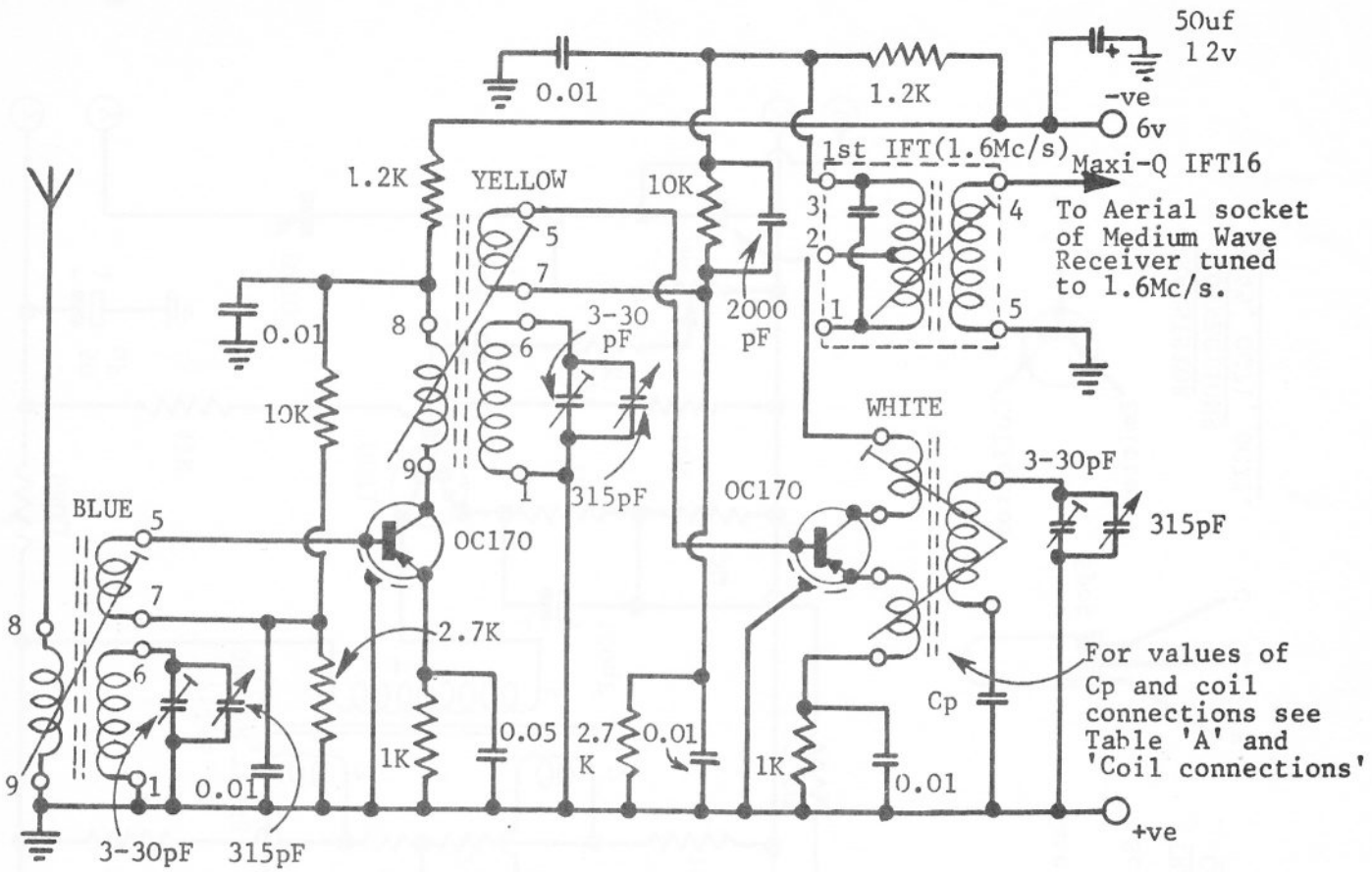


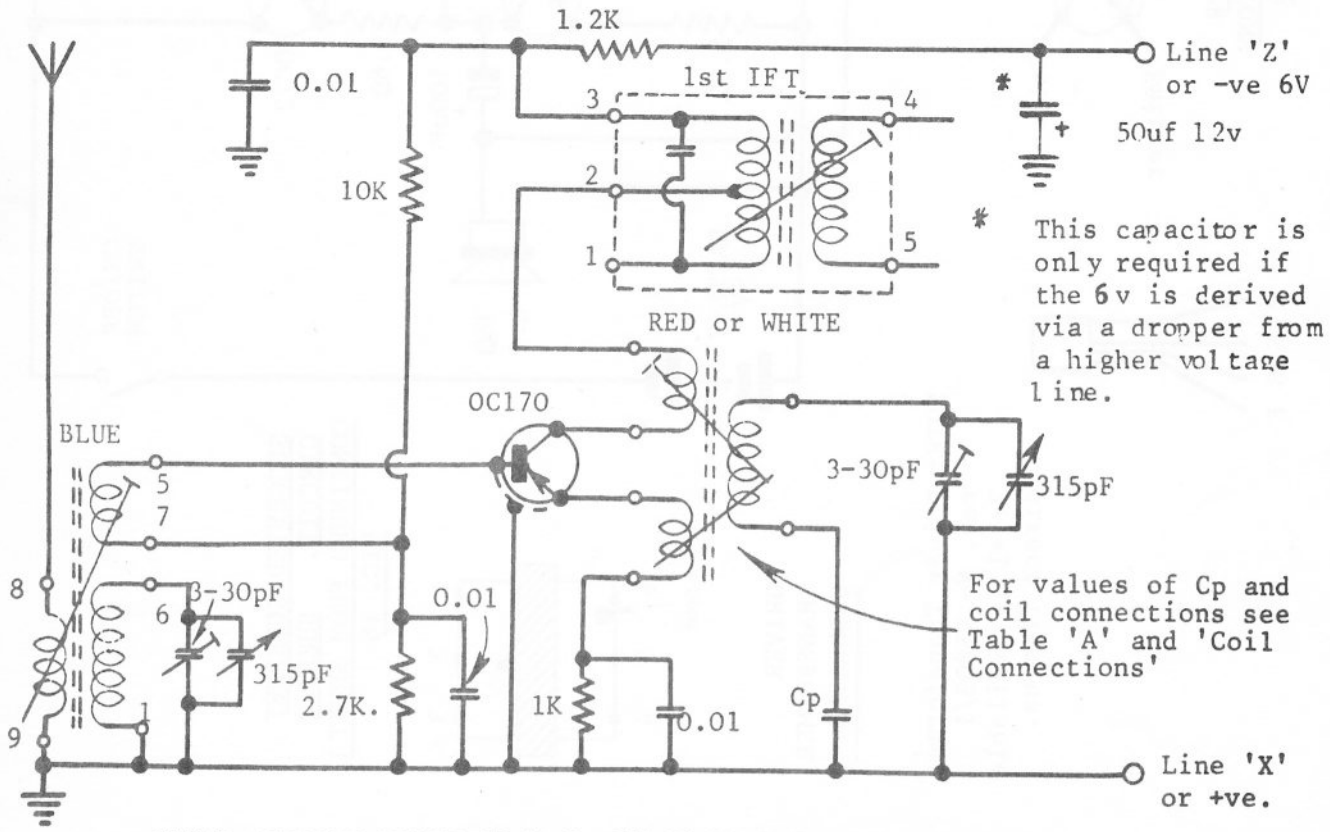

TRANSISTOR CONNECTIONS
OC45, OC71, OC72.




