52

MURPHY SERVICE INSTRUCTIONS

ISSUED BY

MURPHY RADIO LTD, WELWYN GARDEN CITY

TELEPHONE: WELWYN GARDEN 800

SPECIFICATION

A52 A52

BASIC DESIGN:	Superhet, with Push Button (motor) Tuning and Tuning Indicator. Double Frequency Changer on short-waves with wave-bands selected by push buttons. Automatic Tuning Correction on M.W. and L.W. push buttons.
WAVE RANGES:	16–50 metres (18·75 Mc/s to 6 Mc/s). 200–550 metres (1500 Kc/s to 545 Kc/s). 950–2000 metres (316 Kc/s to 150 Kc/s).
INTERMEDIATE FREQUENCY:	465 Kc/s M. and L.W. 3·1 Mc/s and 465 Kc/s S.W.
MAINS SUPPLY:	200–260v. 50–60 cycles A.C. 100–125v. 50–60 cycles A.C.
VALVES:	Mazda SP41, AC/TH1, AC/TH1, AC/VP2, HL41DD, AC/5Pen, 41DD, ME41, UU4.
PILOT LAMPS:	6·3v. 0·3 amps Tubular Frosted.
SPEECH COIL IMPEDANCE:	2 ohms.
TOTAL WEIGHT:	48 lbs.
OVERALL DIMENSIONS:	12″ × 15½″ × 21″
CONSUMPTION:	80 watts.

080/1/39

Circuit Analysis

THE purpose of this analysis is to give full information about the special features in the "52" circuit. No attempt will be made to describe the parts of the circuit which are now accepted as common features in receiver design.

THE R.F. STAGE

To obtain a high signal to noise ratio and high overall gain an R.F. amplifying stage is included in the circuit, using an R.F. pentode valve (V1) with an unusually high slope. This valve is biased for optimum gain by the voltage drop across the cathode resistance (R8), and under suitable conditions, full advantage of this gain can be taken on all wave-bands. In certain places near a powerful transmitter, however, it will be found that with the valve working at full-gain the set will overload on the medium wave-band, causing whistles and "spreading" of the local station.

To overcome this, a variable resistance (R9) is included in the cathode circuit so that negative feed-back can be introduced to reduce the effective gain of the R.F. stage to a suitable level. This resistance is of the pre-set type and is adjusted for maximum gain at the factory. It is therefore most important to see that it is suitably adjusted when the set is installed in the customer's home, and whenever the set is re-installed after service work has been carried out.

It is advisable to make the adjustment at night time when the continental stations are best received, as it is then that the overloading is most evident. It must be remembered, of course, that the control is included to prevent overloading in the R.F. stage and it must not be regarded as an infallible cure for all whistles, bangs, crackles, and other extraneous noises. The adjusting screw is located at the back of the chassis close to the aerial socket (square 27L) and the gain of the R.F. stage is reduced by turning the screw anticlockwise.

THE FIRST FREQUENCY CHANGER

The amplified R.F. signals are fed into the first triode-hexode valve (V2) to be "mixed" with the local signals from the oscillator circuit of that valve.

On medium and long waves the oscillator circuit is tuned to 465 Kc/s above the signal frequency, and alignment over the wavebands is maintained by the padding condensers (C32 and C33). The resulting 465 Kc/s signals are fed directly into the first I.F. transformer (L24 and L26) which is connected to the I.F. amplifier valve (V4).

On short waves, to give better performance by avoiding image signals and to obtain bandspread tuning a "double superhet" circuit is used. The first oscillator circuit (L14, L18, etc.) is tuned to 3·1 Mc/s above the signal frequency. The R.F. circuits are actually tuned to the fixed short wave broadcasting bands, by the motor-tuning mechanism. The band required is selected by pressing the appropriate push button.

The oscillator frequency is then varied (manually) to beat with the various signals on the selected band to give I.F. signals of 3·1 Mc/s. Only a very small variation in the oscillator tuning is required to cover each waveband and it is achieved by varying the inductance of the oscillator coil (L18) by means of a small metal disc which is moved up and down within the coil by the tuning knob.

THE SECOND FREQUENCY CHANGER

The I.F. signals at 3·1 Mc/s are fed through the switch (S1g) and the short wave I.F. transformer (L22 and L23) to the second triode-hexode valve (V3). This valve acts as a second frequency changer on short waves and as the control valve for the automatic tuning correction (A.T.C.) circuit on medium and long waves, but at the moment we shall consider its function as a frequency changer only. The oscillator circuit (L27, L28, etc.) of this valve is "fixed tuned" to 2·635 Mc/s (3·1 Mc/s–465 Kc/s) and as the input signals to the valve are at a frequency of 3·1 Mc/s, a 465 Kc/s beat signal is produced which is passed on to the I.F. amplifying valve (V4) as in the case of the Medium and long wave signals.

A point to be noted here is, that the primary of the 465 Kc/s transformer is connected to the first frequency changer valve for medium and long waves, and to the second frequency changer valve on short waves, and as the wiring capacities in the two circuits are different, an extra trimmer (C23) is added on the medium and long waves.

AUTOMATIC TUNING CORRECTION

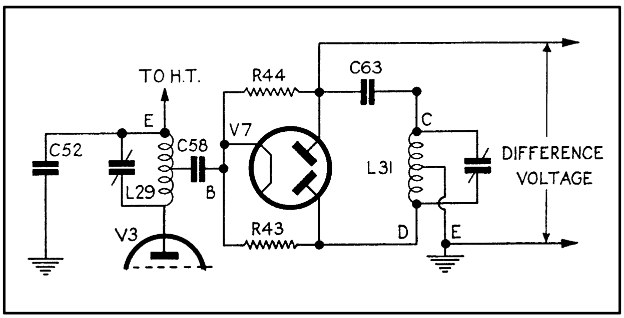
To compensate for small inaccuracies in the stopping of the motor and for any tuning drift that may take place, automatic tuning correction is included on medium and long waves when the push buttons are in circuit. The circuit employed, although similar in principle to that used in the "28" and "40" avoids the complication of special discriminator circuits. It also has the advantage that the tuning correction is made dependent upon the actual setting of the I.F. circuits themselves so that the tuning must be accurate even if a small drift takes place. There is no time lag as in the "40" and the operation of the circuit cannot therefore be checked by listening for the difference in reproduction as the receiver pulls itself into tune. A simple way of checking the operation of the circuit is given on page 15.

Briefly, the method of correcting the tuning is to place in parallel with the oscillator circuit, a control circuit, the reactance of which is varied by applying to it a voltage depending upon the I.F. signal frequency.

This voltage, in the "52" receiver, is developed across two resistances (R43 and R44) which form the loads for two sections of a double diode valve (V7). The valve actually has two independent cathodes and an earthing screen between the diodes, but in the particular circuit the cathodes are strapped together and are shown as a single electrode in the circuit diagram.

