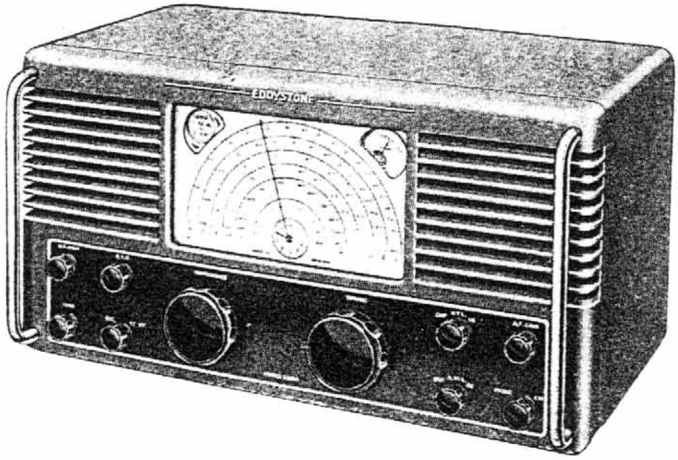
INSTRUCTION BOOKLET

EDDYSTONE COMMUNICATION

RECEIVER - TYPE 504

SPECIFICATION



COMMUNICATION RECEIVER TYPE 504

GENERAL.

This instrument is a 9 valve superheterodyne, with two R.F. stages, designed to meet all the requirements for a first grade Communication Receiver. The coverage of 30,000 to 600 kilocycles (10 to 500 Metres) is provided in five switched bands, as follows :—

Range 1	13·2 to 30·5 Mc/s.
Range 2	6·25 to 13·4 Mc/s.
Range 3	2·9 to 6·5 Mc/s.
Range 4	1·34 to 2·9 Mc/s.
Range 5	580 to 1340 Kc/s.

The tuning dial has five calibrated scales with an inner logging scale marked 0–100 degrees, concentric with which is a fine tuning scale, traversed by a small pointer having a 1 to 20 ratio to the main pointer. The latter has an approximate reduction ratio to the tuning control knob of 1 to 140. At the top left hand corner of the dial is situated the waveband indicator. The signal strength meter is fitted at the top right hand corner. It is permanently in circuit and is operative to an extent governed by the setting of the R.F. gain control. A zero adjuster for the meter is fitted at the rear of the cabinet and is indicated in Fig. 3. Also at the rear are the mains input plug, aerial socket, and jacks for the loud speaker and telephones.

The receiver operates from 40 to 60 cycle A.C. mains of 200/230 or 110 volts, the total consumption being 65 watts.

SPECIFICATION—continued.

CIRCUIT DETAILS.

R.F. CIRCUITS.

The complete circuit diagram is given in Fig. 4. Two R.F. stages, using Mullard Red E type R.F. pentodes, result in high sensitivity and excellent selectivity, both adjacent channel and image. The frequency changer stage employs a triode-hexode valve of a type which is particularly efficient at high frequencies. The signal circuit inductances are wound on dust-iron cores and trimmed with air dielectric trimmer condensers, a combination which enables high coil magnifications to be realised, thereby increasing the overall sensitivity of the receiver.

The oscillator inductances are also wound on dust-iron cores and ceramic trimmer condensers are used. The coil assembly is fitted in a substantial diecast aluminium housing, which ensures complete mechanical and electrical stability. The design as a whole is such that the tuned circuits retain their trim indefinitely and there is complete freedom from frequency drift, once the receiver has had time to warm up to a stable operating temperature.

The input impedance is of the order of 70 ohms, but good results will be obtained with aerial systems showing a wide variation of impedance.

I.F. STAGES AND CRYSTAL FILTER.

Two I.F. stages are used, the frequency being 450 Kc/s. The I.F. transformers, which are permeability tuned, are of efficient design, give high stage gains and can be relied on to maintain their set frequency over long periods. The attenuation 5 Kc/s off resonance is 30 dB., giving adequate selectivity for the reception of any type of signal under normal conditions. For the reception of C.W. signals, particularly when severe interference is present, the crystal filter incorporated in the first I.F. stage will be found very effective. The band width with the filter switched in is of the order of 300 cycles. The advantages of the particular type of crystal filter used are discussed later.

The R.F. gain control is operative on the two R.F. stages and on the first I.F. stage.

DETECTOR AND A.V.C. STAGES.

The fifth valve, a double diode triode, acts as detector and first audio amplifier. Only one diode is used and the circuit is arranged to give non-delayed high speed A.V.C. so that it is operative on weak as well as strong telephony signals. To prevent reduction of sensitivity when switching in the B.F.O. valve to receive C.W. signals, it is necessary to cut out A.V.C. and this is accomplished simultaneously by shorting the A.V.C. line to chassis.

The A.V.C. is applied to the two R.F. stages and to the first I.F. stage and is effective in holding the output constant within a few decibels over a wide range of signal input.

SPECIFICATION—continued.

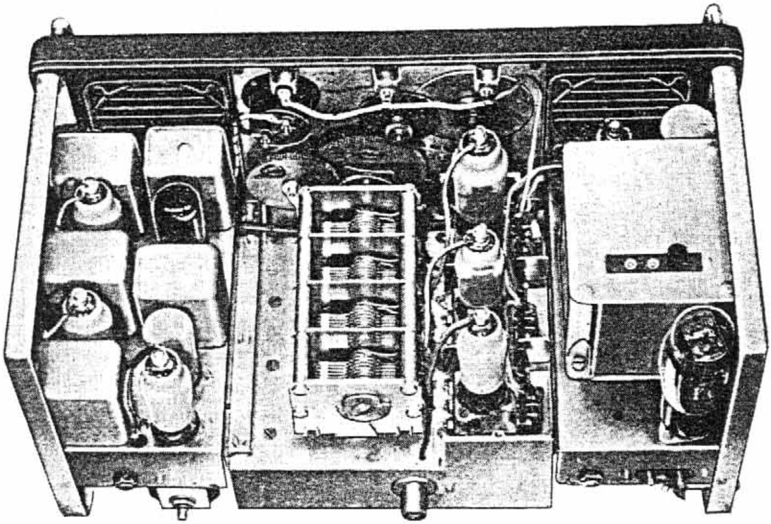


Fig. 1 Plan view of the "504" Receiver.