TRANSISTOR CONNECTIONS
OC170

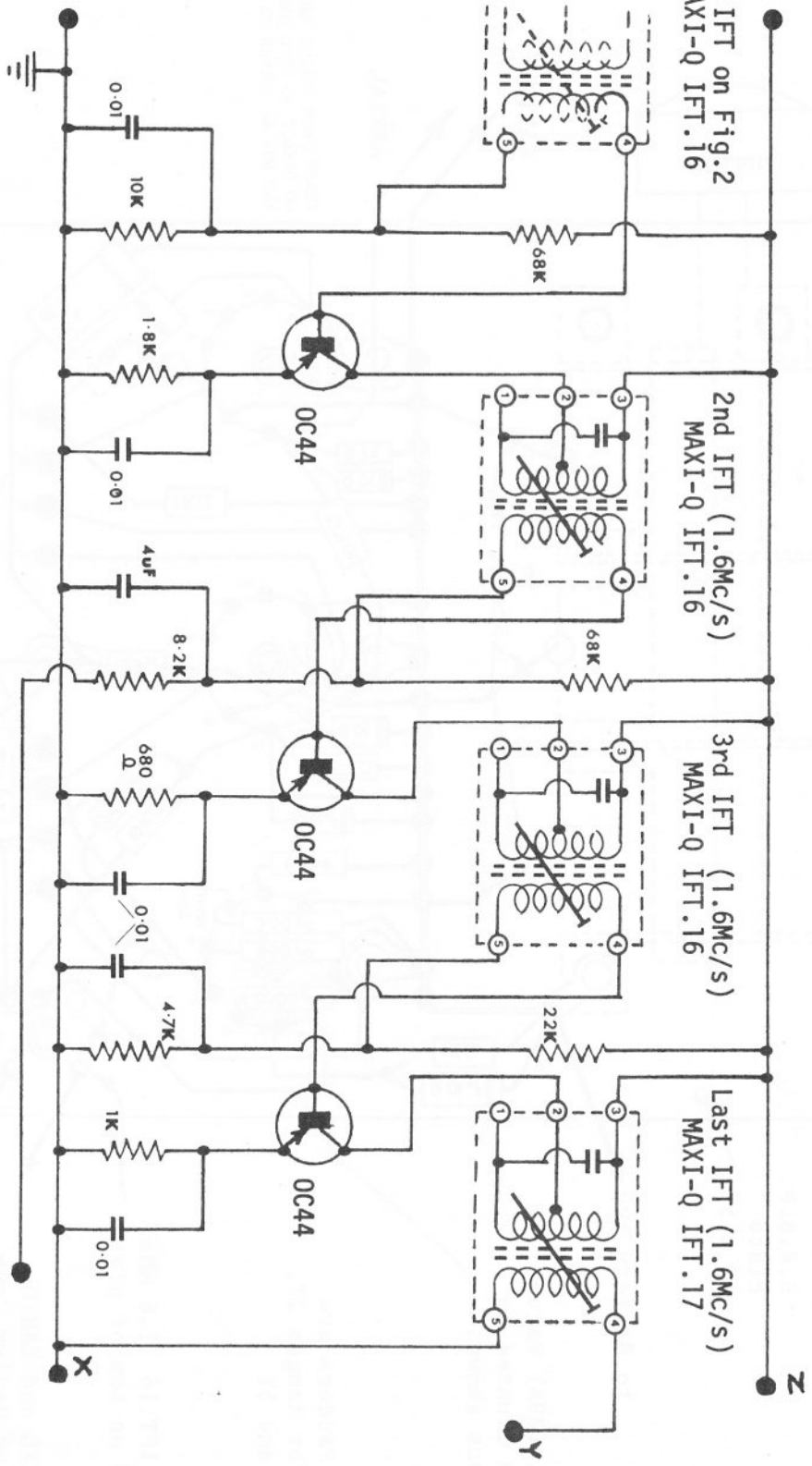



CIRCUIT DIAGRAM OF CONVERTER USING 1.6Mc/s I.F. FIG.2




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

FROM 1.6Mc/s RF, MIXER CIRCUIT, FIG. 2




1.6Mc/s I.F. Strip

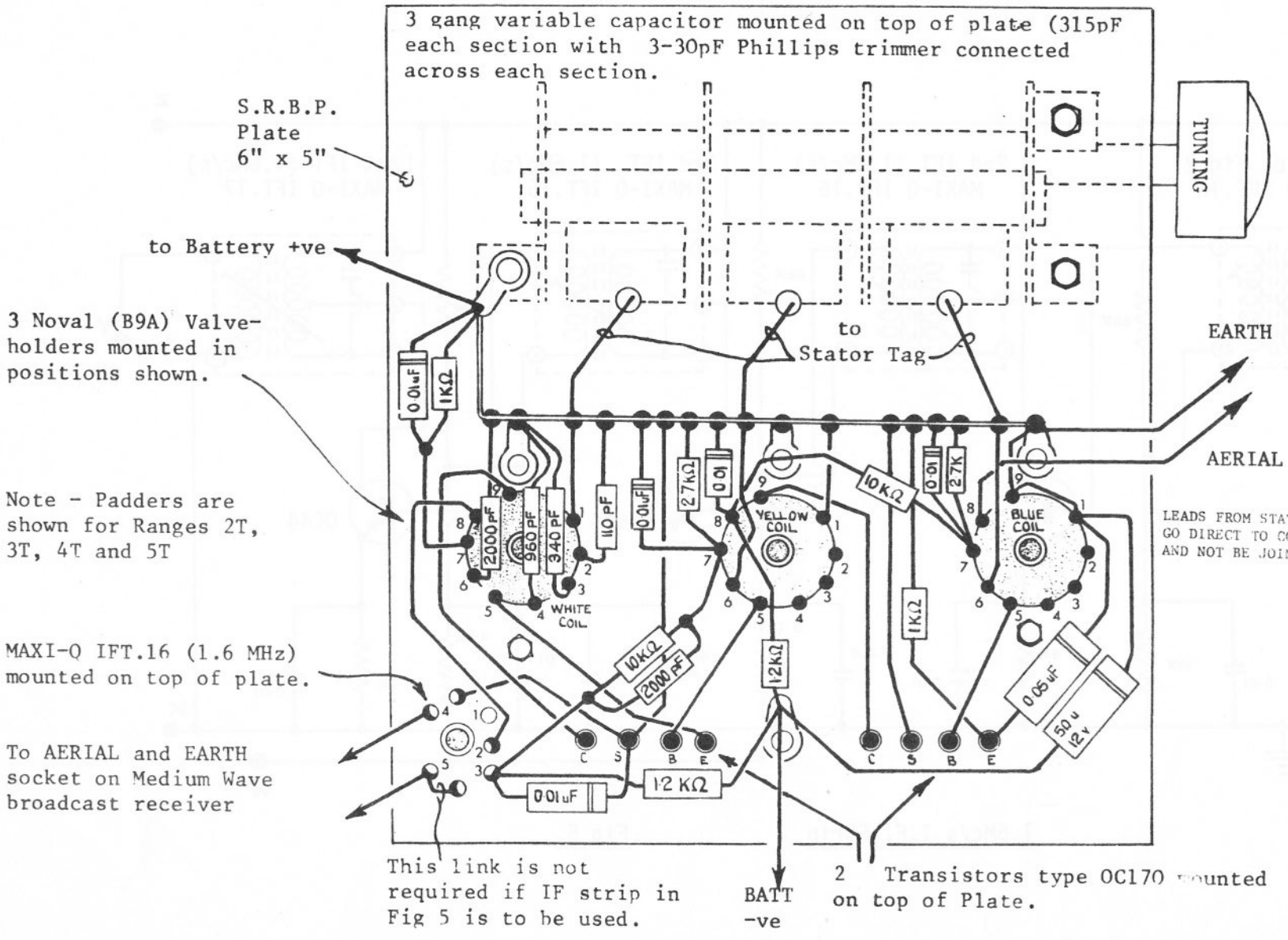
Fig 5.

TO AUDIO STAGES AS IN FIG 1.

LAYOUT OF CONVERTER (1.6 MHz I.F.) USING TRANSISTOR TUNING COILS

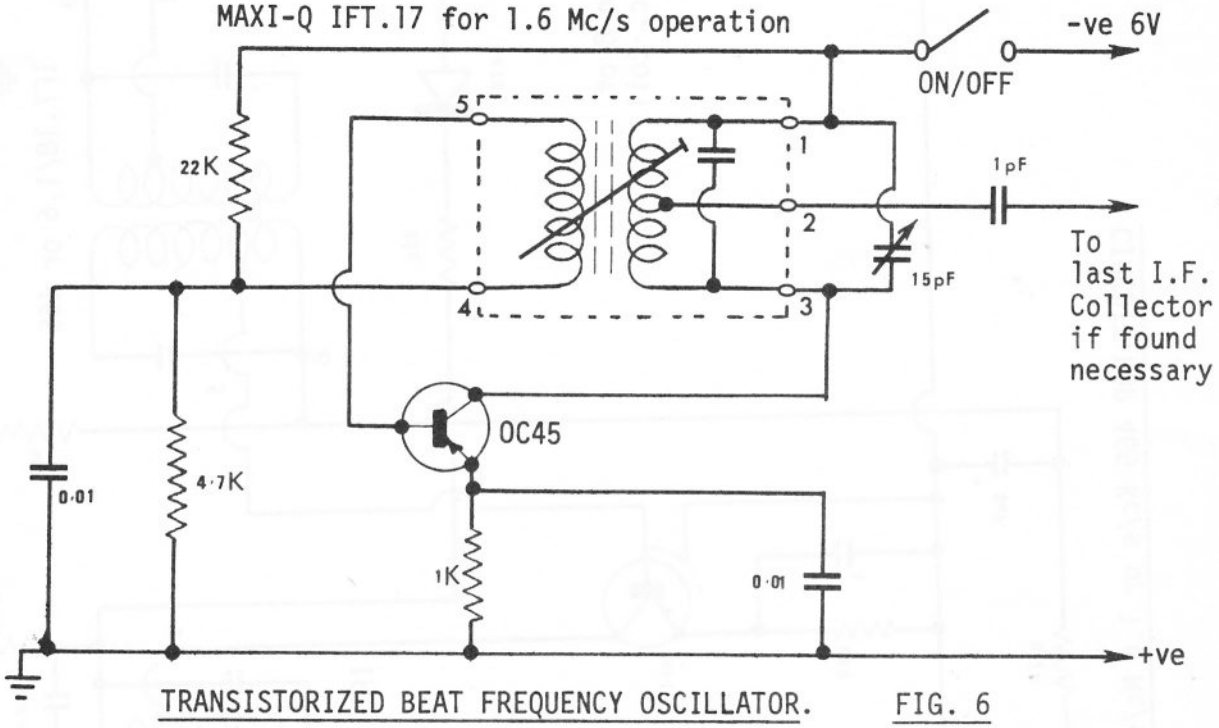
FIG. 4

(Circuit diagram shown in Fig. 2)



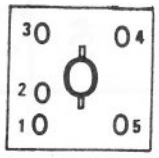
MAXI-Q IFT.14 for 465/470 Kc/s operation

MAXI-Q IFT.17 for 1.6 Mc/s operation

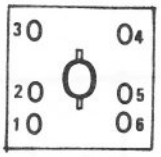



TRANSISTORIZED BEAT FREQUENCY OSCILLATOR. FIG. 6

IFT.13 and IFT.14
IFT.16 and IFT.17




underside

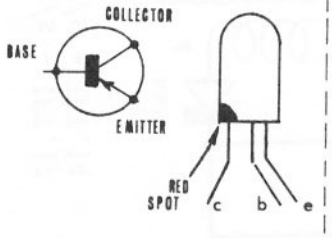



IFT.18 465Kc/s or 1.6 Mc/s

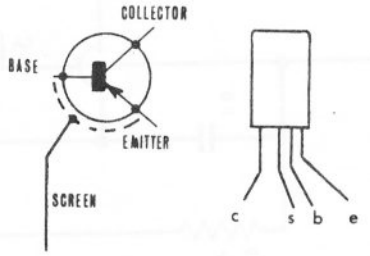
PIN NUMBERING OF IFTs

TRANSISTOR CONNECTIONS.