The signal voltages from the 2nd I.F. transformer are applied to the valve (V7) in such a way that the actual voltage across each diode is dependent on the relative phase of the voltage in the primary and secondary of the I.F. transformer. This phase depends upon the tuning of the signal. The components in this part of the circuit are shown below, rearranged so that the principle involved can be more easily followed.

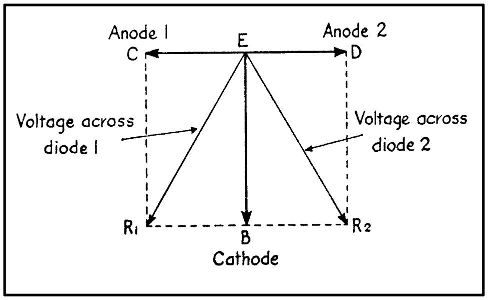
The relative phase of the voltage across the two coils (L29 and L31) varies according to whether the I.F. signal (produced by the beating of the incoming wave and the local oscillator



wave) is above or below the frequency (465 Kc/s) at which the two circuits are tuned to resonate.

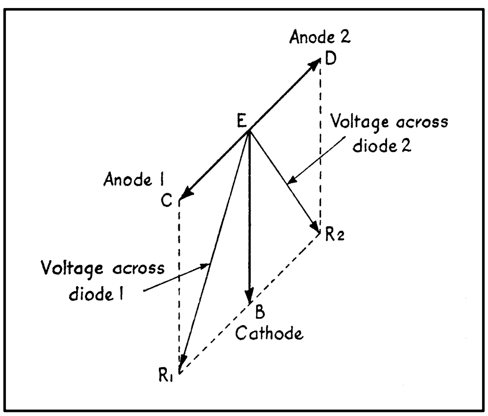
At the resonant point (when the set is correctly tuned), the voltage in the primary is 90 degrees out of phase with the voltage in the secondary, and under these conditions the voltage distribution to each half of the double diode valve (V7) is indicated in the first of the vector diagrams. The voltage between the cathode and earth is developed across part of the primary coil (L29) and the condenser (C58), and this is represented in the vector diagram by the line BE. The voltage between the first anode and earth is developed across half the secondary coil (L31) and as it is

90 degrees out of phase with the primary, or cathode voltage it is represented by the line CE. at right angles to the line BE. Similarly, the voltage applied to the second anode (from the



other half of the secondary coil) is represented by the line DE. The resultant voltage across each diode is represented by the diagonals ER_1 and ER_2, and it will be seen that in this case they are equal, so that the two direct voltages produced by rectifying them will be equal and opposite.

There is therefore no steady voltage passed on to the control valve, and the control circuit is therefore in a state of balance.



The second vector diagram indicates the voltage distribution when the set is slightly mistuned. The phase angle will be above or below 90 degrees according to whether the applied signal is above or below resonance. That is, according to whether the reactance of the tuned circuits, at the frequency of the applied signal, is inductive or capacitative. It will be clear from this diagram that the actual voltages across the two diodes will be unequal (as the two diagonals are of unequal length) resulting in a "difference" voltage in the rectifier loads which is applied to the control valve (V3 hexode) to give tuning correction.

If the above description is not clearly understood, we suggest that a study should be made of the fundamental principles of resonance and coupled circuits, in a text book such as the Admiralty Handbook.

THE CONTROL VALVE

The triode-hexode valve (V3) is made to function as a control valve by the inclusion of a condenser and resistance (C34 and R24) between anode, grid, and cathode. When connected in this way it behaves as an inductance in parallel with the oscillator circuit inductance and its value can be changed by altering the slope of the valve. This is done by applying the voltage from the double diode valve (V7) as bias to the control grid. Initial bias, which is quite critical, is obtained by the voltage drop across the preset cathode resistance (R31).

The setting of this resistance should not be altered unless the instructions given on page 8 are followed.

NEGATIVE FEED BACK HETERODYNE FILTER

Negative feed back is employed in the output stage and the inclusion of the choke and condenser (L32 and C76) in this circuit gives a sharp cut off at 9000 cycles by feeding back a large proportion of the signal at the frequency and so reducing the L.F. gain. There is, of course, high note attenuation from 5000 cycles upwards, due to the I.F. transformers, but even so, there is sufficient response at the higher frequencies to make heterodyne whistles objectionable were not the tuned feed-back circuit provided.

THE PUSH BUTTONS

The push-button circuits are shown in the "open" position in the circuit diagram, and it will be seen that a series arrangement is employed to prevent damage if two or more contacts are pressed at once.

Actually, for mechanical reasons, the series circuit does not run from push button number one to the manual push button, but the circuit on page 10 (which is fundamentally thes ame) is drawn that way to make it easier to follow.

When a station push button is depressed the motor circuit is closed through the switch (S1S) which selects the short, medium, or long-wave contact of the chosen push button, depending on the setting of the wave-range switch knob. Immediately the motor circuit is completed the motor armature is pulled forward magnetically, engaging with the gears of the tuning drive and at the same time closing the contacts of the switch (S11). This switch "mutes" the set by short-circuiting the output valve grid to chassis, and cuts out the A.T.C. circuit while the motor is operating. The motor circuit is broken when the selected contact comes opposite the insulating strip which is inset in the contact plate. The armature at once disengages from the gear so that its momentum does not take the tuning condenser past the correct tuning point. The muting and A.T.C. contacts are also opened.

The motor is operated on 24 volts and takes approximately 2 amps. It will not run continuously at this voltage, and if it does become overheated in operation a thermal switch inside it will break the supply until it has cooled down.

The switch is only likely to come into operation if the push buttons are operated continuously for periods of two minutes or more, or if a fault develops on the tuning drive. If a pause of about 10 seconds is made on each station, as is normal when trying various programmes, the motor will operate continuously without opening the thermal switch.

THE MANUAL PUSH BUTTON

When the manual push button is depressed, the A.T.C. is cut out, the medium- and long-wave pilot lamps are brought into circuit, and if one of the station buttons is also depressed, the grid of the output valve is shorted to earth through the resistance (R64), the station push button, and the contact plate. This latter feature is to simplify the setting of the contact clips as indicated on page 6.

The Push Buttons

The satisfactory operation of the receiver on push buttons is dependent on several features which do not affect the manual operation of the set, and this chapter deals with these features and the adjustments which apply particularly to push-button operation.

THE CHOICE OF STATIONS

The stations selected in the factory for push-button operation are those which are most generally used and the majority of them give satisfactory push-button operation in most parts of the country, but obviously, there will be some parts where certain of the stations will not be well received.

It is obviously essential that a station selected for push-button operation should be reliably received and if any of the stations fade badly, they should be changed for others giving better reception. Sometimes when serious fading occurs the A.T.C. circuit tends to "pull-in" to the neighbouring station.

