

WIRELESS APPARATUS

*For Transmission
and Reception*



A guide to the acquisition of Wireless
Equipment for Every Purpose.

H·W·SULLIVAN

WINCHESTER HOUSE. LONDON. E.C.2

Telephones: Avenue 4871. London Wall 3518.

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ERRATA.

PAGE	22	...	List	No.	122	...	Should read	£1 15 0
"	22	...	"	"	54	...	" "	£1 7 0
"	32	...	"	"	208	...	" "	£17 10 0
"	32	...	"	"	209	...	" "	£13 10 0
"	45	...	"	"	46	...	" "	£22 5 0
"	56	...	"	"	256	...	" "	5 0

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Sullivan Instruments

WIRELESS APPARATUS

(For Reception and Transmission)

List W3

January, 1922

Manufactured by

H. W. SULLIVAN,
WINCHESTER HOUSE, LONDON, E.C.2,

Telephone - London Wall 3518.

Works :

LIVERPOOL HOUSE, MIDDLESEX STREET, LONDON, E.1.

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PRICE 1/-

THE
PRICES IN THIS
CATALOGUE
CANCEL THOSE
IN PREVIOUS
LISTS



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Introduction

THE rapid development and evolutionary character of Wireless Telegraphy and Telephony render the use of an up-to-date catalogue a matter of great importance to experimenters and others interested in Wireless Science. The present catalogue, W3, is the third I have issued since the War, the first and second editions being dated January and October, 1920, respectively.

This last edition has undergone considerable revision. A number of the instruments in the previous catalogue having become obsolete, have been replaced by others representative of the latest developments in Wireless Science, whilst the present issue also includes a selection of complete Telephony transmission sets from 10 up to 250 watts, in addition to the separate components. To the Wireless experimenter, however, the most welcome change will be found in the great reduction in prices of the various instruments, only rendered possible by the wide difference in costs now ruling as compared with those of twelve months ago. A contributory factor in the reduction of prices is the application of mass production to all instruments for which there is a reasonably large demand. The attention of experimenters is specially directed to the Heterodyne Wavemeter which should be included in the equipment of every receiving station where good selectivity is desired. The increase of Wireless Telephony and the daily transmission of the latter from Paris, will considerably increase the popularity of Wireless as a scientific hobby. It will therefore be necessary for experimenters in the near future to use circuits of much greater selectivity to avoid jamming, and for this purpose a Wavemeter will be essential, particularly as it can be used as a separate Heterodyne, thereby avoiding interference with other listening stations.

The price of the **Wavemeter** having a range of 150 to 4,000 metres brings this instrument within the means of the majority of experimenters, and this range of wave-lengths covers the principal telephony stations and many of the most important spark stations in Europe. All my instruments are fully guaranteed. They are made throughout at my works in the City, from entirely new materials, no "disposals" fittings or oddments of any kind being used in their construction.

The Inductances shown in the list are generally wound with Litzendraht wire in order to reduce the high frequency losses to a minimum. The finish and quality of my instruments are well known and recognised by those interested in Wireless Science, and their efficiency is the highest obtainable, being the result of over twenty years' experience in Wireless design and manufacture. I still recommend experimenters to build their own sets from components selected from the list, using my Book of Diagrams as a guide. This is less

expensive and also much more satisfactory than purchasing a completely-wired Receiver, as it enables one to thoroughly understand the circuit, and at the same time ensures a greater interest in the work.

The results obtained with any type of Wireless Receiver depend largely on the pattern and quality of the aerial employed, and circuits and components should be selected which have been found by trial to give the best results on one's own particular aerial. The unit system of purchasing components ensures this being effected in the most satisfactory manner as loss of efficiency can be more readily traced in the circuit where each instrument forms a separate unit.

I am prepared at all times to assist experimenters in selecting the most suitable apparatus. Any technical information given is sound and reliable, as my wide experience places me in a position to understand and advise on most Wireless problems, and to suggest a remedy where difficulties occur. In this connection I would however point out that I am desirous of discouraging correspondence which has no relation to the instruments specified in the catalogue, as much loss of time is involved in answering letters upon extraneous matters.

WHEN ORDERING. customers are advised to quote the name of the article in addition to its list number. The prices in all cases are net. All orders except from the trade must be accompanied by a remittance unless customers have an account with me. Carriage is free within the United Kingdom on all orders over twenty shillings.

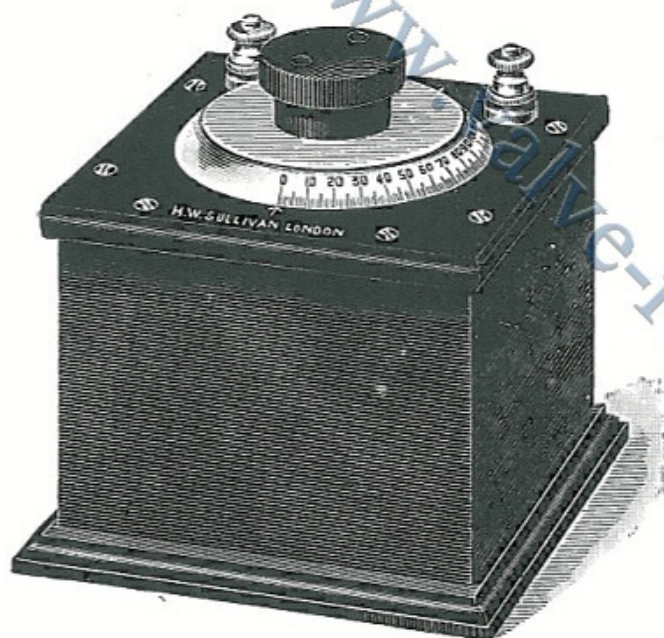
It is not now necessary to obtain a permit for the purchase of Wireless apparatus, and when applying to the Secretary of the G.P.O. for a license to receive or transmit, any desired circuit can be selected from my Book of Diagrams, a special arrangement allowing of this having been made with the G.P.O. The distinguishing number of the diagram should be stated in the letter accompanying any application for a license.

January, 1922.

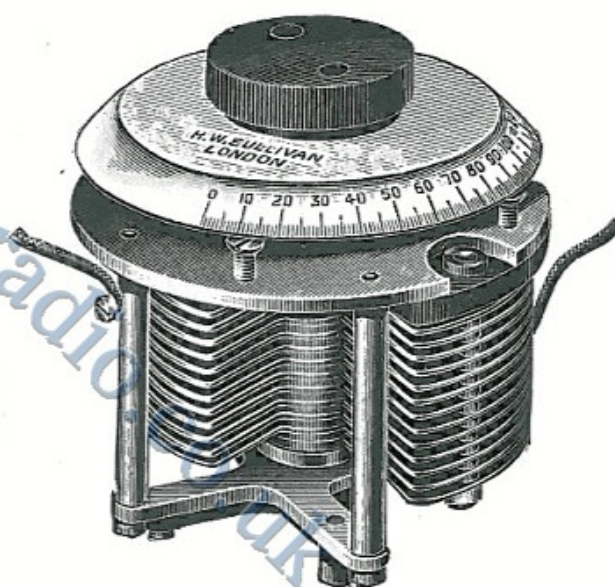
RECEIVING SECTION

Precision Air Condensers

Continuously Variable.



No. 31



No. 34

This instrument has been specially designed to meet the present demand for a thoroughly reliable and inexpensive Condenser suitable for Wireless Receivers and Amplifiers. The working parts are made of aluminium, the spacing washers being gauged to $\frac{1}{2000}$ th part of an inch. The scale is movable and engraved on the bevel in 180 uniform degrees, the graduations and lettering being filled in white. It can be calibrated and engraved in micro-microfarads at an extra charge of 10s. The plates are supported on a metal frame and fitted with a bottom bearing. This Condenser is so designed that it can be fitted to any panel by means of four securing screws, the scale and handle being easily removable. When required for this purpose it is supplied without case and ebonite top board, but the

Precision Air Condensers.

scale, handle, securing screws, and terminals are included. To fit into any customer's own receiver, it is only necessary to bore a hole to allow the spindle to pass through the case, and four clearing holes for securing the brass base plate (as illustration No. 34).

List No.	31	Universal Air Condenser, continuously variable, .0011 Mfd. (1,000 cm., 1 jar, 1.100 M.mfds.), minimum capacity, 35 Mmfds., fitted in Polished Teak Case	PRICE, each	£2 18 0
"	32	Ditto. .00055 Mfd.	2 12 0	
"	33	Ditto. .0011 Mfd., without case or ebonite top for fitting to own receiver	2 12 0	
"	34	Ditto. .00055 Mfd.	2 6 0	

DIMENSIONS AND WEIGHTS :

No. 31	5½ in. × 5½ in. × 6 in. high.	3 lb.
" 32	5½ in. × 5½ in. × 4¾ in. high.	2¾ lb.
" 33	3½ in. diam. × 5½ in. high.	2 lb.
" 34	3½ in. diam. × 4 in. high.	1¾ lb.

Three-Range Variable Air Condenser

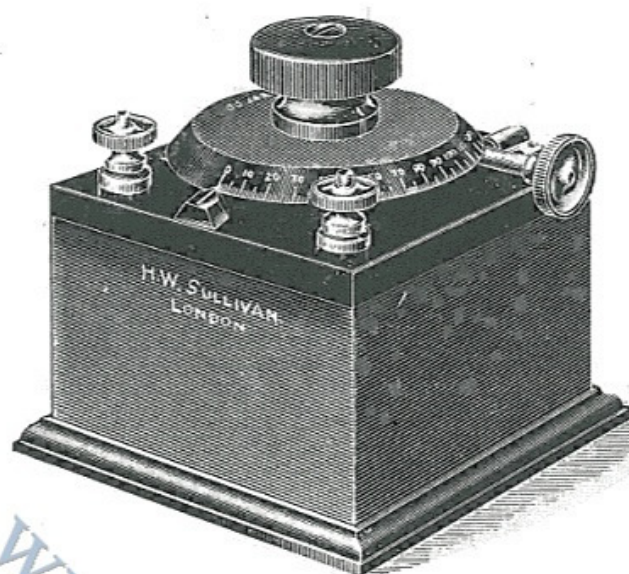
This Condenser has been designed to embody three different ranges of capacity, each variable by the same movement, one scale only being used.

It is especially suitable for a tuning condenser in a wireless receiving circuit in which the first half of the wave-length scale is considerably closed up, and where greater reception efficiency is obtained by using the lowest possible value of capacity for potential-operated detectors such as crystals and valves. By the operation of a switch the first (closed) half of the scale can be opened out to occupy the full 180°, and for the third range the closed half of the second range scale is again opened out to occupy the full 180°.

It will be seen, therefore, that there are actually three Condensers in one instrument, each being continuously variable throughout. Another feature is the low minimum capacity obtained on the lowest ranges, the actual range being from 13 to 1,000 micro-microfarads, giving a maximum to minimum capacity ratio of at least 70 to 1.

List No.	172A	Condenser with Switch for changing maximum value from 1,000 Mmfds. to 500 Mmfds. or to 250 Mmfds.	PRICE, each	£5 10 0
"	172	Condenser as 172A above, but without Switch, the values being changed by connecting one lead to a different terminal	4 10 0	
DIMENSIONS: 5½ in. × 5½ in. × 6 in. high. WEIGHT: 3 lb.				

Variable Air Condenser.

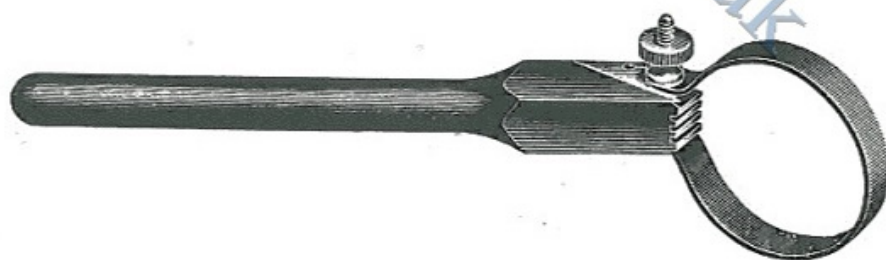


No. 35

Air Condenser, 1,100 micro-microfarads capacity, fitted with Edridge's patent micrometer adjustment. The fine adjustment is automatically rendered inoperative when the large central handle is used for rapid adjustment. The regulation of capacity in this instrument can be adjusted to extremely fine limits.

						PRICE, each
List No. 36	1,100 Mmfs.	...	...	...	...	£7 10 0

Extension Handle for Variable Condenser.



An extension handle which can be attached to the ordinary handle of a variable condenser.

It is extremely useful for very fine tuning and in preventing alteration in capacity due to the proximity of the hand in operation.

The handle can be supplied to suit condensers List Nos. 31, 32, 33, 34, 172, and 172A.

						PRICE each
List No. 320.	...	...	...	...	...	£0 5 0

Small Variable Self Heterodyne Condenser

(AIR DIELECTRIC).



No. 117

These are continuously variable, and have been specially designed to give a very small minimum capacity. They are fitted with a pointer and scale, and mounted in a teak case.

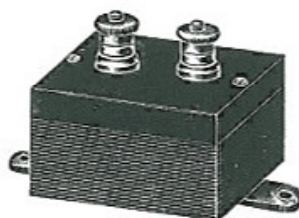
List No. 117 Continuously Variable Air Condenser, 5 to 100 Mmfd. capacity (.000005 to .0001 Mfd.) **PRICE, each**
£1 15 0

Calibrated in micro-microfarads at an extra cost of 10s.

With this Condenser 0.5 Mmfd. can be easily read on the scale; the instrument is therefore a valuable piece of scientific apparatus for research purposes. The present instrument is the first of its kind ever produced in a commercial form.

DIMENSIONS: $3\frac{1}{2}$ in. \times $3\frac{1}{2}$ in. \times $2\frac{1}{4}$ in. WEIGHT: 12 oz.

Mica Condensers



No. 40

Small fixed Mica Condensers mounted in boxes with ebonite top board and terminals, suitable for Blocking Condensers, inter-valve capacities in Multiple-Valve Amplifiers (resistance type), or rectifying grid condensers.

This pattern is also suitable for providing alternative low impedance paths for radio-frequency currents across inductive circuits.

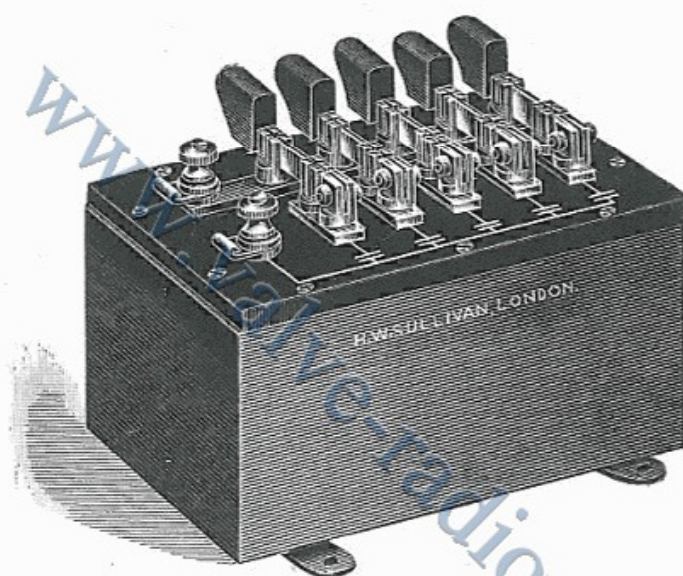
Mica Condensers

DIMENSIONS: $2\frac{1}{2}$ in. \times $1\frac{1}{2}$ in. \times $1\frac{1}{2}$ in. high. WEIGHT: $1\frac{1}{2}$ oz.

			PRICE, each		
List No. 40	Capacities, .000025 Mfd. up to 0.02 Mfd.	...	£0	7	0
„ „ 41	Capacities, 0.02 Mfd. up to 0.05 Mfd.	...	0	12	0

Adjustable Mica Condenser

Adjustable in steps of .0005 mfd.



No. 42

This instrument consists of a number of fixed condensers which may be readily connected in various ways by means of five well-designed and carefully made knife switches. In all 31 different values and capacities can be obtained from a minimum of .0005 mfd. to 0.0155 mfd.

The Condenser units are constructed from the finest selected Ruby Mica sheets and are absolutely constant in value, have an extremely low power factor, and perfect insulation.

THIS CONDENSER IS SUITABLE FOR INCREASING THE RANGE OF A VARIABLE AIR CONDENSER IN A RECEIVING CIRCUIT WITH WHICH IT MAY BE PERMANENTLY CONNECTED IN PARALLEL.

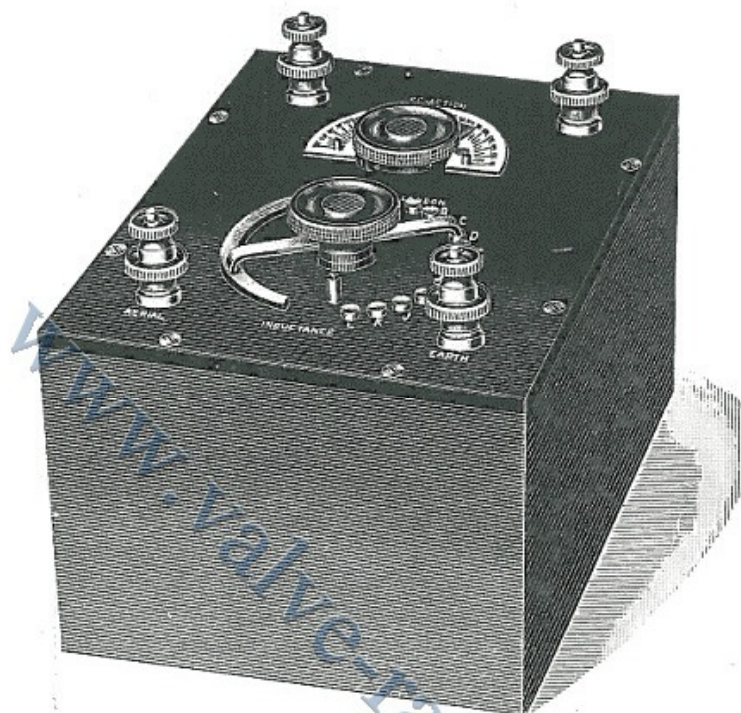
			PRICE, each		
List No. 42	Max. capacity 0.0155 Mfd.	...	£4	10	0

DIMENSIONS: $6\frac{1}{2}$ in. \times $5\frac{1}{2}$ in. \times $4\frac{3}{4}$ in. high. WEIGHT: $2\frac{3}{4}$ lb.

Other selected values can be supplied if desired. Prices on application.

INDUCTANCES

Single Layer Tuning Inductances with Reaction



No. 103a, 103c or 103d

NOTE.—When ordering, customers should state the number of valves from which reaction is to be taken and whether the reaction inductance is to be included in an anode tuned circuit.

This inductance is specially suitable for single-circuit tuning for small sets, as, for instance, those shown by Diagrams Nos. 4, 8, 9, 10, 11, 12, and 13, when used with a G.P.O. Aerial.

The Switch numbered separately as 71 in my diagrams is included in the instrument. The Inductance is wound with double silk-covered wire of the finest quality, and is arranged as a single layer helix with 12 tappings taken at suitable points to a well-made laminated switch.

A highly efficient rotary magnetic reaction coil is fitted in such a position as to give sufficient strength and variation of mutual inductance with the tuning coil over the entire range.

		PRICE, each
List No. 103A	Inductance range 100 to 12,500 microhenries, wave-length range with a 0.0011 mfd. variable condenser, up to 7,000 metres ...	£5 5 0
„ „ 103D	Ditto, but for wave-lengths 3,000 to 20,000 metres with two special Reaction Coils Litzendraht Wire	6 6 0

DIMENSIONS (103A): 10 in. × 6½ in. × 8 in.

DIMENSIONS (103D): 10 in. × 6½ in. × 8 in.

Single Layer Tuning Inductance with Reaction

Specially suitable for reception of Hague Concerts and similar telephonic transmissions.

This is of similar general design to the 103A Tuner, but is much more efficient on the shorter wave-lengths and more especially on the 800-1,200 metres range much used for Telephony and Musical Transmissions.

The Tuning inductance is wound with Litzendraht wire and is of extremely low H.F. Resistance, the losses being reduced to a minimum. Tuning can be accomplished up to 4,000 metres with a parallel capacity.

The magnetic reaction has in this instrument been rendered less critical in adjustment for this somewhat smaller range of speech wave-lengths.

List No. 103c PRICE, each
£4 4 0

Banked Coil Loading Inductance



No. 104

Banked Coil Loading Inductance

This Inductance may be substituted for the single-layer type, and consists of bank-wound coil sections, well spaced and layered to avoid excessive self-capacity. The coils are wound with finely-stranded Litzendraht wire, enamelled and double-silk covered, to reduce as much as possible the high-frequency resistance. A well-made 10-stud tapping switch (No. 71) is included in the instrument, which may be substituted for No. 69 in the diagrams.