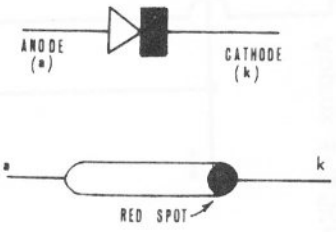
OC.44 OC.71
OC.45 OC.72

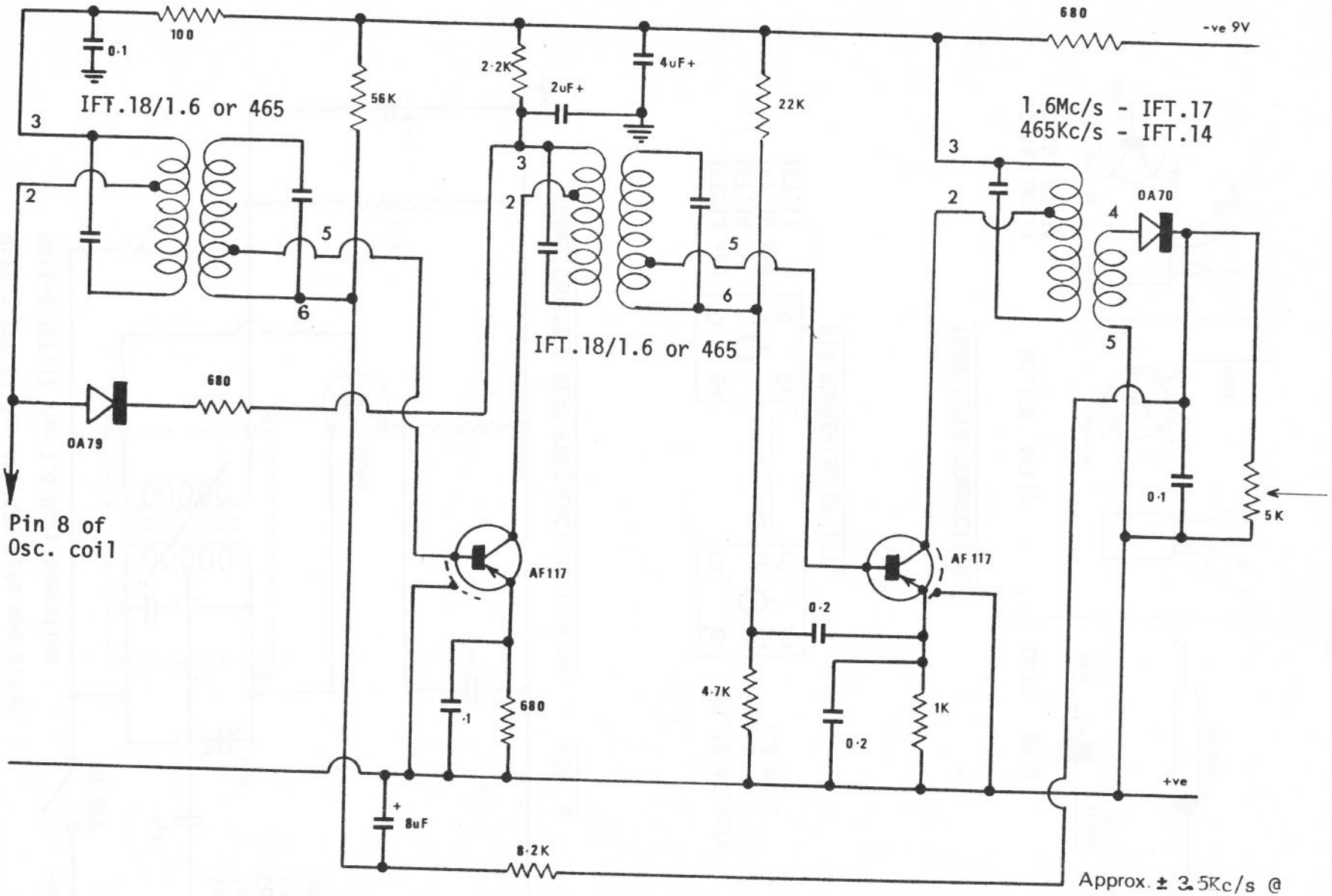



OC.170 AF117




OA70 OA79

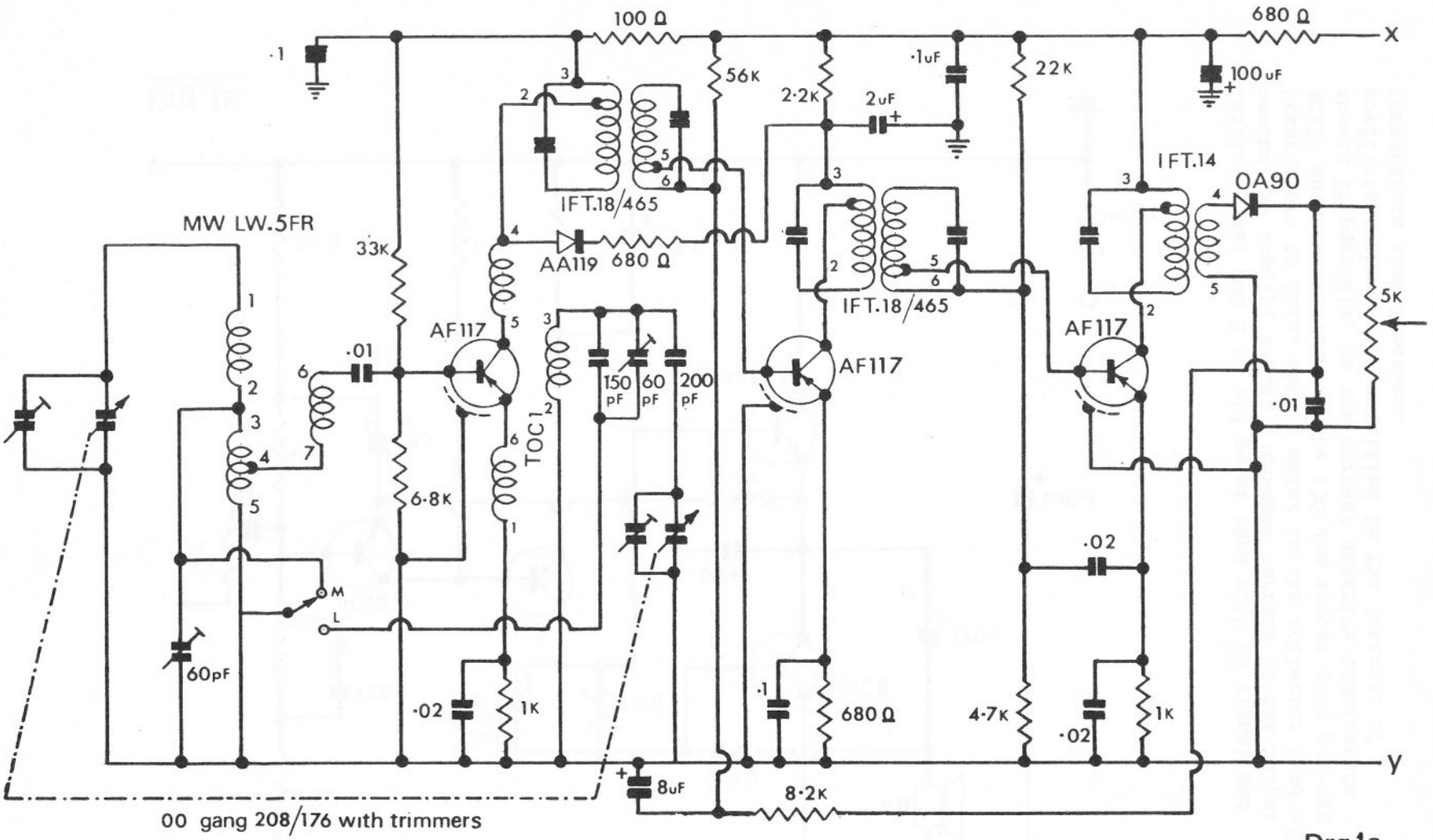





CIRCUIT FOR 465 Kc/s or 1.6 Mc/s I.F. EMPLOYING DOUBLE TUNED TRANSFORMERS.

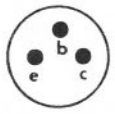
Approx. ± 3.5Kc/s @ -6 dBs. Attenuation at ± 9Kc/s -35 dB.

# Medium & Long Wave Receiver using Ferrite Aerial MW/LW.5FR & Oscillator Coil TOC.1



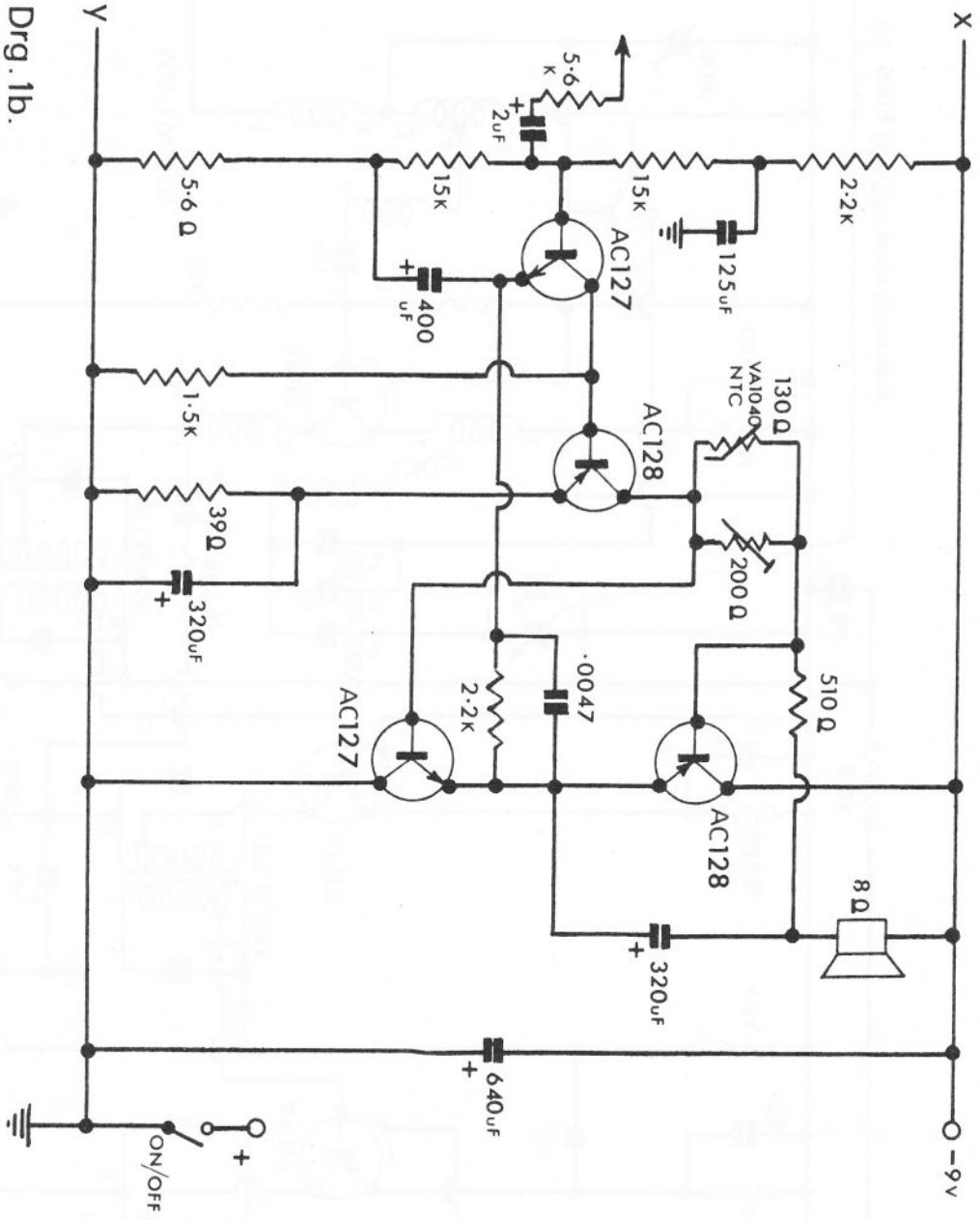

Drg.1a.

AF.117

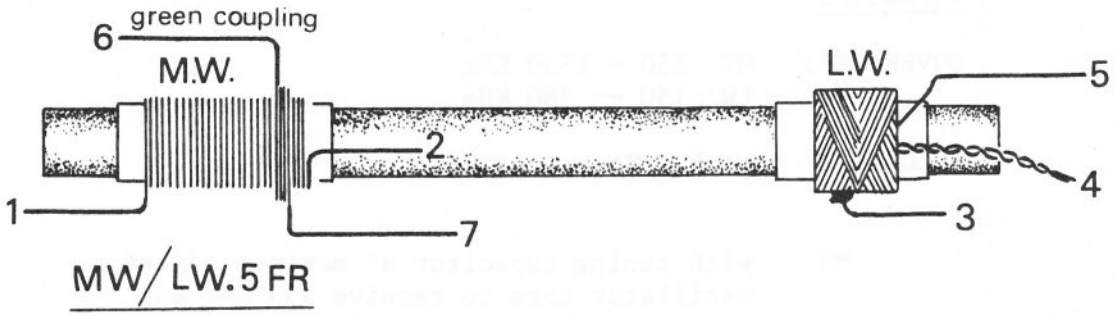




AC.127
AC.128

Drg. 1b.

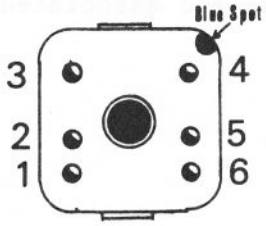



Initially set 200 Ω to mid point then with no signal and nominal 9v supply, adjust quiescent current of the output transistors to 5m/a, with a meter in the collector lead of AC127 output transistor. The 130 ohm across this pre-set should if possible, be the correct negative temperature coefficient thermistor specified in the interest of temperature stabilisation.

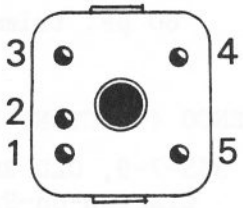



MW/LW.5 FR

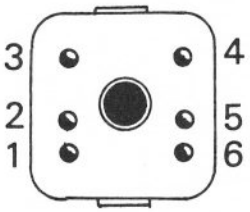
Note that the coils should be on the rod as shown above so that the windings are in the same direction from the 'live' ends (connections 1 and 3).




TOC.1




IFT.14




IFT.18

MW/LW.5FR

COVERAGES: MW 550 - 1550 KHz
LW 150 - 280 KHz

ALIGNMENT: peak IFTs at 465 KHz

MW with tuning capacitor at maximum adjust oscillator core to receive 550 KHz and peak up with MW coil on ferrite rod keeping signal to a minimum at all times. With condenser fully open adjust osc. gang trimmer for 1550 KHz and peak up with signal gang trimmer.

LW with tuning capacitor at maximum adjust LW oscillator trimmer for 150 KHz and peak up with LW coil on ferrite rod. At gang minimum (approx. 280 KHz) peak up with LW aerial trimmer.

MW.5FR

When this version, for Medium Waves only is in use, the LW coil is not provided. Connections 2 and 7 are taken to common earth line and the following components are omitted:-

| | |
|---|---|
| M/L | Change over switch. |
| 60 pF. | LW aerial trimmer |
| 150pF. | LW oscillator padder and associated 60 pF. trimmer. |

DENCO (CLACTON) LIMITED.
355-7-9, OLD ROAD,
Clacton-on-Sea,
Essex.
CO15 3RH.

