A highly efficient and easily constructed five valve self-contained Portable Receiver

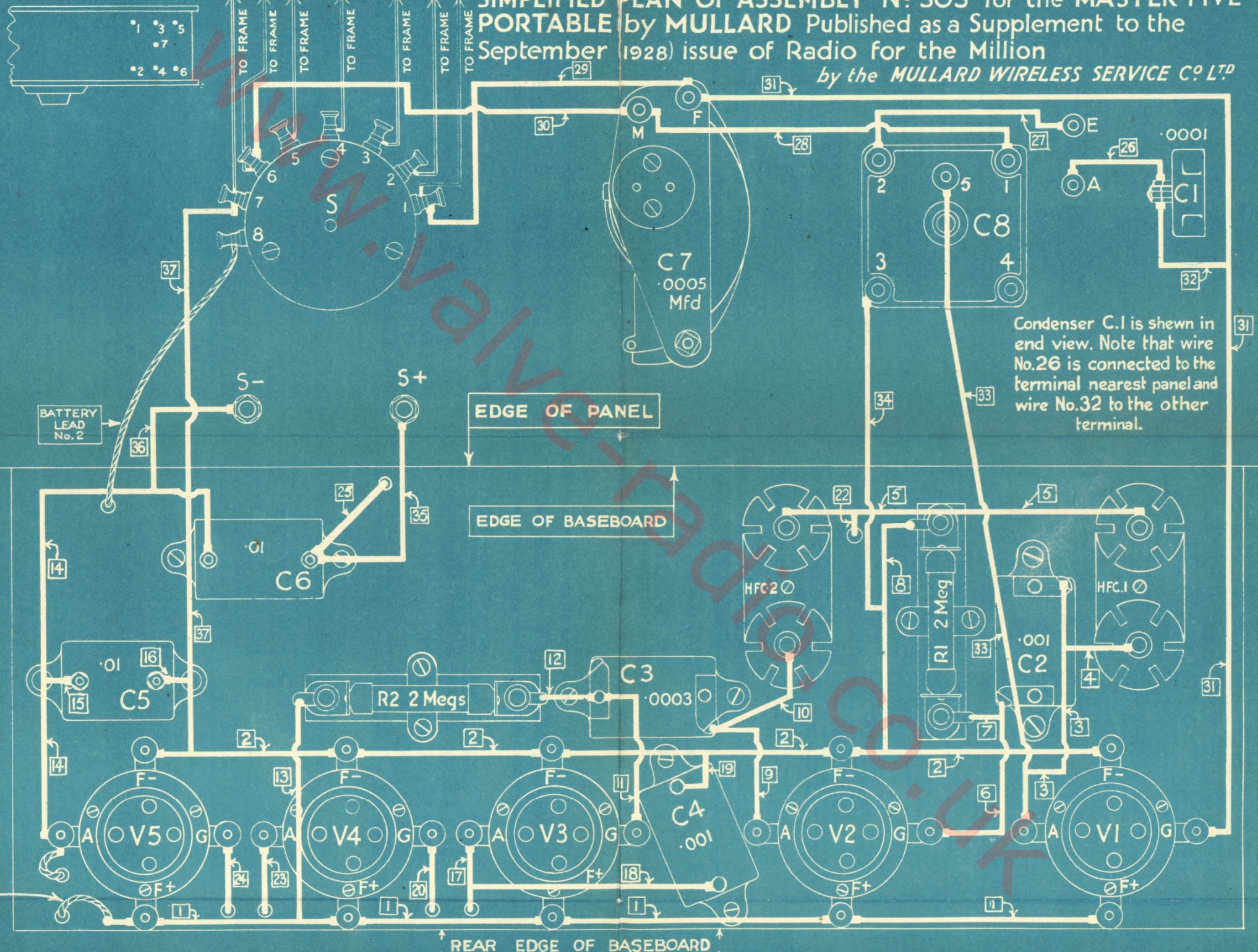
A MAGNIFICENT LONG-WAVE PERFORMANCE IS THE GREAT FEATURE

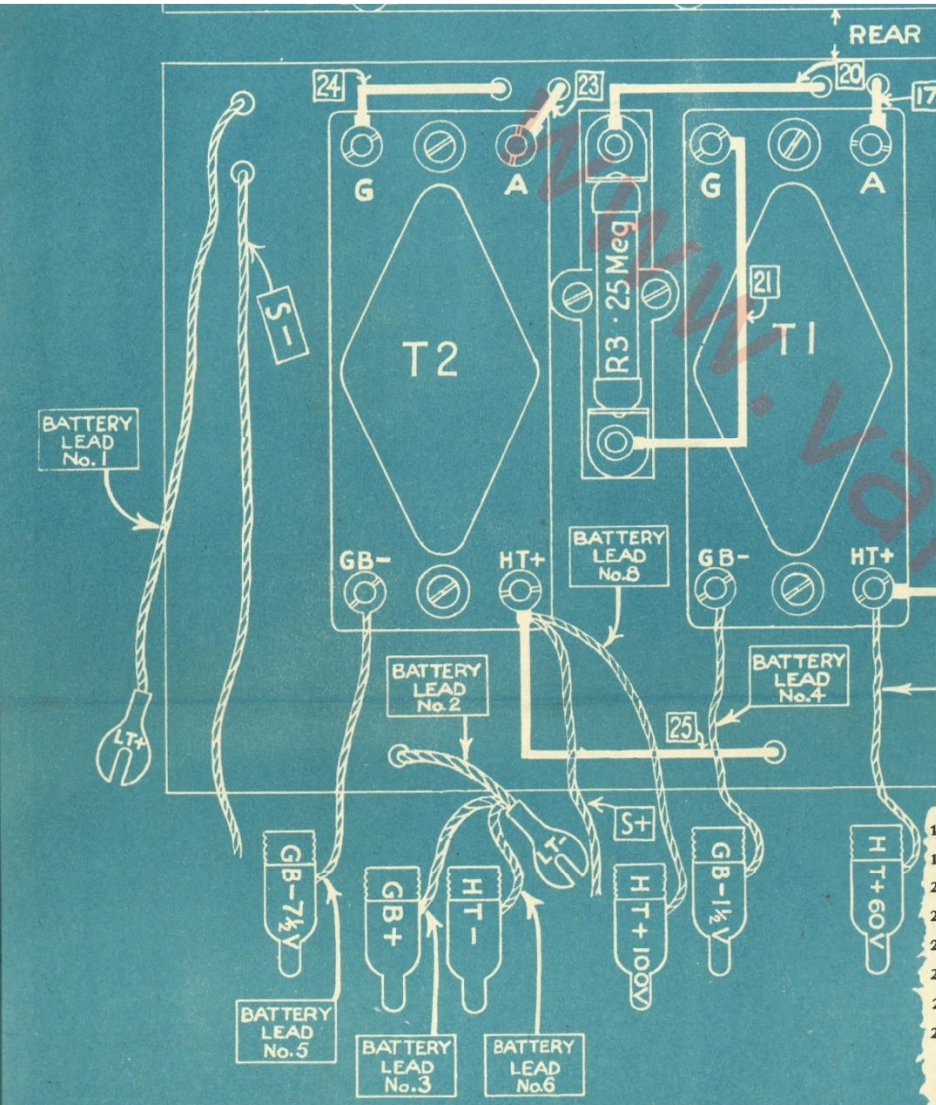
The Master Five Portable by Mullard

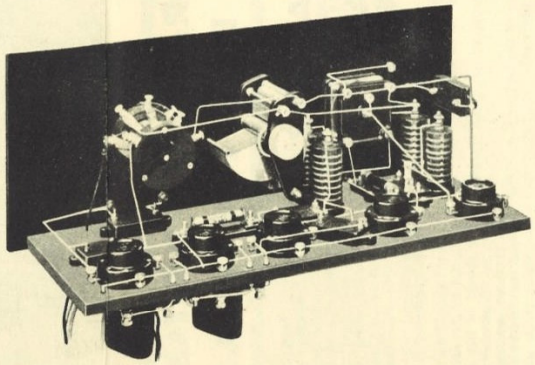
Supplement to