BEAT FREQUENCY OSCILLATOR.

The design of the B.F.O. circuit has received very careful attention. Its stability is of a high order and frequency drift is conspicuous by its absence. If stray radiation from the B.F.O. is picked up at an early stage in the I.F. amplifier, amplification occurs of both the B.F.O. and normal signals. The amount of B.F.O. voltage then injected into the detector will be much greater than it should be, giving rise to a high harmonic output. This effect is often evident by a considerably increased noise level when switching in the B.F.O.

Thorough screening of the B.F.O. is incorporated in the 504 Receiver and injection is controlled so that it occurs only at the proper point and at the voltage which gives optimum results.

NOISE LIMITER.

An efficient noise limiter circuit, which may be switched in or out at will, removes peaks of noise from electrical interference, car ignition, etc.

"S" METER.

This is a moving coil instrument calibrated in "S" units and in decibels above S9. The special circuit employed enables the meter to be left in circuit continually, the needle automatically returning to zero if the R.F. gain is reduced.

OUTPUT STAGE AND POWER SUPPLY.

The output valve is of the beam power type and gives up to 3 watts of audio output. An output transformer is fitted, the secondary of which is connected to a jack at the rear of the receiver. The loud speaker used should have a speech coil impedance of 3 ohms. A second jack is provided to take high impedance telephones.

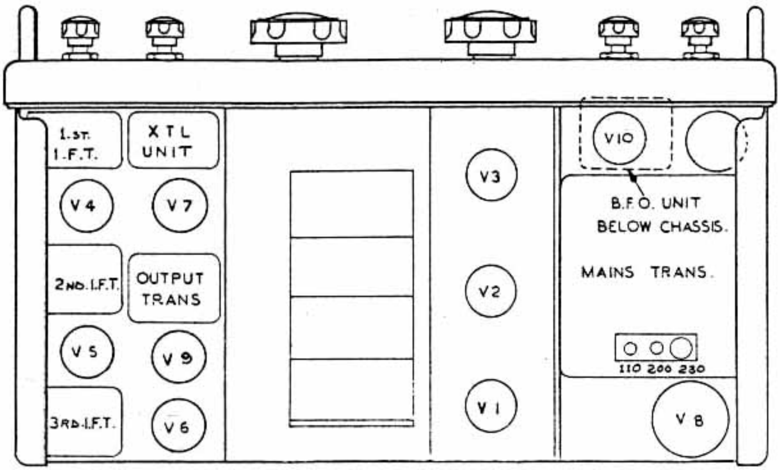


Fig. 2. Plan view in outline of the "504" Receiver.

The regulation of the power unit is good and the generous smoothing ensures a very low hum level. The mains transformer is tapped for inputs of 110, 200 and 230 volts, the consumption being 65 watts. The receiver on/off switch is combined with the tone control, a second switch being provided for stand-by purposes during periods of transmission. This latter switch removes the H.T. supply from certain valves but leaves it on others in order to prevent any possibility of frequency drift during the transmission period.

VALVES.

The positions of the valves are shown in Figs. 1 and 2 and the types used are as follows :—

V1	EF39	Mullard	1st R.F. Amp.
V2	EF39	Mullard	2nd R.F. Amp.
V3	ECH35	Mullard	Frequency Changer
V4	EF39	Mullard	1st I.F. Amp.
V5	EF39	Mullard	2nd I.F. Amp.
V6	EBC33	Mullard	Det. A.V.C. & 1st A.F. Amp.
V7	6V6GT	Brimar	Output
V8	5Z4	S.T. and C.	Rectifier
V9	EB34	Mullard	Noise Limiter
V10	EF39	Mullard	B.F.O.

CONTROLS.

The following controls are on the front of the receiver. Their functions are clearly indicated and notes on their use are given later under the heading of "Operation."

Wavechange.	Tone, combined with Power On/Off.
Tuning.	Crystal Filter In/Out.
Radio Frequency Gain.	Noise Limiter In/Out.
Audio Frequency Gain.	Phone/C.W.
Receiver/Stand-by.	B.F.O.

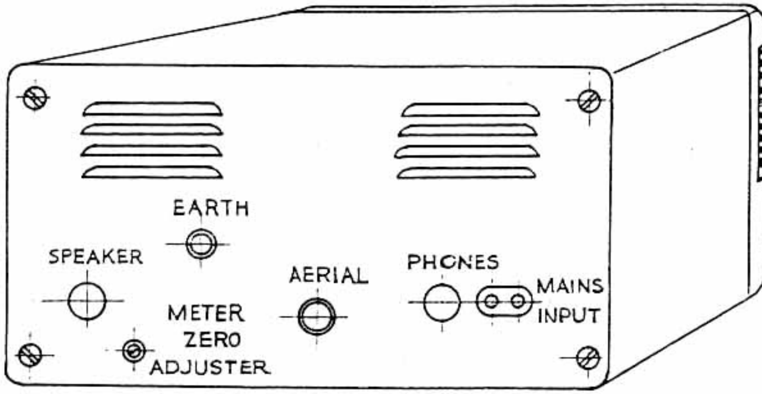


Fig. 3. Rear outline of the Receiver, with details of external connections.

INSTALLATION.

The receiver has been aligned, calibrated and thoroughly tested before despatch and the only adjustment that may be necessary is the mains input voltage. A voltage tapping panel is provided on the mains transformer (see Figs. 1 and 2) and the screw is normally fitted in the 230 volt position, where it may remain for input voltages between 220 and 250 volts. If the mains voltage is between 195 and 215 volts, the 200 volt tapping should be used. The 110 volt tap is suitable for mains supplies between 100 and 125 volts.

Access to the transformer is obtained by removing the four screws at the rear of the cabinet, when the cover can be removed completely.