List No. 104 Inductance with Switch mounted in teak case
as illustrated, maximum inductance 43,000 microhenries, minimum inductance 500 microhenries
PRICE, each
£6 6 0

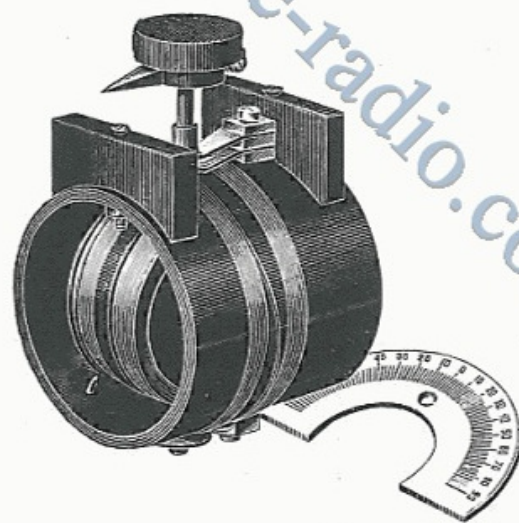
DIMENSIONS: 8 in. × 5 in. × 6 $\frac{3}{4}$ in. WEIGHT: 4 lb. 6 oz.

Rotary Magnetic Reaction Coupling Coils

FOR REGENERATIVE CIRCUIT.

Suitable for C. W. Heterodyne Work.

These are supplied ready for mounting on any receiver, and are assembled with great mechanical accuracy. Securing screws and white engraved scales are included.



No. 67

DIMENSIONS :
2 $\frac{1}{2}$ in. diam. ×
2 $\frac{1}{2}$ in. long
× 4 $\frac{1}{4}$ in. high.
WEIGHT : 4 $\frac{1}{2}$ oz.

NOTE.—When ordering, customers should state the number of valves from which reaction is to be taken and whether the reaction inductance is to be included in an anode tuned circuit.

List No. 67	Wound	...	...	...	...	...	...	PRICE, each	£2 2 0
„ „ 68	Unwound	...	...	...	...	...	...		1 18 0

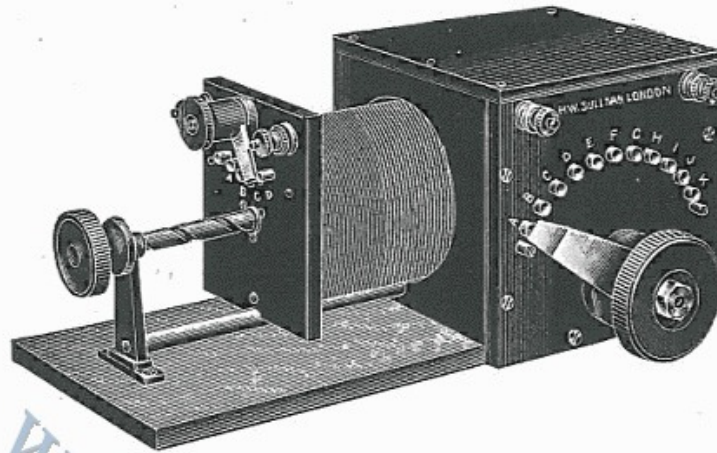
These Reaction Coils are also supplied mounted in teak boxes with ebonite tops and provided with external terminals.

List No. 140	Reaction Coil in Box (wound)	...	...	...	...	...	PRICE, each	£2 10 0
„ „ 141	„ „ „ (unwound)	...	...	...	...	...		2 5 0

DIMENSIONS: 3 $\frac{1}{2}$ in. × 3 $\frac{1}{2}$ in. × 3 $\frac{1}{4}$ in. WEIGHT: 15 oz.

Oscillation Transformers

(Variable Coupling)

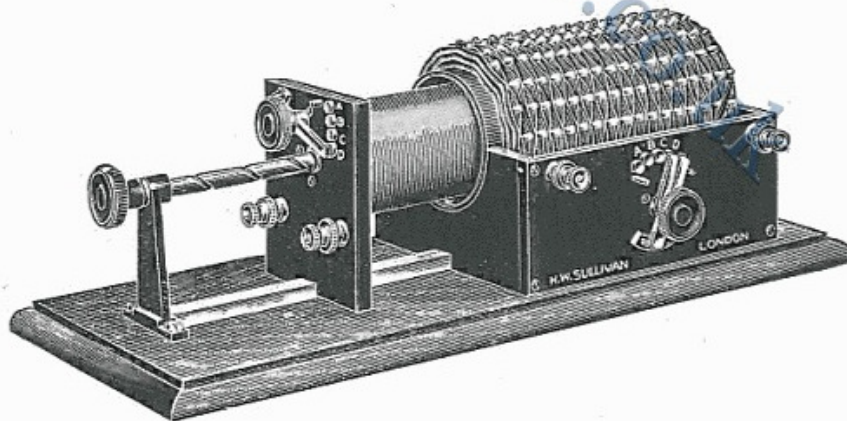


No. 206

A new type of variable coupling Oscillation Transformer has just been developed, giving a high degree of efficiency and convenient adjustment.

Three models have been produced with inductance values arranged so as to cover the widest range of wave-length in use at the present time.

Models A and B have single layer coils for both primary and secondary windings, the self capacities and high frequency resistance being therefore low.



No. 207

Model C has a single layer primary and a secondary inductance specially wound with heavy Litzendraht wire to give a series of single layer pancake coils, well spaced to decrease the self-capacity and H.F. Resistance. This secondary winding is by far the most efficient possible for an inductance value of this order.

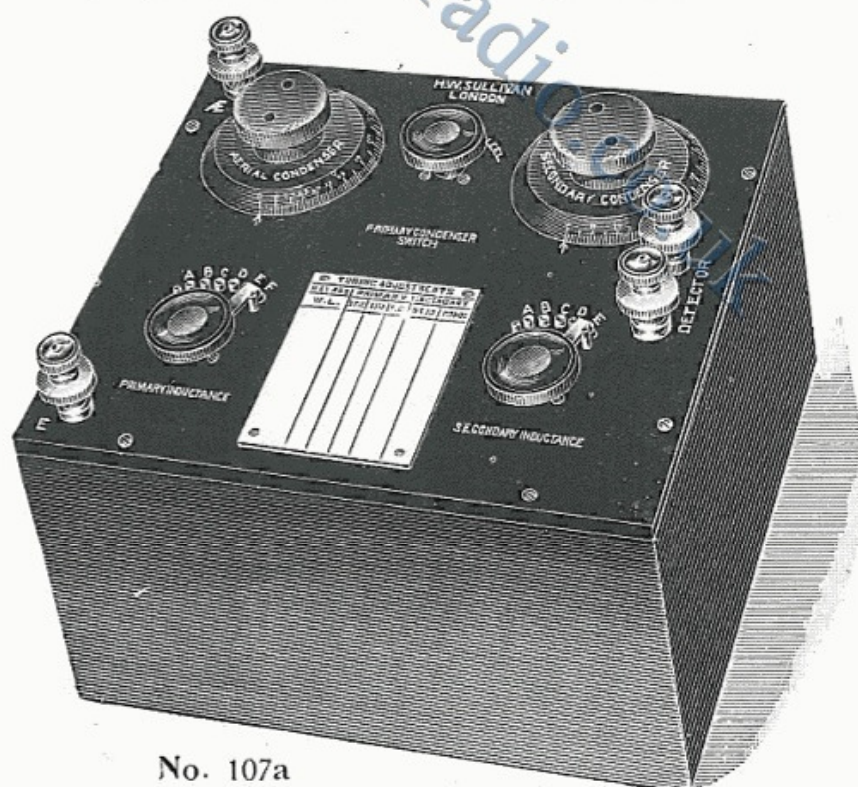
The sliding of the primary into and from the secondary is an easily-controlled movement making fine adjustment of coupling a simple and rapid operation.

Oscillation Transformers

		PRICE, each
MODEL A. List No. 205	Primary inductance from 7 to 100 microhenries Secondary " " 4 to 150 With Variable Condenser of .0011 mfd. maximum capacity a wave-length range of 100 to 700 metres is easily obtained ... DIMENSIONS OF BASE: 9 in. \times 4 in.	£7 10 0
MODEL B. List No. 206	Primary inductance from 35 to 1,500 microhenries Secondary inductance from 40 to 4,100 microhenries With a Variable Condenser of .0011 mfd. maximum capacity a wave-length range of 600 to 4,000 metres is obtained ... DIMENSIONS OF BASE: 13 $\frac{1}{4}$ in. \times 5 $\frac{7}{8}$ in.	8 10 0
MODEL C. List No. 207	Primary inductance from 200 to 2,000 microhenries Secondary inductance from 5,000 to 100,000 microhenries With a Variable condenser of .0012 mfd. maximum capacity a wave-length range of 1,000 to 20,000 metres is obtained ... DIMENSIONS OF BASE: 23 $\frac{1}{4}$ in. \times 9 $\frac{3}{4}$ in.	12 0 0

Complete Loose Coupled Tuning Circuits

(For Multi-Valve Amplifiers.)



No. 107a

This consists of primary and secondary tuned circuits, to which aerial and earth leads are brought direct on one side, and from which the leads to the detecting circuits are taken on the other side. It comprises Litzendraht wire bank-wound primary and secondary in-

Complete Loose Coupled Tuning Circuits

ductances of low high-frequency resistance and self capacity, loosely coupled together to form an oscillation transformer giving great selectivity. Both primary and secondary inductances are tapped by independent switches and are tuned by two variable air condensers of 0.0011 mfd. capacity. A series-parallel switch is provided to connect the primary or aerial condenser, either in parallel with the primary of the transformer for the longer wave-lengths, or in series with it for the shorter wave-lengths. The whole set is mounted in a teak case with ebonite top, and electrically is as shown by the tuning portion of Diagram No. 18. A white writing tablet is provided for noting the various adjustments corresponding to certain wave-lengths or stations.

List No. 107A	Complete loose coupled Tuner as above, suitable for wave-lengths up to 7,000 metres, with ample overlap between the inductance tappings	PRICE, each
		£14 14 0
List No. 107B	As above, but for a wider range of wave-lengths (up to 20,000 metres) obtained by extra inductances, and fixed condensers which are automatically connected in parallel with the variable condensers upon their maximum value being reached	16 16 0
DIMENSIONS AND WEIGHTS: 107A 11 in. × 10 in. × 8 in. 11 lb.		
" " " 107B 13 in. × 12 in. × 8 in. 18 lb.		

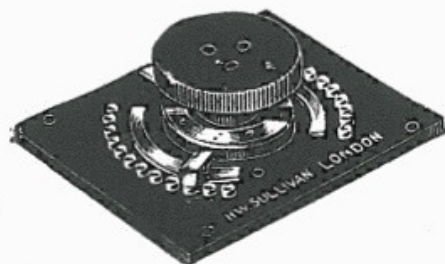
Loose Coupled Oscillation Transformers

These consist of bank-wound coil sections of Litzendraht wire, as described under the heading of Banked Coil Tuning Inductances, grouped to form primary and secondary inductances with moderately loose coupling between them. The degree of coupling will be found sufficiently loose to give good selectivity.

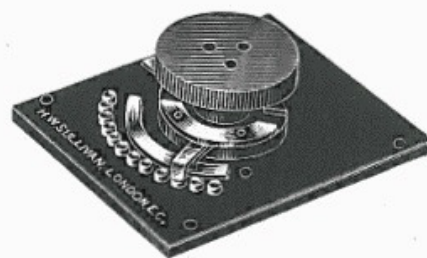
They are exactly similar to the previously-described Loose Coupled Tuners 107A and 107B, but with the variable condensers and series parallel switch omitted.

List No. 105A	Oscillation transformer, suitable for wave-length ranges up to 7,000 metres, using variable condensers of .0011 mfd. capacity	PRICE, each
		£6 10 0
" " 105B	Oscillation transformer as above, but for wider range of wave-length up to 20,000 metres	8 10 0
DIMENSIONS AND WEIGHTS: 105A 11 in. × 6 in. × 7 in. 7 lb.		
" " " 105B 13½ in. × 6½ in. × 7½ in. 10½ lb.		

Inductance Tapping Switches



No. 70



No. 71

Inductance Tapping Switches

List No. 70 10- or 12-stud Switch with good contact and decided position clicking device. Two sets of studs and two isolated laminated brushes for simultaneous adjustment of both Primary and Secondary Inductance ...

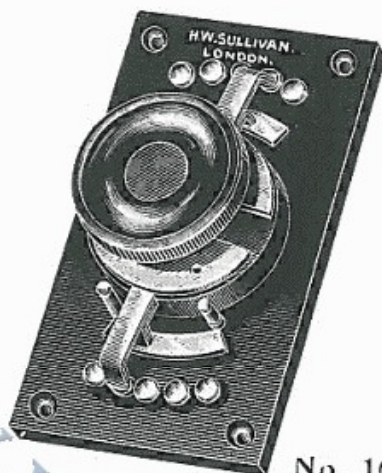
PRICE, each

£0 18 0

„ „ 71 As No. 70, but for tapping one Inductance only

0 16 0

DIMENSIONS: $4\frac{1}{2}$ in. \times $3\frac{3}{4}$ in. \times 2 in. high. WEIGHT: 9 oz.



No. 163

List No. 163 As No. 70, but only five studs at each side. Two switch blades isolated ...

PRICE, each

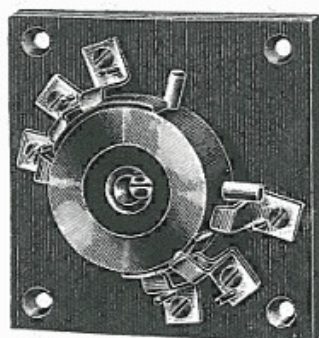
£0 15 0

„ „ 164 As No. 71, but only five studs ...

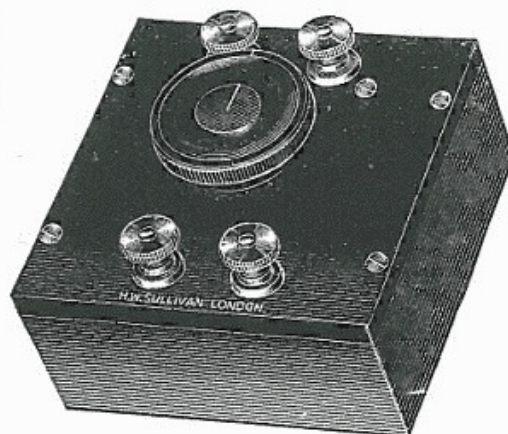
0 12 0

DIMENSIONS: 4 in. \times $2\frac{1}{2}$ in. \times 2 in. WEIGHT: 6 oz.

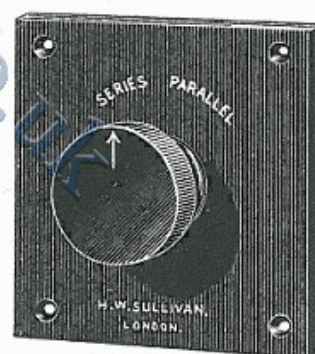
Series-Parallel Switches



No. 98



No. 99



A two-position Rotary Switch for changing the position of the tuning condenser in the aerial circuit. The method of connecting is given in Plate No. 1 of the diagram book, an inspection of which will

Series-Parallel Switches

show that for one switch position the condenser is in parallel with the inductance, while for the other position it is connected in series, this latter position being essential for the shorter wave-lengths.

List No. 98	Series-Parallel Switch mounted on ebonite plate ready for mounting on customer's own receiver	PRICE, each
		£0 15 0
	DIMENSIONS: $3\frac{1}{2}$ in. \times $3\frac{1}{2}$ in. \times $1\frac{7}{8}$ in. WEIGHT: $8\frac{1}{2}$ oz.	
" 99	Series-Parallel Switch mounted in teak case and provided with four terminals for external connections	1 0 0
	DIMENSIONS: $3\frac{1}{2}$ in. \times $3\frac{1}{2}$ in. \times $2\frac{1}{2}$ in. WEIGHT: 11 oz.	

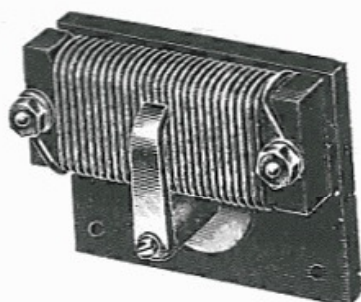
External Connections to Series Parallel Switch

Terminal A is connected to one side of condenser and to aerial.
 " C " " " the other side of condenser.
 " E " " " the earthed end of the tuning inductance.
 " I " " " the other end of the tuning inductance.

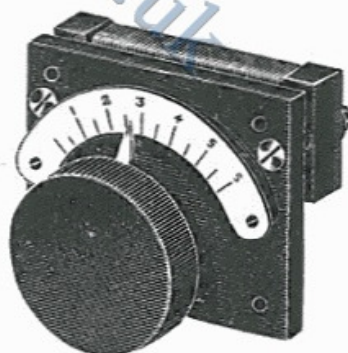
Rotary Type Rheostats

For Valve Filament Current Regulation.

Mounted in wood case, with engraved celluloid scale, and pointer. The resistance is continuously variable, and the "OFF" position acts as a switch.



No. 59



No. 62

					PRICE, each
[List No. 55	0.5 ohm to carry 6 amps. for 6 to 8 valves	...			£1 5 0
" 89	1 " " 4 " " 4 or 5 "	...			1 5 0
" 56	2 ohms " 2.5 " " 2 or 3 "	...			1 5 0
" 57	6 " " 1 amp. " 1 valve	...			1 5 0
	DIMENSIONS: $3\frac{3}{4}$ in. \times 3 in. \times $2\frac{1}{2}$ in. high. WEIGHT: $10\frac{1}{2}$ oz.				

Potentiometer

For Grid Potential Regulation.

Same type as Rheostat.

							PRICE, each
List No.	58	200 ohms	...	...	...	...	£1 7 0

Rheostat and Potentiometer*As on previous page, but without case.*

Suitable for mounting on customer's own receiver or amplifier.
 Provided with handle, pointer, scale, and insulated mounting.

							PRICE, each
List No.	59	Rheostat 0.5 ohm	...	...	...	...	£0 18 0
"	90	" 1 "	...	...	...	...	0 18 0
"	60	" 2 ohms	...	...	...	...	0 18 0
"	61	" 6 "	...	...	...	...	0 18 0
"	62	Potentiometer 200 ohms	...	...	...	...	1 0 0

DIMENSIONS: 3½ in. × 3 in. × 2 in. high. WEIGHT: 8 oz.

Grid Leak Resistances

(Mullard's Patent.)

							PRICE, each
List No.	63A	Resistance 0.5 megohm	...	...	...	...	£0 7 6
"	63B	" 1 "	...	...	...	...	0 7 6
"	63C	" 2 megohms	...	...	...	...	0 7 6
"	63D	" 3 "	...	...	...	...	0 7 6
"	63E	" 4 "	...	...	...	...	0 7 6
"	63F	" 5 "	...	...	...	...	0 7 6
"	65	Spring Clips for above—per pair	...	...	...	...	0 1 3

DIMENSIONS OF RESISTANCES: 4 in. long × ⅝ in. diam.

If desired, a combined grid leak and condenser can be supplied. Price 16s.

Anode Resistances

(Mullard's Patent.)

For resistance-capacity coupling for cascade amplification.

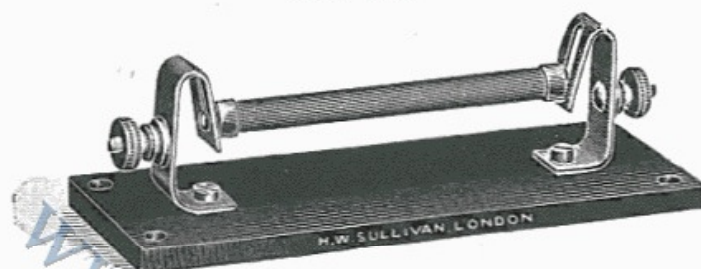
							PRICE, each
List No.	64A	Resistance 50,000 ohms	...	...	...	...	£0 9 0
"	64B	" 60,000 "	...	...	...	...	0 9 0
"	64C	" 70,000 "	...	...	...	...	0 9 0
"	64D	" 80,000 "	...	...	...	...	0 9 0
"	64E	" 100,000 "	...	...	...	...	0 9 0
"	65	Spring Clips for above—per pair	...	...	...	...	0 1 3

DIMENSIONS OF RESISTANCES: 5 in. long × ⅝ in. diam.

Grid Leak and Anode Resistances Mounted



No. 132



No. 181

These are mounted in the most convenient sets, on ebonite panels, ready for fitting on any board, and are provided with terminals.