RADIO FOR THE MILLION
SEPTEMBER 1928

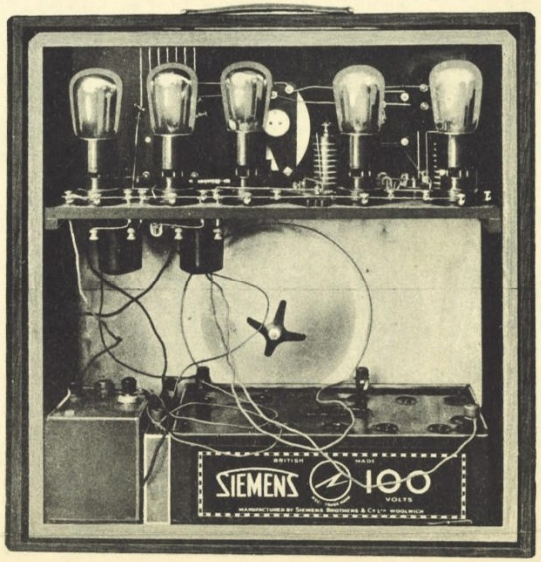
SIMPLIFIED PLAN OF ASSEMBLY No 303 for the MASTER FIVE PORTABLE by MULLARD Published as a Supplement to the September 1928) issue of Radio for the Million

by the MULLARD WIRELESS SERVICE Co LTD









Point by Point Table

SECTION 1 (Baseboard Wiring).