External connections to the receiver are indicated in Fig. 3. Supplied with it are a mains input lead fitted with a socket to match the plug on the receiver, a co-axial plug for aerial connection and two telephone type plugs for attachment to the loud speaker and telephones. An output transformer is fitted in the receiver and the loud speaker speech coil impedance should be 3 ohms. Telephones, if used, should be of the high impedance type.

OPERATION.

It is recommended that operation of the receiver should not be attempted before reading the following instructions, which will serve as a guide in obtaining optimum results.

A brief description of the panel controls is given, followed by information relating to the reception of C.W. and telephony signals. Correct operation will result in more satisfactory reception generally and will enable weak signals to be received at readable strength, which incorrect operation would render difficult if not impossible. A receiver of this type requires some experience in securing maximum results from it, and care in handling the controls will be found well worth while.

TUNING AND WAVECHANGE.

The tuning control knob on the right operates a four-gang variable condenser through the medium of a high precision geared drive, the operating frequency being read off against the appropriate dial scale. By noting the readings of the inner and vernier scales, it is possible to return to any particular signal.

The wavechange switch is operated by the large left hand knob, the band selected being shown on the indicator.

TONE CONTROL AND ON OFF SWITCH.

Clockwise rotation of the tone control results in increased high note response. The on/off switch is incorporated, connected in series with the transformer primary.

R.F. GAIN.

Clockwise rotation increases the gain of the two R.F. valves and of the first I.F. valve—the second I.F. valve operates at maximum gain continually in order to provide good A.V.C. characteristics.

When receiving telephony (or other modulated signals) the R.F. gain should be at maximum, in which position A.V.C. is fully operative and the "S" meter will indicate the relative strength of the received carrier. The degree of fading present can be judged by the movement of the "S" meter needle. It may be noted that sharp kicks of the needle (not to be confused with movements due to fading) indicate over-modulation of the distant transmitter. With a very strong local transmission it may be advantageous to reduce the R.F. gain somewhat—the A.V.C. will remain operative to a lesser degree and it will be easier to give comparative reports of adjustments made at the transmitting station.

Greater use of the R.F. gain will be called for in the reception of C.W. signals. It will require to be well advanced for the reception of weak signals but strong signals will tend to cause overloading and the R.F. gain must then be reduced.

A.F. GAIN.

The A.F. gain should be adjusted to give the amount of audio output, either on the speaker or on telephones, favoured by the individual operator. When receiving telephony, this control should be the sole one used for adjustment of signal strength but, when receiving C.W. signals, variation of both R.F. and A.F. gain controls is advisable to secure the greatest signal to noise ratio. These adjustments are a matter of practical experience and the skill of the operator in making them will increase with familiarity of the receiver controls.

BAND PASS CRYSTAL FILTER.

Where the advantages of extremely high selectivity are required, the use of some form of Quartz Crystal Filter becomes essential. There are two types available, the single peaked and the band-pass. The latter possesses many advantages and is the type incorporated in the 504 Receiver.

Two similar crystals are used, differing in frequency by the width of the pass band required—in this case, about 300 cycles. The crystals are mounted in a special holder which is fitted inside a screening box. The latter also contains the phasing condenser and other associated components. The switch marked "Crystal In/Out" on the panel enables the crystal to be switched out when not required, leaving the selectivity at normal.

The crystals are placed in opposite arms of a bridge circuit and are balanced by means of the phasing condenser, which, once set, requires no further adjustment. Frequencies between the crystal frequencies are passed with little loss but those outside are greatly attenuated. An improvement in the signal to noise ratio results, of the order of 20 db over a typical single crystal filter.

Another advantage of the band pass filter is the absence of "ringing" (border line oscillation) usually associated with single crystal filter circuits. In the latter, the intermediate frequency is carefully adjusted to resonate exactly with the crystal frequency, an ideal condition to set up ringing. In the band pass arrangement, the intermediate frequency lies midway between the two crystal frequencies and ringing does not occur.

Phasing and selectivity controls, essential with single filters, become unnecessary and therefore the panel controls are simplified.

On switching in the Crystal Filter, the reduction in noise will be apparent immediately and may give an erroneous impression of reduced sensitivity. Careful adjustment of the B.F.O. control will be necessary to bring the signal within the filter band pass, when it will stand out clear of all interfering signals. In fact, it will be found possible to read a C.W. signal through very severe interference, providing the latter is slightly separated in frequency from the wanted signal.

Obviously, the use of the crystal filter is confined to C.W. signals, since the band width is much less than necessary for even "communication" telephony.

USING THE B.F.O.

During the reception of C.W. signals, the use of the B.F.O. control is important, particularly if the signal is weak.

With the knob set with the white spot on top, the B.F.O. frequency is identical with the intermediate frequency—450 Kc/s—and with a signal properly tuned in, no beat note should be audible. On moving the B.F.O. knob in either direction, a beat will be produced and the note will increase in pitch.

It will be appreciated that a beat note will result if the B.F.O. is set at zero and the tuning suitably adjusted, but, due to the mistuning of the signal frequency circuits, both sensitivity and selectivity will be impaired.

OTHER CONTROLS.

The use of the remaining controls is practically self-evident. In a quiet area, the noise limiter may be left in the "Out" position but if car ignition or other electrical interference of a peaky character is experienced, the noise limiter should be switched into circuit.

The phone/C.W. control performs two functions. In the phone position, the A.V.C. is allowed to operate and the H.T. supply to the B.F.O. valve is disconnected. In the C.W. position, the A.V.C. line is connected to earth and is therefore inoperative, whilst H.T. is connected to the B.F.O. valve which is then able to perform its normal function.

The Receive/Stand-by switch is intended for use when the receiver is employed in conjunction with a transmitter. During periods of transmission, the receiver, if left in the normal condition, is likely to be overloaded (depending on the frequency separation of transmitter and receiver). When this occurs, the receiver should be switched to "Stand-by" during periods of transmission. H.T. is thereby removed from all valves with the exception of the R.F. amplifiers, frequency-changer and B.F.O. valves, which are left in circuit in order to prevent frequency drift. Upon switching to "Receive," the receiver becomes operative immediately.