When a selection of stations has been found which is well received in your locality, this combination should be set up on all sets received.

CHANGING A PUSH-BUTTON STATION

The procedure for changing the push-button stations, which is very simple, is given in the instruction books issued with the receiver and it is reprinted below.

Depress the manual push button and tune in the new station manually. Holding the manual button down, push down the button which is to be used for the new station. If the pressure is taken off both buttons together they will both remain depressed. This will partially mute the loudspeaker, by shorting the L.F. signal to earth through the resistance (R64). Next, move the contact corresponding to the selected button, around the contact rail until it is opposite the setting line marked on the disc (insulating strip). The contacts are marked "M" for medium waves and "L" for long waves and are numbered for identification purposes, number one referring to the bottom push button, the other push buttons being numbered consecutively upwards.

When the selected contact is opposite the insulating strip the circuit through the resistance (R64) is broken and the normal volume returns. This gives a positive indication that the contact is correctly set.

The medium-wave contacts are normally arranged around the outside of the contact rail, and the long-wave ones around the inside, but where two contacts come very close together one of them may be transferred from the outside rail to the inside or vice versa.

THE SHORT-WAVE CONTACTS

The seven short-wave contacts are adjusted in the factory to tune the set to the middle of each of the short-wave broadcast bands. The setting is fairly critical and the contact rail should not, therefore, be moved in relation to the commutator disc. If it is moved or if a contact has to be replaced the location should be fixed with the aid of a reliable service test oscillator.

Connect the oscillator between the aerial and earth socket of the receiver, and turn the tuning knob to bring the short-wave pointer to "5" on the scale.

The short-wave contacts should then be adjusted so that the following signals from the service oscillatory are received as each push button is depressed.

PUSH BUTTON	OSCILLATOR FREQUENCY
1	6.1 Mc/s
2	7.15 Mc/s
3	9.5 Mc/s
4	11.9 Mc/s
5	14.2 Mc/s
6	15.25 Mc/s
7	17.77 Mc/s

It is rather difficult to adjust all the push-button contacts so that the signals indicated above are received with the short-wave indicator set exactly to "5" on the scale, but provided they are received within "4" and "6" on the scale, the adjustment is sufficiently accurate.

CONTACT TENSION

The spring on the push-button contacts should be so adjusted that it gives a light and yet firm contact on the commutator disc. If the pressure on the disc is too heavy there is risk of drive slip, while if it is too light intermittent-operation may result. Other causes of drive slip are dealt with under "Mechanical Details." The spacing between the commutator disc and the contact rail must also be correct for satisfactory operation (approximately $\frac{1}{2}''$). If it is too great the contacts may be set so that they ride on the tips instead of on the contacts. There is then risk of them being damaged by the insulating strip being burnt away.

THE INSULATING STRIP

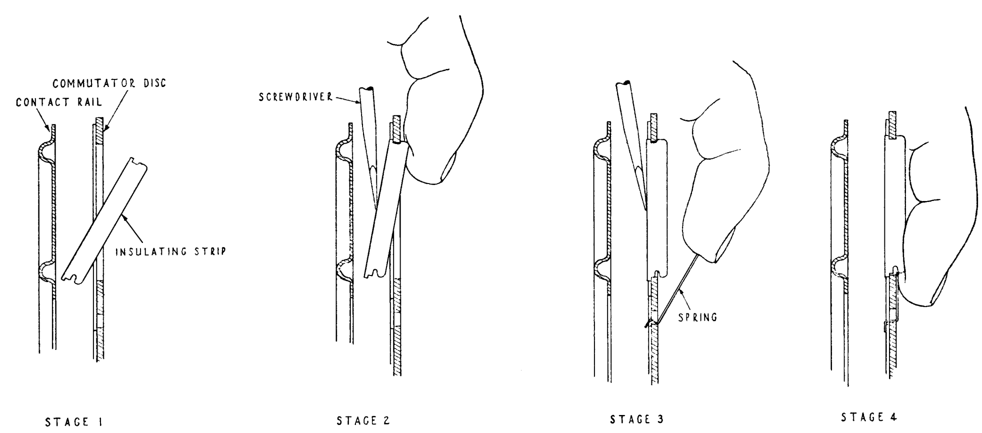
The insulating strip in the commutator disc should have quite a long useful life, but like all parts which are subject to mechanical wear, replacement may eventually become necessary. It has therefore been designed so that it can be removed from the disc very easily, but as the retaining lugs are necessarily small it may be broken if a wrong method of replacement is attempted.

The drawings below illustrate quite clearly the method of replacement, and if these are followed it will be found that a new insulating strip can be inserted very easily and quickly. It will be noticed that a screwdriver is used for holding the strip between the commutator disc and the contact rail. If fingers are used the two plates will be forced apart, and the pressure on the contacts may be upset.

The contact rail itself should not be removed, because slotted screw holes are used for the mounting and any movement of the fixing in refitting will upset the adjustment of the push-button contacts.

THE PUSH-BUTTON MOTOR

The motor which drives the push-button mechanism is well lubricated when it is fitted in the receiver and should run for a considerable time without attention. If adjustments are made to the drive spindle, the motor fixing screws should first be slackened to allow free movement, and so avoid straining the motor spindle. If the motor will not drive the tuning mechanism, first see that it is running freely, and if it is, look for stiffness in other parts of the tuning mechanism.



Fitting the insulating strip to the commutator disc

The Gain Control

The gain control (R9) is provided so that the highest possible gain can be obtained from the receiver under widely varying reception conditions.

The adjusting screw is turned fully clockwise before the set leaves the factory, and under these conditions maximum gain is obtained. It is exceptionally high, and can only be used in this way if conditions are suitable.

If it is found that there are a number of whistles on medium-wave reception, which vary in pitch on turning the tuning control, the set is probably overloading and the gain control must be reduced.

Tune to the strongest whistle, and turn the control (square 27L) in an anti-clockwise direction until the whistle disappears. It should be possible to adjust the control so that overloading is eliminated and the gain will still be high compared with that of an average receiver.

In extreme cases, where the customer is using an efficient aerial, and is very close to a powerful transmitter, it may be better to put a 25 p.f. or 50 p.f. condenser in series with the aerial, as well as adjusting the gain control. This will avoid the possibility of reducing the gain control to a point at which there is a serious loss of sensitivity.

The Diagrams

The diagrams on pages 10 and 13 of this book contain most of the information required for carrying out normal service work. The following information will help you to make full use of them.

The circuit diagram is numbered at each "junction point," so that every component has a number at each terminal. These numbers are marked at the ends of the components in the underside and top views of the chassis so that the respective terminals may easily be identified with those on the circuit diagram.

The underside and top views of the chassis are divided into squares which are lettered horizontally and numbered vertically so that any section may be referred to by quoting the appropriate "square."