1 Join together nearest terminals (F +) of valve holders V1, V2, V3, V4 and V5.
2 Join together farthest terminals (F —) of V1, V2, V3, V4 and V5.
3 Connect terminal A of valve holder V1 to the farthest terminal of fixed condenser C2.
4 Connect wire No. 3 to the nearest terminal of HF Choke (HFC. 1).
5 Connect farthest terminal of HF Choke (HFC. 1) to farthest terminal of HF. Choke (HFC. 2).
6 Connect terminal G of valve holder V2 to nearest terminal of condenser C2.
7 Connect wire No. 6 to nearest terminal of grid leak R1.
8 Connect farthest terminal of grid leak R1 to wire No. 2.
9 Connect terminal A of valve holder V2 to right hand terminal of condenser C3.
10 Connect right hand terminal of condenser C3 to nearest terminal of HF. Choke (HFC. 2).
11 Connect terminal G of valve holder V3 to left hand terminal of condenser C3.
12 Connect left-hand terminal of condenser C3 to right-hand terminal of grid leak R2.
13 Connect left-hand terminal of grid leak R2 to wire No. 1.
14 Connect terminal A of valve holder V5 to left-hand terminal of condenser C6.
15 Connect wire No. 14 to left-hand terminal of condenser C5.
16 Connect right-hand terminal of condenser C5 to wire No. 2.
17 Connect terminal A of valve holder V3 to terminal A of Transformer T.1.
18 Connect wire No. 17 to the nearest terminal of condenser C4.
19 Connect farthest terminal of condenser C4 to wire No. 2.
20 Connect terminal G of valve holder V4 to nearest terminal of Grid Leak R3.
21 Connect farthest terminal of Grid Leak R3 to terminal G of Transformer T.1.
22 Connect terminal + HT of Transformer T.1 to wire No. 5.
23 Connect terminal A of valve holder V4 to terminal A of Transformer T.2.
24 Connect terminal G of valve holder V5 to terminal G of Transformer T.2.
25 Connect terminal + HT of Transformer T.2 to right-hand terminal of condenser C6.

Note that wires Nos. 17, 20, 22, 23, 24 and 25 pass through the baseboard and should be insulated from the latter with short lengths of sleeving.

Note that when we speak of "nearest" or "farthest" terminals, we presume the constructor to be viewing the back edge of the baseboard, *i.e.*, that farthest from the panel.

SECTION 2 (Panel Wiring).

26 Connect socket A on panel to terminal nearest panel of fixed condenser C1.
27 Connect socket E on panel to terminal No. 2 of reaction condenser C8.
28 Connect terminal No. 1 of reaction condenser C8 to moving vanes (terminal M) of variable condenser C7.
29 Connect fixed vanes (terminal F) of variable condenser C7 to terminal No. 1 of switch S.
30 Connect moving vanes (terminal M) of variable condenser C7 to terminal No. 6 of switch S.

Note that fixed condenser C1 is supported in its position by wire No. 26.

SECTION 3 (Wiring between Panel and Baseboard).

31 Connect fixed vanes (terminal F) of condenser C7 to terminal G of valve holder V.1.
32 Connect wire No. 31 to terminal farthest from panel of fixed condenser C1.
33 Connect terminal No. 5 of reaction condenser C8 to wire No. 3.
34 Connect terminal No. 3 of reaction condenser C8 to wire No. 8.
35 Connect right-hand terminal of fixed condenser C6 to socket S + on panel.
36 Connect socket S — on panel to wire No. 14.
37 Connect terminal No. 7 of switch S to right-hand terminal on fixed condenser C5.

SECTION 4 (Battery Leads).

BATTERY LEAD No. 1 LT +.

An 18-inch length of flexible wire with red covering should be fitted with a red spade terminal at one end and marked "LT +." The other end should be bared, passed through a suitable hole in the baseboard and connected to the nearest terminal (F +) of valve holder V5.