		PRICE, each		
List No.	181	One Grid Leak suitable for Diagrams 2, 3, 4, 5, 6, 12, 16 and 17	£0 12 0	
" "	131	Two Grid Leaks suitable for Diagram 15	1 1 0	
" "	132	One Grid Leak and one Anode Resistance suitable for Diagram 11	1 2 6	
" "	133	Two Grid Leaks and two Anode Resistances suitable for Diagram 14	2 1 0	
" "	134	Three Grid Leaks and three Anode Resistances suitable for Diagram 20 or a 4-valve Resistance Amplifier	3 5 0	
" "	135	Five Grid Leaks and five Anode Resistances suitable for Diagram 19	5 10 0	

DIMENSIONS AND WEIGHTS :

No.	181	6 in. × 2 in. × 2 in.	3 oz.
"	131	6 in. × 3 in. × 2 in.	6 oz.
"	132	7 in. × 3 in. × 2 in.	7 oz.
"	133	7 in. × 5 in. × 2 in.	13 oz.
"	134	7 in. × 7 in. × 2 in.	1 lb.
"	135	7 in. × 7 in. × 2 in.	1½ lb.

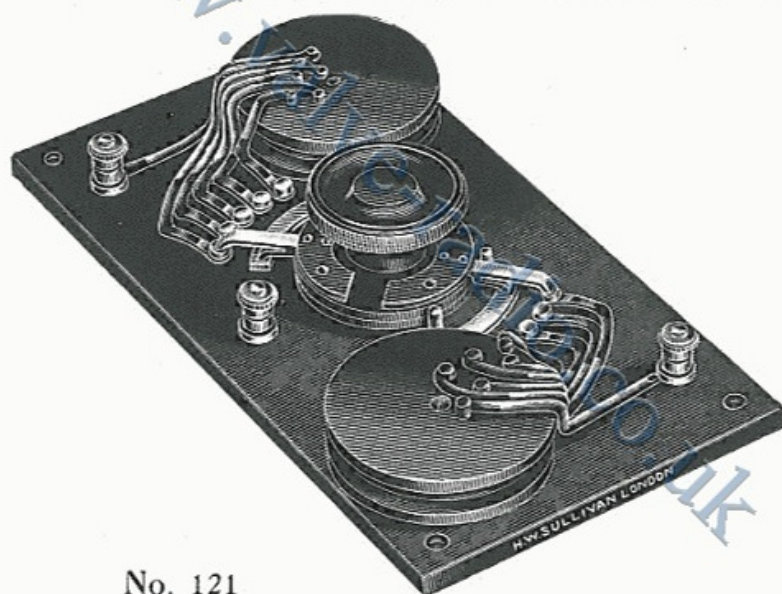
Adjustable Anode Reactance Coils

A Coil of high inductance and low steady current resistance for reactance-capacity coupled radio-frequency amplifiers. It takes the place of the anode series resistance of the resistance-capacity coupled amplifier as shown in my *Book of Diagrams*, plate No. 15. If a reactance of comparatively negligible steady current resistance is used, across which the A.C. potential is varied, no extra anode potential is required to compensate for the loss of energy which takes

Adjustable Anode Reactance Coils

place in a high steady current resistance traversed by the anode current. *This advantage is particularly evident on the short wave-lengths.* The coil is adjustable by tappings in order to keep the reactance value roughly constant for all wave-lengths.

		PRICE, each
List No. 100	Reactance Coil for wave-lengths of from 100 to 5,000 metres with 10 tapping points ...	£0 18 0
	DIMENSIONS: $2\frac{1}{4}$ in. diam. \times $\frac{3}{4}$ in. WEIGHT: $1\frac{1}{2}$ oz.	
" "	113 Tapping Switch for adjustment of a single reactance coil, List No. 100, mounted on ebonite ...	0 12 0
	DIMENSIONS: 4 in. \times $2\frac{1}{2}$ in. \times $1\frac{5}{8}$ in.	
" "	114 Double Tapping Switch for adjusting simultaneously two successive reactance coils in an amplifier, as my Diagram No. 15 ...	0 15 0
	DIMENSIONS: 4 in. \times $2\frac{1}{2}$ in. \times $1\frac{5}{8}$ in.	
" "	120 Reactance Coil No. 100 mounted together with Tapping Switch No. 113 on an ebonite panel, wired and provided with two terminals for external connection ...	1 10 0
	DIMENSIONS: 5 in. \times 4 in. \times $1\frac{1}{2}$ in. WEIGHT: 10 oz.	



No. 121

		PRICE, each
List No. 121	As No. 120, but for two reactances, including Switch No. 114 ...	£2 11 0
	DIMENSIONS: $7\frac{1}{4}$ in. \times 4 in. \times $1\frac{1}{2}$ in. WEIGHT: 13 oz.	

Adjustable Anode Reactance Coils For Wider Wave-length Range.

		PRICE, each
List No. 167	Reactance Coil as List No. 100, but with 12 tappings, giving finer adjustment to wave-lengths from 150 to 25,000 metres	£1 5 0
	DIMENSIONS: $2\frac{1}{4}$ in. diam. \times $\frac{3}{4}$ in. WEIGHT: $1\frac{1}{2}$ oz.	
" "	168 Switch for Reactance No. 167 ...	0 16 0
	DIMENSIONS: 4 in. \times 4 in. \times $1\frac{5}{8}$ in.	
" "	169 Switch for Two Reactances No. 167 ...	0 18 0
	DIMENSIONS: 4 in. \times 4 in. \times $1\frac{5}{8}$ in.	

Adjustable Anode Reactance Coils

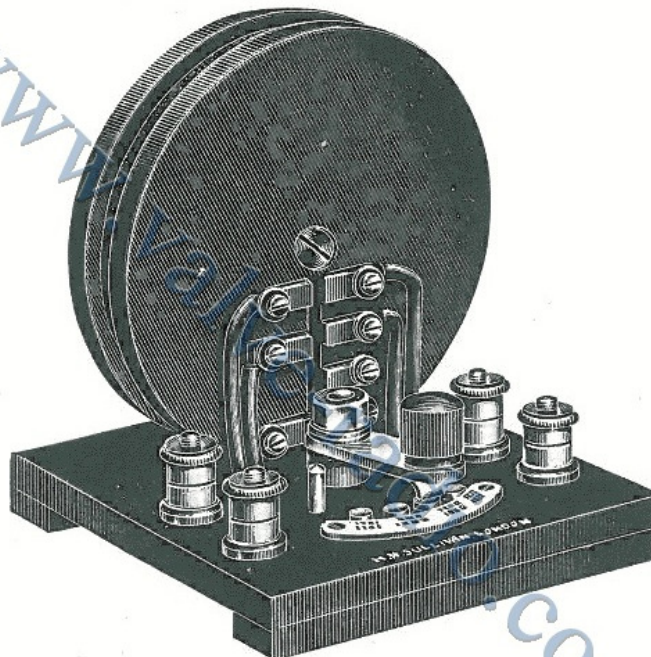
List No. 170 Reactance No. 167 mounted with Switch ... £2 1 0

DIMENSIONS: 5 in. \times 4 in. \times 1½ in. WEIGHT: 12 oz.

„ „ 171 Two Reactances No. 167 mounted with Switch 3 8 0

DIMENSIONS: 7¼ in. \times 4 in. \times 1½ in. WEIGHT: 15 oz.

Improved Radio-Frequency Intervalve Transformer



No. 122

An air core Transformer for use in coupling successive valves of radio-frequency amplifiers.

The primary and secondary are wound together on the former, resulting in a tight coupling, and have therefore the same total number of turns.

The insulation is of the highest order, the wire being enamelled and silk covered.

The secondary winding is continuous, but the primary has four tapping points for varying the approximate wave-length. When more than one transformer is used it is advisable to mechanically couple these switches together in order to eliminate unnecessary adjustments.

The tapping points correspond to the following wave-length ranges:

200 to 400 metres 1,000 to 3,000 metres.

400 to 1,000 metres. 3,000 to 30,000 metres.

This method of coupling has proved itself to be very efficient for single and multi-step amplifiers.

Radio-Frequency Intervalve Transformer

The former for the coils is moulded in solid material, the brass terminal plates for the coil ends and tappings being moulded in the material itself.

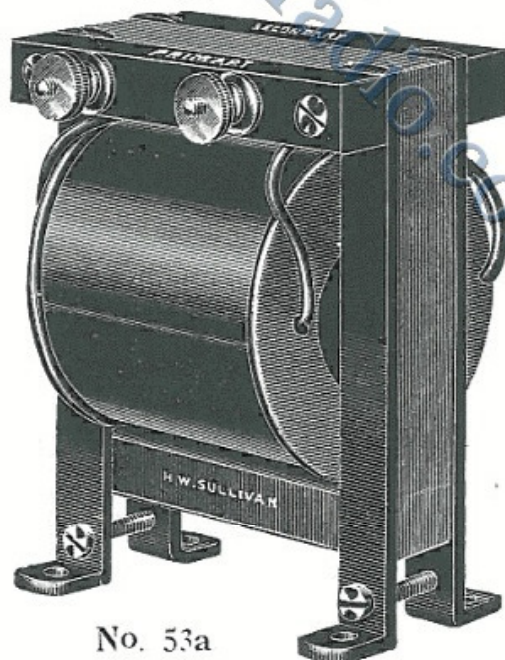
The transformer is supplied mounted, together with a well-finished and efficient tapping switch, on an ebonite base as shown in the illustration. The connections from the transformer to the switch are made, four terminals being provided for external connections.

PRICE, each

List No. 122	Single Transformer mounted with switch, as illustration	£1 7 0
	DIMENSIONS: $3\frac{5}{8}$ in. \times $3\frac{5}{8}$ in. \times $4\frac{1}{8}$ in. high. WEIGHT: 1 lb. 2 oz.	
List No. 54	Transformer as above, but unmounted and without switch. A 2 B.A. brass stud projects $\frac{1}{2}$ in. from back of transformer to enable the latter to be readily secured to any panel or board. A blue print showing method of connecting is supplied	1 15 0
" " 123	Two radio-frequency intervalve Transformers mounted on ebonite base with a double switch for tapping their primaries simultaneously. Seven terminals are provided for external connections	3 15 0

Intervalve Audio-Frequency Transformer

5 to 1 Ratio



No. 53a

THE MOST EFFICIENT TRANSFORMER FOR THE INTERVALVE COUPLING OF NOTE MAGNIFIERS IN EXISTENCE, SPEECH DISTORTION IN TELEPHONY RECEPTION WITH MANY STAGES BEING PRACTICALLY ABSENT.

This Transformer has a closed and magnetic circuit built up of the finest "Stalloy" iron laminations and has been specially designed for ratio of transformation, primary impedance, insulation, self capacity of windings, quality of iron core laminations.

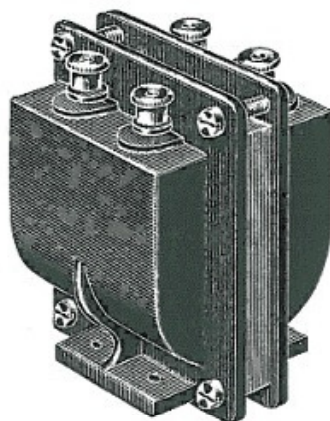
Intervalve Audio-Frequency Transformer

List No. 53A Supplied, mounted on four brass feet ready for screwing down to any amplifier panel or board, and provided with separate ebonite terminal boards for primary and secondary connections

PRICE, each

£1 14 0

DIMENSIONS: $3\frac{1}{2}$ in. \times $2\frac{1}{8}$ in. \times $4\frac{3}{4}$ in. high. WEIGHT: $2\frac{1}{4}$ lb.



No. 53

List No. 53 Intervalve Transformer exactly as List No. 53A, but fitted in cast iron screening case as shown by illustration

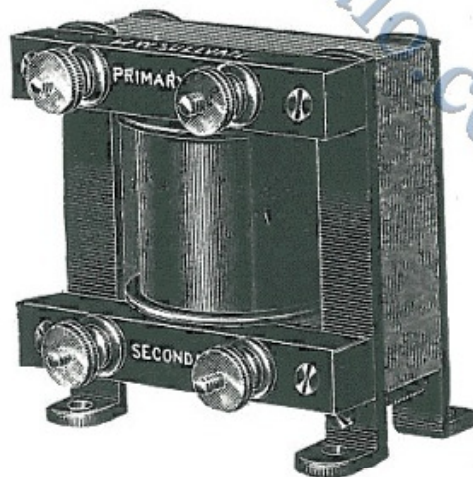
PRICE, each

£2 4 0

DIMENSIONS: $3\frac{1}{2}$ in. \times 3 in. \times $4\frac{1}{2}$ in. high. WEIGHT: 4 lb.

Telephone Transformers

5 to 1 Ratio.



No. 52a

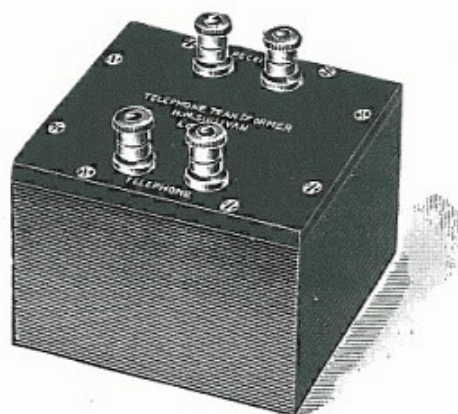
The Transformer has a "Stalloy" laminated closed iron magnetic circuit and is similar in construction to list No. 53A, with the exception of the windings. High insulation is guaranteed.

List No. 52A 5 to 1 Telephone Transformer as illustrated, mounted on four brass feet ready for screwing down to any receiver panel or board. Separate ebonite terminal boards are provided for primary and secondary connections

PRICE, each

£1 1 0

DIMENSIONS: $3\frac{1}{4}$ in. \times $2\frac{1}{4}$ in. \times $3\frac{1}{2}$ in. high. WEIGHT: $1\frac{1}{4}$ lb.



No. 52

Telephone Transformers

List No. 52 5 to 1 Ratio Telephone Transformer exactly similar to List No. 52A, but mounted in wood case with ebonite top and terminals

PRICE, each

£1 5 0

DIMENSIONS : 4 in. \times 3 $\frac{7}{8}$ in. \times 3 $\frac{3}{4}$ in. high.

WEIGHT : 1 lb. 10 oz.

Telephone Transformers

1 to 1 Ratio.

(Recommended for use with High-Resistance Telephones for insulating the H.T. Battery from the operator.)

Exactly as 52A, but wound for use with high-resistance telephones.

PRICE, each

List No. 88A £1 5 0

DIMENSIONS AND WEIGHT as No. 52A.

List No. 88 1 to 1 Ratio Telephone Transformer as List No. 88A, but with case. Similar in construction to List No. 52

1 9 0

Patent Double Head Telephone Receivers



No. 51.—Sullivan Patent High-Resistance Receivers.

Patent Double Head Telephone Receivers

These well-known Receivers have been still further improved and are now made **super-sensitive**. They are wound for any resistance up to 8,000 ohms, fitted with Safety Spark Gaps, and are tested up to 500 volts R.M.S. Their chief advantage is their sensitivity over a wide range of frequencies. Telephones with special diaphragms are selected for speech reception.

The 8,000-ohm winding is equally suitable for Valve or Crystal reception. If used with transformer the 120-ohm receiver is recommended.

								PRICE, each
List No. 47	...	120 ohms	...	...	...	...	...	£1 15 0
" " 48	...	1,500 "	...	...	...	...	...	2 5 0
" " 49	...	2,000 "	...	...	...	...	...	2 5 0
" " 50	...	4,000 "	...	...	...	...	...	2 5 0
" " 51	...	8,000 "	...	...	...	...	...	2 5 0

WEIGHT : 13 oz.

Standard Valve Amplifier Terminal Board



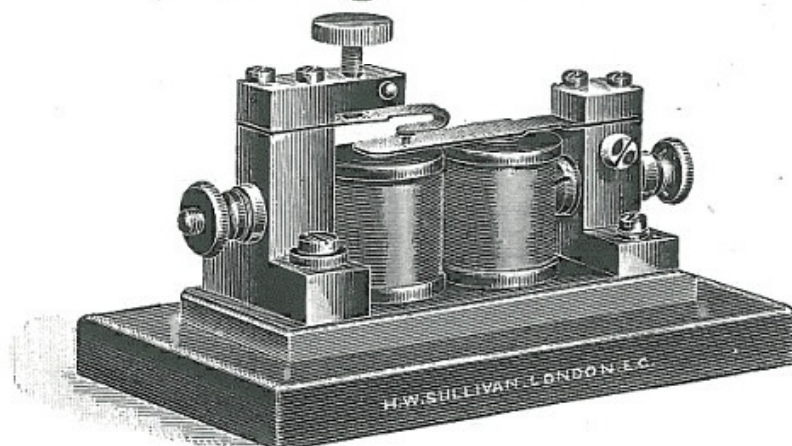
No. 66

This comprises an ebonite base fitted with three pairs of terminals engraved : "Telephones," "Filament Battery 4 Volts + -" and "Anode Battery 50 Volts + -."

								PRICE, each
List No. 66	...	...	...	...	...	...	...	£0 12 0

DIMENSIONS : 7 in. \times 1 $\frac{1}{4}$ in. \times 1 $\frac{1}{8}$ in. high. WEIGHT : 7 oz.

Testing Buzzer



No. 268

Testing Buzzer

A well-designed Buzzer of robust construction. The windings are of high resistance and are shunted by a resistance coil of suitable value.

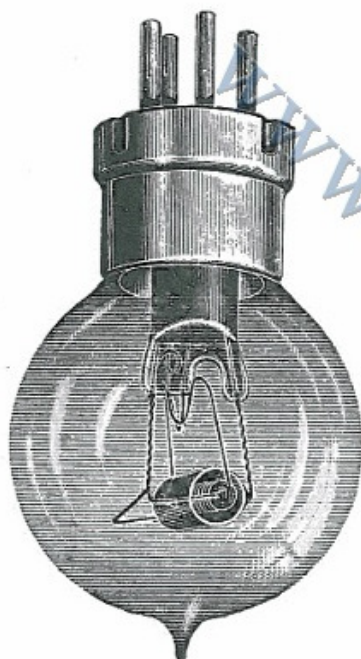
Special attention has been paid to contacts and to the armature reed, the vibrations of the latter being noiseless and of constant frequency.

PRICE, each

List No. 268 Testing Buzzer as illustration £1 10 0

DIMENSIONS: $3\frac{1}{8}$ in. \times $1\frac{3}{4}$ in. \times $2\frac{3}{8}$ in. high. WEIGHT: $\frac{1}{2}$ lb.

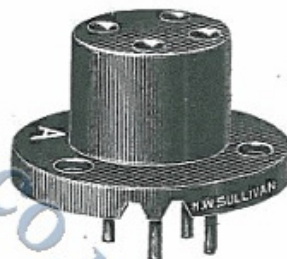
Improved Three-Electrode Thermionic Valves For Reception.



No. 80

*Any type of Valve can
be supplied.*

Prices on application.



No. 81

PRICE, each

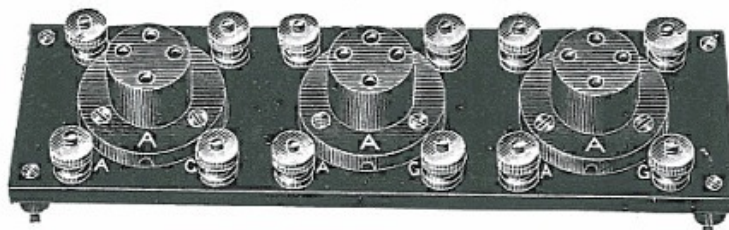
List No. 80 R Type with 4 pin contacts £0 14 0

DIMENSIONS: $2\frac{1}{8}$ in. diam. \times 4 in. high. WEIGHT: $1\frac{1}{2}$ oz.

„ „ 81 Valve Socket, suitable for No. 80 0 2 6

DIMENSIONS: $1\frac{3}{4}$ in. diam. \times $1\frac{1}{2}$ in. high. WEIGHT: $1\frac{1}{4}$ oz.

Valve Sockets mounted on Ebonite Panels (Ready for planting on any board, etc.)



No. 96

Valve Sockets mounted on Ebonite Panel

List No. 94 One Valve Socket No. 81, mounted on ebonite panel and provided with four engraved terminals PRICE, each
£0 7 6

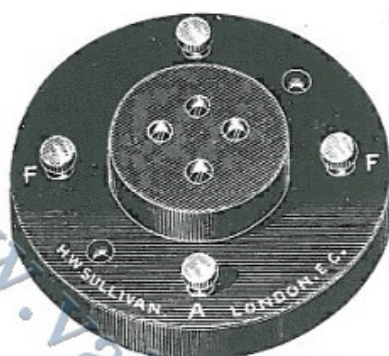
DIMENSIONS: $3\frac{1}{4}$ in. \times $2\frac{1}{2}$ in. \times $1\frac{1}{2}$ in. WEIGHT: $4\frac{1}{2}$ oz.

„ „ 95 Ditto, but for two Valve Sockets of same pattern 0 13 0

DIMENSIONS: 6 in. \times $2\frac{1}{2}$ in. \times $1\frac{1}{2}$ in. WEIGHT: $8\frac{1}{2}$ oz.