In the component tables, all resistances are given in ohms, and capacities in microfarads, unless otherwise stated. The D.C. resistance of coils is quoted in ohms in all cases, except where the reading would be too small to be of use, when they are omitted altogether.

The Control Valve Bias

The second triode-hexode valve (V3), when it is used as a control valve, is biased by the voltage drop across the preset resistance (R31 square 39K).

The resistance is set in the factory, and further adjustment should be unnecessary unless the valve is changed.

Two service oscillators are necessary to obtain the correct setting, and the procedure is as follows:—

1. Connect the first service oscillator between V4 control grid (test point 56, square 36E) and chassis, and tune it to 465 Kc/s.

2. Connect the second oscillator between

aerial and earth, and tune it to 666 Kc/s.

3. Remove the grid cap of V3, and short circuit the grid itself to chassis.

4. Tune the receiver to about 450 metres. This should cause the two signals to beat with one another. Tune the receiver for "zero beat."

5. Remove the short circuit from the grid of V2, and replace the cap.

6. Adjust the oscillator which is connected between aerial and earth to 674 Kc/s.

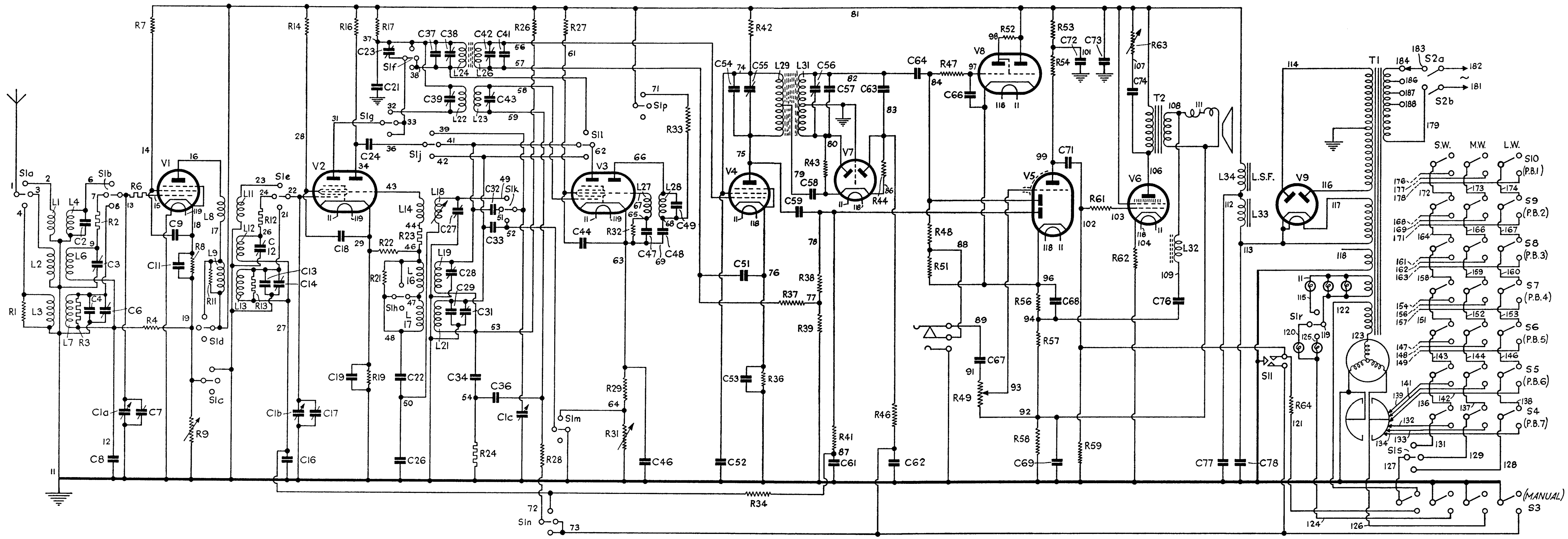
7. Adjust the bias resistance (R31, square 39K) to produce "zero beat" in the receiver.

This completes the adjustment. It is important that the setting of the resistance should not be altered unless the above method is used.

Modifications

CERTAIN minor modifications have been made to the circuit in the course of production, and full particulars of these are given in the table below. If any further modifications are announced in the *Murphy News*, they should be added in the space provided at the bottom of the table.

SERIAL NUMBER OF 1st SET MODIFIED	MODIFICATION
174673	·002 condenser (C80) added between the variable tapping on the mains transformer and chassis.
174810	L18 modified. C32 changed from 703 p.f. to 1000 p.f. (Note: replacements should be of the type originally fitted in the receiver.)
All Receivers	In cases where the minimum resistance of the Tone Control is less than 100 ohms, a 100 ohms resistance is added between the Tone Control and Panel 2.



Code	Value	Test	Pts.	Square
C1a	Variable	11	13	30 G
C1b	,,	11	22	30 E
C1c	,,	11	39	30 D
C2	10 pf	6	11	7 H
C3	Trimmer	9	11	34 F
C4	30 pf	8	11	38 M
C6	Trimmer	8	11	34 G
C7	Trimmer	11	13	30 F
C8	·1	11	12	7 G
C9	·025	14	18	14 G
C11	·025	18	19	14 H
C12	Trimmer	26	11	27 D
C13	20 pf	21	11	32 M
C14	Trimmer	21	11	27 E
C16	·015	27	11	13 E
C17	Trimmer	11	22	30 G
C18	·025	28	29	10 E
C19	·05	11	29	9 G
C21	·05	11	37	6 F
C22	200 pf	48	50	15 C
C23	Trimmer	33	37	33 A
C24	100 pf	34	36	9 E
C26	·001	11	50	13 C
C27	Trimmer	11	49	38 D
C28	Trimmer	41	11	32 C
C29	200 pf	42	11	34 M
C31	Trimmer	42	11	32 D
C32	703 pf	11	51	12 C