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 section is to offer suggestions on the use of these 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 individuals and technical queries should be limited generally to apply to our particular components and circuits. (please send an SAE with any queries.)

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 the the opposite end with an 0 BA 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 a screening can for the coil.

These formers are made of pure polystyrene moulded in colour ... BLUE, RED, GREEN and WHITE for easy circuit identification.

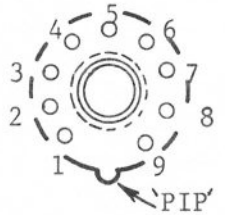
Complete range for Superhet or Straight receivers covering approx. 150 KHz to 80 MHz.

DIMENSIONS:

Former Diameter ..... .375"
Maximum overall height - excluding
adjusting stem of core & pins ..... 1.250"
Plug-In Base Diameter ..... .625"
Fixing Hole Diameter ..... .250"
Core ..... .50" long x .250" diameter (6 BA threaded brass insert).

# GENERAL DATA

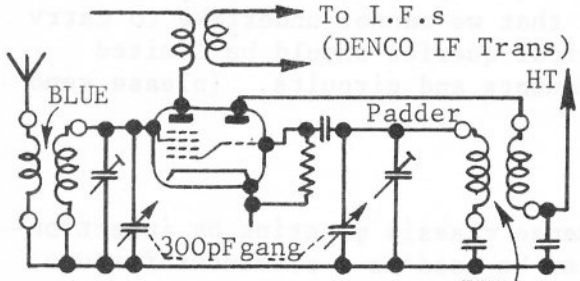
Looking at open end of former

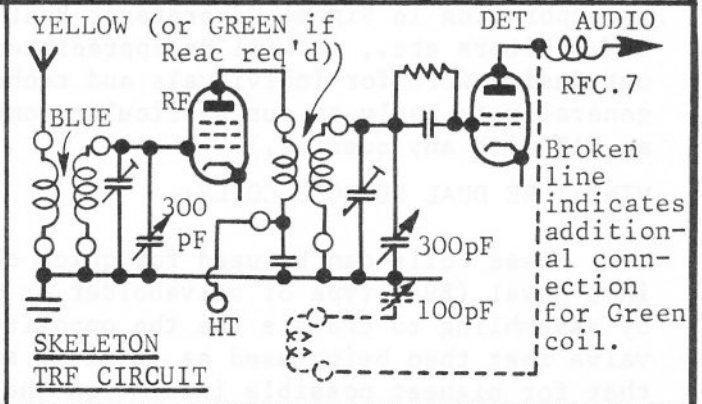



Numbers refer to standard Noval Base numbering

PIP on base simulates locator

| COIL COLOUR | PIN CONNECTIONS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| BLUE | Earth AVC | | | | | GRID | | Ae. | Earth |
| YELLOW | Earth AVC | | | | | GRID | | HT | RF Anode |
| RED except Range 1 | GRID | Padder or Earth | | | | Padder or Earth | | Osc Anode | HT |
| WHITE except Range 1 | GRID | Padder or Earth | | | | | | Anode | HT |
| Range 1 RED and WHITE | | | | | Padder | | GRID | Anode | HT |
| GREEN | | Earth AVC | Anode Reac | Reac | GRID | | | Ae or RF | Earth or HT |




## GENERAL DATA—Table 1

| Range | Ls uH | Coverage 39/352pF | | 'Q' Ls | 465 Kc/s | | | | 1.6 Mc/s | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Mc/s | Metres | | Lo uH | Cp pF | | Cto pF | Lo uH | Cp pF | | Cto pF |
| 1 | 2350 | .15/0.50 | 2000/750 | 65 | 535 | 110 | 5 | 30 | 156 | 50 | 5 | 21.5 |
| 2 | 271 | .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 | 5/15 | 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 incl trimmer these ranges have IF of approx 5Mc 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)

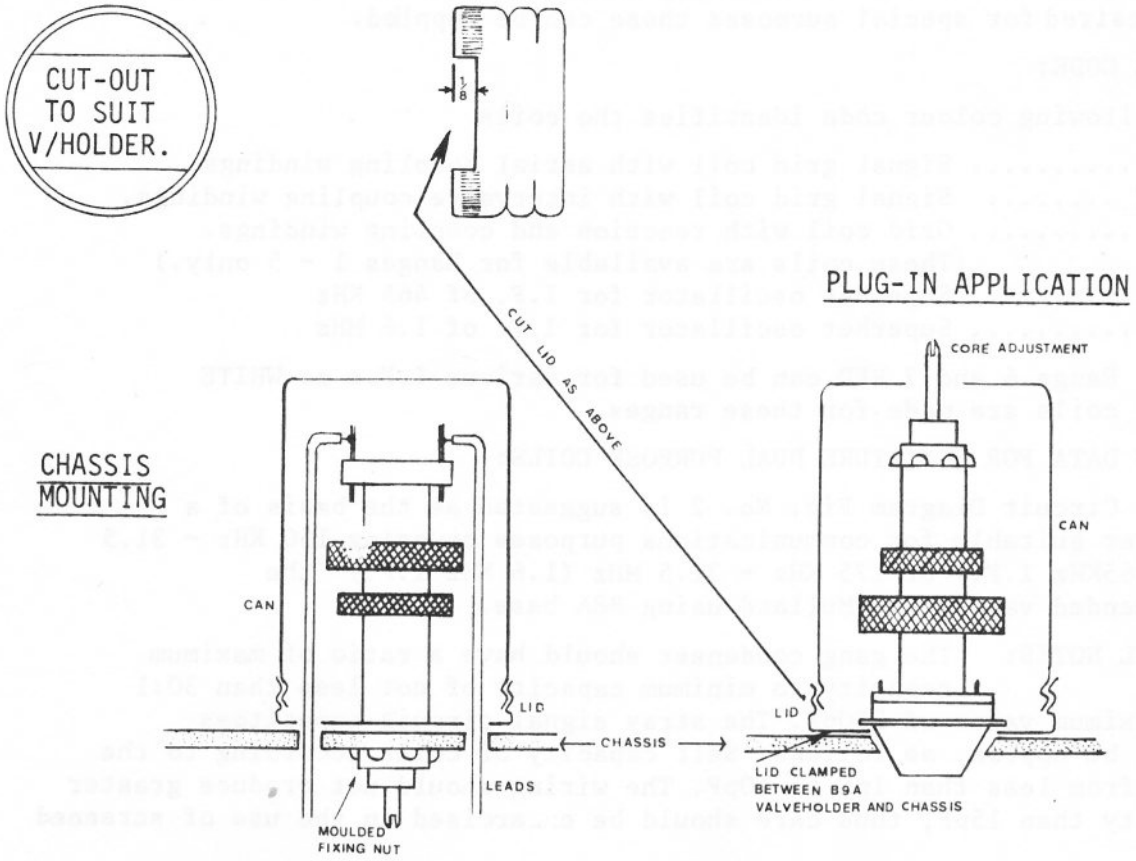
QLs 'Q' of Main Winding at mid point of tuning range.

Lo Nominal Inductance of Oscillator windings Cp Padder

Cto Oscillator Trimmer (nb over and above an assumed circuit capacity of 39pF.

| THE APPROXIMATE FIXED CAPACITORS REQUIRED TO TUNE 'MINIATURE DUAL PURPOSE COILS' TO THE PRINCIPAL BROADCASTING STATIONS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Station | Wave-length Metres | Freq Kc/s | Signal Blue Yellow Green | Osc for 465Kc/s IF. Red | Station | Wave-length Metres | Freq Kc/s | Signal Blue Yellow Green | Osc for 465Kc/s IF. Red |
| Range 1 BBC Light | 1500 | 200 | 260pF | 80pF | Berlin | 303 | 989 | 85pF | 70pF |
| Range 2 BBC Third | 464 | 647 | 215 | 130 | Hilversum II | 298 | 1007 | 80 | 65 |
| | | | | | BBC West | 285 | 1052 | 75 | 60 |
| BBC North | 434 | 692 | 185 | 120 | BBC Midland | 276 | 1088 | 70 | 60 |
| Hilversum I | 402 | 746 | 160 | 110 | BBC North & NI | 261 | 1151 | 65 | 55 |
| BBC Scottish | 371 | 809 | 135 | 100 | BBC Light | 247 | 1214 | 55 | 50 |
| Paris I | 348 | 863 | 120 | 90 | Luxembourg II | 208 | 1439 | 35 | 30 |
| BBC Welsh | 341 | 881 | 110 | 85 | BBC West | 206 | 1457 | 35 | 30 |
| BBC London | 330 | 908 | 105 | 80 | BBC Third | 194 | 1546 | 30 | 25 |

## - METHOD OF USING PACKING CAN FOR SCREENING PURPOSES -



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 obtaing 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 valued required. These condensers should be of high quality insulated mica 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 with the 0.001 mfd series condensers.

(c) It will be noted that there is a slight break in the coverage given in the Table from Range 2 1.545MHz to Range 3 1.67MHz. This avoids I.F instability when using 1.6MHz 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 KHz and 1.6 MHz 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 windings.
YELLOW ..... Signal grid coil with intervalve coupling windings.
GREEN ..... Grid coil with reaction and coupling windings.
(These coils are available for Ranges 1 - 5 only.)
RED ..... Superhet oscillator for I.F. of 465 KHz
WHITE ..... Superhet oscillator for I.F. of 1.6 MHz

NOTE: Range 6 and 7 RED can be used for various I.F.s no WHITE coils are made for these ranges.

DESIGN DATA FOR MINIATURE DUAL PURPOSE COILS:

Circuit Diagram Fig. No. 2 is suggested as the basis of a receiver suitable for communications purposes covering 150 KHz - 31.5 MHz (465KHz I.F.) or 175 KHz - 31.5 MHz (1.6 MHz I.F.) the recommended valves are Mullard using 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 capacitees should be approx. 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 3-30 pF trimmer is required to bring the total minimum circuit capacity up to the required 39pF. It is recommended that for reliability the Phillips 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 Base and whichever range of coils are used, the correct padder value 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 wavechange wafer type 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 inductance and capacity introduced may make it impossible to obtain the coverage on the high frequencies taking particular care that there is a direct coupling between the gang and the 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 RF stage 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 IF, for better selectivity it is desirable to use an extra IF stage, this 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 with controlled output.

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

(1) Inject into the mixer grid via a 0.1 mfd. condenser and with the tuning condenser at maximum, adjust the core of Lo to give the lower frequency (Table 1) of the band selected. With the tuning condenser at minimum, adjust Ct for high 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 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 the 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 appreciable 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 be seen that the lowest frequency of the band is 10.5 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 ie. the one with the trimmer furthest 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 carrying 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, re-set as above.

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

TABLE 2

| | | | |
|---|---|---|---|
| Range 1 | 192.500 | 277.500 | 472.50 Kc/s |
| Range 2 | 566.500 | 817.000 | 1390.50 Kc/s |
| Range 3 | 1.835 | 2.640 | 4.50 Mc/s |
| Range 4 | 5.500 | 7.930 | 13.50 Mc/s |
| Range 5 | 11.550 | 16.650 | 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 & hence instability between the RF grid circuit and the RF anode-mixer grid circuit, suitable layout and screening should be used.

ALIGNMENT: After setting frequency coverages (Table 1) by osc. padder, trimmer and core adjustment as already described inject into the R.F grid via 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'

BANDSPREAD: Where required, bandspreading 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 reduce 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 9pF). Care should be taken to make 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. | Bank Spread Coverage. |
|---|---|
| 3.65 MHz | 150 KHz |
| 7.15 MHz | 125 KHz |
| 14.20 MHz | 970 KHz |
| 29.00 MHz | 1.87 MHz |

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 EF.54, EC52.