„ „ 96 Ditto, but for three Valve Sockets of same pattern 0 19 0

DIMENSIONS: $8\frac{1}{2}$ in. \times $2\frac{1}{2}$ in. \times $1\frac{1}{2}$ in. WEIGHT: 12 oz.



No. 142

List No. 142 High-insulation Circular Ebonite Holder for single valve No. 80, provided with terminals PRICE, each
£0 8 0

DIMENSIONS: $3\frac{1}{4}$ in. diam. \times 1 in. high. WEIGHT: 5 oz.

Primary Cell Anode Battery



No. 211

The merits of various forms of cells for the supply of H.T. Anode current have long been under observation and the battery here described has proved the most satisfactory under prolonged tests.

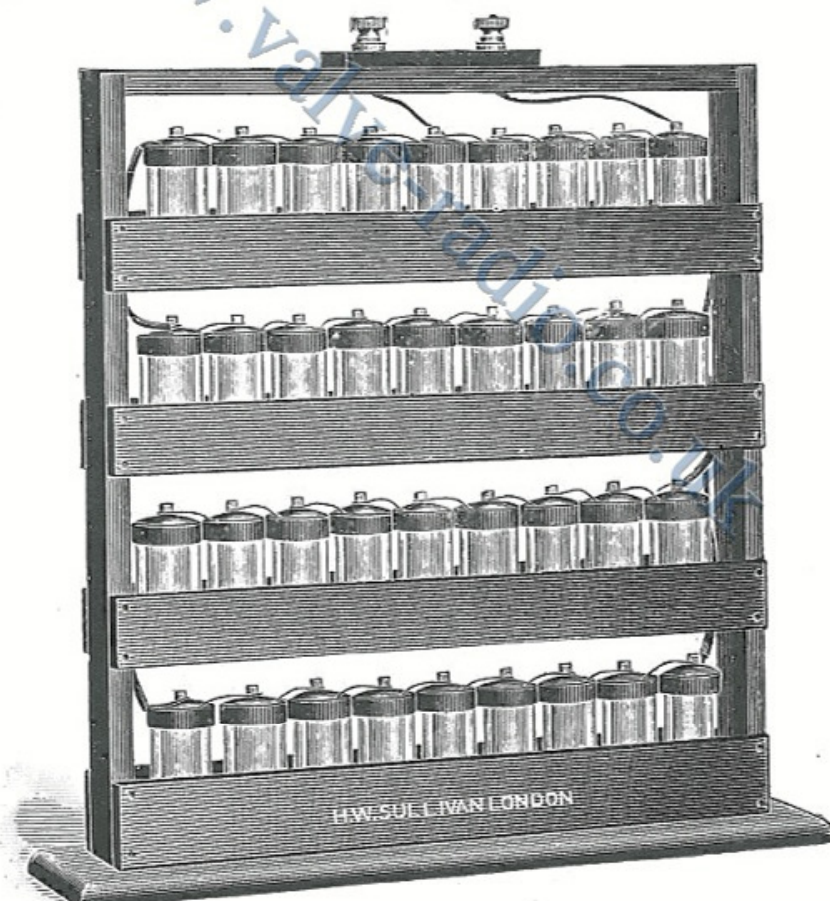
Primary Cell Anode Battery

A number of Sac Leclanche unspillable cells are mounted in a well-made paraffined box to form 50 volt units. Each cell is fitted in a separate highly-insulated compartment, and is supplied with the requisite amount of Sal Ammoniac, the addition of water (preferably distilled) only being necessary.

The advantages of long life (25 times that of a dry battery of similar size) and low internal resistance of a battery of this type will be appreciated by all users of valve receivers.

			PRICE, each
List No. 210	50 volt unit complete in box with 36 cells each 2½ in. high × 1⅜ in. × 1⅜ in.		£2 10 0
DIMENSIONS: 14½ in. × 6⅞ in. × 4½ in. high. WEIGHT: 11½ lb.			
„ „ 211	Larger type as illustration, complete in box with 36 cells, each 5½ in. × 1½ in. × 1½ in.		£4 10 0
DIMENSIONS: 17 in. × 8⅞ in. × 6 in. WEIGHT: 26 lb.			

Primary Cell Anode Batteries Fitted in Racks



No. 267

The above batteries can be supplied in wooden racks as illustrated. As will be seen from the illustration the individual cells are very easily accessible.

			PRICE, each
List No. 267	Rack as illustrated, containing 50 volt battery of cells, each 2½ in. high × 1⅜ in. × 1⅜ in.		£2 7 6

Dry Cell Anode Batteries

These Batteries are mounted in portable case, fitted with terminals and switch. The highest degree of insulation is maintained throughout.



No 84

							PRICE, each
List No. 82	...	50 volts	...	...	...	...	£1 10 0
„ „ 83	...	100 „	...	...	...	...	2 15 0
„ „ 84	...	200 „	...	...	...	...	5 5 0

DIMENSIONS AND WEIGHTS:

No. 82	...	9½ in. × 6¾ in. × 5¼ in.	6 lb.
„ 83	...	11 in. × 8 in. × 5 in.	10 lb.
„ 84	...	11 in. × 8 in. × 8 in.	18½ lb.

List No. 160	100-volt Battery in case, subdivided in steps of 20 volts and fitted with a special selector switch for rapidly obtaining intermediate voltages	3 15 0
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DIMENSIONS: 11 in. × 8 in. × 5 in. WEIGHT: 13 lb.

List No. 118	200-volt Battery, subdivided in steps of 25 volts and fitted with special selector switch for rapidly obtaining intermediate voltages	6 10 0
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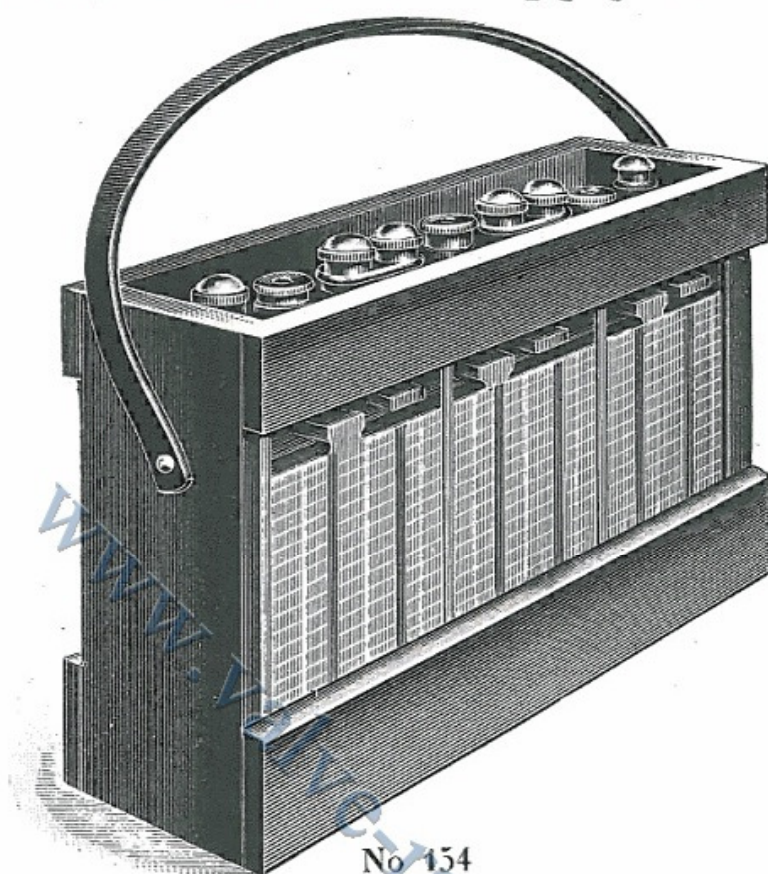
DIMENSIONS: 11 in. × 8 in. × 8½ in. WEIGHT: 21½ lb.

List No. 161	Refill Battery, 50 volts	0 15 0
DIMENSIONS: 8¼ in. × 3⅞ in. × 2⅞ in. WEIGHT: 3¾ lb.						

List No. 162	Refill Battery, 100 volts	...	...	...	...	1 10 0
DIMENSIONS: 10¼ in. × 5¼ in. × 2⅞ in. WEIGHT: 7 lb. 3 oz.						

List No. 173	Refill Battery, 200 volts	...	...	...	...	3 0 0
DIMENSIONS: 10¼ in. × 5¼ in. × 6½ in. WEIGHT: 14¾ lb.						

Accumulators for Filament Current Supply to Valves



No. 154
Four-Volt Accumulators.

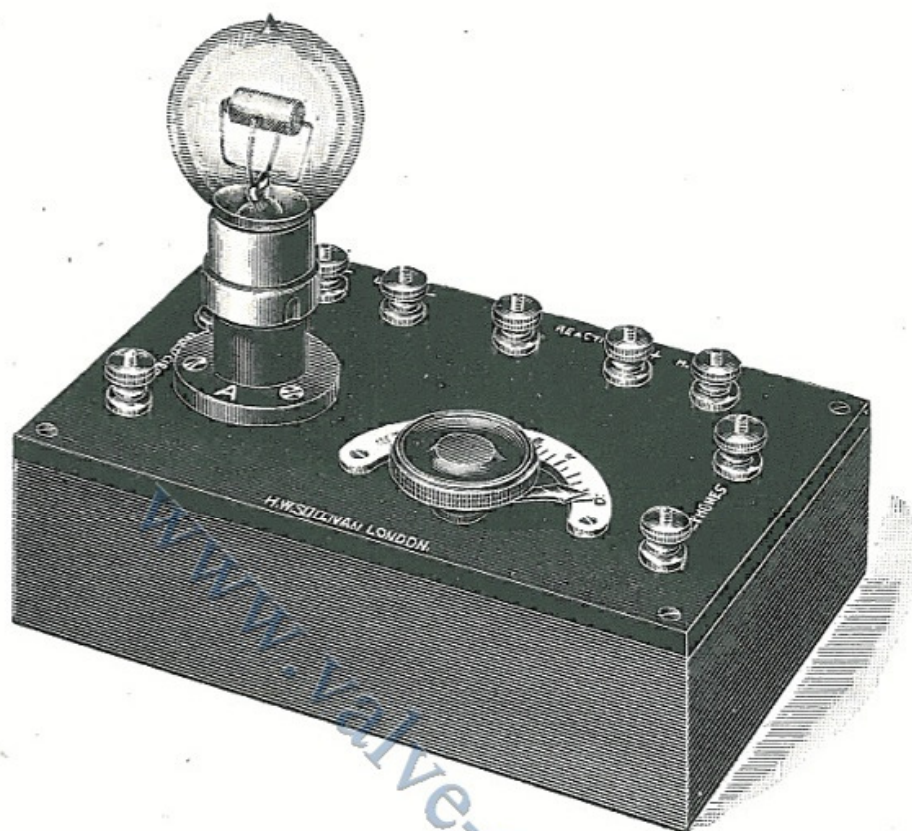
Number of Valves	List No.	Ampere-Hours Capacity	PRICE	Extra for Portable Grate
I	150	13	£1 4 0	£0 10 0
Up to 3	151	25	1 10 0	0 15 0
Up to 5	152	50	2 7 6	0 19 0
Up to 7	153	75	3 7 0	1 5 0

Six-Volt Accumulators.

Number of Valves	List No.	Ampere-Hours Capacity	PRICE	Extra for Portable Grate
I	154	13	£1 16 6	£0 15 0
Up to 3	155	25	2 6 0	1 0 0
Up to 5	156	50	3 10 9	1 5 0
Up to 7	157	75	5 1 0	1 10 0

NOTE.—The ampere-hour capacity given is the continuous discharge rating.

Valve Detector Unit



No. 179

A complete Valve-Detecting Unit for attachment to any tuning circuits WITH OR WITHOUT REACTION. It is suitable for any of the Amplifiers shown in my Diagrams Nos. 2, 4, 5, 7, 8, and 9, without any alteration to wiring or the addition of any other detecting apparatus whatever. The following components are included: Valve holder, combined rotary filament rheostat and switch, grid condenser, "Mullard" grid leak resistance, and H.T. battery condenser, this latter being essential if a reaction coil is used. Terminals with appropriate engraving are provided for TUNING CIRCUIT, LOW TENSION, HIGH TENSION, REACTION COIL, and TELEPHONES. If a reaction coil is not being used, it is only necessary to short-circuit the two terminals provided for it.

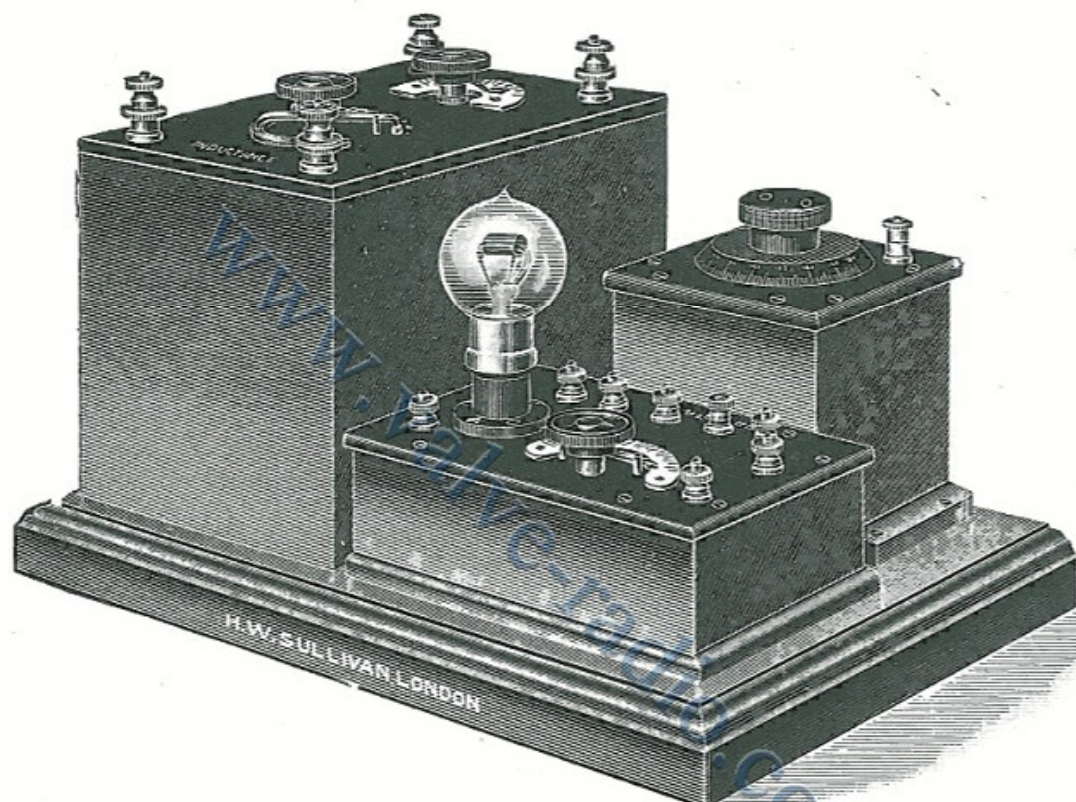
List No. 179	Complete Valve Detector Unit, in teak box	PRICE. each
	with ebonite top	£3 5 0

DIMENSIONS: $7\frac{1}{2}$ in. \times 5 in. \times $3\frac{1}{2}$ in.

Complete Receiving Installation

(For Wave-lengths up to 7,000 metres.)

WITH 50-VOLT ANODE BATTERY, ACCUMULATORS,
8,000-OHM TELEPHONES AND VALVE.



No. 209

LIST OF INSTRUMENTS

Single layer tuning Inductance with reaction (No. 103A).
Variable Air Condenser (0.0011 mfd.).
Valve detector Unit (complete with valve, rheostat, grid, condenser,
"Mullard" grid leak and bye-pass condenser).
Series-parallel switch for changing the connections to the tuning condenser.
50-volt dry battery
4 volt Filament Accumulators.
"Sullivan" 8,000-ohm telephone headgear set.

The above is by far the most efficient and simple receiving set using only a single valve and single circuit tuning and is wired to circuit No. 4 of my "Book of Working Diagrams."

				PRICE, each
List No.	208	Complete installation as above	...	...
"	209	Set as No. 208, but without batteries, telephones and Valve	...	£17 10 0

DIMENSIONS OF PANEL: 17 in. × 13 in.

High Power Four-Valve Amplifying Receiver

MODEL H.W.S.

(150—25,000 Metres.)

SPECIALLY SUITABLE FOR THE RECEPTION OF THE
HAGUE CONCERTS AND SIMILAR TRANSMISSIONS.



No. 300

This piece of apparatus has been designed especially to meet the ever-increasing demand for a self-contained amplifier of sufficiently high power and stability of adjustment to ensure the perfect reception of the above mentioned transmission of telephony at all times. For this purpose a special form of single layer tuning inductance with magnetic reaction has been designed and listed in the section on tuning inductances (List No. 103C).

The Amplifier, however, may be used with any type of tuned reaction circuit and any type of tuning coils including separate honeycomb coils.

With a loud speaker, signals and speech can be heard at great distances.

Although developed more particularly for Dutch Concert reception, the Amplifier, which has two high frequency valves, and two stages of note magnification, is equally suitable for speech or general telegraphic reception on ALL WAVE-LENGTHS between 150 and 25,000 metres.

High Power Four-Valve Amplifying Receiver

List No. 300 Four-valve amplifier as illustrated, but *without* valves PRICE, each
valves £12 12 0
DIMENSIONS: 13 in. × 10 in. × 6½ in. high. WEIGHT: 12 lb.

High Power Low Frequency Amplifier.



No. 200

In response to repeated enquiries I have developed a multi-valve Amplifier which should meet the need for an instrument entirely free from disturbing internal noises and which will not cause distortion of speech or other signals.

A special system of intervalve coupling has been adopted, using air core anode reactances of low capacity and high efficiency.

The first valve of the series is provided with a grid leak and condenser and therefore acts as the rectifying valve.

A pair of terminals marked "Reaction" are fitted for connection to a suitable coupling coil for regenerative reception. If the latter is not desired these terminals only require "shorting."

List No. 200 Five-valve low frequency Amplifier, as illustration, but without valves PRICE, each
... .. £14 0 0
DIMENSIONS: 16 in. × 10 in. × 6½ in. high. WEIGHT: 12 lb.

High Power Amplifier



No. 201

The above illustration shows a very successful combination of high and low frequency amplification.

The system of high frequency intervalve coupling adopted makes use of three air core transformers tapped at suitable intervals and giving a high degree of amplification over a wide range of wavelengths, viz : 200-25,000 metres.

Grid potential control is effected by means of a potentiometer across the filament battery.

A variable air condenser is fitted, providing the necessary electrostatic retroaction for C.W. reception. This has been found to give excellent results both for C.W. reception and for boosting up the intensity of spark signals.

Standard audio-frequency iron core intervalve transformers are used for the note magnification. These produce less speech distortion in Wireless Telephony than many other types now on the market.

The instrument is, as may be seen from the illustration, a highly finished model.