At the rear of the receiver is the pre-set control for adjustment of the "S" meter zero. To effect this adjustment, short circuit the input to the receiver and rotate the slotted spindle with a screwdriver until the needle of the meter indicates zero. Then remove the short circuit and reconnect the aerial.

ALIGNMENT INSTRUCTIONS.

As previously stated, the receiver has been aligned carefully before despatch and the various trimmers should not be touched unless there is very good reason to suspect that one or more circuits have gone out of tune. Proper test equipment and a knowledge of superheterodyne alignment procedure is desirable when making adjustments to the tuned circuits. The instructions which follow should be carried out with care, since the performance depends entirely on the correct adjustments being made.

I.F. CIRCUITS.

The intermediate frequency is 450 Kc/s. The I.F. transformers are unlikely to drift off frequency over long periods and adjustment will rarely be necessary. Re-alignment of the I.F. stages is bound up with the crystal filter, since, for the latter to function correctly, the intermediate frequency stages must be tuned to the exact mid-point of the two crystal frequencies.

If re-alignment is thought desirable, a signal generator supplying a test signal at a frequency of 450 Kc/s, modulated at will to a depth of 30%, and an output measuring meter, are necessary. Before commencing alignment, ensure that the receiver is otherwise in the same condition as for normal use, i.e., all valves firmly in place, screens in position, etc. Switch on both receiver and signal generator and allow them to warm up for at least five minutes, to minimise frequency drift. The leads from the output meter, which should be set to represent an impedance of 2·5 ohms, are plugged into the speaker jack at the rear of the receiver.

The output from the signal generator, the internal modulation of which is switched off, is connected across the top cap of V3 and chassis, after removing the connector from the latter. Ensure that a continuous D.C. path of a resistance not greater than 3 megohms exists between the two signal generator leads. Failing this, connect a ·5 megohm resistor across them. The positions of the various controls should be as follows :—

R.F. Gain.	Maximum.	Crystal.	In.
A.F. Gain.	Maximum.	A.N.L.	Out.
Wavechange.	Range I.	Phone/C.W.	C.W.
Dial Setting.	13·2 Mc/s.	Rec./St.By.	Rec.

With the tone control fully clockwise, adjust the B.F.O. knob so that the white spot is slightly one side of centre. On rocking the signal generator frequency back and for, the output meter should indicate two points of maximum output. The signal generator should be set to a frequency midway between the two peaks, the input being adjusted to give a reading on the output meter of not more than 50 milliwatts. The cores in the I.F. transformers are then adjusted for maximum response, commencing with the secondary of transformer No. 3 (see Figs. 5 and 6) and finishing with the primary of transformer No. 1. Access to the primary cores is secured through the side bracket and to the secondary cores from the underside of the chassis. During the process of alignment, it will probably be necessary to reduce the input from the signal generator, to prevent the output meter reading going off the scale. The average sensitivity of the I.F. amplifier section is 7·5 microvolts.

TESTING A.V.C. ACTION.

At this point, it will be convenient to make a check to ensure that the A.V.C. circuits are functioning correctly. Switch on the internal modulation in the signal generator, switch out the crystal and change to "Phone" in the receiver. Reduce the A.F. gain to about half-way to prevent the output meter being overloaded. The input from the signal generator should be progressively increased and, up to a certain point, a rapid increase of audio output should be indicated. Beyond this point, the increase should be comparatively slow.

B.F.O. ADJUSTMENT.

To adjust the beat frequency oscillator, set the knob marked "BFO" so that the white spot is at the top, in which position the condenser C57 which it controls, is at half capacity. Move the Phone CW switch to the C.W. position, leaving all other controls set as for alignment of the I.F. stages, but with the crystal filter "out." The internal modulation of the signal generator should be switched off. Then adjust the core in the B.F.O. Unit beneath the chassis (see Figs. 5 and 6) to the silent point of the beat note. Rotation of the B.F.O. control knob to the right or left should result in an even increase in the pitch of the note.

CRYSTAL FILTER ADJUSTMENT.

The Crystal Unit calls for very careful adjustment and it is recommended that no attempt be made to improve on the original setting, unless the filter is obviously not functioning correctly.

The instructions given previously under "I.F. Alignment" apply, and before lining up the I.F. transformers, adjustment of the core in the crystal unit for maximum response may be made. Access to the core is obtained from the underside of the chassis (see Figs. 5 and 6).

On swinging the frequency of the test signal, the final result should be a high output showing a fairly flat response over a band width of about 300 cycles, and, on each side, a sharp drop in output, followed by a small peak at the resonant frequency of each crystal. The ratio between the maximum signal output and that of one of the crystal peaks should be at least 25 dB—with careful adjustment a ratio of over 30 dB is possible. If the meter indicates a poor ratio, adjustment of the phasing condenser in the Crystal Unit will be necessary. This is accessible through the top of the Crystal Unit screening box (see Figs. 1 and 2). Adjust a little at a time and carry out the procedure described above afresh until the minor crystal peaks on each side of the main band are equal.

R.F. ALIGNMENT.

In the photograph of the underside of the receiver, Fig. 5, the cover of the coil box has been removed and the positions of the R.F. coils and trimmer condensers are visible. For the sake of clarity, the key drawing Fig. 6, is also included. In many cases, re-trimming the small condensers will be all that is necessary but the following instructions are supplied to enable complete re-alignment to be carried out.

OSCILLATOR CIRCUITS.

The oscillator frequency, on all ranges, is 450 Kc/s higher than the signal frequency. The output leads from the signal generator (check for a D.C. path as before) should be connected to the grid of the frequency changer valve (V3) and chassis, and the output meter plugged in the speaker jack. The main tuning pointer should be set at the frequency given below, for each range, and that particular frequency injected from the signal generator. The appropriate oscillator *core* should then be adjusted to a point which gives maximum reading on the output meter.

Range.	*Frequency.*	*Core No.*
1	14 Mc/s	4
2	6·5 Mc/s.	8
3	3 Mc/s.	12
4	1·4 Mc/s.	16
5	600 Kc/s.	20

Turning to high frequency end of the tuning dial, set the pointer at and inject the undermentioned frequency for each range as before and adjust the oscillator *trimmer condensers* for maximum output.