The wave range is from 30-78 MHz 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 MHz Range 7 ... 45 - 78 MHz

The alignment points are:
Range 6 ... 33 and 46.8 MHz Range 7 ... 49.5 - 70.2 MHz

The IFT used is for 5MHz 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.

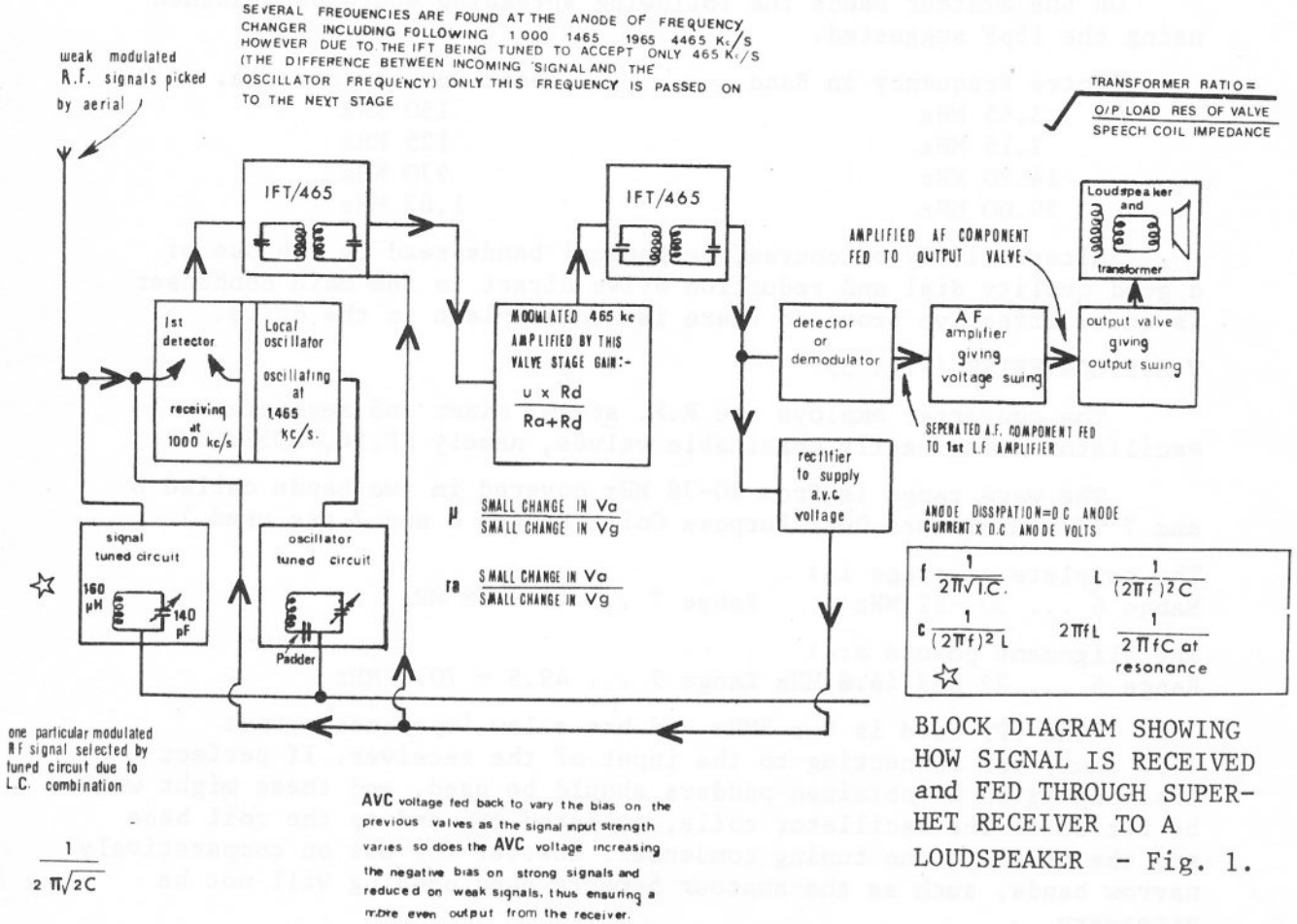
The alignment procedure is the same as for the 5-band Superhet receiver, the adjustment at the IF end if necessary being achieved by spaceing of coil turns.

Important Electrical Features: The EF50 valve used as a mixer, fed by a separate oscillator, although advatageous in many respects has a low input resistance (G1-K) at frequencies greater than 30MHz (eg 5000 ohms at 40MHz to 1250 ohms at 80MHz). This being so, the anode circuit of the RF 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 MHz to 4,000 ohms at 80MHz and the grid circuit is tuned with the aerial input (approx. 80 ohms) coupled to it.

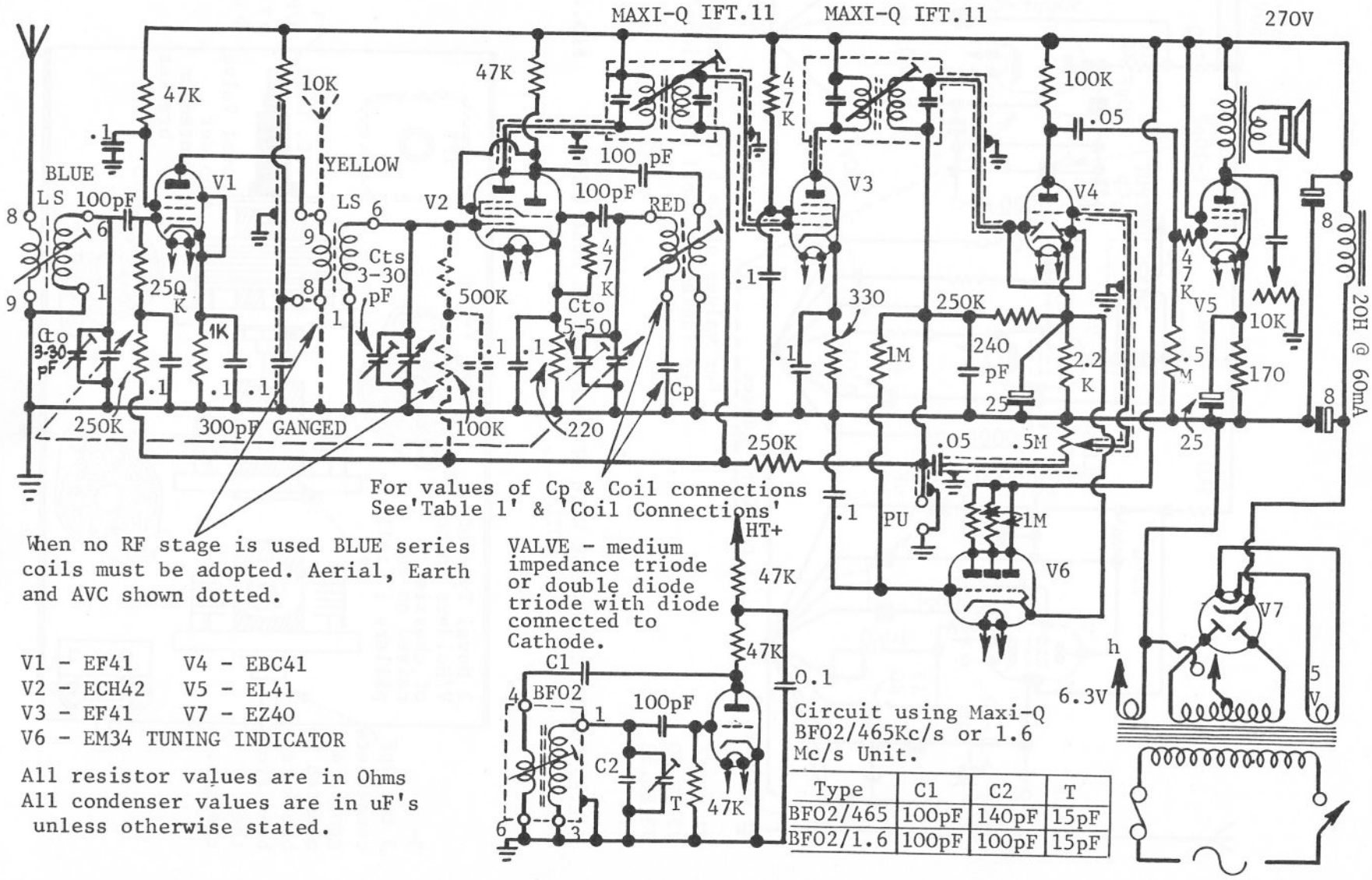
Important Mechanical Features: Perhaps the most important point in the design of this type of converter is mechanical layout and the following suggestions must be adhered to:-

(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 circuit 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 connections necessary.




BLOCK DIAGRAM SHOWING HOW SIGNAL IS RECEIVED and FED THROUGH SUPER-HET RECEIVER TO A LOUDSPEAKER - Fig. 1.




When no RF stage is used BLUE series coils must be adopted. Aerial, Earth and AVC shown dotted.

V1 - EF41 V4 - EBC41
V2 - ECH42 V5 - EL41
V3 - EF41 V7 - EZ40
V6 - EM34 TUNING INDICATOR

All resistor values are in Ohms
All condenser values are in uF's unless otherwise stated.

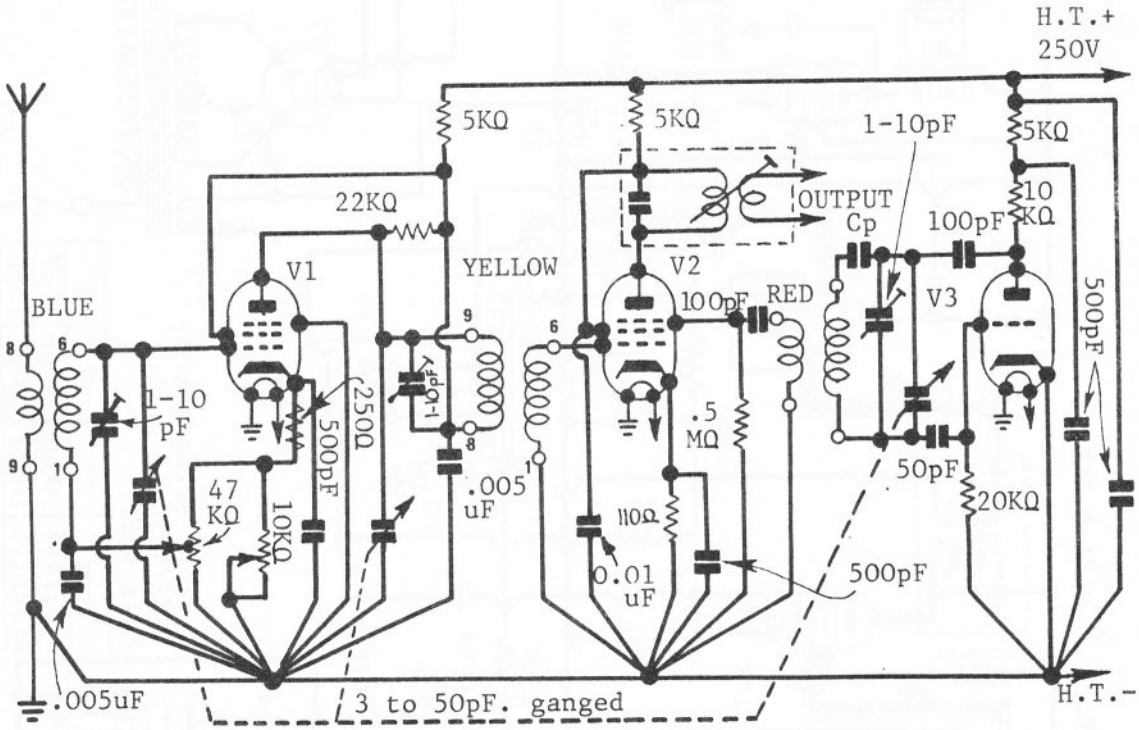
VALVE - medium impedance triode or double diode triode with diode connected to Cathode.