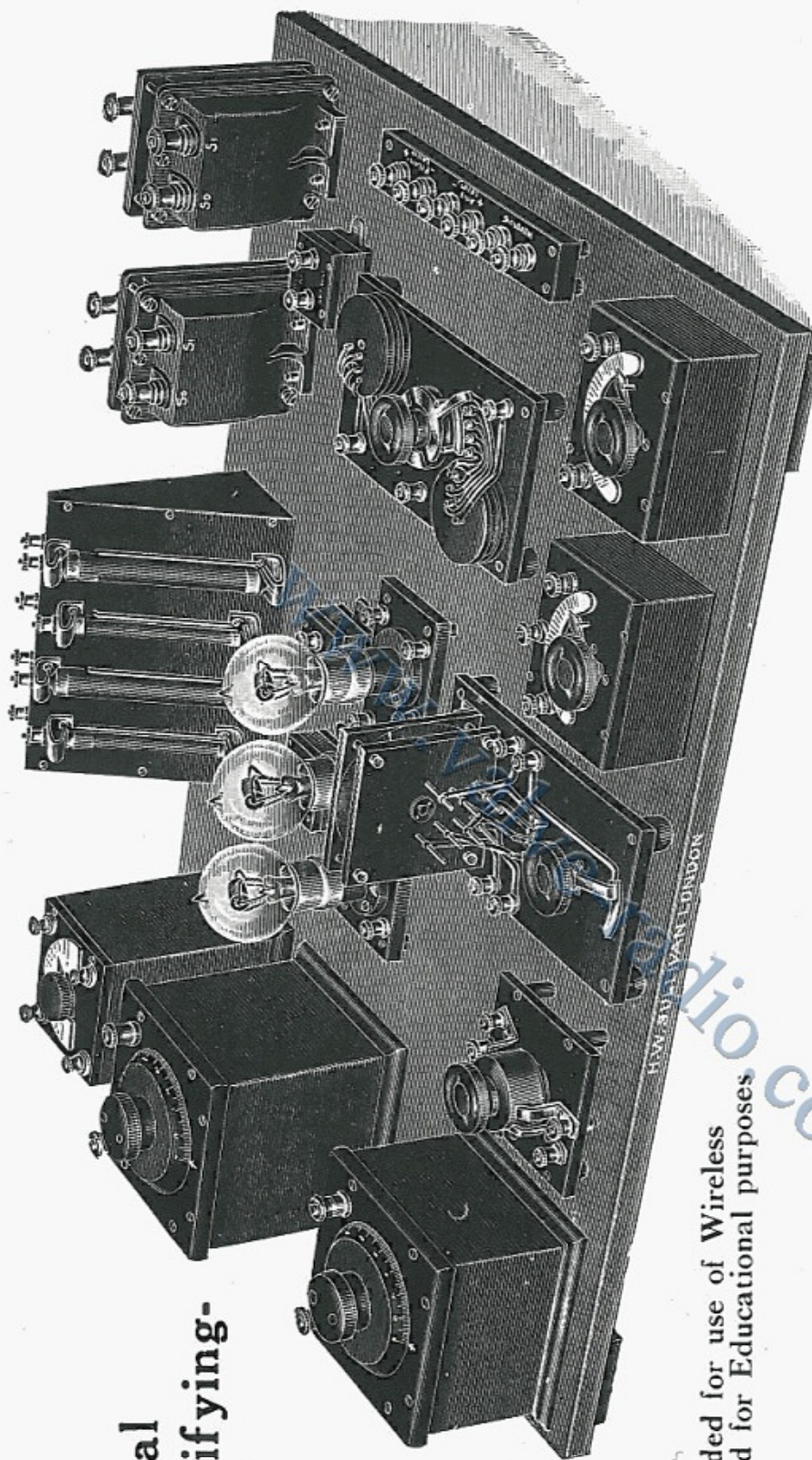
PRICE, each

List No. 201 Amplifier as illustration but without valves ... **£25 0 0**

DIMENSIONS : 19 $\frac{3}{4}$ in. \times 8 $\frac{3}{4}$ in. \times 7 in. WEIGHT : 14 $\frac{3}{4}$ lb.

Standard Experimental Valve Amplifying- Receiver Panel

DIMENSIONS :
26 in. X 20 in.



Specially recommended for use of Wireless
Training Schools and for Educational purposes

No. 130.

The following is a list of the components with their List Nos.

1 Variable Air Condenser 0.0011 mfd. (Aerial Circuit) ...	31	2 Iron-Cored Transformers for Intervalve Coupling between Audio-Frequency Amplifying Valves ...	53	1 PANEL on which is mounted :—	96
1 Variable Air Condenser 0.00055 mfd. (Secondary Circuit) ...	32	1 RESISTANCE ROD PANEL, consisting of the following mounted in spring clips (for Resistance-Capacity Amplification) :	99	2 Anode Series Reactance Coils, for Rectance-Capacity Amplification, together with a Double Tapping Switch ...	121
1 Series-Parallel Switch for Aerial Condenser ...	140	2 Anode Series Resistances ...	64	1 PANEL on which is mounted :—	40
1 Rotary Magnetic Reaction Coupling Coil for Regeneration Spark Work and Self-Heterodyne Work ...	56	2 Grid Leak Resistances ...	63	Three Valves, Three Sockets for same ...	40
1 Filament Rheostat for 3 valves (acting also as Switch) ...	58	1 PANEL on which is mounted :—	122	2 Small Fixed Valve Condensers for Intervalve Capacity Coupling ...	41
1 Grid Potentiometer, 200 ohms ...	66	One Air Core Transformer, for Radio-Frequency Intervalve Coupling together with Tapping Switch ...		1 Bye-pass Condenser ...	49
1 Terminal Board ...				1 Pair of High Resistance Telephone Receivers 3 Valves ...	80

Standard Experimental Valve Amplifying-Receiver Panel

A carefully selected group of the components already described, with a view to making possible the greatest number of variations of circuits employing one, two, three or more valves, for the reception of telephony and spark or C.W. telegraphy. Many of the circuits shown in my *Book of Diagrams* can be wired and tested with this apparatus, the tuning inductance alone being omitted, and this because the many and various types and wave-length ranges cannot be conveniently and efficiently reduced to one instrument. The components have been specially prepared to render all connections visible, and terminals have been fitted to avoid frequent soldering. A considerable saving is effected by purchasing this set instead of a complete receiver, the construction of which cannot be changed as new circuits are developed.

					PRICE, each
List No. 130	Standard Experimental Valve Amplifying-receiver Panel	...	...	...	£32 0 0

Alternative Experimental Receiver Panel

(Complete with Tuning Inductance.)

In the standard Apparatus Panel the tuning inductances have been omitted for reasons explained under that heading. In order, however, to make the set complete for single-circuit tuning, a single-layer tuning inductance with rotary magnetic reaction (List No. 103A) may be substituted for the rotary magnetic reaction coil (List No. 140) and the 0.00055 mfd. variable condenser.

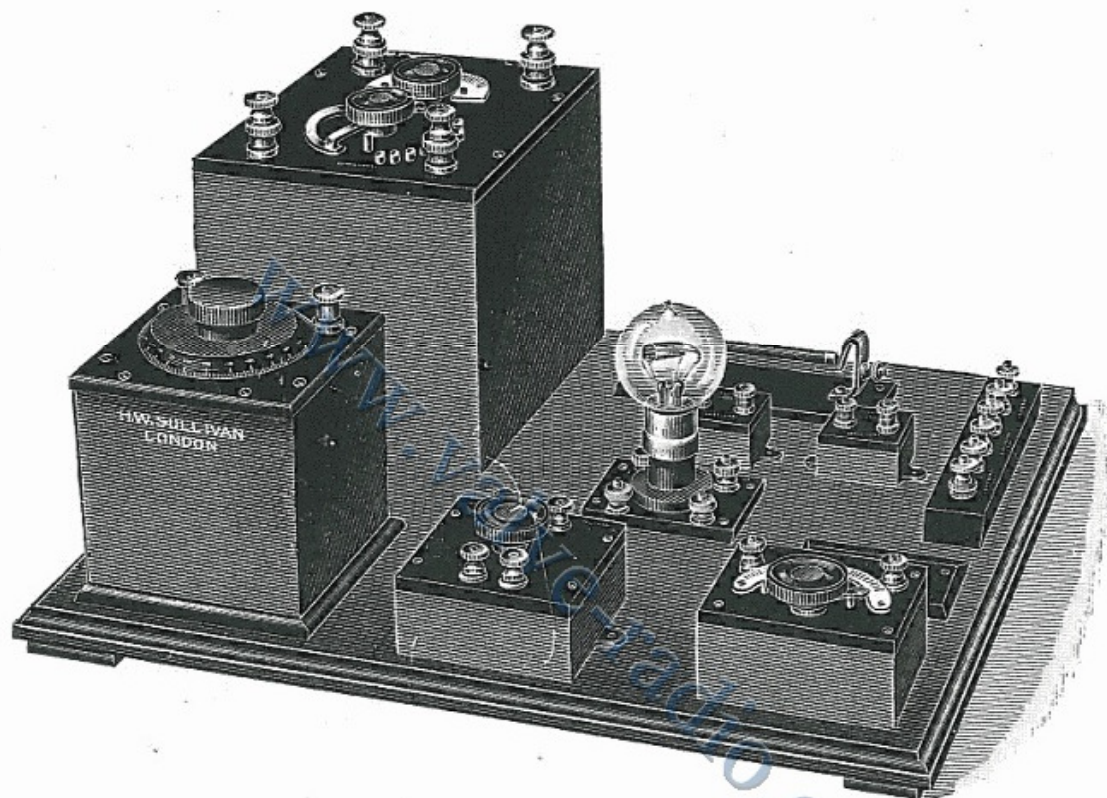
					PRICE, each
List No. 130A	Alternative Experimental Apparatus Panel	...	...	...	£32 0 0

A number of similar Apparatus Panels have been designed to correspond with various useful circuits given in my book of working diagrams.

Single-Valve Receiving Circuit

(Circuit No. 4)

The most efficient outfit for a single valve.



No. 183.

LIST OF COMPONENTS AND LIST NUMBERS.

	List Nos.
1 Variable Air Condenser, 0.0011 mfd.	31
1 Series-Parallel Switch	99
1 Tuning Inductance with Switch and Reaction	103A
1 Grid Leak (mounted)	181
1 Grid Condenser	40
1 Valve Socket (mounted)	94
1 Filament Rheostat and Switch	57
1 Terminal Board	66
1 Bye-Pass Condenser	40

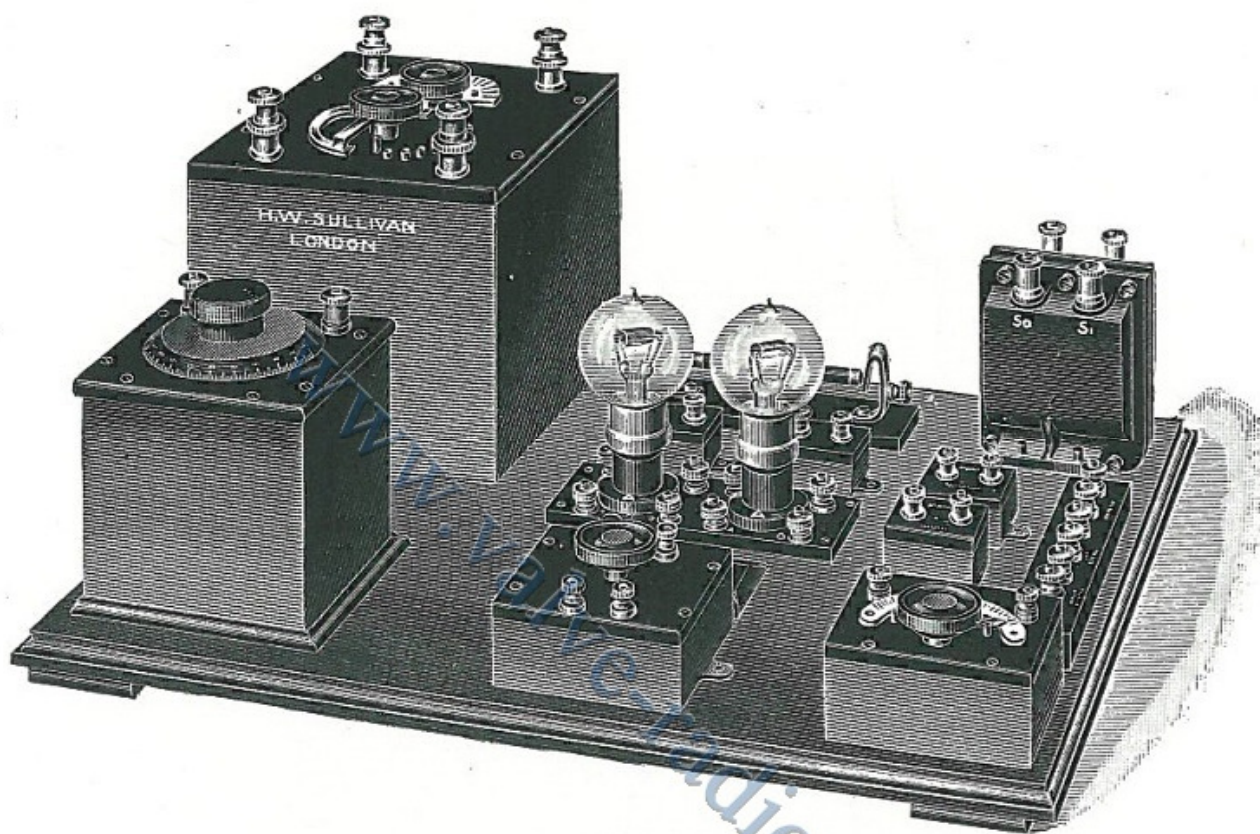
PRICE, each

List No. 183 Panel as above £14 14 0

DIMENSIONS OF PANEL : 19 in. × 17 in.

Two-Valve Amplifying-Receiver Panel

(Circuit No. 12)



No. 184

LIST OF COMPONENTS AND LIST NUMBERS.

	List Nos.		List Nos.
1 Variable Air Condenser 0.0011 mfd. ...	31	1 Terminal Board ...	66
1 Series-Parallel Switch ...	99	1 Audio-Frequency Intervalve iron-cored Transformer ...	53
1 Tuning Inductance with Switch and Reaction ...	103A	1 Bye-pass Condenser for Transformer Primary ...	40
1 Grid Leak (mounted) ...	181	1 Bye-Pass Condenser for Telephones ...	40
1 Grid Condenser ...	40	1 Bye-pass Condenser for H. T. Battery ...	40
1 Valve Socket Panel (for two valves) ...	95		
1 Filament Rheostat and Switch ...	56		

PRICE, each

List No. 184 Panel as above £17 0 0

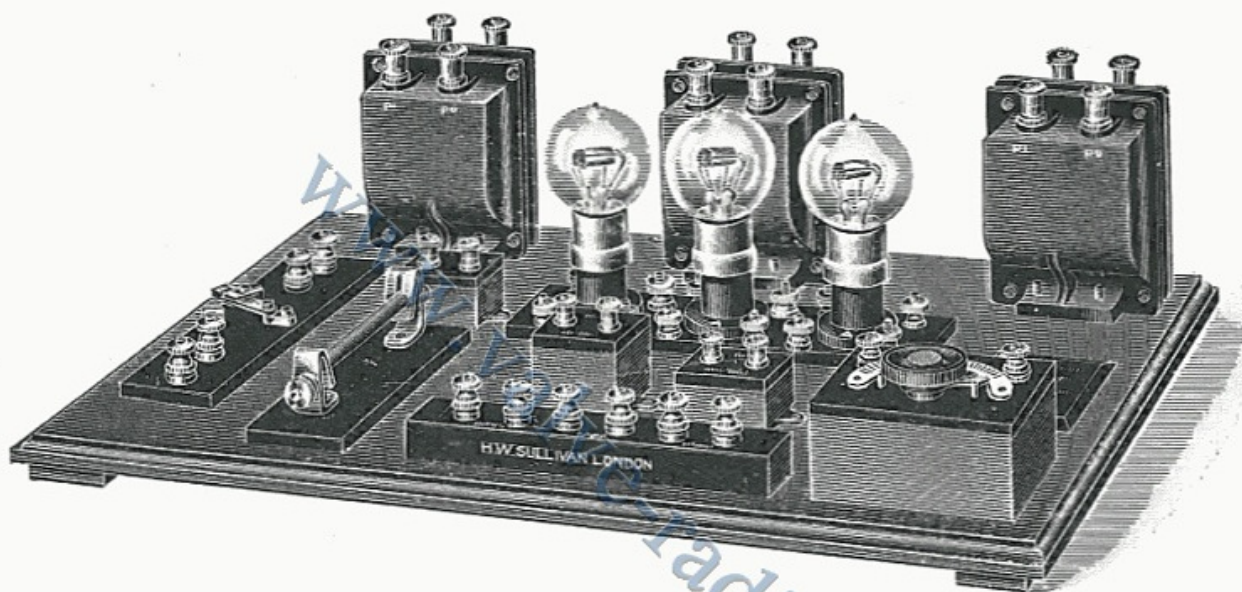
DIMENSIONS OF PANEL: 21 in. X 17 in.

Three-Valve Note Magnifier Panel

(Circuit No. 16)

Complete with rectifying attachment and two-way switch.

Wired ready for use.



No. 186

LIST OF COMPONENTS AND LIST NUMBERS.

	List Nos.
3 Audio-Frequency Intervalve iron-cored Transformers	53
1 Three-Valve Socket Panel	96
1 Filament Rheostat and Switch	56
1 Terminal Board	66
1 Grid-Leak Resistance (mounted)	181
1 Grid Condenser	40
1 Telephone Condenser	40
1 H. T. Battery Condenser	41
1 Input Terminal Board with two sets of input terminals and a two-way switch	

PRICE, each

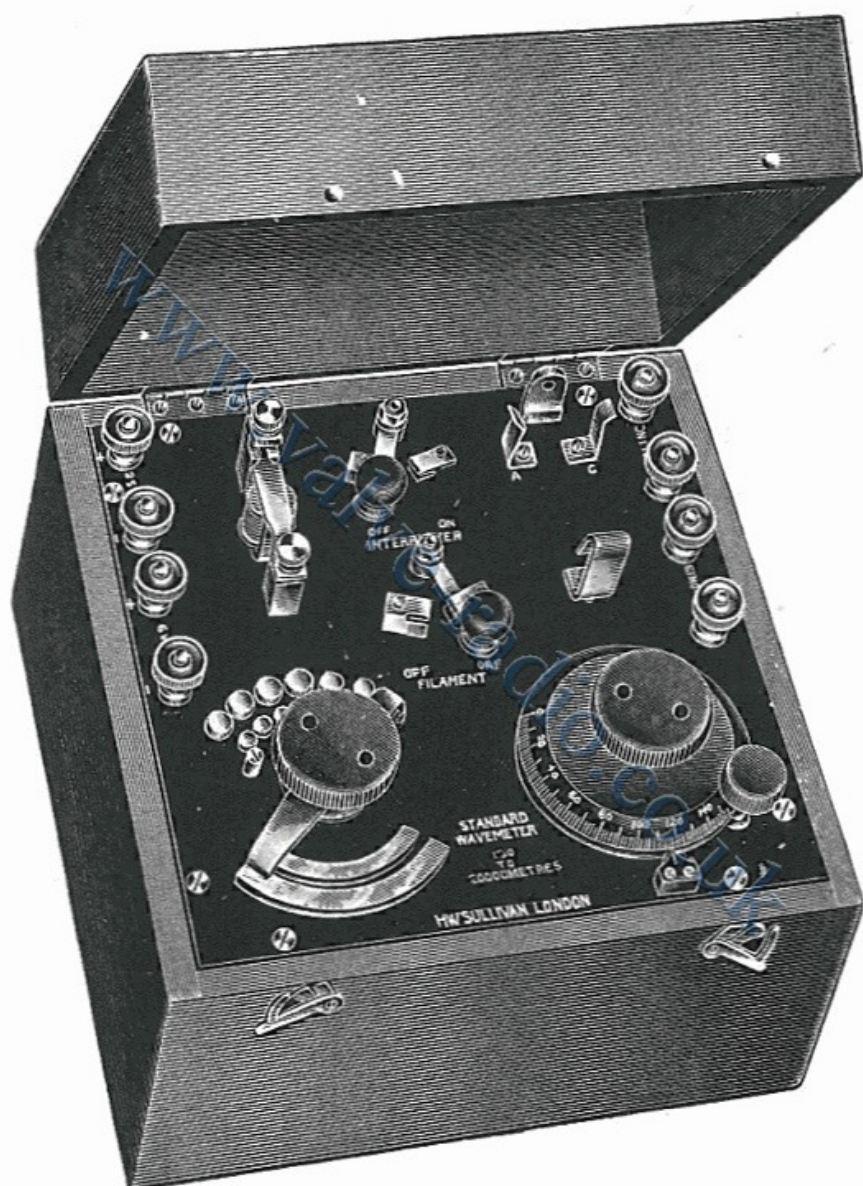
List No. 186	Panel as above	£14 14 0
List No. 191	Three-Valve Note Magnifier as above, but without rectification attachment	12 12 0

DIMENSIONS OF PANEL : 20 in. × 15 in.

WAVEMETERS.

Universal Precision Standard Heterodyne
Wavemeters.

150 to 20,000 Metres.



No. 223

The Wavemeter illustrated is the first of its kind produced for commercial use. It is a self-contained laboratory standard for precision measurements of continuous and spark waves, covering the whole useful range of wave-lengths without the addition of separate coils.

The variable air condenser includes a fine adjustment of an entirely new and reliable design, thereby enabling simple short-wave adjustments to be easily obtained.

Universal Precision Standard Heterodyne Wavemeters

A special type of electro-magnetic interrupter is included for the production of interrupted continuous waves for spark adjustments.

The current for the filament of the valve is supplied from a 6-volt accumulator. A 50-volt battery is necessary for the anode supply.

The instrument is accurately calibrated against an N.P.L. standard. The workmanship throughout is of the highest order.

A full range of seven calibration curves is supplied with each instrument.

List No. 223	Wavemeter 150-20,000 metres as illustrated, but with socket for "R" type valve. Complete with coupling coil	PRICE, each 27 gns.
--------------	---	--------	-------------------------------

DIMENSIONS : 12 in. \times 11½ in. \times 10 in. high. WEIGHT : 17½ lb.

Heterodyne Wavemeter

(150 to 4,000 Metres).



Heterodyne Wavemeter

The Wavemeter illustrated has been specially developed to meet the requirements of an efficient, accurate and inexpensive instrument for the measurement of continuous and spark waves. It may also be used as a separate heterodyne in conjunction with non-oscillating receiving apparatus. As is shown in the illustration, a special type of electro-magnetic interrupter is included for the production of interrupted continuous waves, thereby enabling spark or damped wave adjustments to be obtained.

The instrument is carefully calibrated against an N.P.L. standard, and a set of calibration curves supplied.