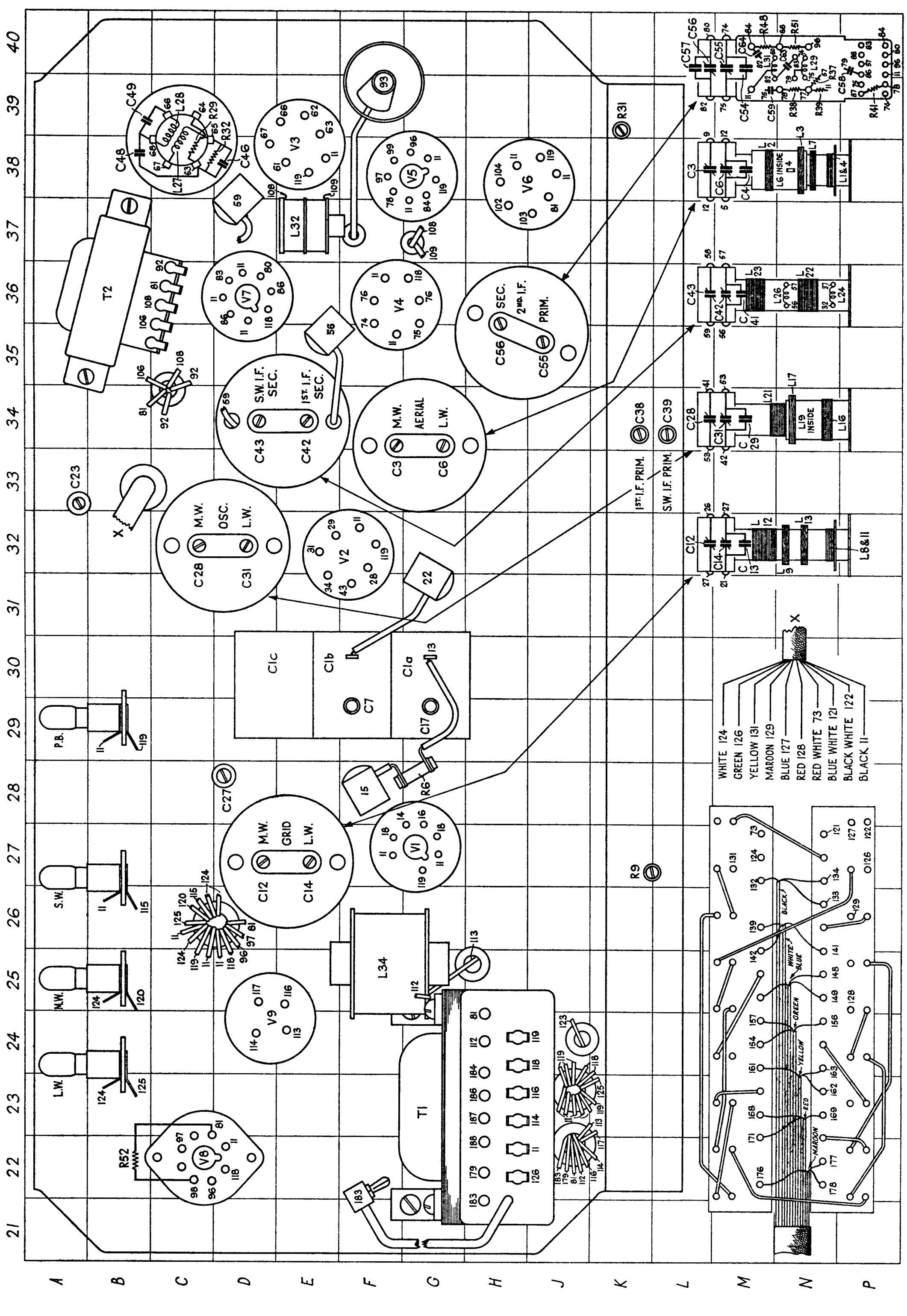
Code	Value	Test	Pts.	Square
C33	386 pf	42	52	10 C
C34	·05	53	54	8 D
C36	·01	54	59	7 D
C37	100 pf	37	38	8 F
C38	Trimmer	37	38	8 F
C39	Trimmer	32	38	7 F
C41	125 pf	56	57	36 M
C42	Trimmer	56	57	34 E
C43	Trimmer	58	59	34 D
C44	·025	61	63	3 E
C46	·025	11	63	3 E
C47	300 pf	63	65	38 D
C48	·002	63	68	38 B
C49	200 pf	66	68	39 B
C51	·01	57	76	5 G
C52	·025	11	74	5 H
C53	·025	11	76	4 C
C54	100 pf	74	75	40 M
C55	Trimmer	74	75	35 J
C56	Trimmer	80	82	36 H
C57	125 pf	80	82	40 M
C58	200 pf	79	86	40 P
C59	50 pf	75	78	39 M
C61	·01	11	87	6 G
C62	·01	11	73	4 C
C63	200 pf	82	83	40 N
C64	100 pf	82	84	40 M
C66	·025	96	97	3 F

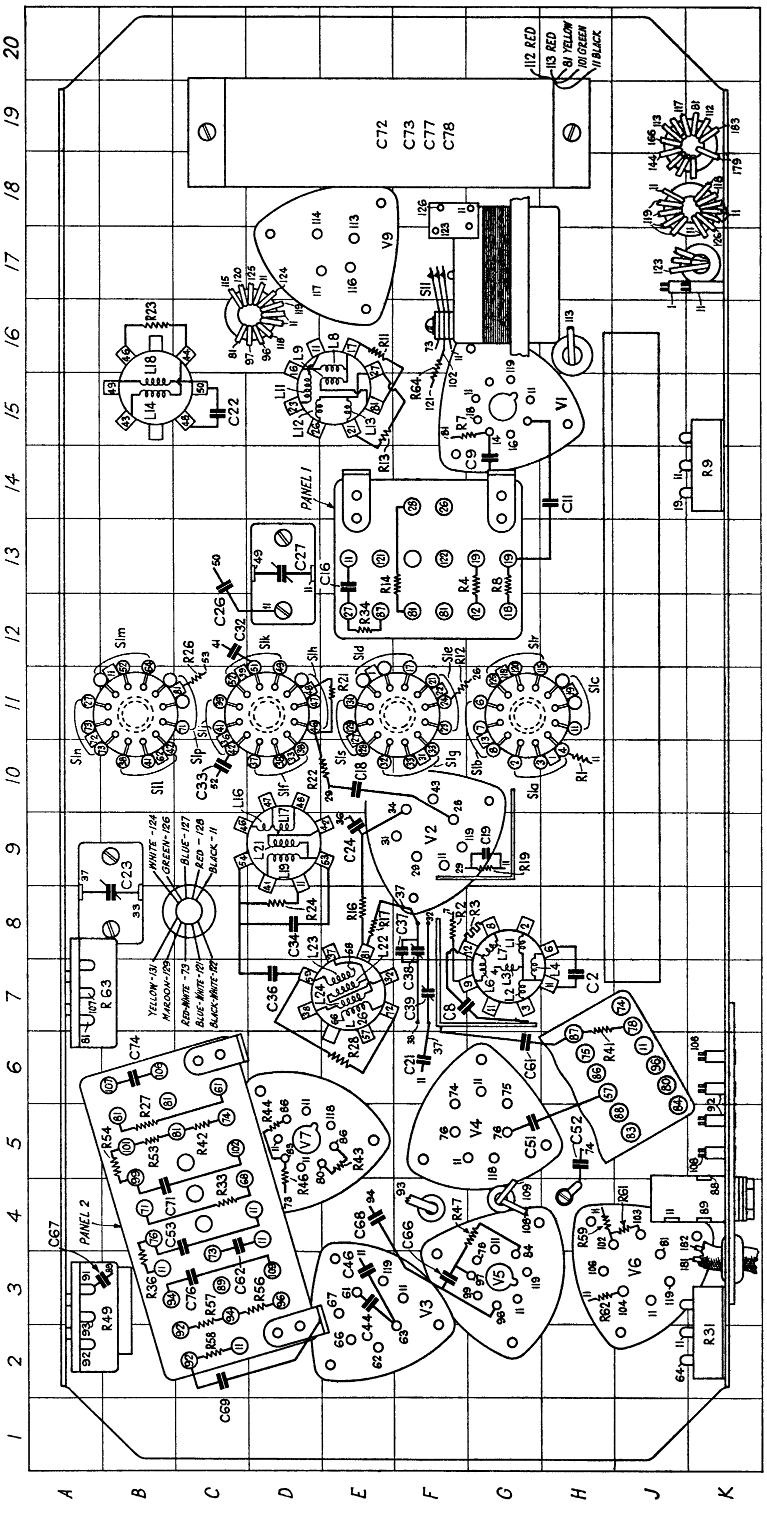
Code	Value	Test	Pts.	Square
C67	·005	89	91	3 A
C68	25 12v.	94	96	4 E
C69	·1	11	92	2 C
C71	·05	99	102	4 B
C72	4	11	101	19 E
C73	8	11	81	19 F
C74	·04	106	107	6 B
C76	·1	94	109	3 C
C77	8	11	112	19 F
C78	8	11	113	19 F
R1	20,000	4	11	10 H
R2	10	7	9	8 F
R3	100,000	8	12	8 G
R4	10,000	12	19	13 G
R6	10	13	15	28 G
R7	20,000	14	81	15 G
R8	300	18	19	13 G
R9	2,000	11	19	14 K
R11	1,000	17	81	16 E
R12	10	24	26	11 F
R13	40,000	21	27	15 E
R14	25,000 1w	28	81	13 E
R16	33,000 1w	34	81	8 E
R17	5,000	37	81	8 E
R19	200	11	29	9 G
R21	2,000	46	48	11 E
R22	20,000	29	46	10 E