Circuit using Maxi-Q BFO2/465Kc/s or 1.6 Mc/s Unit.

| Type | C1 | C2 | T |
|---|---|---|---|
| BFO2/465 | 100pF | 140pF | 15pF |
| BFO2/1.6 | 100pF | 100pF | 15pF |

GENERAL PURPOSE SUPERHET FOR USE WITH MINIATURE DUAL PURPOSE COILS

FIG.2.

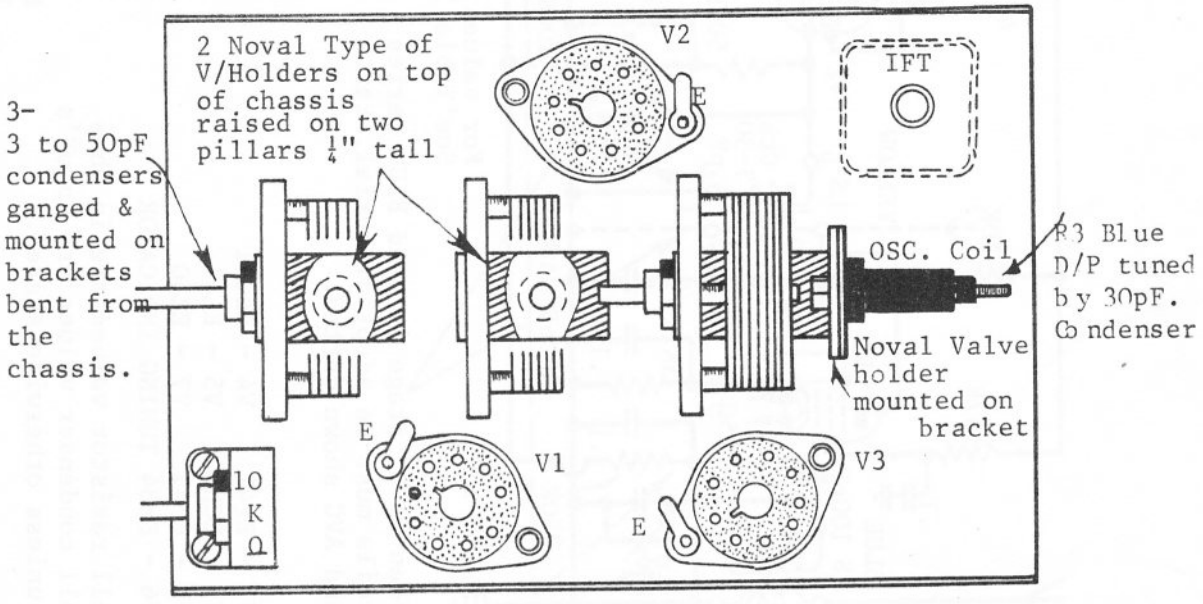



For values of Cp & Coil connections see Table 1 & 'Coil Connections'

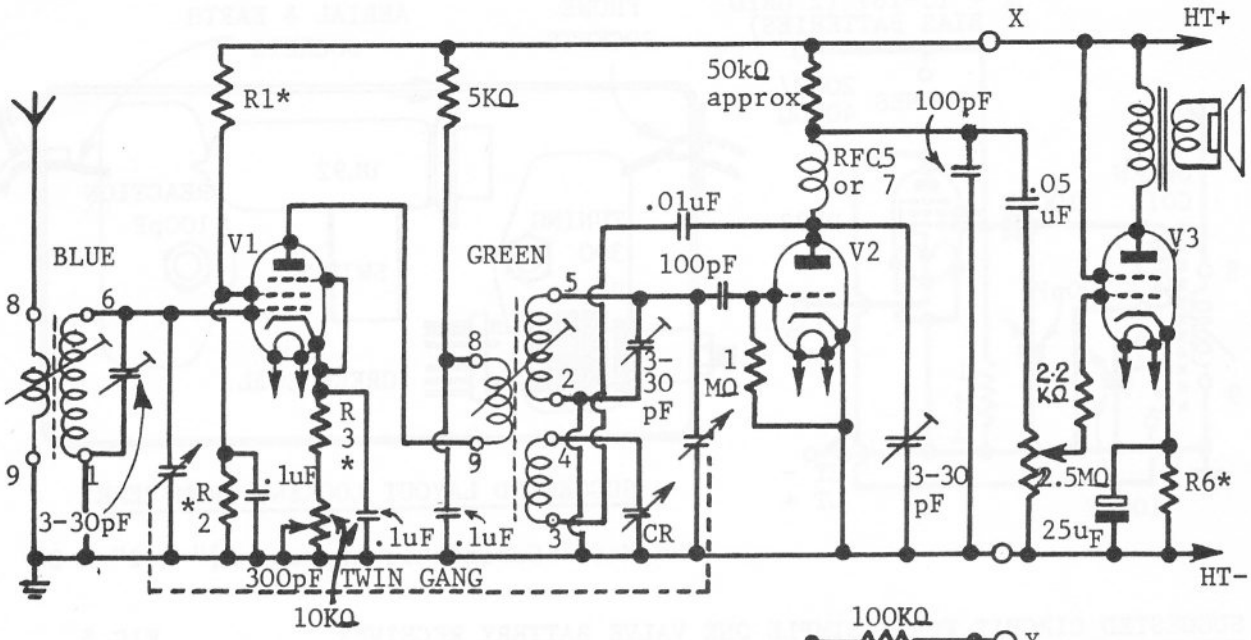
V1 EF.54
V2 EF.50
V3 EO.52

V.H.F. CONVERTER FOR USE WITH DENCO MINIATURE DUAL·PURPOSE COILS....

**FIG. 3.**




UNDERCHASSIS VIEW

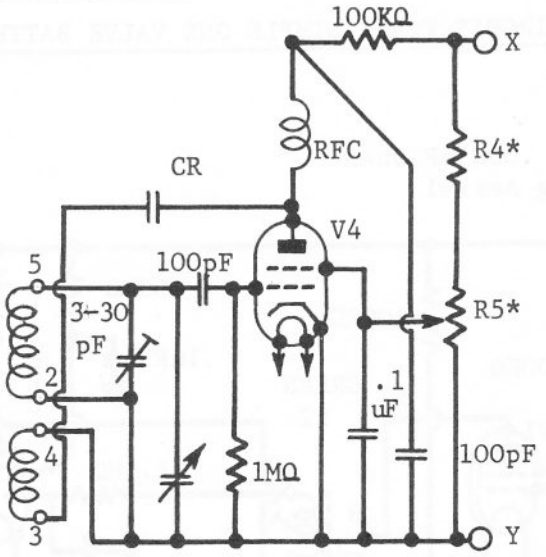



V1..KTW61 - EF39 - 6K7 - EF41
V2..H63 - 6C5 - TRIODE ½ ECL80
V3..KTZ63 - 6J7

*****
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:

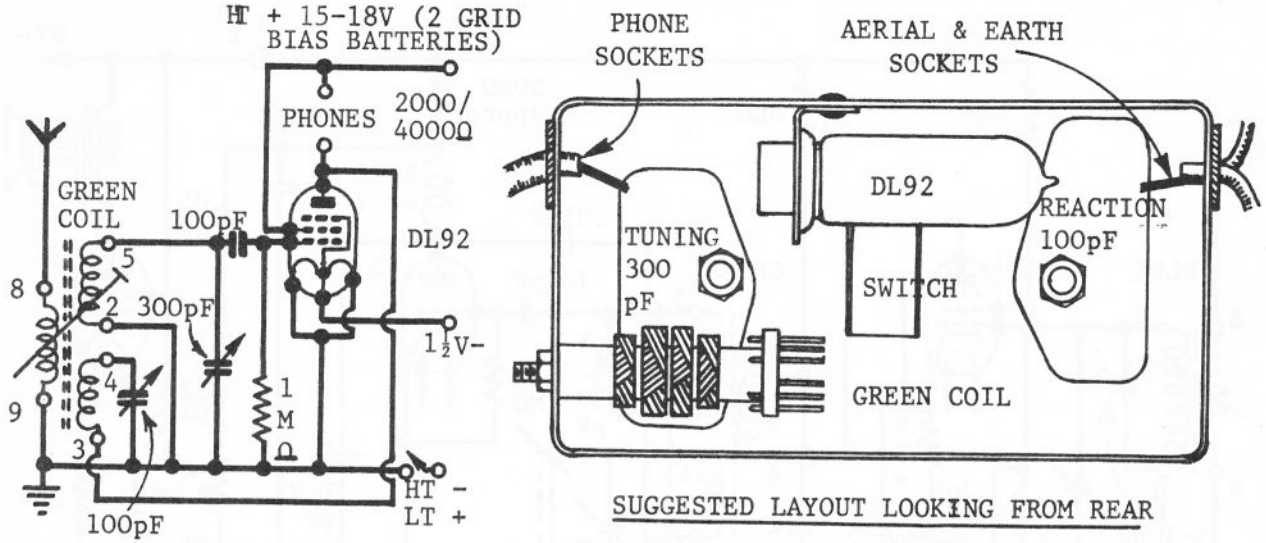
The receiver circuit shown above uses the BLUE and GREEN series of coils and comprises one RF, detector and output stage. The RF stage is essentially the same as in the supehet receiver, but with provision for biasing the stage to prevent overloading the detector on high levels of input.

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 prevent instability the RF stage grid circuit should be carefully screened from the following detector grid circuit. The RF valve should be neutralised or mounted in a metal screening can.

T.R.F. RECEIVER CIRCUIT DIAGRAM FOR USE WITH 'MAXI-Q' MINIATURE DUAL PURPOSE COILS.