BATTERY LEAD No. 2 LT —.

A 2-foot length of flexible wire with black covering should have a black spade terminal connected to one end and marked "LT —." The other end should be bared, passed through the appropriate hole in the baseboard and connected to terminal No. 8 of switch S.

BATTERY LEAD No. 3 GB +.

A 12-inch length of flexible wire with red covering should be fitted at one end with a red wander plug labelled "GB +." The other end should be inserted together with battery lead No. 2 into the black spade terminal marked "LT —."

BATTERY LEAD No. 4 GB—1½v.

A 12-inch length of flexible wire with black covering should be fitted at one end with a black wander plug and marked "GB—1½v." The free end of this wire should be connected to terminal—GB of transformer T.1.

BATTERY LEAD No. 5. GB—7½v.

A 12-inch length of flexible wire with black covering should be fitted at one end with a black wander plug and marked "GB—7½v." The free end of this wire should be connected to terminal —GB of transformer T.2.

BATTERY LEAD No. 6. HT —.

A 12-inch length of flexible wire with black covering should be fitted at one end with a black wander plug and marked "HT —." The free end should be inserted with battery leads Nos. 2 and 3 into the black spade terminal LT —.

BATTERY LEAD No. 7. HT + 60v.

An 18-inch length of flexible wire with red covering should be fitted at one end with a red wander plug and marked "HT + 60v." The free end of this wire should be connected to terminal + HT of transformer T.1.

BATTERY LEAD No. 8. HT + 100v.

An 18-inch length of flexible wire with red covering should be fitted at one end with a red wander plug and marked "HT + 100v." The free end of this wire should be connected to terminal + HT of transformer T.2.

SECTION 5 (Frame Connections).

Connect frame aerial wire No. 1 to terminal 1 on the switch S. Connect the remaining wires to their respective numbered terminals on the switch.

SECTION 6 (Wiring to SPEAKER UNIT).

A 15-inch length of black flexible wire should have one end connected to terminal A of valve holder V5. It should then be passed through a hole in the baseboard close to this terminal, and through a hole in the speaker baffleboard. The other end should be connected to the left-hand terminal of the Speaker Unit (*i.e.*, the terminal to which the green speaker wire is attached).

A 15-inch length of red flexible wire should have one end connected to terminal + HT of transformer T.2. It should then be passed through the hole in the speaker baffleboard and the other end connected to the right-hand terminal of the Speaker Unit (*i.e.*, that to which the red wire is attached).

COMPACTABILITY — PORTABILITY — UTILITY AND RELIABILITY

THE MULLARD MASTER FIVE IS THE MODERN VERSION OF IDEAL RADIO

EVERY aspirant to the real joys of radio has at heart an ambition to become the possessor of a portable receiver. The many attractive features of this type of set advance radio from association with perplexing technical apparatus to a refreshing similarity with the simple gramophone. It is because the portable receiver is complete in itself that its appeal has found a universal welcome from those who have previously had radio in their homes, as well as people interesting themselves in broadcast entertainment for the first time.

Nor does this claim of the portable for popularity pass over the people who are experienced in assembling their own receivers. They see in the portable a chance to practise their aptitude for manual skill and to achieve a technical accomplishment which will command the approbation of family and friends. With a successful portable receiver to one's credit, there is good ground for personal satisfaction.

In the past the building of a portable receiver was a tricky affair—not so now.

The Master Five Portable is the outcome of a desire to give people the simplest embodiment of the modern idea of radio. It is complete.—Every part of its equipment is contained within a cabinet which is attractive in design and appearance. Disfiguring and unsightly appurtenances such as batteries and meandering leads are things of the past. The inartistic mast and uninteresting aerial wire are dispensed with now that the modern idea of radio takes material shape as The Master Five Portable.

That instead of an inelegant case, which at the best of times added little, if any, ornamentation to the drawing room, this receiver could take its place in the decorative scheme. This is one aspect of modern radio which The Master Five Portable brings within the reach of every homestead with or without radio at present.

But there are many more points no less strong in their appeal. For example who has not looked rather despairingly at the tangled skein of wire and jumble in the radio corner, when a member of the family has expressed the wish for the comfort of music in the sick-room?

Or perhaps to carry radio into another room of the house for the entertainment of the children during their artless but very important birthday festivities? Often arises the need for a radio set which is transportable from one place to another with ease. The tenant of a one-roomed flat as much as the owner of a mansion has frequent occasion to appreciate the utility of a portable receiver. The former for reasons of compactability as well as portability.