A coupling coil is provided with a length of flexible lead.

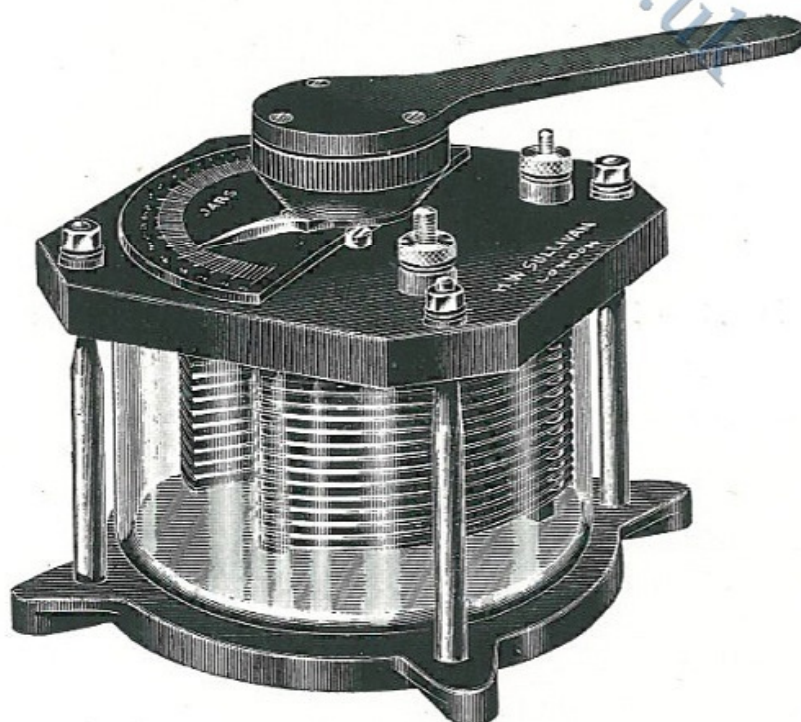
List No. 224 Wavemeter 150-4,000 metres as illustrated ... **PRICE, each**
£10 10 0
 DIMENSIONS: $12\frac{1}{2}$ in. \times $6\frac{3}{4}$ in. \times $8\frac{3}{4}$ in. high. WEIGHT: $10\frac{1}{4}$ lb.

TRANSMITTING SECTION

Transmitting Condensers

High-Voltage Variable Condenser

(Air or Oil Dielectric)



Nos. 227, 228 and 229

High-Voltage Variable Condenser

A well-constructed variable condenser having a uniform dielectric gap which does not vary appreciably with the rotation of the moving plate system. The body of the condenser is enclosed in a glass container, protected by means of a brass base casting. This container is filled with vaselin oil for voltages above 1,000 and is therefore made oil-tight by a rubber jointing washer recessed into the ebonite top. An ebonite lever handle is fitted as illustrated.

List No. 227	Variable condenser (air dielectric) .0012 mfd. maximum capacity. Safe working voltage	PRICE, each
	1,000 volts	£6 6 0
" " 228	Variable Condenser (oil dielectric) .002 mfd. maximum capacity. Safe working voltage	
	2,000 volts	6 16 0
List No. 229	Variable Condenser (oil dielectric) .001 mfd. maximum capacity. Safe working voltage	
	3,000 volts	10 10 0
DIMENSIONS: 7 in. × 7 in. × 6½ in. HANDLE EXTENDS: 3½ in. WEIGHT: 10¼ lb.		

Fixed Value Transmitting Condensers

(AS SUPPLIED TO THE ADMIRALTY, WAR OFFICE, AND THE
PRINCIPAL WIRELESS COMPANIES).

Glass Dielectric Transmitting Condenser

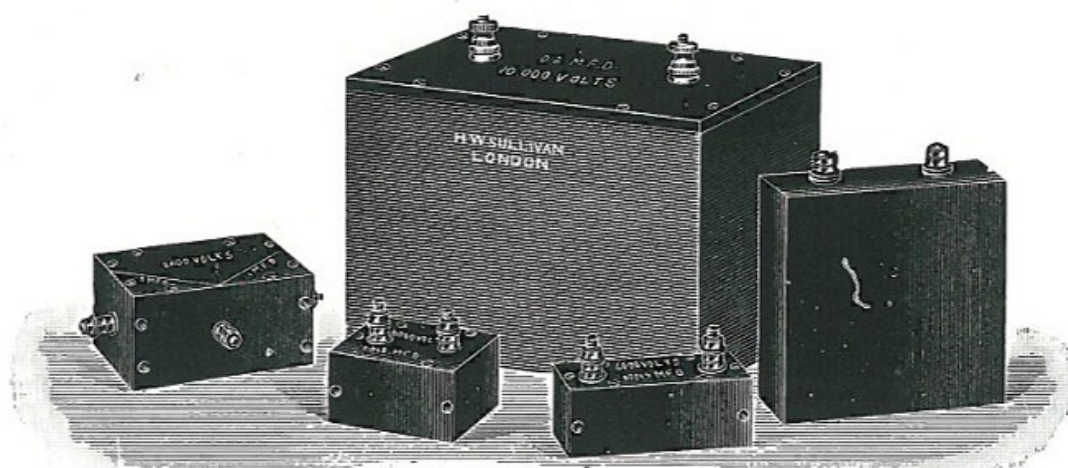


No. 43.—Glass Dielectric Transmitting Condenser.

This Condenser has been specially designed to supersede the Leyden Jar, and is practically unbreakable. It is fitted in a teak case and filled in solid with a special high-insulation compound. It is also fitted with safety spark points set at 15,000 volts R.M.S. A number of these condensers can be conveniently stored one above the other.

DIMENSIONS: 10¾ in. × 7½ in. × 3¾ in. high. WEIGHT: 12 lb.		PRICE, each
List No. 43	Glass .0011 Mfd., working voltage 15,000 volts, R.M.S.	£2 0 0

Mica Dielectric Transmitting Condensers



Nos. 44 to 46

Quotations for Condensers of any capacity can be submitted upon receipt of inquiries.

						PRICE, each		
List No.	44	...	Mica .002 Mfd.,	10,000 volts	...	£3	3	0
"	45	...	" .004 "	10,000 "	...	5	5	0
"	46	...	.016 "	20,000 "	...	2	5	0

High-Voltage Condensers

For Valve Transmitters

(FOR USE AS HIGH-TENSION SUPPLY CONDENSERS AND FOR OTHER PURPOSES IN VALVE TRANSMITTING CIRCUITS).



No. 230

These are fitted in wood boxes with ebonite cover and terminals.

The condensers are built up of a number of series sections and the complete condenser units are insulated by pure paraffin wax.

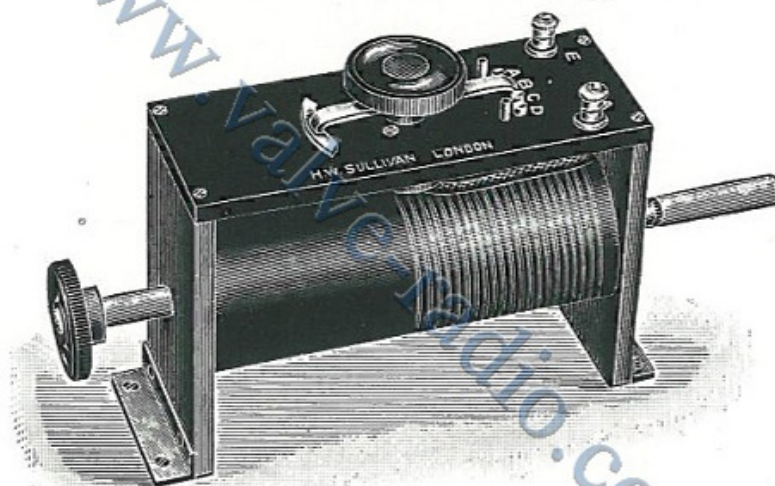
The voltages given below are not of course breakdown pressures but working voltages allowing a high factor of safety.

High Voltage Condensers

			PRICE, each
List No. 230	0.2 Microfarad capacity, working pressure 1,000 volts	(DIMENSIONS $4\frac{3}{4}$ in. \times 2 in. \times $5\frac{3}{4}$ in. high).	£1 10 0
List No. 231	0.5 Microfarad capacity, working pressure 1,000 volts	(DIMENSIONS 8 in. \times $2\frac{1}{2}$ in. \times $6\frac{1}{2}$ in.)	2 0 0
List No. 232	1.0 Microfarad capacity, working pressure 1,000 volts	(DIMENSIONS: $11\frac{3}{4}$ in. \times $2\frac{1}{4}$ in. \times 10 in. high).	3 0 0
List No. 233	5 Microfarad capacity, working pressure 1,000 volts. For use as a smoothing condenser	(DIMENSIONS: $11\frac{3}{4}$ in. \times 5 in. \times 10 in. high).	6 6 0

Inductances and Coupling Coils

For Valve Transmitting Sets.



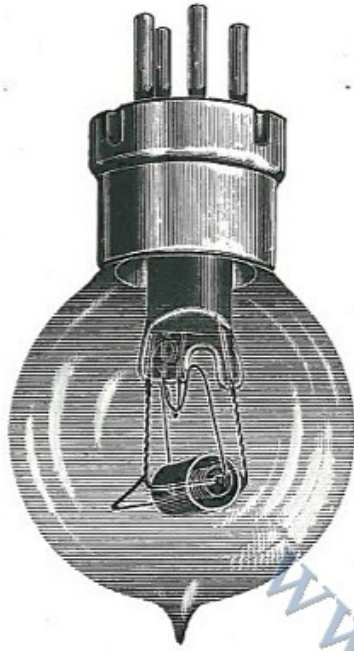
No. 226

		PRICE, each
List No. 226	Oscillatory circuit inductance with grid coupling coil for 180-metre transmitter. The tuning inductance is carefully wound in a screw thread to ensure low H.F. Resistances which is of the greatest importance at these extremely low wave-lengths; it may be tapped by means of the switch shown. A smoothly sliding inner coil provides a variable mutual inductance coupling to the grid of the oscillating valve. The instrument is ready for mounting direct on an experimental board or panel	£2 2 0
	For other wave-lengths—prices on application.	

The individual requirements of experimenters for coupled inductances vary so greatly with the type of control and wave-length employed that it is impossible to form a comprehensive list of this apparatus.

Transmitting Valves

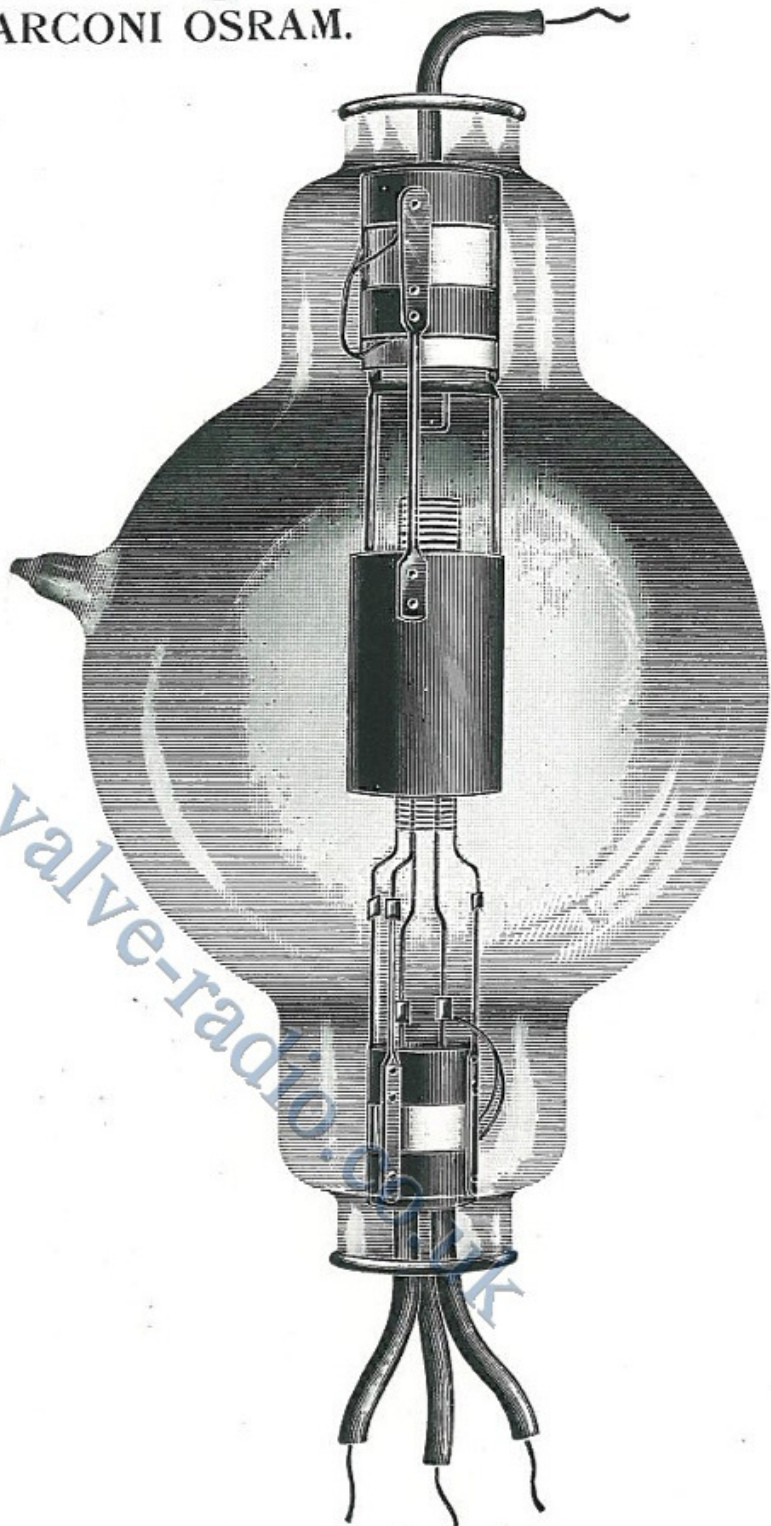
MARCONI OSRAM.



No. 212



No. 213



No. 215

- | | | | | |
|--------------|--|-----|-----|-----|
| List No. 212 | 10-watt valve with 4 pin contacts to fit into ordinary standard French valve sockets (List Nos. 81 and 142). Filament voltage 6. Anode voltage 200-750 | ... | ... | ... |
| List No. 213 | 25-watt valve, 4 pin contacts as 212. Filament voltage 6-8. Anode voltage 500-1,000 | ... | ... | ... |
| List No. 214 | 40-watt valve, 4 pin contacts as 212. Filament voltage 6-8. Anode voltage 700-1,250 | ... | ... | ... |
| List No. 215 | 100-watt valve as illustration. Filament voltage, 10-12. Anode voltage, 1,500-2 000. Diameter of bulb, 4 in. | ... | ... | ... |
| List No. 216 | 250-watt valve similar type to 215. Filament voltage, 12-16. Anode voltage, 1,500-2,000. Diameter of bulb, 5 in. | ... | ... | ... |

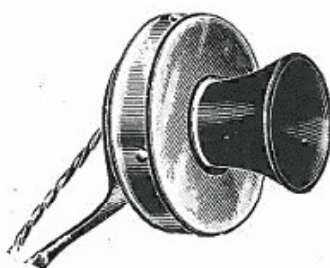
The Prices of Valves are subject to fluctuations. Prices upon application only.

Mountings for 100 and 250-Watt Transmitting Valves.

- List No. 264 Hinged spring retaining grips for above valves, mounted on an ebonite panel provided with terminals, the complete mounting unit ready for securing to a vertical board or panel

PRICE, each
£1 10 0

Microphones (For Radio-Telephony)



No. 219

The microphone illustrated above has been found to give excellent results in practice and is thoroughly reliable. It is of the solid-back carbon granular type in a nickel-plated brass case with moulded mouthpiece. Resistance 40 ohms.

- List No. 217 Microphone mounted on a highly finished standard ready for securing to a *horizontal* panel or board
OVERALL HEIGHT: 10 in. WEIGHT: 1 1/4 lb.

PRICE, each
£1 14 6

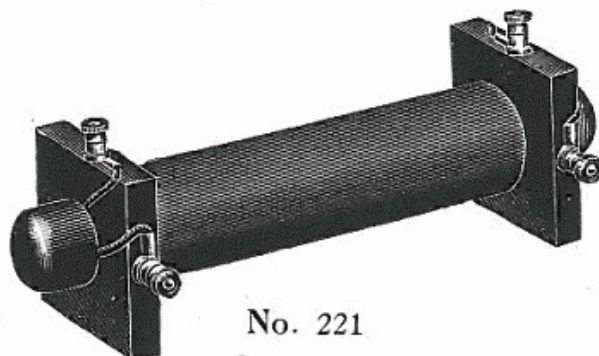
- List No. 218 Microphone as above, but mounted on adjustable bracket suitable for securing to a *vertical* panel. The bracket is hinged to allow the transmitter to be moved up or down to accommodate itself to the height of the person speaking
OVERALL LENGTH: 7 3/4 in. WEIGHT: 1 1/4 lb.

1 17 0

- List No. 219 Microphone as illustrated in case with mouthpiece, and with flexible leads but without mounting bracket

1 7 0

Microphone Transformer



No. 221

Microphone Transformer

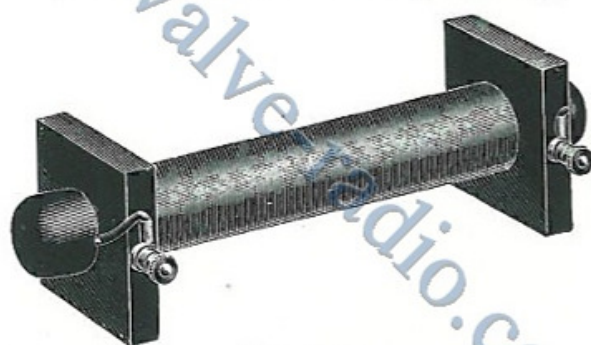
A well-designed and efficient step-up open-core transformer intended for use in the grid circuit of a speech-control valve of "choke" control transmitters or in the grid circuit of the oscillator valve in single-valve transmitters. The primary is wound to suit standard commercial microphones and may be connected, in series with its microphone, across the 6-volt filament accumulators. The secondary is wound to give the maximum voltage change on the grid.

The complete transformer is of convenient size and shape for securing to the back of a panel or to an experimental board.

List No. 221 Microphone transformer as illustrated ... **PRICE, each** £1 10 0
 DIMENSIONS: $7\frac{3}{4}$ in. \times $2\frac{1}{2}$ in. \times $2\frac{1}{2}$ in. WEIGHT: $2\frac{1}{2}$ lb.

Modulation Choke

(For Radio-Telephony)



No. 222

An open-core choke coil for use in the anode circuit of the power valve when using the well-known "CHOKE CONTROL" method of speech modulation.

Its inductance value has been chosen to give efficient modulation under all conditions with no appreciable distortion of speech.

List No. 222 Modulation choke as illustrated (ready for mounting) ... **PRICE, each** £1 5 0
 DIMENSIONS: $7\frac{3}{4}$ in. \times $2\frac{1}{2}$ in. \times $2\frac{1}{2}$ in. WEIGHT: $2\frac{1}{4}$ lb.

Smoothing Choke

A choke coil of high inductive value for smoothing out commutator ripples and other variations of audible frequency which occur when using D.C. mains, or rectified A.C. Supply for the anode H.T. supply of a transmitting set.

List No. 234 ... **PRICE, each** £1 12 0

Complete Smoothing Circuit

Pattern R.T.

(See Diagram on page 61)

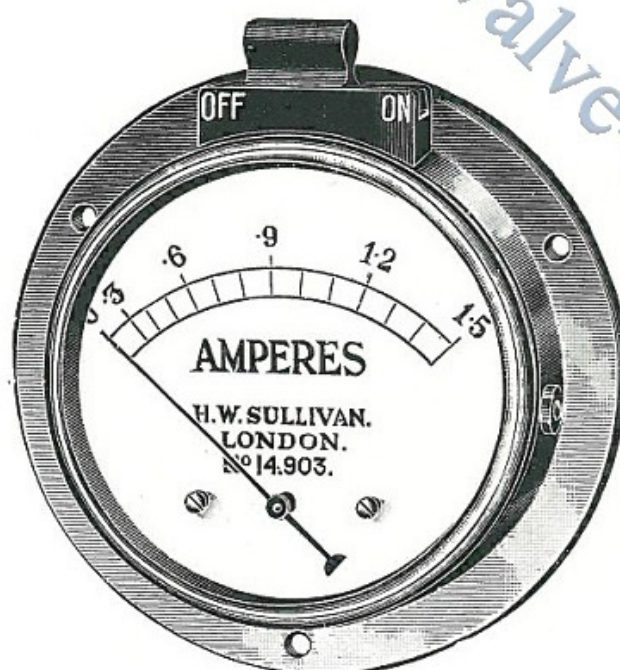
This consists of the necessary chokes and condensers for eliminating commutator or other ripples from ordinary mains or Machine D.C. or rectified A.C.