Code	Value	Test	Pts.	Square
R23	10	44	46	16 B
R24	10	11	54	8 D
R26	2,000	53	81	11 C
R27	25,000 1w	61	81	5 B
R28	10,000	59	72	6 E
R29	150	63	64	38 C
R31	1,000	11	64	2 K
R32	20,000	63	65	38 D
R33	33,000 1w	68	71	4 C
R34	5,000	27	87	12 E
R36	300	11	76	3 B
R37	1	57	77	39 N
R38	1·5 MΩ	77	78	39 N
R39	500,000	11	77	39 N
R41	2 MΩ	87	78	7 H
R42	20,000	81	74	5 C
R43	1·5 MΩ	80	86	5 E
R44	1·5 MΩ	83	86	5 D
R46	1 MΩ	73	83	5 D
R47	2 MΩ	84	97	4 G
R48	500,000	84	88	40 M
R49	1 MΩ	91	92	3 B
R51	500,000	88	96	40 N
R52	1 MΩ	81	98	22 B
R53	15,000	81	101	5 B
R54	50,000	99	101	5 B
R56	500	94	96	3 D

Code	Value	Test	Pts.	Square
R57	10	92	94	2 C
R58	9,000	11	92	2 C
R59	100,000	11	102	4 H
R61	50,000	102	103	4 J
R62	180 ½w	11	104	3 H
R63	25,000	81	107	7 A
R64	1,000	102	121	16 F
L1	——	2	11	7 G
L2	1·5	3	11	7 G
L3	10	4	11	7 G
L4	——	6	11	8 G
L6	4	9	12	7 G
L7	12	8	12	8 G
L8	——	16	17	16 E
L9	15	17	81	15 E
L11	——	11	23	15 D
L12	4	27	26	15 D
L13	12	27	21	15 E
L14	——	43	44	15 B
L16	1·5	46	47	9 D
L17	2·5	47	48	9 D
L18	——	49	50	15 B
L19	2·5	41	53	9 D
L21	4	42	53	9 D
L22	1·5	32	37	7 E
L23	1·5	58	59	7 E
L24	5	37	38	7 E

Code	Value	Test	Pts.	Square
L26	5	56	57	7 E
L27	1	65	67	38 C
L28	1	66	68	39 C
L29	1·5	74	75	40 N
	+3·5			
L31	2·5	80	82	40 M
	+2·5			
L32	4	108	109	37 E
L33	250	81	112	L.S.F.
L34	550	112	113	25 F
T1 Prim				
200–213	16	179	188	23 G
214–228	17·5	179	187	
229–244	19	179	186	
245–260	20·5	179	184	
H.T. Sec.	115	11	114	
	+125	11	116	
T2 Prim.	325	81	106	36 B
Sec.	—	92	108	
L.S. Sp. Coil	2	92	108	—


T2
T1
L34
L32
C1c
C1b
C1a
C7
C17
M.W. OSC. L.W.
C28
C31
M.W. GRID L.W.
C12
C14
M.W. AERIAL L.W.
C3
C6
S.W. I.F. SEC.
1ST. I.F. SEC.
C43
C42
SEC. 2ND. I.F. PRIM.
C56
C55
1ST. I.F. PRIM.
S.W. I.F. PRIM.
C38
C39
R31
R9
C23
C27
R52
R6
L.W.
M.W.
S.W.
P.B.
WHITE 124
GREEN 126
YELLOW 131
MAROON 129
BLUE 127
RED 128
RED WHITE 73
BLUE WHITE 121
BLACK WHITE 122
BLACK 11
L6 INSIDE
L19 INSIDE
L1&4
L16
L8&11
L24
L26



C72
C73
C77
C78
112 RED
113 RED
81 YELLOW
101 GREEN
11 BLACK
V9
V1
V2
V3
V4
V5
V6
V7
PANEL 1
PANEL 2
L14
L18
C22
R23
L9
L8
L11
L12
L13
R11
R13
R64
R7
C9
C11
R9
C26
C27
C16
R34
R14
R4
R8
C32
R26
S1m
S1k
S1h
S1d
S1e
R12
S1r
S1n
S1l
S1p
S1j
C33
S1s
S1g
S1b
S1c
S1a
R1
L16
S1f
R22
C18
C24
C19
R19
L17
L19
L21
R24
R16
C23
WHITE-124
GREEN-126
BLUE-127
RED-128
BLACK-11
YELLOW-131
MAROON-129
RED-WHITE-73
BLUE-WHITE-121
BLACK-WHITE-122
R63
C34
C36
L22
L23
L24
L25
L26
R17
C37
C38
C39
R2
R3
L1
L2
L3
L4
L5
L6
L7
C2
C8
C21
R28
C74
C61
R41
R54
R53
R27
R42
R44
R46
R43
C71
R33
C52
C51
C53
C67
R36
C76
C62
R57
R56
R58
R49
C69
C68
C66
C46
C44
R47
R59
R61
R62
R31

The Voltage Tables

THE table of voltages below was taken with the receiver switched to medium waves, unless otherwise stated, and working on 230 volts 50 cycles. A.C. mains. A voltmeter with 0-50 and 0-500 volt ranges, and with an internal resistance of 1000 ohms-per-volt was used.