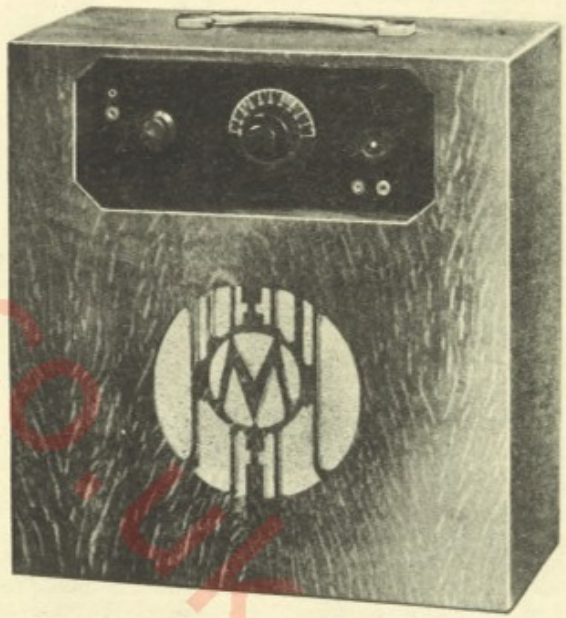
Without trouble or disturbance The Master Five Portable may be carried single handed about the house, into the car, round to the party at friends living in the next street, away to the country cottage for the week-end—anywhere and everywhere—as it is completely housed in a serviceable cabinet light in weight. Aerial, speaker, batteries—problems to every radio owner—are concealed out of sight. It is a great point. Far too long have we endured the inconvenience of these accessories being external.

EXHIBITS THE MAGIC POWER OF A MUSICAL KALEIDOSCOPE BY ONE DIAL OPERATION

Mark you, extreme compactability which brings with it this high measure of utility is the home constructor's opportunity. Every owner of a Master Five Portable will have something about which to feel proud. Besides the very important features already referred to, one takes thought of the immense pleasure to be gained from its inherent power to receive broadcast music at almost every hour of the day or night. Previously mentioned advantages are incidental and minor in comparison with this essential and major ability. Thus, by means of an instrument as small as The Master Five Portable excellent music from talented musicians is receivable from the great broadcasting stations of Europe. It is this remarkable efficiency on such a diminutive aerial that directs so much appreciative attention to the performance of The Master Five Portable.

Judge for oneself: here is a brief outline of the performance it may be relied upon to give in Britain. Consider The Master Five to possess the magic power of a musical kaleidoscope which, through the simple turning of one dial, holds in store for you the illimitable and inexhaustible treasures of entertainment, inspiration and relaxation. Neither operative skill nor patience is imperative to make so invaluable a use of this receiver. Unlike any receiver you may have before handled, The Master Five calls for no more deftness of finger than the accurate setting of the hands of a watch.

Having followed the working plans diligently and undeviatingly, stations are to be found within a hair's breadth of the dial readings given later in the description of the set. Disregard all technical methods of arriving at the correct tuning point for your local station. Set the dial to the published reading when you will find that its



The tuning dial is situated in the centre of the panel with the volume and wavelength controls on either side.

A RECEIVER GIVING RADIO THE TOUCH OF REALITY

ITS EFFICIENCY IS ALWAYS CONSTANT AND ITS PERFORMANCE CONSISTENTLY REMARKABLE

transmission is to be received a thread's diameter on either side. Here also is something which will be appreciated by every member of the family. Set the switch to long or short section according to the classification given in the list of dial readings, press the switch into position—which puts the receiver into operation—and register the numbering on the central dial with the indicating mark on the panel. A slight touch on the small left hand control will bring up the signal to comfortable speaker volume. A very simple scheme within the skill of everyone able to read.

It is that The Master Five Portable combines simplicity with compactability and utility. In any room of the house—from attic down to basement—its efficiency is always constant and its performance consistently remarkable. Its facility to stretch beyond the sea and fill the house with melody, rhythm and harmony from distant cities is unvarying. It is independent of aerial or earth . . . .

Living in London, the short wave section of the set would give us under the most unfavourable conditions the programme sent out by 2LO with an alternative from 5GB. Both stations would be received at ample speaker strength, the former can be far too strong for comfortable listening while the latter—Daventry Experimental—would be heard astonishingly and notably loud. With the correct high-tension voltages perfect reception would be experienced at the minimum setting of the volume control.