Range.	*Frequency.*	*Trimmer No.*
1	30 Mc/s.	4
2	13 Mc/s.	8
3	6·5 Mc/s.	12
4	2·8 Mc/s.	16
5	1300 Kc/s.	20

Repeat the foregoing as necessary, returning to the low frequency end of each range and re-adjusting the cores, followed by re-adjustment of the trimmers at the H.F. end, until no further improvement is possible.

REMAINING R.F. CIRCUITS.

Transfer the generator lead from the frequency changer grid to the aerial terminal and replace V3 grid connector. Then adjust all *cores* at the L.F. end of the dial in the following recommended order, using the same frequencies and method outlined for the oscillator circuits.

Range.	*Adjust Core.*	*Trim.*	*Coil/Cond. No.* OSC.	F.C.	2nd R.F.	1st R.F.
1	14 Mc/s.	30 Mc/s.	4	3	2	1
2	6·5 ,,	13 ,,	8	7	6	5
3	3 ,,	6·5 ,,	12	11	10	9
4	1·4 ,,	2·8 ,,	16	15	14	13
5	600 Kc/s.	1300 Kc/s.	20	19	18	17

Return to the H.F. end of the tuning dial and adjust all *trimmer condensers* in the same order as the cores. The process should be repeated until the cores need no further adjustment.

Finally, screw down the coil box lid and re-adjust all air trimmers, i.e., all trimmers except those in the oscillator circuits.

PERFORMANCE FIGURES.

Overall sensitivity—better than 2 microvolts for an output of 50 milliwatts I.F. Amplifier sensitivity—approx. 7·5 microvolts.

Selectivity—Crystal out : 30 dB attenuation 5 Kc/s off resonance.

Crystal in : 300 cycle band pass, attenuation 500 cycles off resonance greater than 30 dB.

Image Ratio :	at 20 Mc/s attenuated ...	35 dB
	at 10 Mc/s attenuated ...	50 dB
	at 5 Mc/s attenuated ...	60 dB
	at 2 Mc/s attenuated ...	75 dB

Max. Audio Output ... 3 watts.

Aerial Input Impedance ... 70 ohms.

SERVICING.

When a multi-range meter is available, the accompanying chart showing the voltages to be expected at the appropriate points indicated on the circuit diagram will prove an invaluable aid in the quick location of any fault which may arise. When a meter is not to hand, the task of locating a fault may not be easy but certain symptoms outlined below will be helpful in tracking it. If the receiver stops working, it is almost certain that replacement of a valve or component will be necessary and the user who happens to be in an isolated area will be well advised to keep some spare parts ready for use if required.

Under normal working conditions, a red glow can be seen from all the valve heaters with the exception of the EB34. Failure of the latter valve will render the noise limiter and "S" meter inoperative but will not cause cessation of signals. If the valves appear to be sound, turn the A.F. gain full on and touch the top grid of V6 (there is no danger of shock). A loud howl or hum should result—if not, the trouble lies in the sections of the receiver associated with V6 and the following stages, including the output transformer. If the howl is obtained, then the fault lies in an earlier stage. The top caps of the other valves should be touched in turn, working backwards from V5. In each case, at least a click should be audible and if, on touching one particular cap, no sound is heard, it is likely that the fault lies in the circuit elements between the silent valve and the next good one. The actual fault may be in the valve, in a resistor or condenser (usually indicated by burning) or possibly (but rarely) in one of the coils.

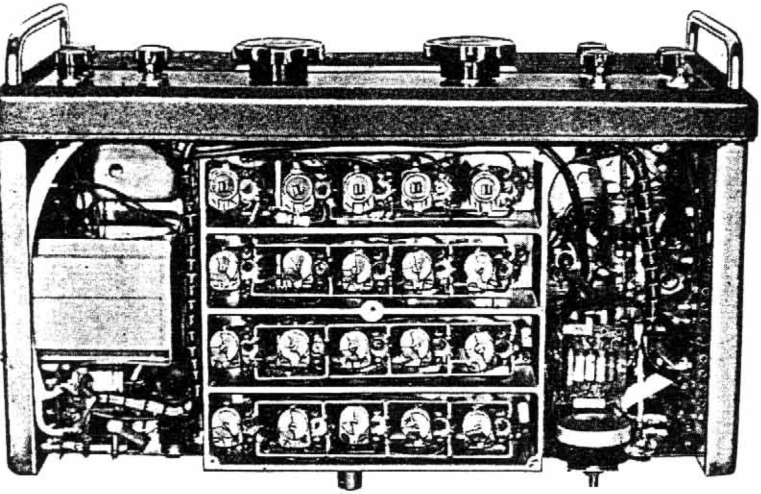


Fig. 5. Photograph of the underside of the Receiver. Compare with Fig. 6 for location of trimmers, etc.

If gradual deterioration of performance occurs, it is probably due to the falling off in emission of one or more valves and, in the absence of valve testing equipment, there is no alternative but to substitute a new valve in turn in each position.

CHANGING DIAL LIGHTS.

The holders for the lamps which illuminate the dial are sprung into place. To change a lamp, all that is necessary is to press the holder and pull out. The lamp is of the miniature bayonet fixing type, rated at 6·3 volts, 1 watt.

ACCESSIBILITY FOR SERVICING.

It will be noticed that unit construction has been adopted in the construction of the 504 Receiver, there being three major units, viz., tuning assembly, power unit and I.F. and output section. The majority of the condensers, resistors, potentiometers are readily accessible, but it may be necessary, in some cases, to remove certain parts of the receiver. In particular, the right hand side bracket may be completely removed after unscrewing the right hand handle, three screws at the side and one at the rear.

With the tuning condenser at maximum capacity, the main pointer should be truly horizontal and coincide with the zero mark on the innermost scale. Adjustment, if necessary, is made by slackening the grub screws on the flexible coupler, aligning the pointer and then tightening up the grub screws again.