The voltage tables should only be taken as a guide, as some variation is to be expected between different receivers.

Signals which are sufficiently powerful to operate the A.V.C. circuits will cause a variation in the voltages of the circuits to which A.V.C. is applied.

TABLE OF VOLTAGES

Valve	Type	Electrode	Test Point	Square	Voltage
V1	SP41	Anode Screen Cathode (R9 Max) Cathode (R9 Min.)	16 14 18 18	15 G 15 G 15 G 15 G	**245** **210** **18** **2·2**
V2	ACTH1	Hexode Anode Hexode Screen Triode Anode Cathode	31 28 34 29	9 F 9 F 10 F 9 F	**220** **95** **80** **2·5**
V3	ACTH1	Hexode Anode Hexode Anode S.W. Hexode Screen Hexode Screen S.W. Triode Anode Triode Anode S.W. Cathode	62 62 61 61 66 66 63	2 E 2 E 3 F 3 E 2 E 2 E 2 F	**220** **200** **105** **85** **—** **85** **2**
V4	ACVP2	Anode Screen Cathode	75 74 76	5 G 5 F 5 F	**225** **225** **3**
V5	HL41DD	Anode Cathode	99 96	3 G 3 G	**110** **25**
V6	AC5Pen	Anode Screen Cathode	106 81 104	3 H 3 J 3 J	**240** **245** **8·5**
V8	ME41	Anode Triode Anode Cathode	81 98 96	22 C 22 C 22 C	**245** **40** **25**
V9	UU4	Cathode	113	17 E	**310**

Fault Finding

The table below is included to assist servicemen in recording systematically faults which develop in the "52" receiver. The faults already included in the table are taken from our service records, and service men should add particulars of any faults which are subsequently published in *Murphy News* and any which develop in the field.

FAULT FINDING TABLE

SYMPTOMS	FAULTS
Weak Signals	R7 o/c C9 o/c C8 o/c
Instabliity	R9 not adjusted (see page 8). C36 o/c R63 o/c V4 metallizing o/c
Distortion	A.V.C. line s/c: Check C61, C16, C51, R 34. C58 o/c.
Push-Button Tuning Inoperative	Push-button contacts out of adjustment Motor not aligned. Motor winding s/c. Motor Drive cord slack (see page 19). Commutator disc and contact rail too close.

Trimming

TRIMMING on this receiver is very critical and must be carried out carefully as small inaccuracies may completely spoil the performance of the receiver.

THE SERVICE OSCILLATOR

It is also important to ensure that the service oscillator is accurately calibrated, and it is advisable to check this regularly by the "beat" method. This method is fully described in the operating instructions supplied with our All-Wave Service Oscillator Type M1. It is also described in the "28" Service Manual on page 10.

Checking points for the higher I.F. range are not given in these instructions, but the stations listed below can be used, and as they will beat with the second harmonic of the service oscillator in each case, it should be quite easy to adjust the two inputs to give the required beat.

STATION	FREQUENCY	SERVICE OSCILLATOR FREQUENCY
	Kc/s	Kc/s
Milan	814	407
Berlin	841	420.5
London Regional	877	438.5
Hamburg	904	452
Radio Toulouse	913	456.5
Brussels, No. 2	932	466
Breslau	950	475
Post Parisien	959	479.5
NorthIrelandReg.	977	488.5
Hilversum, No. 2	995	497.5

THE OUTPUT METER

We suggest the use of a 0 to 3 volt rectifier type voltmeter, placed across the loud-speaker sockets, for measuring the output of the receiver when trimming as this method is both simple and straightforward.

The input from the service oscillator, when the output meter is used, should always be kept sufficiently low to keep the reading below 1 volt. It is therefore necessary to reduce the input as each stage is brought into tune.

The correct sequence for completely retrimming is I.F.'s (465 Kc/s) S.W. I.F.'s (3·1 Mc/s), S.W., M.W., and L.W. Small errors in calibration occurring at the lower end of the bands may be corrected by adjusting the oscillator trimmers only, and on this receiver these can be adjusted without affecting the calibration of the other bands.

The trimmer positions are marked on the chassis plan view, and may also be located by the square numbers in brackets.

DAMPING

The characteristics of the I.F. transformers make it essential to damp one of each pair of coupled circuits as the other is trimmed, and a unit for this purpose should be made up with a 20,000 ohms (quarter watt) resistance and a 0·1 mfd. condenser. Attach a crocodile clip to one end of the resistance and connect the other end to the condenser. Then attach a short flexible lead terminated with a crocodile clip, to the free end of the condenser.

I.F. TRIMMING. 465 Kc/s

1. Connect the output meter across L.S. terminals.
2. Clip the flexible lead of the damping unit to chassis and the resistance end to the 2nd I.F. transformer (square 6J, test point 80).
3. Tune the receiver to the 21 metre band.
4. Connect the service oscillator between the control grid of V4 (square 36E, test point 56) and chassis, through a fixed condenser of 0·1 mfd.
5. Tune the service oscillator to exactly 465 Kc/s and switch on the internal modulation.

6. Adjust C55 (square 35J) for maximum reading on the output meter.

7. Remove the damping unit from the 2nd I.F. transformer, and clip it to anode of V4 (square 6G, test point 75). Adjust C56 (square 36H).

8. Connect the service oscillator between the control grid of **V3** (**square 38E test point 58**) and chassis via the dummy aerial.

9. Remove the damping from V4 anode and apply it to V4 control grid (square 36F, test point 56). Adjust C38 (square 35K).

10. Remove the damping from V4 grid and apply to **V3** hexode anode (square 2E test point **62**). Adjust C42 (square 34E).

"Connect the service oscillator to the control grid of V2 (square 32F test point 22)."

13. Switch the receiver to medium waves. Adjust the compensating trimmer C23 (square 33A).

If the trimmers are found to require only a very small adjustment, the 465 Kc/s I.F. trimming may now be regarded as complete, but if large adjustments have been made, it is advisable to repeat the whole procedure as a final adjustment.

The accuracy of long-wave calibration depends upon the accuracy of the I.F. trimming.

I.F. TRIMMING. 3·1 Mc/s

1. With the service oscillator still connected to the control grid of V2, tune it to exactly 3·1 Mc/s (96·77 metres).

2. Adjust C43 (square 34D) and C39 (square 35L) for maximum reading in the output meter.

S.W. TRIMMING

The second S.W. oscillator circuit is adjusted to 2·635 Mc/s in the factory and should not require further adjustment. The adjustment is not one which can easily be carried out by dealers, and we suggest that if fault does develop in this circuit the assembly should be returned to us for readjustment.