Naturally, in any residence unscreened by steel buildings or high trees results would strikingly improve to render extremely easy the reception of several stations such as are included in the supplementary list of dial readings in the short wave section. After nightfall many German, French and Spanish transmissions reach this country and it is not outside the power of The Master Five to respond to them. But the great merit of this receiver lies in its long wave section. Its long wave performance is truly magnificent.

This feature is one of outstanding importance for every radio enthusiast whose ambition it is to build a Master Five for the coming winter evenings. Very short experience of distant reception reveals the disappointing fact that, although there are no fewer than 150 stations allocated on the short waves, the receivable ones are surprisingly few if it is intended to enjoy from them a musical programme. But conditions are happily different on the long waves. There one finds five or six exceedingly good stations operating on very high power free of interference from heterodyning, overlapping, and maritime morse.

In this eminent long wave performance of the Master Five Portable its owner has reliable radio. British programmes would be obtainable from Daventry—not an uncommon practice even with the ordinary set employing an external aerial and an earth—while the selection of an alternative evening's pleasure could be derived from Holland, France, Germany or Denmark. Mark this point, reception is unimpaired by those nightmares of distant reception—interference and fading. Therefore, the design of the Master Five Portable provides for maximum efficiency where the best and most reliable stations are operating. When you come to use your Master Five make the most of the long waves—radio will then mean something more than just a diversion.

The long-wave stations listed for and calibrated on the original receiver are to be heard in London at speaker strength. They are quickly tuned-in because of their strength. Examine for a moment the rated power of these stations. Here, obviously, on this waveband, lies the alternative programme to which one can listen with the same degree of pleasure as the local. That the efficiency of The Master Five is strongly emphasized where it is most useful and most practical at once places real radio or the ideal reception of a choice of programmes inside the operative capacity of everyone. In the careful adherence to the working plans and specified components your own Master Five will be distinguished by a similar merit.

In the possession of this receiver you have a radio set which may be described as magnificently efficient on the long-wave high-powered stations, compact, portable, easily operated in that it is one dial tuning, combined long and short waves, serviceable, attractive and sensitive to weak signals. Technical merit of this order becomes reality at the touch of a switch. Music, whose language knows neither race nor age, comes from The Master Five with a faithfulness of reproduction to prompt the mind to fashion human form

THE WORKING PLAN GIVES DETAILS—POINT BY POINT

THE GREAT MERIT OF THIS RECEIVER LIES IN ITS LONG-WAVE PERFORMANCE WHICH IS TRULY MAGNIFICENT

round voice and song and animate with life the dominating euphony of symphony and serenade.

Builders of this receiver must not attempt to use components other than those specified. In the current issue of "Radio for the Million" reasons for this precept are given. Here it should be said that any change of component may seriously affect the performance of the set. This particularly applies to the high-frequency chokes which must be of the type named. Two are embodied and are sold as a pair. One is marked L.R. and is placed in the second position. Similar care should be taken to purchase the listed switch. It is specially designed for the purpose.

1	Cabinet to design and dimension	Lock
1	Carriage, baseboard, sounding board to design and dimension	Lock
1	Ebonite panel (16″×6″×¼″) ..	Becol
1	P.M. Speaker Unit	Mullard
5	P.M. Radio Receiving Valves to specification	Mullard
5	Anti-Vibratory valve-holders ..	Pye
1	·0005 Mfd. slow-motion tuning condenser	Pye
1	Differential reaction condenser	Pye
1	Long and short wave switch ..	Junit
1	Kit (one pair) of high-frequency chokes to specification ..	Climax
2	"Permacore" Transformers ..	Mullard
	Fixed condensers 2-·001 mfd. 1-·0003 mfd. 2-·01 mfd. 1-·0001 mfd.	Mullard
	Fixed resistances (grid-leak type) 2-2 meg., 1-·25 meg.	Mullard
3	Grid-leak holders	Mullard
	Springmore battery plugs, 3 red, 3 black	Igranic
2	Spade connectors, 1 red, 1 black	Lisenin
4	Sockets, 2 red, 2 black	Lisenin
3	Packets of connecting wire ..	Junit
	Quantity of red and black twin flex	
1	2-volt low-tension accumulator, type S.P.7.	Exide
1	100-volt high-tension battery, type 1202	Siemens
1	9-volt grid-bias battery, type G.9.	Siemens
	Say 1 oz. of 38 gauge D.S.C. wire 25 yds of stranded wire (18 strands 40 gauge)	

RECOMMENDED MULLARD P.M. VALVES.