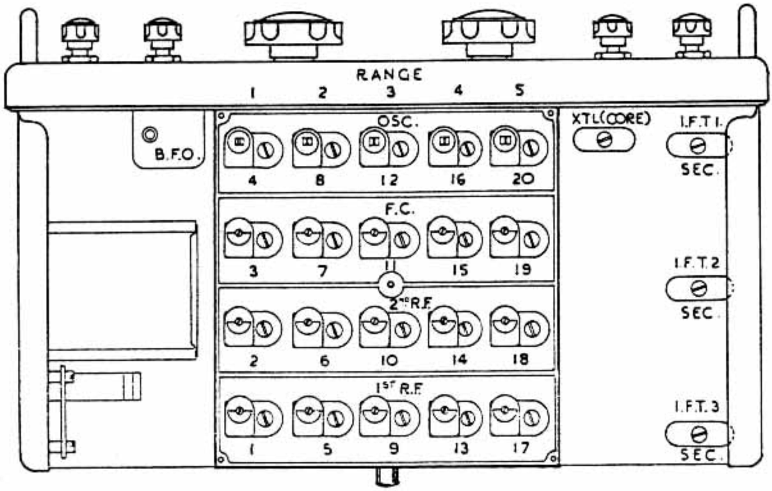


Fig. 6.

COMPONENT VALUES.

RESISTORS.

Circuit Ref.	*Resistance.*	*Wattage.*
R2	330 or 300 ohms.	½ Watt.
R3	·47 or ·5 megohm	½ ,,
R4	4,700 or 5,000 ohms	½ ,,
R5	47,000 or 50,000 ohms.	½ ,,
R7	·27 or ·25 megohm.	½ ,,
R8	I megohm.	½ ,,
R9	1,000 ohms.	½ ,,
R10	0·1 megohm.	½ ,,
R14	47 or 50 ohms.	½ ,,
R15	560 or 500 ohms.	½ ,,
R25	22,000 or 20,000 ohms.	½ ,,
R59	27,000 or 30,000 ohms.	½ ,,
R61	200 ohms.	½ ,,
R62	·5 megohm Pot. 3136P.	—
R63	10,000 ohm Pot. 2326PC.	—
R86	22,000 or 20,000 ohms.	I Watt
R87	27,000 or 30,000 ohms.	I ,,
R89	12 ohm.	½ ,,
R90	50,000 ohm. Pot. with switch 3137P.	—
R91	50,000 ohm.	2 Watts
R92	600 ohm. Pot.	—
R93	25 ohm. Wire Wound (D940)	—

Resistance of A.F. Choke ... 500 ohms.
Resistance of Output Transformer Primary ... 400 ohms.

CONDENSERS.

Circuit Ref.	*Capacity.*	*Type.*
C3	10 pfd.	Ceramic.
C6	·01 mfd.	Tub. Paper.
C9	0·1 mfd.	Tub. Paper.
C10	·0005 mfd.	Moulded Mica.
C18	25 mfd. 25v.	Tub.
C34	·01 mfd.	Moulded Mica.
C40	3·5—20 pf.	Trimmer Ceramic.
C42	2000 pfd.	Silvered Mica.
C44	100 pfd.	Ceramic.
C45	3—20 pfd.	Trimmer Air.
C46	16 mfd.	Tub. Electrolytic.
C47	8 mfd.	Tub. Electrolytic.
C49	315 pfd.	Silvered Mica.
C50	640 pfd.	Silvered Mica.
C51	1425 pfd.	Silvered Mica.
C52	20 pfd.	Ceramic.
C53	3 pfd.	Ceramic.
C54	3000 pfd.	Silvered Mica.
C55	510 pfd.	Ceramic.
C56	12·5—212·5 pfd.	Four Section Gang.
C57	5·2 pfd.	Trimmer (D925)

VOLTAGE VALUES.

Refer to the circuit diagram, Fig. 4. Voltages are between the point indicated and chassis. The receiver was set at 14 Mc/s on range 1 with the aerial shorted out, R.F. and A.F. gain controls at maximum, crystal and noise limiter switched out, the phone/CW switch at "phone," send/receive switch at "receive" and tone control fully clockwise. Two sets of values were taken, using different meters as shown. It will be evident that the actual voltage indicated depends on the particular meter employed. A tolerance of plus or minus 5% should be allowed on the figures given.

	VOLTS.	
Circuit Ref.	*Weston 1000 ohms/volt.*	*Avo Model 40.*
A	180	180
B	65	25
C	1·3	0·6
D	3·2	0·6
E	170	160
F	80	70
G	65	60
H	2·5	2·5
I	165	160
J	65	60
K	2·25	2·25
L	160	152
M	60	48
N	2·2	2·0
O	50	40
P	220	220
Q	185	185
R	1·65	1·7
S	9·5	8·7
T	185	185

WIRING COLOUR CODE.