The procedure for trimming the other short-wave circuits, assuming that the push button contacts are correctly adjusted (see page 6), is the same as in an ordinary short-wave receiver and should be carried out as follows.

1. Connect the service oscillator between the aerial and earth sockets and tune it to 14·28 Mc/s. Connect the output meter across the L.S. sockets.

2. Switch the set to the 21 Metre band and adjust the '5' on the short-wave scale.

3. Adjust C27 (square 29D). The signal should be received at two setting of this condenser. The correct adjustment is the one with the higher capacity, that is, the second point when screwing in the trimmer screw. The other is the "image."

4. Adjust C17 (square 29G) and C7 (square 29F) for maximum gain.

M.W. TRIMMING

1. Connect the service oscillator to the aerial and earth terminals, and the output meter to the L.S. terminals.

2. Tune the receiver and oscillator to 220 metres.

3. Adjust the oscillator trimmer C28 (square 32C), the grid trimmer C12 (square 27D), and the aerial trimmer C3 (square 34F) in that order. Repeat for final adjustment.

4. If possible, check the calibration on the local broadcast station.

L.W. TRIMMING

1. Connect the service oscillator to the aerial and earth terminals, and the output meter to the L.S. terminals.

2. Tune receiver and oscillator to 1,000 metres.

3. Adjust the oscillator trimmer C31 (square 32D) to correct calibration, and the trimmers C14 (square 27E), and C6 (square 34G) for maximum gain.

Mechanical Details

THE flexible leads to the loudspeaker and to the push-button units are made sufficiently long to allow the chassis to be removed for service without disturbing these two units.

Before the chassis is withdrawn from the cabinet, the push-button station name panel and its pilot lamp bracket must be removed. The pilot lamp bracket is held by a thumb-screw at the top, and when it has been removed the screw securing the station name panel to the operating link can be slackened and the panel lifted up and out.

To take the chassis right away from the cabinet, the push-button unit can be freed by undoing the fixing screws. To locate this unit conveniently while repairs are being carried out, it may be screwed to the chassis at the loudspeaker socket end.

Care should be taken when replacing the chassis to see that the leads to the push-button switches are not pinched and that they do not foul the back ends of the switch rods. Also, the push-buttons must be central in the holes in the escutcheon.

THE TUNING DRIVE

The tuning control in the "52" operates two independent drive mechanisms, by means of friction wheels. The driving wheel is held against the driven wheels of the short-wave or the medium- and long-wave mechanisms by a link connected with the wave-range switch, and the correct tension is maintained by two springs located in the link itself. **If either of these springs is weak or broken, slipping will occur in the drive. Slipping will also occur if the control knob is pressed sideways while it is being rotated, as any sideways pressure will obviously oppose the tension of the springs.**

THE M.W. AND L.W. DRIVE WHEEL

The "resistance" or friction in the medium- and long-wave tuning mechanism is a little higher than in the short-wave section, and to increase the driving pressure the wheel in this case is milled. **In some of the earlier sets a smooth wheel was fitted, but this should be replaced with the new type if slipping occurs.**

The procedure for changing this wheel is quite straightforward. Slacken the screws securing the tuning motor before taking out the old drive wheel, and tighten them again after the new one is fitted. This is necessary to ensure that the bearings of the spindle are aligned.

THE FRICTION DRIVE ADJUSTMENT

The screws holding the drive spindle bearings are in slotted holes to provide an adjustment for the correct spacing between the drive wheels. When the main drive wheel is engaged with the S.W. drive wheel there should be about 1/32-in. space between the main wheel and the M.W.-L.W. driven wheel. **If the spacing is less, rubbing may occur, if it is more there may be a tendency to drive slip from insufficient pressure.**

THE SHORT-WAVE CORD DRIVE

The length of the S.W. drive cord is approximately 30 inches, but to simplify fitting, it is advisable to take a 36-inch length and cut off the surplus when the work is completed.

Turn the control knob clockwise until the S.W. drive mechanism reaches the stop nearest the front of the set.

Thread the cord through the small hole in the worm drive wheel and pull through a sufficient length to go round the two guide wheels, up the front of the scale, over the top guide wheel, and about half-way down the back of the scale. This end of the cord can, for the present, be wound around one of the control spindles, while the other end is being threaded. Wind the other end of the cord five times round the worm wheel towards the back of the chassis, then over the fourth guide wheel, and up the back of the scale. Tie this end to one end of the tension spring so that the junction will come opposite the lower of the two holes in the side of the scale frame.

Thread the other end of the cord through the other end of the tension spring, and pull it through until the spring is under tension. Tie the cord securely and cut off any surplus. The top end of the tension spring should now come close to the top guide wheel if the tuning drive is rotated to the other end of its travel.

THE M.W. AND L.W. CORD DRIVE

The M.W.-L.W. drive cord is approximately 42 inches long and to allow for handling, a 4-feet length should be used when a replacement is fitted.

Turn the tuning control until the condenser vanes are set to minimum capacity.

Place the drive cord down the front of the scale, over the guide wheels at the top and bottom, and round the second pair of guide wheels at the back of the scale. The cord from the top of the scale should go round the lower of these guide wheels and the cord from the bottom of the scale round the higher one.

From the higher guide wheel take the cord directly through the small hole in the condenser drive pulley, and from the lower one take the cord round the lower side of the condenser drive pulley, then through the small hole.

Thread the tension spring over the two ends of the cord, and then double back the cord and clamp it, close to the hole in the pulley.

Finally ease the tension spring over the securing lug on the pulley, and cut off any surplus cord.

THE POINTERS

A pointer can be fitted by placing the "trolley" under the cord, then pressing the cord through the hole in the centre. This will allow the pointer itself to be pushed through, so that it is held by the trolley and the cord.

When the pointers have been fitted they should be eased up or down the cord until they cover the bottom markings on the scales when the stops on the S.W. and M.W.-L.W. tuning are reached.

THE MOTOR CORD DRIVE

The motor cord drive is approximately 26 inches long and about 32 inches should be used to allow for handling.

Before fitting the cord, see that the commutator disc is properly located on the condenser spindle. The setting line (insulating strip) should be horizontal when the condenser is set to maximum and minimum capacity. Set the condenser to minimum before fitting the cord.

Wind the cord four times round the cord pulley on the motor assembly. Take the two ends round the rim of the commutator pulley and through the small hole.

Thread the tension spring over the ends of the cord. Double the cord back and clamp it close to the hole in the pulley, and ease the other end of the tension spring over the fixing lug. **This spring must be under fairly strong tension, otherwise drive slip may occur.**

Notes