FIG. 4

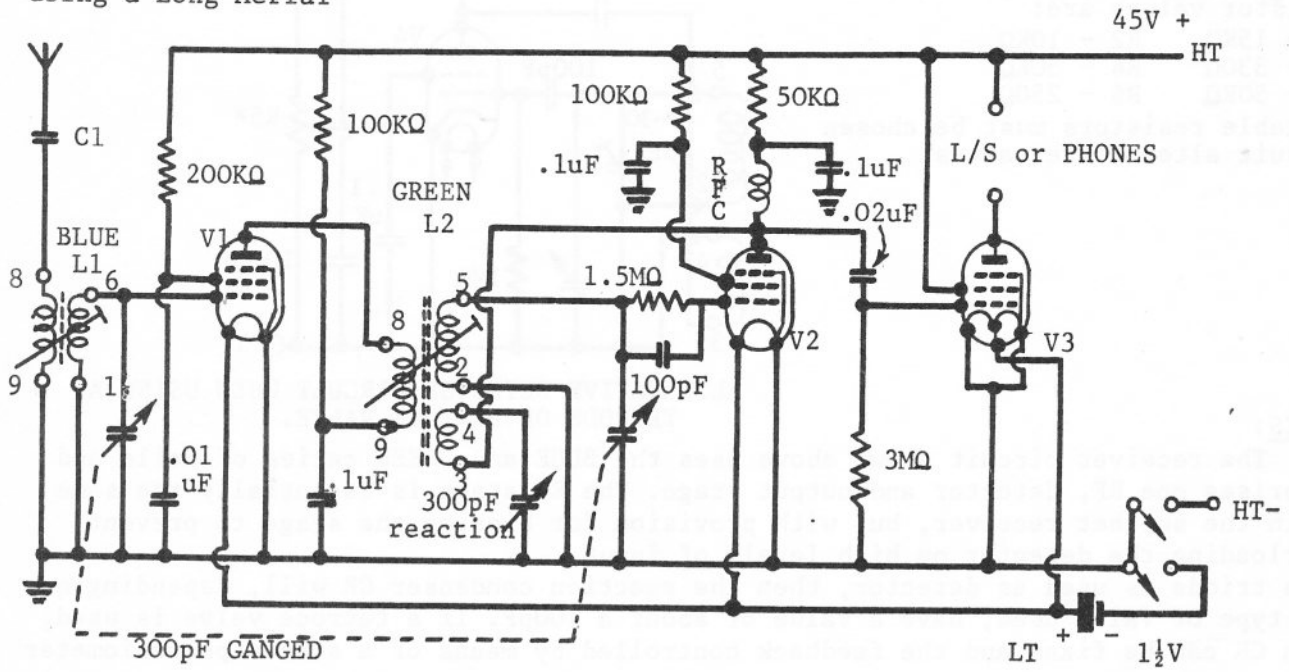



SUGGESTED LAYOUT LOOKING FROM REAR

The Metal Cabinet is approx. 3¾" x 2" x 2"

SUGGESTED CIRCUIT FOR A SIMPLE ONE VALVE BATTERY RECEIVER FIG.5

Insert C1 - .0005uF when using a Long Aerial

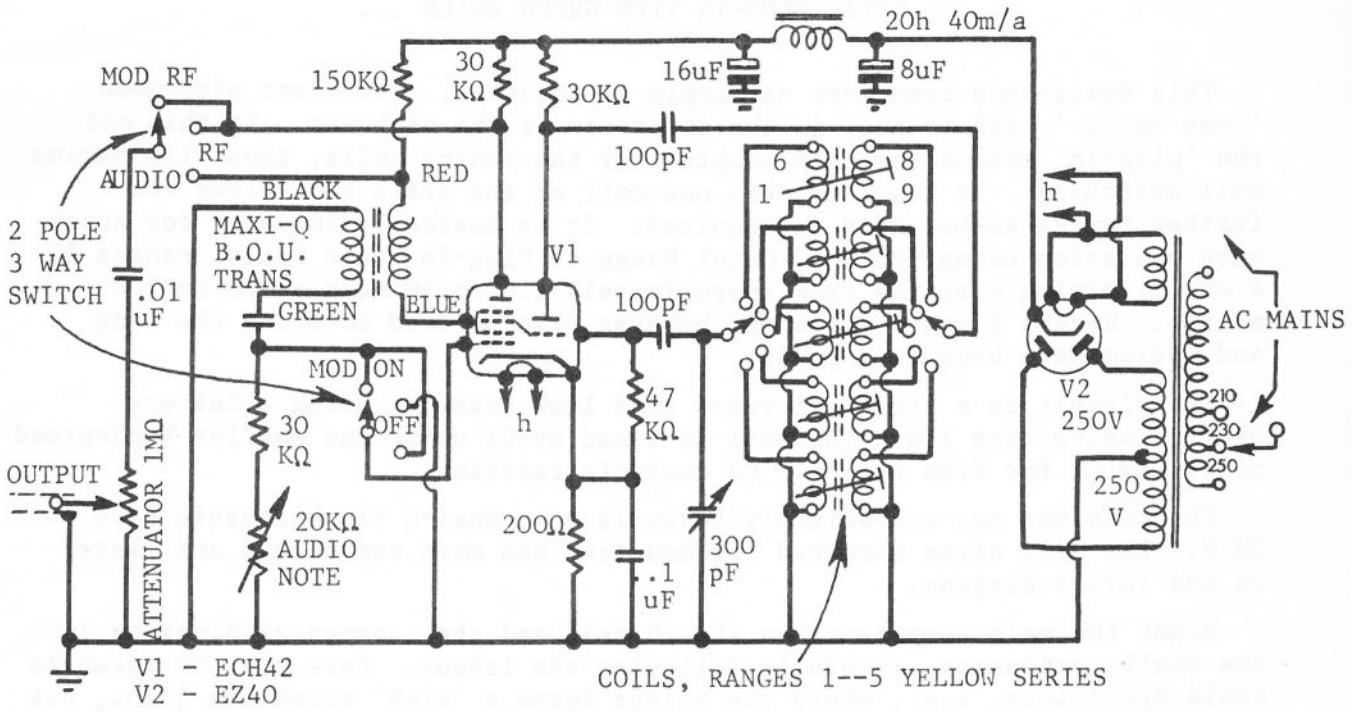



NOTES:

Shoulder strap or 'Throwout' aerial can be used.
DENCO Frame Aerials can be supplied to replace L1 if required.

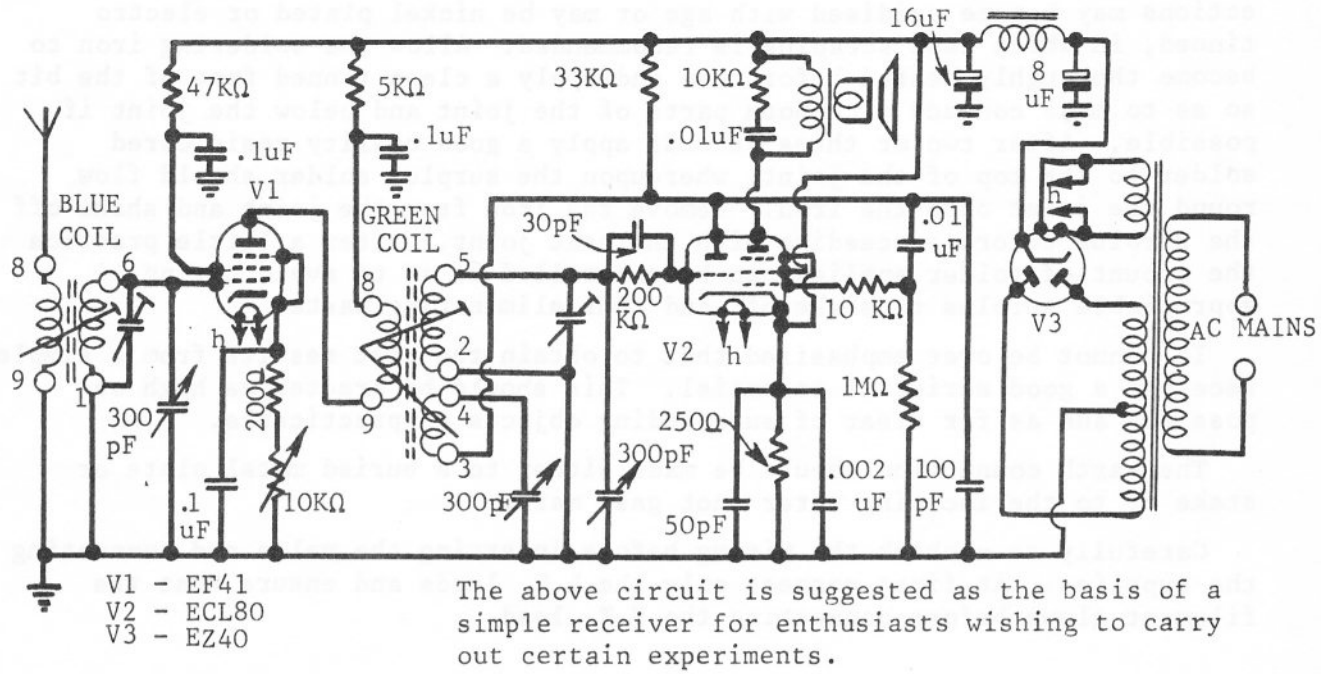
V1 - DF91
V2 - DF91
V3 - DL92

SUGGESTED CIRCUIT FOR A PORTABLE RECEIVER. FIG.6.




SUGGESTED CIRCUIT FOR A SIMPLE SIGNAL GENERATOR 175 Kc/s - 28 Mc/s.

FIG. 7.




The above circuit is suggested as the basis of a simple receiver for enthusiasts wishing to carry out certain experiments.

SUGGESTED CIRCUIT FOR A SIMPLE 3-VALVE RECEIVER.

FIG. 8.

# BEGINNER'S SIMPLE SHORT-WAVE RECEIVER USING MAXI-Q

## OCTAL PLUG-IN TYPE 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' Octal Range of Plug-In Green Coils, ranges 3, 4 and 5, giving coverage 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 bandspread 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 oxidised 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 re - check 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, ⅛ watt res.
R2 - 10000 ohm ½ watt res.
R3 - 22000 ohm, ½ watt res.

Battery - EverReady B103
Headphones - 2,000 ohms
Valveholders - 1 B7G (valve)
*** - 1 Octal(coils)

C1 - 310pF Variable Cond. Jackson Type 'E' ***
C2 - 15pF Variable Cond. Jackson Type C804/15***
C3 - 100pF Variable Cond. Jackson Type C804/100***
C4 - 100pF Ceramic Condenser
C5 - 0.1 uF Condenser

Maxi-Q Octal Plug-In Coils - GREEN Ranges 1 -- 5 inclusive ***
Maxi-Q Blank Aluminium Chassis Type 8 ***

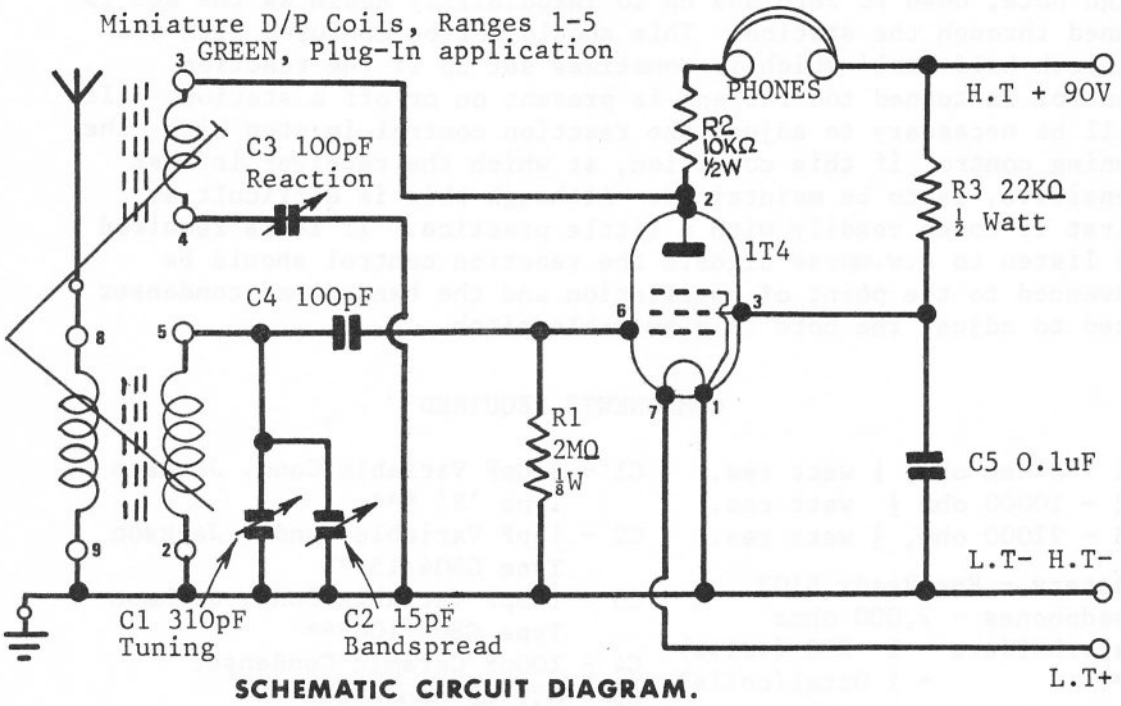
1 - Front Panel
3 - Knobs Type 'E'***
1 - Aerial/Earth Socket
3 - Wander Plugs (for battery connection)
1 - Headphones socket
1 - Grommet ½"
1 - 6BA Solder Tag
1 - 4BA Solder Tag