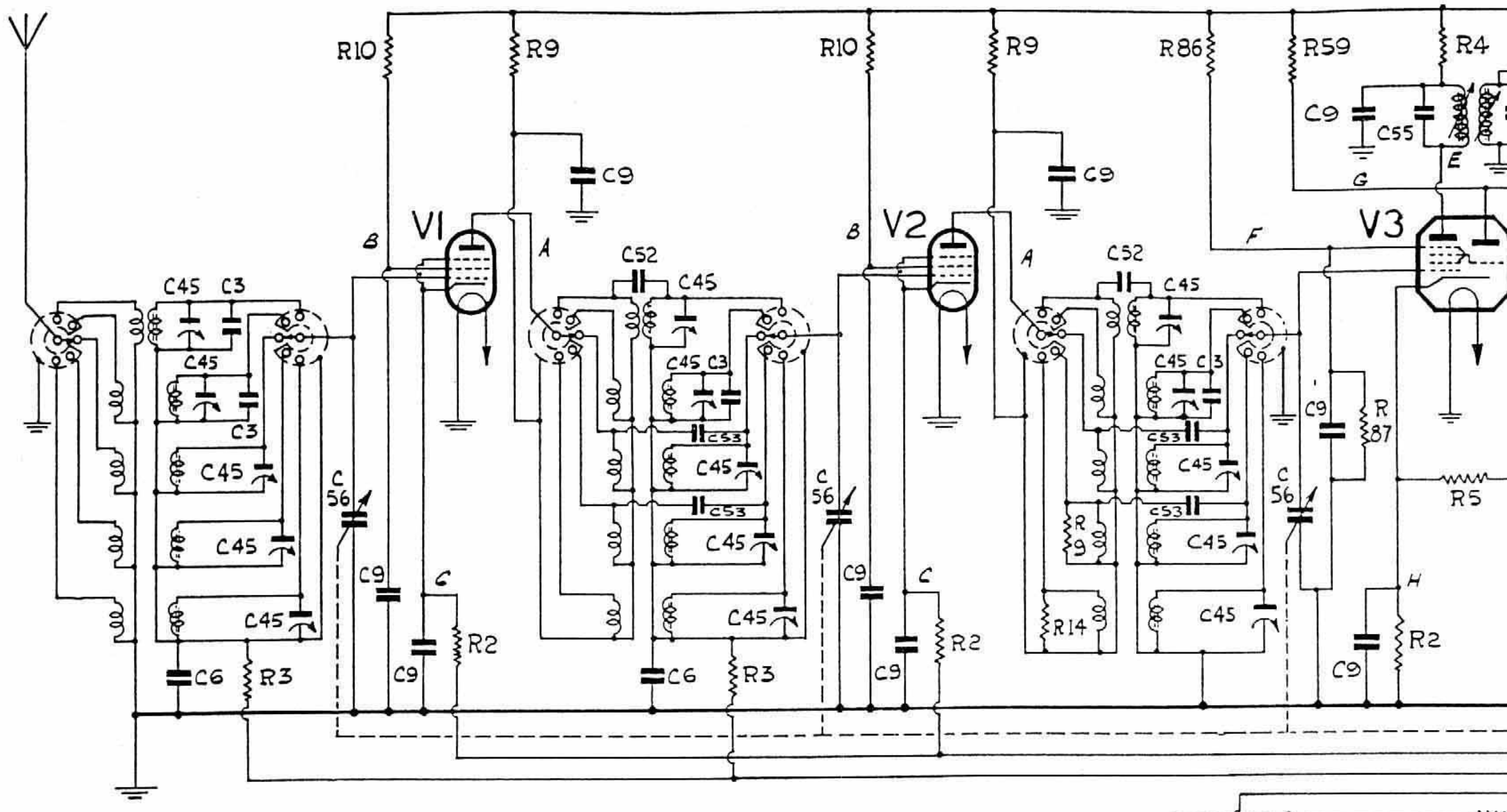
A.C. Mains—Grey.	Grids—Green.
H.T.—Red.	Heaters—Yellow.
Anodes—Light Blue.	Chassis potential—Black.
Other Leads—White.	Neg. to chassis—Brown.

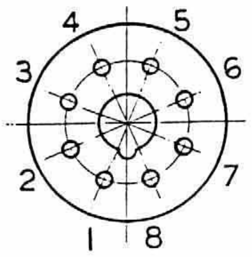
RESISTOR COLOUR CODE.

Body Colour	or 1st band	...	1st digit.
Mid-colour	or 2nd band	...	2nd digit.
Dot	or 3rd band	...	Number of noughts.
Narrow end colour	or 4th band	...	Tolerance.

	Digit.	*Noughts.*
Black	0	—
Brown	1	0
Red	2	00
Orange	3	000
Yellow	4	0,000
Green	5	00,000
Blue	6	000,000
Violet	7	0,000,000
Grey	8	00,000,000
White	9	000,000,000
Gold	1/10	or 5% tolerance.
Silver	1/100	or 10% tolerance.

No narrow end or 4th band ... 20% tolerance.





VALVE	1	2	3	4	5	6	7	8	TOP CAP
EF 39	M	H	A	G2	G3	—	H	K	G1
ECH 35	M	H	A	G2 G4	GT G3	AT	H	K	G1
EBC33	M	H	A	D1	D2	—	H	K	G1
6V6GT	—	H	A	G2	G1	—	H	K	—
5Z4	—	H	—	A2	—	A1	—	K H	—
EB 34	M S	H	D1	K1	D	—	H	K	—