Three P.M.1 H.F. Valves, one P.M.1 L.F. and one P.M.2 Valve. These are to be obtained from any wireless dealer in the country.

Valve efficiency figures very largely in the performance of a portable receiver. Moreover, it is important that the standard of efficiency of a recommended combination of valves should be constant throughout manufacture. The Master Five Portable was designed on the published characteristics of the particular Mullard P.M. Valves specified below and no deviation should be made from the specification. Any substitution will make itself apparent in some form of inefficiency which in this case would work irreparable harm on the good performance and behaviour of the set. More so than in a less carefully designed receiver.

Inefficiency due to substitution would deprive the set of its simplicity of control by the introduction of instability. Therefore adhere rigidly to the recommendation; it means success from the start. A score or more tests have been made with different groups of valves conforming to the specification and in each case the receiver maintained its delightful ease of control and perfect stability.

Looking at the back of the receiver and commencing from the right the valves are inserted in the following order:—

V.1.—P.M.1 H.F.; V.2.—P.M.1 H.F.;
V.3.—P.M.1 H.F.; V.4.—P.M.1 L.F.;
V.5.—P.M.2.

The assembly of The Master Five Portable is not one whit more difficult than the construction of an ordinary receiver. Consider its method of assembly to be exactly the same. There is the panel which is placed at right angles to the baseboard in the normal way.

Commence by drilling the panel to carry the tuning and reaction condensers, the switch and the four sockets the exact positions for which are indicated by the working plan. Drill also the fixing holes at the same time. Next proceed to the baseboard and mount on the underside the two Mullard "Permacore" Transformers and the resistance holder. Carry on now by placing and screwing into place according to the plan all the components arranged on the upper face of the baseboard. Make a point of following the layout inch by inch as a departure from the plan may lead to subsequent trouble. Rather than damage the transformers during assembly and wiring, it would be wise to rest the baseboard on two

CALIBRATIONS PUBLISHED FOR ALL BRITISH STATIONS

LONG-WAVE OR SHORT-WAVE CONTROLLED BY A SWITCH

REMARKABLE RESULTS ON INTERNAL DIMINUTIVE AERIAL REVEAL INTRINSIC EFFICIENCY

small blocks of wood or two small cardboard boxes.

The joining up of the various parts is the immediate step afterwards. Do not attempt to execute this little operation without constant reference to the Point by Point Table. Commence at wire number one and complete in the order given until arrival at wire number 37. By this scheme no wire can be omitted nor any wire joined to an incorrect point. Wherever practicable connection to a terminal is made. A soldered joint is adopted only in the isolated places where the extra length of wire necessary to carry the wire to the nearest terminal might be liable to introduce an element of trouble in the operation of the receiver.

For the reason that the publication of assembly details of a portable receiver as simply designed as The Master Five will influence thousands to assemble a receiver at home for the first time, each lead to the batteries is described in detail. These are numbered and their point of attachment to the set is given so that no element of chance exists to make an incorrect join. All battery leads should be in place before mounting the baseboard inside the carriage.

When every wire and lead described in the first two sections of the Point by Point Table has been dealt with, the moment has arrived to turn to the winding of the aerial. The special carriage is purchasable ready for you to commence. A small diagram of the top of this carriage is given here. It shows the disposition of seven points which are numbered in a particular manner. Points with odd numbers represent the starting points of the frame windings while the even numbers indicate the finishing points. Very small holes — seven in all — should be drilled through the carriage at these points.

Take first the thin wire and starting at point number one in the diagram, wind into the slots provided, in a clockwise direction, 12 turns finishing at point number two exactly opposite at the other side of the top of the carriage. Then restarting at point number five, wind also with thin wire into the same slots, in a similar direction, another winding to be finished at point number six which is in line with point number five but at the opposite side of the carriage. Then with the stranded wire and beginning at point number three, wind still in the same direction and into the same slots, to complete the centre winding at point number four.

As the ends of the three windings are to be connected to the switch, a liberal length of wire should be left at all six ends for this purpose. Remember the frame aerial is made up of three separate windings. The wire should therefore be snipped off when firmly attached at points numbered two, four and six.

An easy way to do this would be to sharpen up a very thin strip of wood to a point—a matchstick serves admirably—and holding the winding tightly after the end has been pushed through the hole, fix by inserting the pointed piece of wood. A spot of seccotine or celluloid adhesive would maintain it in position for good and for all. Point number seven remains for attention. It is the centre point of the centre winding. Bare the stranded wire carefully exactly at this point, after which attach there a few inches of the same wire by a spot of solder. Carry through the hole as before.