It is a completely self-contained unit to which the H.T. source is connected and from which the valve anodes are directly fed.

List No. 235 PRICE, each
£8 8 0

High Frequency Thermal Ammeters

For measuring Radiation Current, 2½-in. Dial.

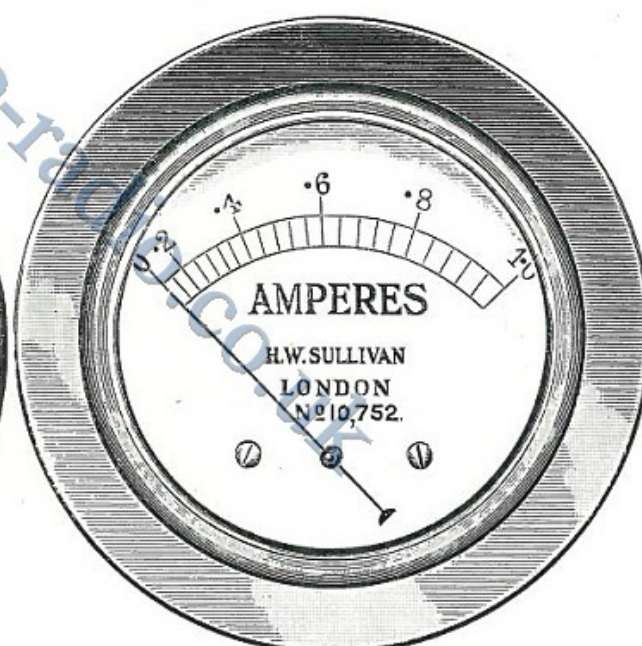


No. 73

FLANGE PATTERN
with Short Circuit Switch.

List		PRICE, each
No. 72	0.5 ampere	£1 11 6
„ 73	1 „	1 11 6
„ 74	2 amperes	1 11 6

DIMENSIONS : 3 in. diam. × 1 in. high.
Terminals project ⅞ in. from back.
WEIGHT : 7½ oz.



No. 76

FLUSH TYPE
without Switch

List		PRICE, each
No. 75	250 milliamperes	£1 7 0
„ 76	1 ampere	1 7 0
„ 77	1.5 „	1 7 0

DIMENSIONS : 3 in. diam. × ¾ in. high.
Terminals project ⅞ in. from back.
WEIGHT : 4 oz.

High Frequency Thermal Ammeters

High-Tension Pattern.

Mounted on Pedestal fitted with Universal Joint for Demonstration and X-Ray Work.

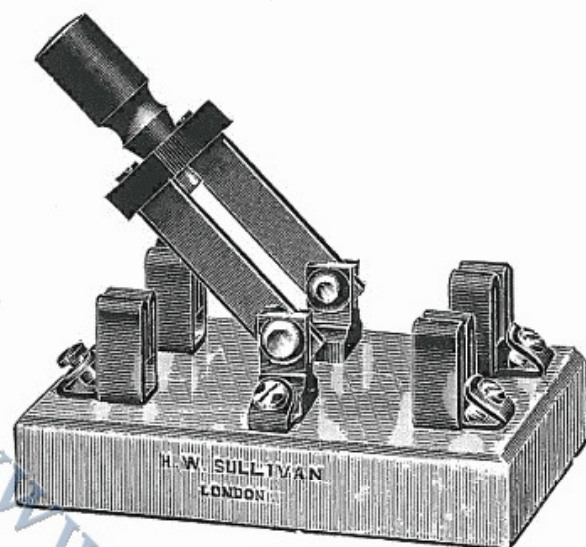


No. 78

					PRICE, each
List No. 78	Any range up to 5,000 milliamperes	...	...	...	£7 10 0
	DIMENSIONS: $5\frac{1}{2}$ in. diam. \times $13\frac{1}{2}$ in. high.				
	WEIGHT: $12\frac{1}{2}$ lb. (base weighted with lead).				
List No. 79	Without Pedestal	...	...	...	5 5 0
	DIMENSIONS: $6\frac{1}{4}$ in. diam. \times 3 in. high.				
	WEIGHT: 2 lb.				

This instrument can be supplied for any range up to 100 amperes.

Knife Switches.



No. 260

These are of specially sound and robust construction with heavy and rigid copper contacts and switch blades. They are mounted on highly-glazed white porcelain bases of ample proportions to ensure mechanical strength and perfect insulation.

				PRICE, each		
List No. 260	Double-pole change-over switch as illustrated			£0	5	6
List No. 261	Single-pole change-over switch			0	4	0
List No. 262	Double-pole single-way switch			0	4	6
List No. 263	Single-pole single-way switch			0	2	6

DIMENSIONS OF BASE :

260	...	$2\frac{5}{8}$ in. × $3\frac{7}{8}$ in.	8 oz.
261	...	$1\frac{3}{8}$ in. × $3\frac{7}{8}$ in.	6 oz.
262	...	$2\frac{3}{8}$ in. × $3\frac{1}{8}$ in.	7 oz.
263	...	$1\frac{1}{8}$ in. × $3\frac{1}{8}$ in.	4 oz.

Morse Keys

These keys are of high finish and are of solid and rigid construction with contacts of gold-silver alloy.

The degree of tension and limits of movement can be readily adjusted. The keys are supplied mounted with terminals on polished bases.

PRICE, each

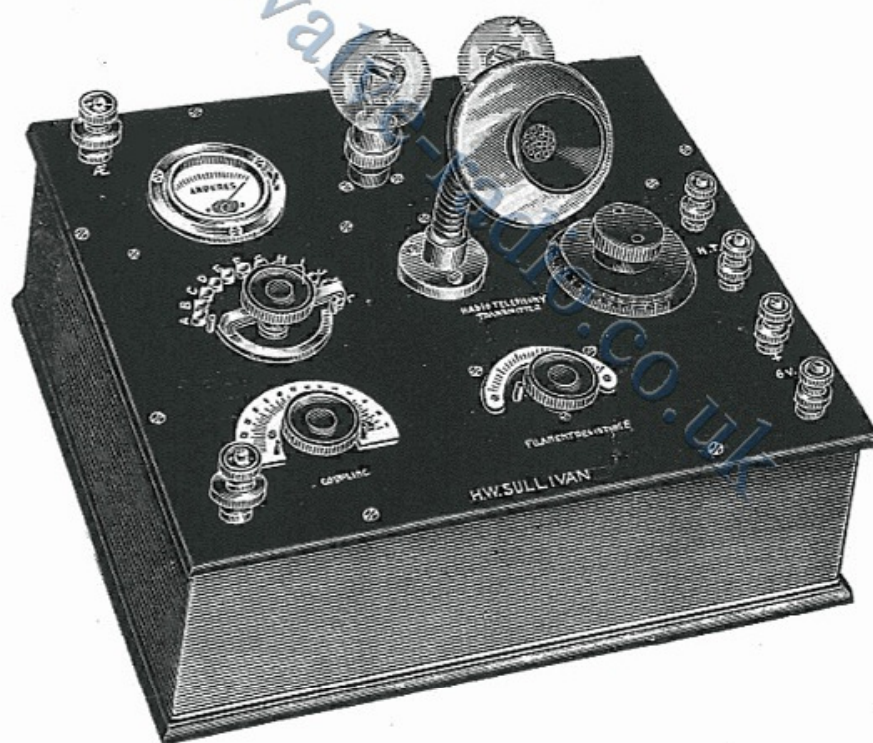
List No. 266, £0 18 0

DIMENSIONS OF BASE : 5 in. \times 3½ in.

Radio-Telephone Transmitter

WAVE-LENGTH RANGES : 150-200 or 950-1,150 metres.

POWER : 10 to 50 watts.



No. 240.

A high-class reliable radio-telephone transmitter of high efficiency which is **completely self-contained** and ready for attachment to the aerial, no additional tuning apparatus being required.

The wave-length ranges have been arranged to embrace those waves authorised by the P.M.G.

A system of speech control is adopted which has, in an extensive series of trials, given more complete and clearer modulation than any other method for a transmitter of this power.

Radio Telephone Transmitter

The oscillatory circuit is tuned by means of a variable air condenser and is loosely coupled to a secondary or aerial circuit. The use of two separate circuits, one most suited to the aerial constants, and the other more suited to the transmitting valve constants, ensures maximum all-round efficiency.

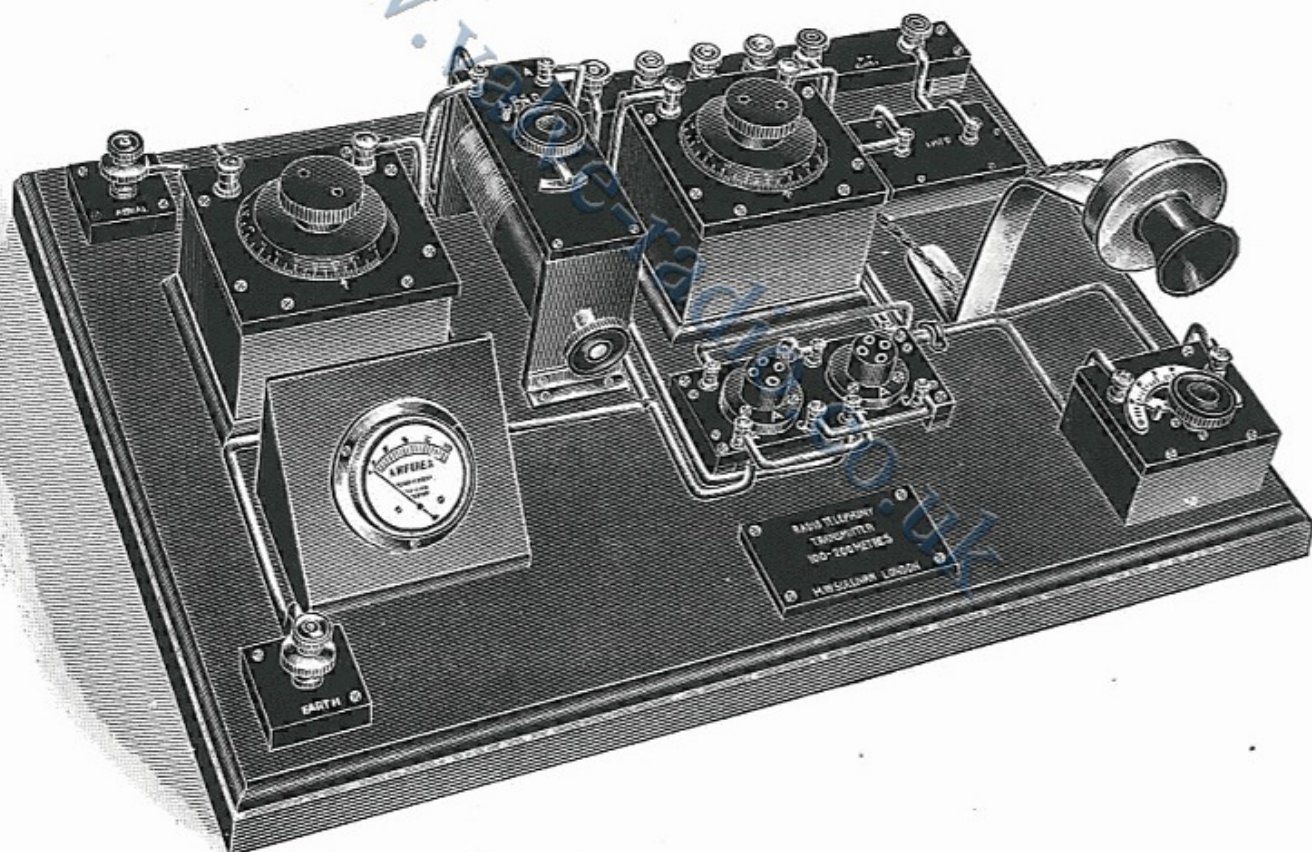
The workmanship and finish of the instrument is of a high order.

List No. 240 Complete Transmitter as illustration (but without valves) **PRICE, each**
22 gns.

DIMENSIONS: 15 in. × 13 in. × 13½ in. high. WEIGHT: 15 lb.

Radio-Telephone Transmitter

(Experimental or Demonstration Type.)



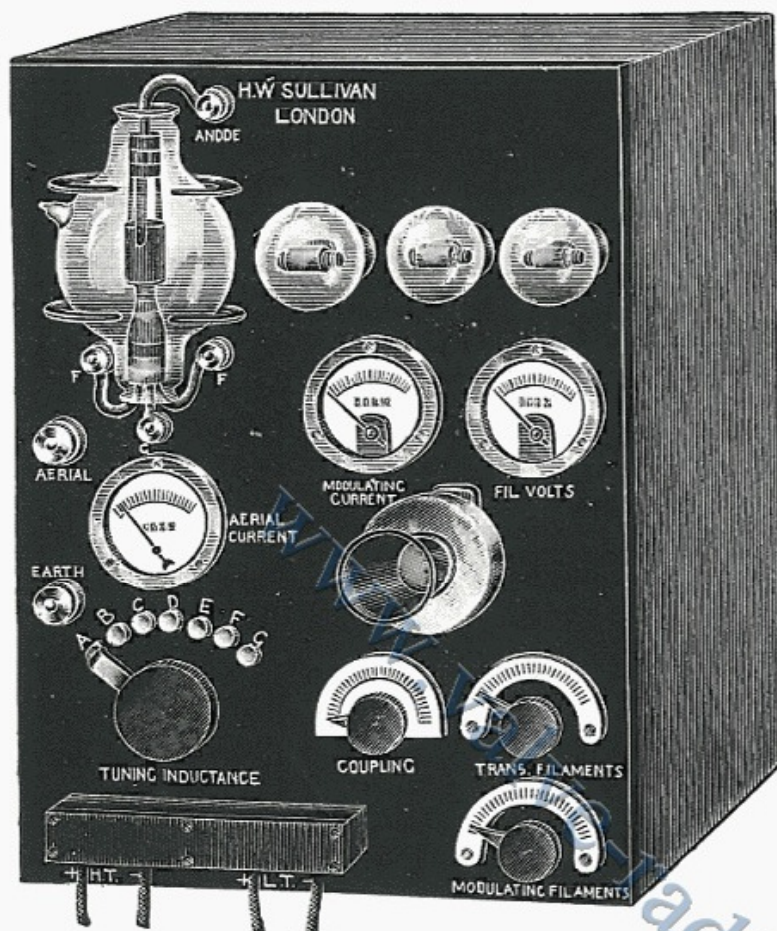
No. 241

This Transmitter is similar in wave-length, power, and circuit arrangement to List No. 240. Its components, however, are each separately mounted on a board to render all the connections visible.

List No. 241 Complete Radio Telephone Transmitter ... **PRICE, each**
22 gns.

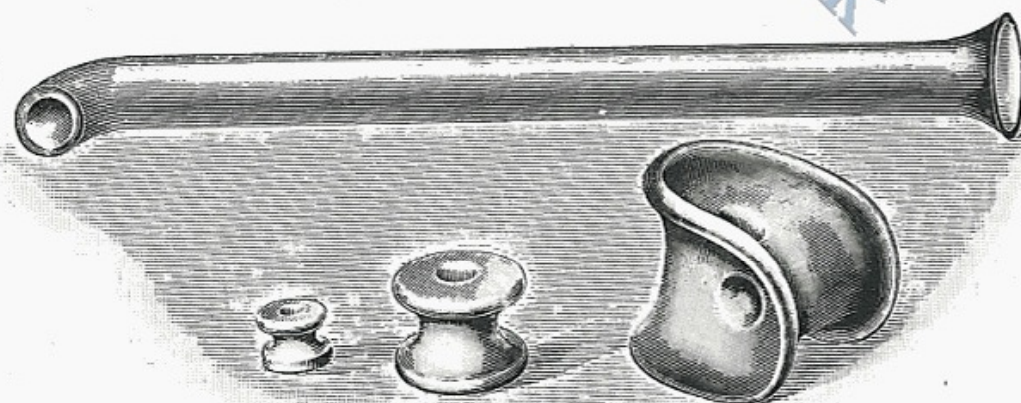
DIMENSIONS: 25 in. × 18 in. WEIGHT: 17½ lb.

High Power Radio-Telephone Transmitters



No. 250

Aerial Fittings



Nos. 255 to 259

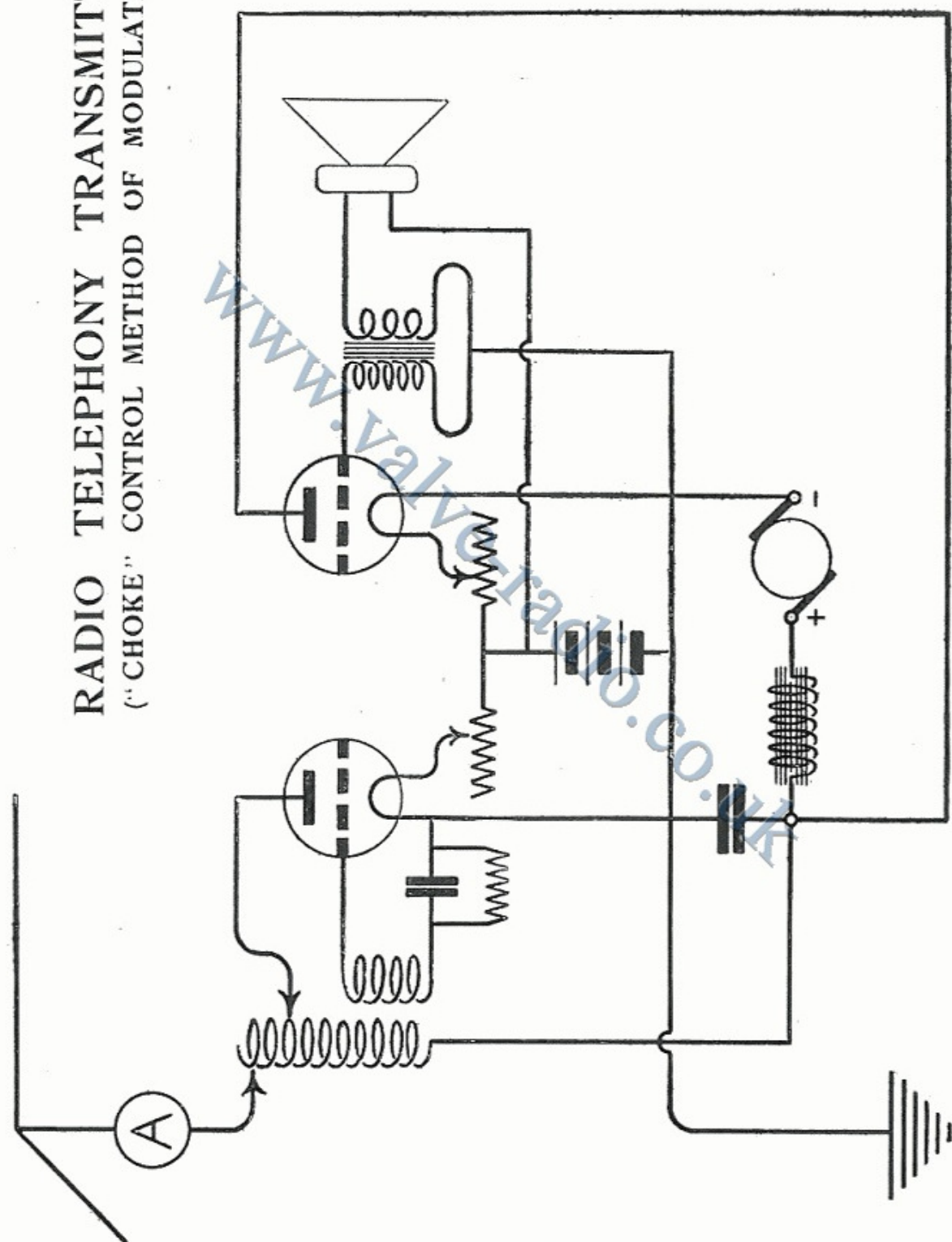
These are of shapes as illustrated above and are of the highest quality glazed porcelain.