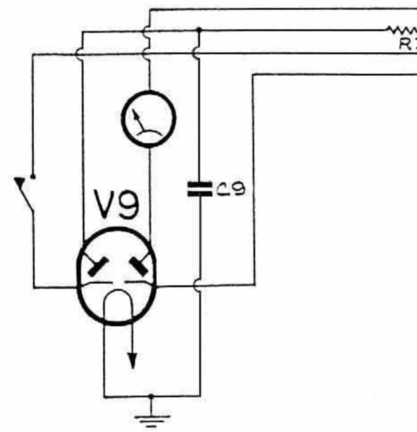


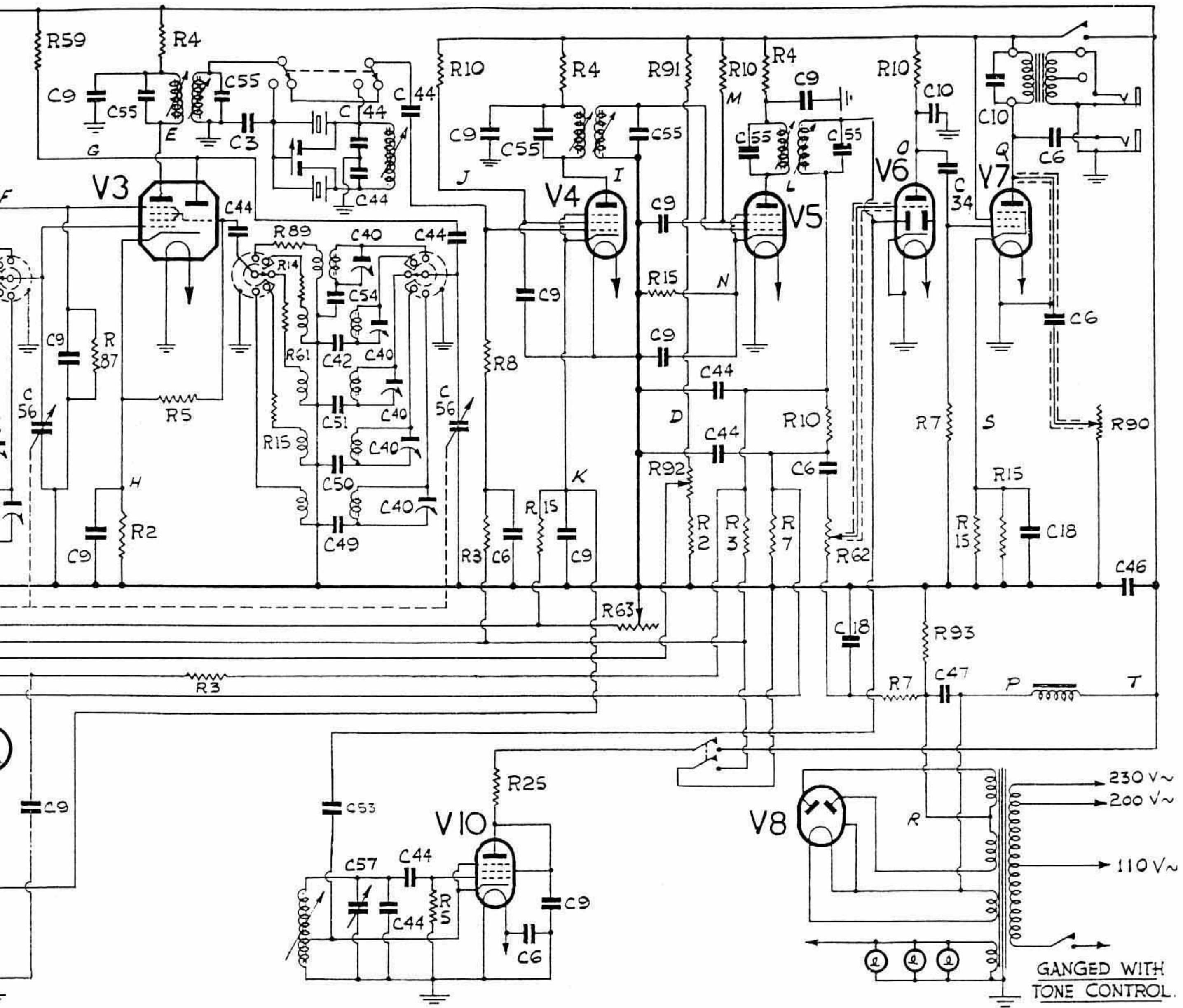
FIG. 4. RECEIVER

VOLTAGE VALUES.

Refer to the circuit diagram, Fig. 4. Voltages are between the point indicated and chassis. The receiver was set at 14 Mc/s on range 1 with the aerial shorted out, R.F. and A.F. gain controls at maximum, crystal and noise limiter switched out, the phone/CW switch at "phone," send/receive switch at "receive" and tone control fully clockwise. Two sets of values were taken, using different meters as shown. It will be evident that the actual voltage indicated depends on the particular meter employed. A tolerance of plus or minus 5% should be allowed on the figures given.

VOLTS.

Circuit Ref.	*Weston 1000 ohms/volt.*	*Avo Model 40.*
A	180	180
B	65	25
C	1·3	0·6
D	3·2	0·6
E	170	160
F	80	70
G	65	60
H	2·5	2·5
I	165	160
J	65	60
K	2·25	2·25
L	160	152
M	60	48
N	2·2	2·0
O	50	40
P	220	220
Q	185	185
R	1·65	1·7
S	9·5	8·7
T	185	185



RECEIVER TYPE 504.

CONDENSERS.

Circuit Ref.	*Capacity.*	*Type.*
C3	10 pfd.	Ceramic.
C6	·01 mfd.	Tub. Paper.
C9	0·1 mfd.	Tub. Paper.
C10	·0005 mfd.	Moulded Mica.
C18	25 mfd. 25v.	Tub.
C34	·01 mfd.	Moulded Mica.
C40	3·5—20 pf.	Trimmer Ceramic.
C42	2000 pfd.	Silvered Mica.
C44	100 pfd.	Ceramic.
C45	3—20 pfd.	Trimmer Air.
C46	16 mfd.	Tub. Electrolytic.
C47	8 mfd.	Tub. Electrolytic.
C49	315 pfd.	Silvered Mica.
C50	640 pfd.	Silvered Mica.
C51	1425 pfd.	Silvered Mica.
C52	20 pfd.	Ceramic.
C53	3 pfd.	Ceramic.
C54	3000 pfd.	Silvered Mica.
C55	510 pfd.	Ceramic.
C56	12·5—212·5 pfd.	Four Section Gang.
C57	5·2 pfd.	Trimmer (D925)

RESISTORS.

Circuit Ref.	*Resistance.*	*Wattage.*
R2	330 or 300 ohms.	½ Watt.
R3	·47 or ·5 megohm	½ ,,
R4	4,700 or 5,000 ohms	½ ,,
R5	47,000 or 50,000 ohms.	½ ,,
R7	·27 or ·25 megohm.	½ ,,
R8	1 megohm.	½ ,,
R9	1,000 ohms.	½ ,,
R10	0·1 megohm.	½ ,,
R14	47 or 50 ohms.	½ ,,
R15	560 or 500 ohms.	½ ,,
R25	22,000 or 20,000 ohms.	½ ,,
R59	27,000 or 30,000 ohms.	½ ,,
R61	200 ohms.	½ ,,
R62	·5 megohm Pot. 3136P.	—
R63	10,000 ohm Pot. 2326PC.	—
R86	22,000 or 20,000 ohms.	1 Watt
R87	27,000 or 30,000 ohms.	1 ,,
R89	12 ohm.	½ ,,
R90	50,000 ohm. Pot. with switch 3137P.	—
R91	50,000 ohm.	2 Watts
R92	600 ohm. Pot.	—
R93	25 ohm. Wire Wound (D940)	—

Resistance of A.F. Choke ... 500 ohms.
Resistance of Output Transformer Primary ... 400 ohms.

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