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

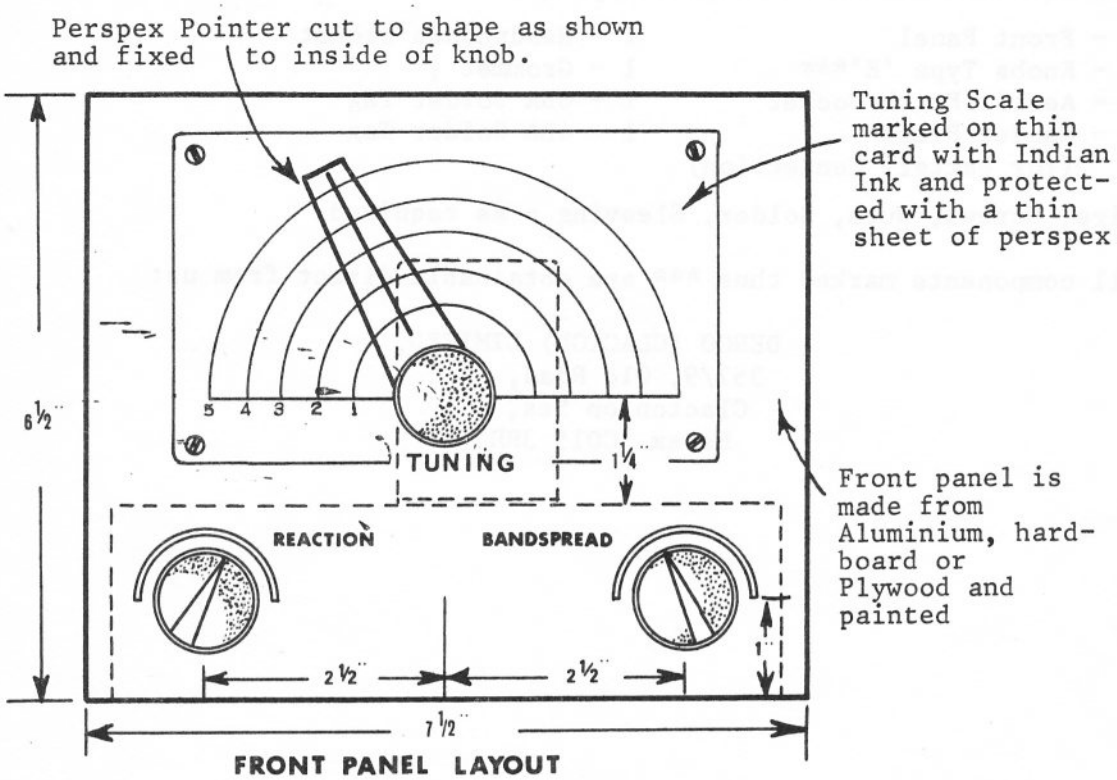
All components marked thus *** are obtainable direct from us:

DENCO (CLACTON) LIMITED,
357/9, Old Road,
Clacton on Sea,
Essex. CO15 3RH.

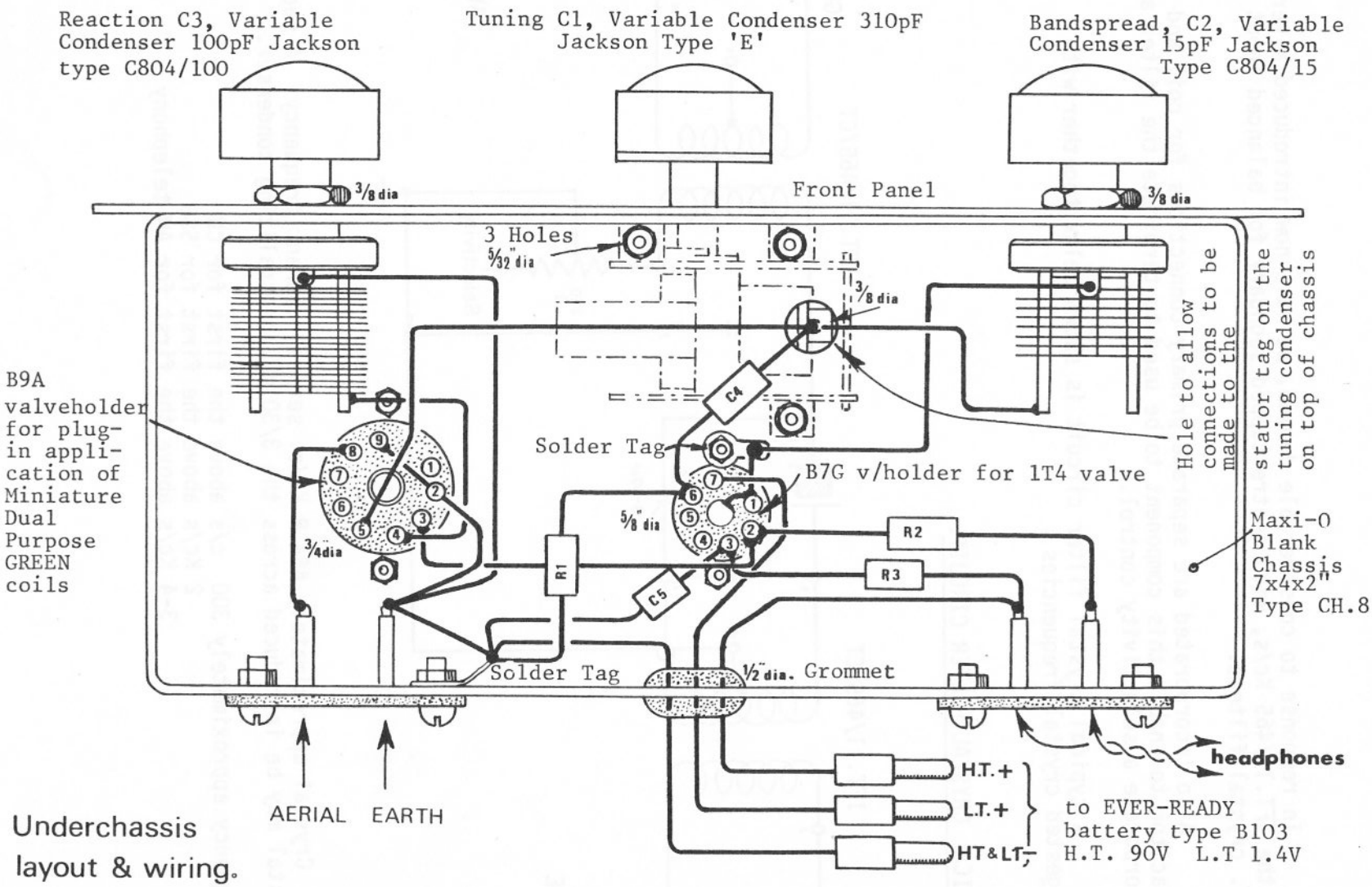
# Beginner's Simple Short Wave Receiver using Miniature Dual Purpose Coils.




**SCHEMATIC CIRCUIT DIAGRAM.**




**FRONT PANEL LAYOUT**



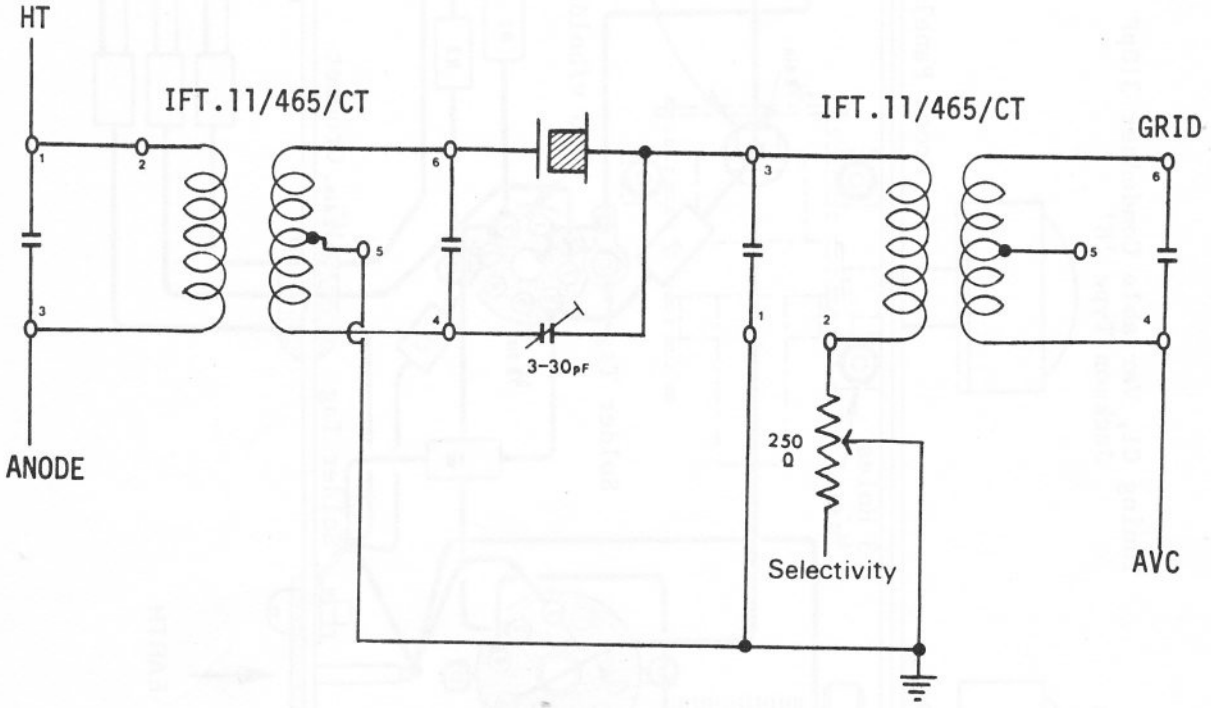

Underchassis layout & wiring.

In response to considerable demand, we have now introduced a version of the IFT.11/465 Kc/s, with centre tapped seondary for balanced input to I.F. crystal filters.

Also incorporated are separate primary connections for coil and capacitor to enable this component to be used to terminate the filter and incorporate a selectivity control.

A typical crystal filter circuit is shown below together with suggested crystal frequencies.

TYPICAL CRYSTAL FILTER CIRCUIT.

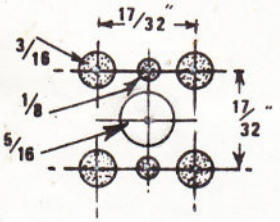



Crystal approximately 464.8 Kc/s. series resonant frequency. A second crystal may be introduced across the 3/30 pF. neutralizing condenser.

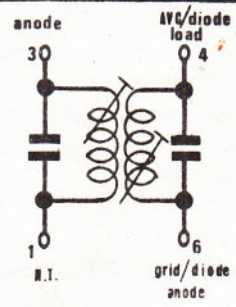
Frequency approximately 300 c/s above the first for CW
2 Kc/s above the first for SSB
3-4 Kc/s above the first for AM telephony

# I.F. TRANSFORMER
## TYPE IFT.11

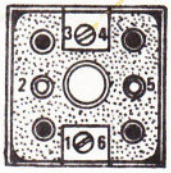
465Kc/s or 1.6Mc/s




Fixing




UNDERSIDE VIEW




Due to variation in width of the can lugs the numbers 1, 3,4,6 are sometimes obscured, but can be identified from the sketch in relation to 2 & 5.