Aerial Fittings

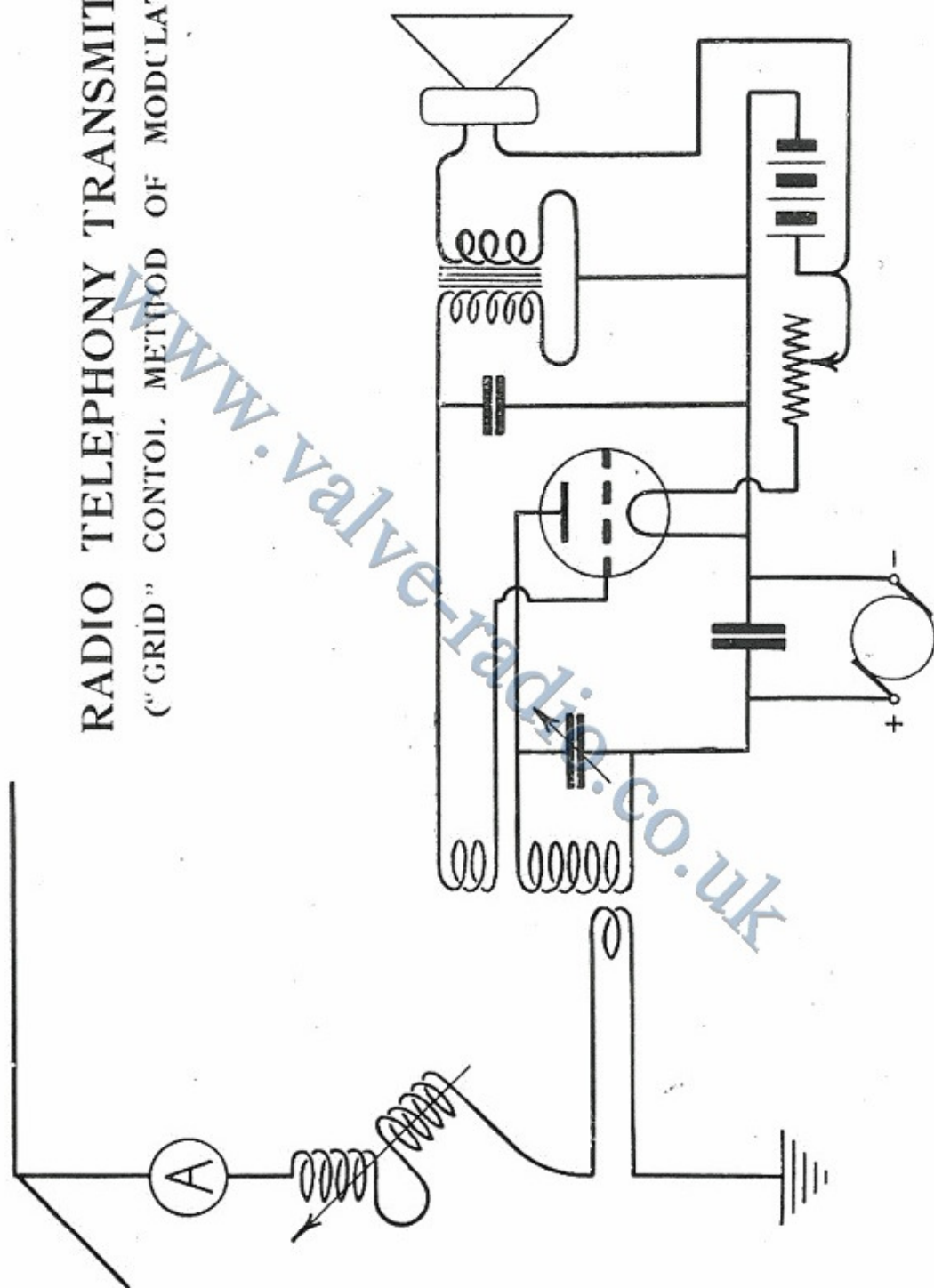
				PRICE, each		
List No. 255	Leading-in Tube (OVERALL LENGTH : 13 in.)	...	...	£0	5	0
List No. 256	Strain insulator (large size)	...	...	
	DIMENSIONS : $2\frac{3}{4}$ in. \times $2\frac{1}{2}$ in. \times $2\frac{1}{2}$ in. WEIGHT : 8 oz.					
List No. 257	Strain insulator (small size)	...	...	0	3	6
	DIMENSIONS : $1\frac{3}{4}$ in. \times $1\frac{1}{2}$ in. \times $1\frac{1}{2}$ in. WEIGHT : 4 oz.					
List No. 258	Reel Insulator ($1\frac{5}{8}$ in. diam.)	...	...	0	1	6
List No. 259	Reel Insulator ($\frac{7}{8}$ in. diam.)	...	...	0	1	0
<hr/>						
Aerial Wire, $\frac{7}{18}$	...	...	...	0	7	6

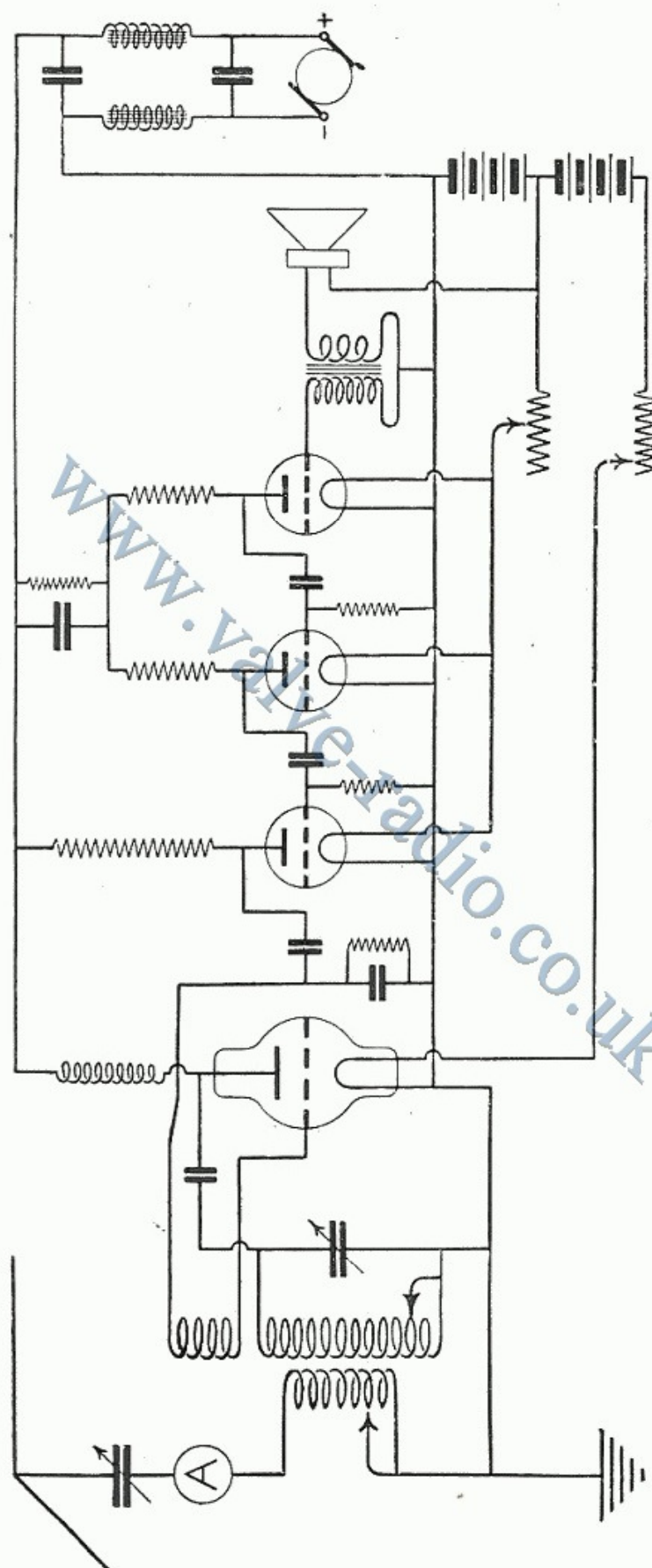
www.valve-radio.co.uk

RADIO TELEPHONY TRANSMITTER ("CHOKE" CONTROL METHOD OF MODULATION.)

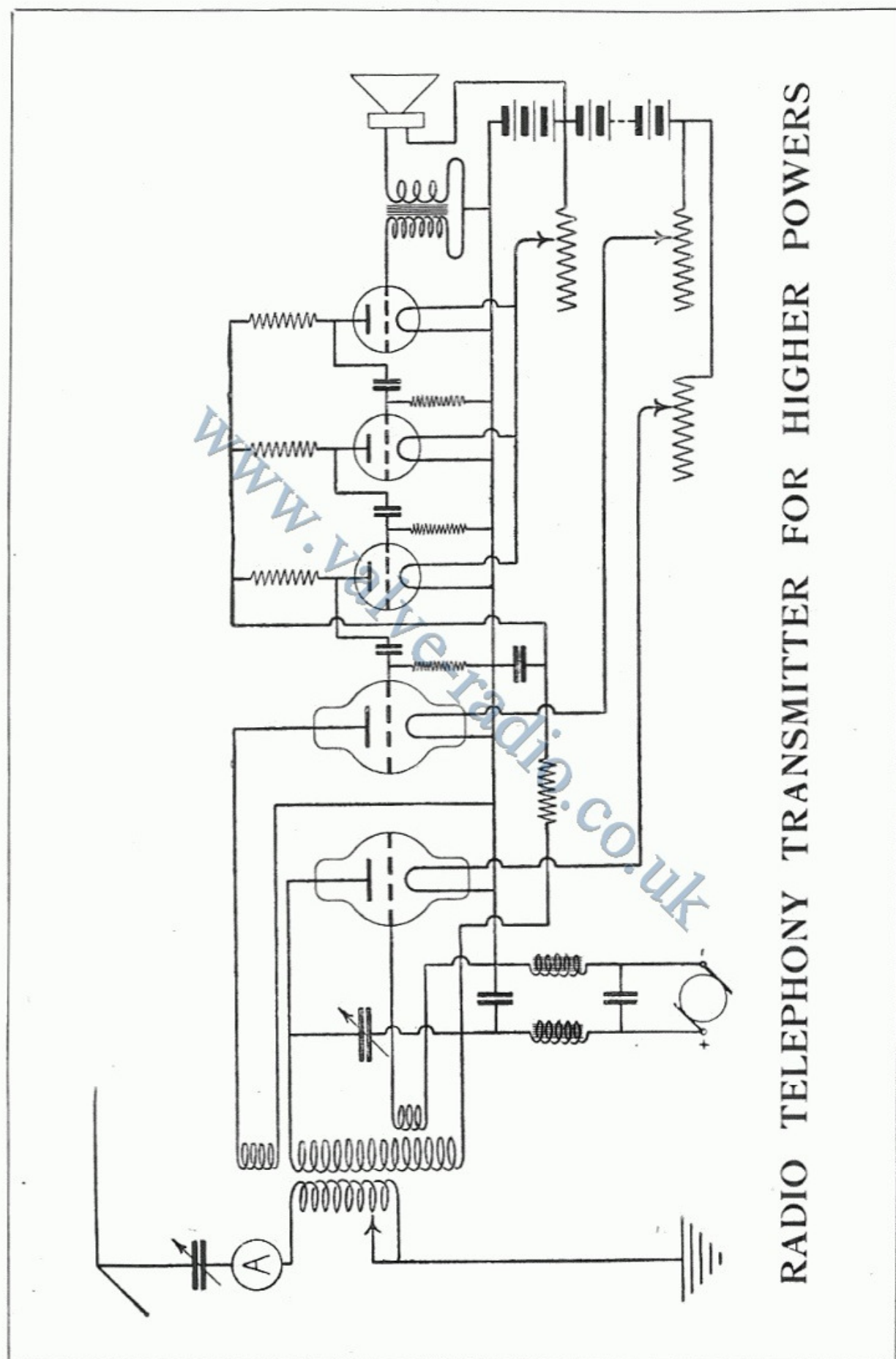


RADIO TELEPHONY TRANSMITTER ("GRID" CONTROL METHOD OF MODULATION)



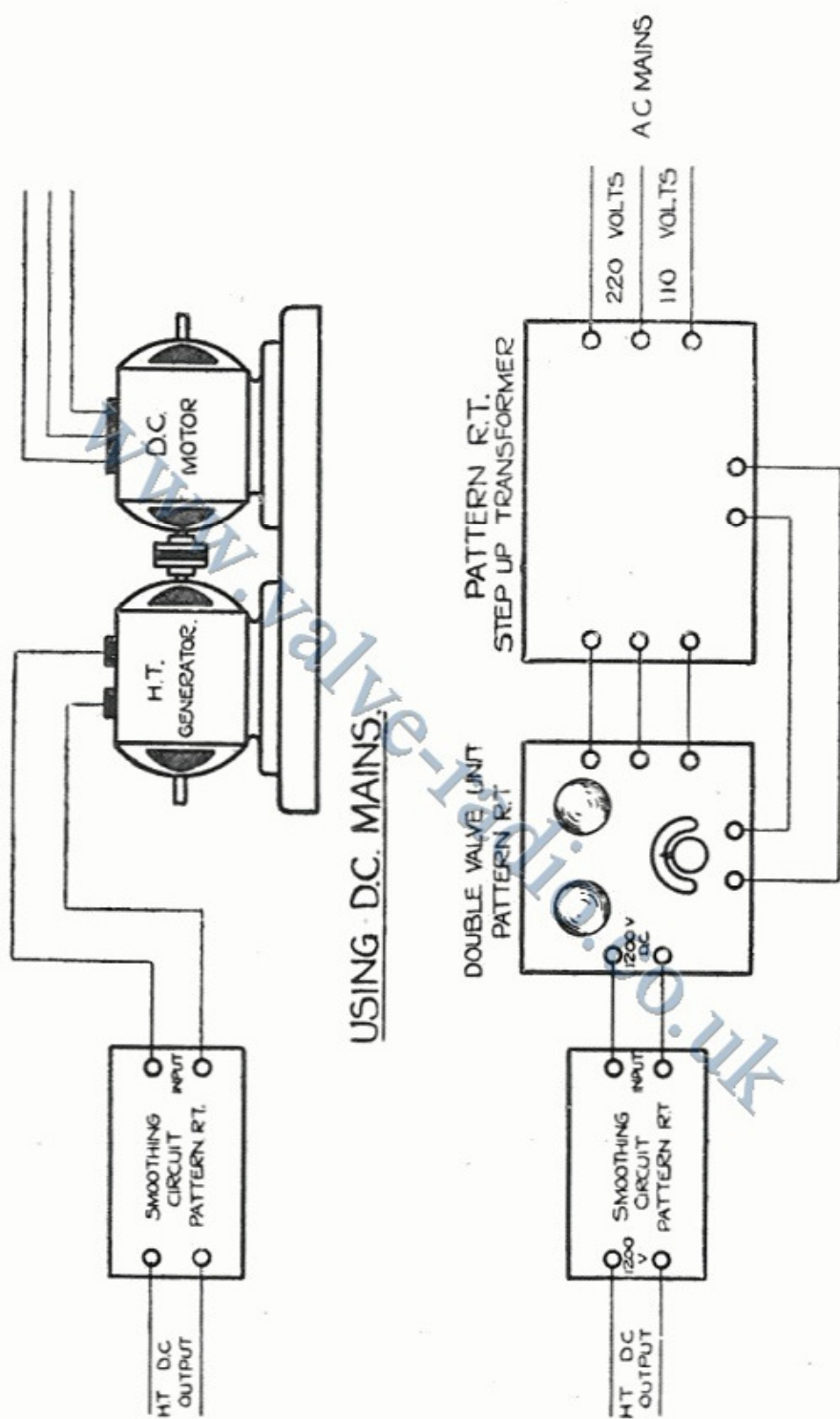


RADIO TELEPHONY TRANSMITTER FOR HIGHER POWERS



RADIO TELEPHONY TRANSMITTER FOR HIGHER POWERS

COMPLETE H.T. SUPPLY CIRCUITS FOR RADIO-TELEPHONE TRANSMITTERS



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156	30	" " 50 "
157	30	" " 75 "
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74	50	" " 2 amperes " " " "
75	50	" " .25 ampere " " " flush type
76	50	" " 1 " " " " "
77	50	" " 1.5 amperes " " " "
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107B	15	" " " " " 20,000 "
183	38	" Single Valve Receiving (mounted)
235	50	" Smoothing, complete, for Transmitting Sets
67	12	Coils, Rotary Magnetic Reaction Coupling (wound)
68	12	" " " " " (unwound)
140	12	" 2 " " " " (wound), in box
141	12	" " " " " (unwound), in box
100	19-20	" Anode Series Reactance 10 tapings
167	20	" " " " " 12 "
120	20	" 1 Reactance, with Switch (mounted)
121	20	" 2 Reactances " " "
170	21	Coil 1 Reactance " " "
171	21	Coils, 2 Reactances " " "
42	9	Condenser, Adjustable Mica Receiving
40	8-9	" Small fixed Mica
41	9	" " " (higher values)
43	44	" Glass Dielectric Transmitting
44	45	" Mica " " .002 mfd.
45	45	" " " " .004 "
46	45	" " " " .016 "
31	5-6	" Variable, .0011 mfd. (in case)
32	5-6	" " .00055 " " "
33	5-6	" " .0011 " (unmounted)
34	5-6	" " .00055 " " "
36	7	" " with Micrometer adjustment
172	6	" " 3-range

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LIST NO.	PAGE.	DESCRIPTION.
172A	6	Condenser, Variable, 3-range, with switch
117	8	" " Heterodyne
230	45-46	" High voltage .2 mfd., 1,000 volts
231	46	" " " .5 " 1,000 "
232	46	" " " 1.0 " 1,000 "
233	46	" " " 5 " 1,000 "
227	43-44	" Air, for Transmitting, 1,000 volts
228	43-44	" Variable Oil " 2,000 "
229	43-44	" " " " 3,000 "
320	7	Handle, Extension, for Variable Condenser
142	27	Holder, for 4-pin Valve, with Terminals
104	11-12	Inductance, Banked Coil Loading
226	46	" Transmitting, with Coupling
209	32	Installation, Complete Receiving, Single-valve
255	55-56	Insulator, Aerial (Leading-in tube)
256	55-56	" " (Large strain insulator)
257	55-56	" " (Small " ")
258	55-56	" " (Large reel insulator)
259	55-56	" " (Small " ")
63A	18	Leak, Grid, .5 megohm
63B	18	" " " "
63C	18	" " " 2 megohms
63D	18	" " " 3 " "
63E	18	" " " 4 " "
63F	18	" " " 5 " "
131	19	Leaks, 2 Grid (mounted)
132	19	Leak, 1 " and 1 Anode Resistance (mounted)
133	19	Leaks, 2 " " 2 " Resistances "
134	19	" 3 " " 3 " " "
135	19	" 5 " " 5 " " "
181	19	Leak, 1 " " (mounted)
217	48	Microphone, with mounting for horizontal panel
218	48	" " " " vertical "
219	48	" " without mounting
264	48	Mounting for 100 and 250-watt valves
266	53	Morse Key
130	36-37	Panel, Experimental Valve Amplifier
130A	37	" " " " with Tuner
208	32	" Single-Valve Receiver, with Detector Unit
184	39	" Two- " Amplifying Receiver
186	40	" Three- " Note Magnifier
191	40	" " " " without rectification
58	18	Potentiometer, Grid, 200 ohms (in case)
62	17-18	" " " 200 " (unmounted)
300	33-34	Receiver, Amplifying, High-Power, 4-valve, Model H.W.S. (Hague Set)
64A	18	Resistance, Anode, 50,000 ohms
64B	18	" " 60,000 "
64C	18	" " 70,000 "
64D	18	" " 80,000 "
64E	18	" " 100,000 "
65	18	" " Spring Clips for
55	17	Rheostat, Filament, .5 ohm (in case)
89	17	" " 1 " "
56	17	" " 2 ohms "
57	17	" " 6 " "
59	17-18	" " .5 ohm (unmounted)
90	18	" " 1 " "
60	18	" " 2 ohms "

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261	52	" Single " "
262	52	" Double-pole single-way
263	52	" Single " "
70	15-16	" Inductance Tapping (double)
71	15-16	" " " (single)
113	20	" Tapping, for Anode Series Reactance
114	20	" Double-tapping Anode Series Reactance
98	16-17	" Series-Parallel (mounted)
99	16-17	" " " "
163	16	" Double-tapping 5-stud, Insulated
164	16	" Single- " 5 "
168	20	" " " 12- " for Anode Series Reactance Coil
169	20	" Double- " 12- " " " " " "
47	25	Telephone, 120 ohms
48	25	" 1,500 "
49	25	" 2,000 "
50	25	" 4,000 "
51	24-25	" 8,000 "
66	25	Terminal Board, Standard, for Amplifier
240	53-54	Transmitter, Radio-Telephone, 10-50 watts
241	54	" " " " (Demonstration type)
250	55	" " " 250 watt set
88	24	Transformer, Telephone, 1 to 1 ratio (in case)
88A	24	" " " (new mounting)
52	24	" " 5 to 1 " (in case)
52A	23	" " " (new mounting)
53	23	" Audio-frequency Intervalve (in case)
53A	22-23	" " " (new mounting)
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105B	15	" " " 20,000 "
205	14	" " variable coupling, Model A
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179	31	Valve Detector Unit
80	26	" Receiving, 4-pin type
81	26	" Socket, " "
94	27	" " 1 (mounted)
95	27	" Sockets 2 "
96	26-27	" " 3 "
212	47	" Transmitting, 10-watt
213	47	" " 25 "
214	47	" " 40 "
215	47	" " 100 "
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223	41-42	Wavemeter, Long-range Standard Heterodyne
224	42-43	" Short-range Heterodyne
	56	Wire, Aerial