Now securely fix the panel to the baseboard by means of screws along the bottom edge and complete the connections given in the third section of the Point by Point Table. Slip the unit into the carriage where it will rest on the two supports provided. Two screws on either side through the carriage into the side edges of the baseboard will serve to keep it in position while several screws are driven home through the holes at the edges of the panel into the front edge of the carriage.

The next little undertaking is the attachment of the frame windings to the switch. No mistake can happen here as every associated point of frame and switch are numbered with identical figures.—Number one to one, number two joins two and so on up to seven. Of this, the Point by Point Table gives every detail.

So much having been done, the assembly is completed when the Mullard P.M. Speaker Unit is screwed to the sounding board and two of its leads—green and red—attached to the appropriate points of the receiver. It is as well to cut out a ring of cardboard with a seven inch internal and an eight inch external diameter and place between the speaker mounting ring and the sounding board. This

EFFICIENCY STRONGLY EMPHASISED WHERE DISTANT STATIONS ARE MOST RELIABLE

scheme effectually eliminates any tendency of case-dither.

The cabinet which has been specially designed for this receiver has a novel feature in that the grille appears at the back of the case as well as at the front. Apart from successfully relieving an otherwise uninteresting appearance at the reverse side, this duplication of speaker grille possesses distinct and decided acoustical advantages. It greatly improves the tone quality of the reproduction by relieving the back pressure behind the cone. This small but very important point renders the quality mellow, full and round in tone colour. Close up the back and reproduction becomes distressingly resonant, unnatural and uninteresting. Overlaid with a piece of silk at the inside the grilles become quite an effective decorative design. If a cabinet of your own design is preferred, adhere to the specification in the one respect that a grille appears at both back and front.

STATION CALIBRATION CHART.

For every British station there is a dial reading which is given in the following list of stations. Whatever the name of your local transmission, refer to this chart as it is most helpful in bringing the dial into the correct position for immediate reception. Similarly, until you know by heart the disposition of all the stations you may wish to receive, set the dial of the tuning condenser to the reading given. It is the shortest path to quick and successful reception. Stations are divided into three sections—Long wave, British Short wave (or pedantically, medium waves) and Continental Short wave.

The first listed stations are to be received with the switch set for long waves while both second and third lists are receivable when the switch is in the short-wave position. The first two lists will be in daily use by every owner of The Master Five Portable in whatever part of the country he (or she) may reside and irrespective of conditions. The third list has been made up of the more popular Continental transmissions which are known to come over with great strength after nightfall. Among these are quite a large number which would be received at speaker volume after a few evenings experience with the set. These dial readings are included for the assistance of the more skilful radio enthusiast who takes a rightful pleasure in exercising his tuning proficiency. Even those less ambitious will have a choice so varied among the really high-powered stations on the long-waves particularly, that this third section may well be left to the expert. The modern idea of real radio means the strength and quality of the local station. On this count The Master Five is a receiver realising this ideal elaborately and completely.

Metres	LONG-WAVES.	Dial Reading.
1071	Hilversum	27
1153.8	Kalundborg	36
1250	Konigswusterhausen	48
1604.8	Daventry (5XX)	83
1765	Radio Paris (CFR)	98
	BRITISH SHORT-WAVES.	
200		18
252.1	Bradford (2LS)	30
273	Sheffield (6FL)	34.5
276	Nottingham (5NG)	35
277.8	Leeds (2LS)	36.5
288.2	Edinburgh (2EH)	38
294.1	Swansea (5SX)	39
294.1	Stoke (6ST)	39
294.1	Dundee (2DE)	39
294.1	Hull (6KH)	39
297	Liverpool (6LV)	40
306.1	Belfast (2BE)	42
312.5	Newcastle (5NO)	43
319.1	Dublin (2RN)	45
326.1	Bournemouth (6BM)	47
353	Cardiff (5WA)	53
361.4	London (2LO)	56
384.6	Manchester (2ZY)	61
400	Plymouth (5PY)	65.25
401	Cork (6CK)	65.75
405.4	Glasgow (5SC)	67
491.8	Daventry (5GB)	89
500	Aberdeen (2BD)	91
	CONTINENTAL SHORT-WAVES.	
250	Münster	29.5
303.6	Königsberg	41.5
323.2	Breslau	46
340.9	Huizen	50
396.3	Hamburg	64
429	Frankfurt-on-Main	73
471.6	Langenberg	84
508.5	Brussels	92.5
517.2	Vienna	95
535.7	Munich	99.5