TECHNICAL MANUAL No. T.M./101
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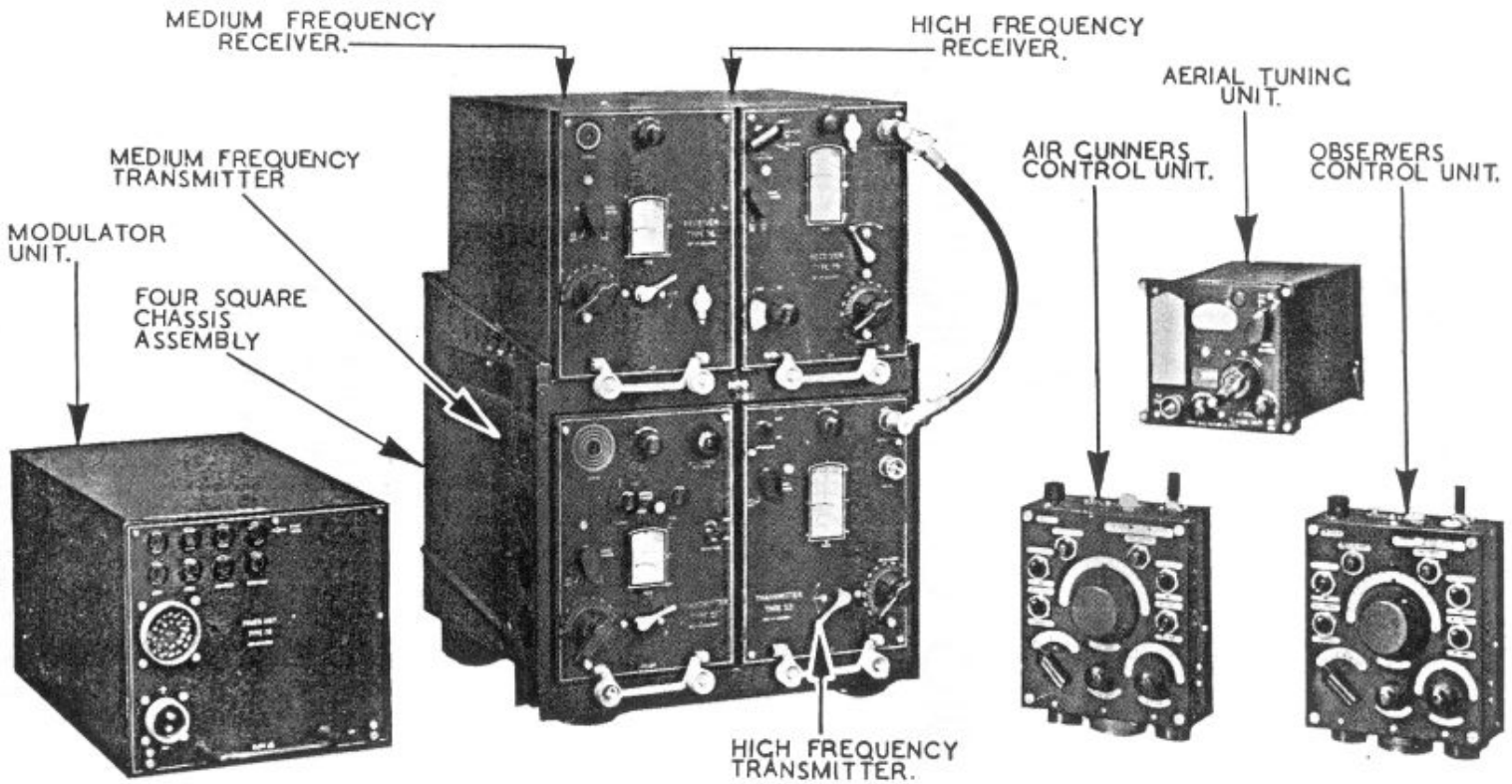
S.T.R. 16/17 (A.R.I.5206)

AIRCRAFT RADIO COMMUNICATION EQUIPMENT

This Technical Manual is intended for technical personnel as a source of reference and for study of the equipment in detail.

Routine instructions covering the equipment are given in Instruction Manual I.M./101.

Standard Telephones and Cables Limited
RADIO DIVISION
LONDON, N.11



A.R.I.5206

UNITS COMPRISING FOUR-SQUARE MODEL

INTRODUCTION

The A.R.I.5206 is a combination of medium and high frequency transmitters and receivers designed for operation in aircraft.

It consists of an assembly so arranged that the medium frequency or high frequency units may be removed without affecting the operation of the remaining pair.

FREQUENCY, SERVICES AND METHOD OF OPERATION

The frequency ranges covered are 150 to 505 kc/s in the medium frequency band, and 2.4 to 13 mc/s in the high frequency band.

The services provided are C.W. on the medium frequency band ; and C.W., M.C.W., and R.T. on the high frequency band. Watch may be kept on both bands simultaneously, and when receiving traffic on one, reception of the other may be cut out if desired.

When the set is used on two frequencies, one in the medium frequency band and one in the high frequency band, full remote control is effected from alternative positions, with facilities for remotely selecting either of the two frequencies and for vernier tuning of the two receivers.

Frequency determination on both bands is by high stability auto oscillators controlled by tuning dials of high setting accuracy. A crystal calibrator is incorporated in the H.F. Receiver for providing checking frequencies at 100 kc/s intervals over the whole range of transmitters and receivers.

The transmitters and receivers for both bands may be continuously tuned, each band being covered in two ranges by selector switch and dial control. Frequency setting is manual, by controls on the front panels of the units.

The A.R.I.5206 may be remotely controlled from one of two positions, accordingly there are two remote control units. Either operator can take charge by pressing a " Take Control " button on his control unit.

USE WITH TR.1366

An alternative Observer's control unit (Type 276) is available to permit the A.R.I.5206 to be used in association with the TR.1366.

AERIALS

Three aerials are required :—

A trailing aerial for the M.F. Transmitter.
A fixed aerial for the M.F. Receiver.
A fixed aerial for H.F. transmitting and receiving.

(For emergency working the M.F. Transmitter may be operated into the M.F. Receiver fixed aerial. The frequency range of the transmitter will be reduced under these circumstances to a band covering approximately 505 to 300 kc/s.)

POWER OUTPUT AND POWER SUPPLIES

The power output delivered to the aerial is 5 to 10 watts on C.W. in the M.F. band, and approximately 25 watts C.W., or 6 watts M.C.W. and R.T. in the H.F. band. In the reduced power condition the C.W. output on both bands is .04 of full power.

13 and 26-volt models are available and are designed for operation in aircraft where the negative side of the supply is earthed.

The valve heaters are fed direct from the aircraft supply, and plate supplies of 500 and 250 volts are obtained by means of a rotary transformer.

Power consumption does not exceed 250 watts for receiving or 350 watts for transmitting.

CABLING AND SCREENING

All units and cables are screened and input filters are incorporated in the aerial circuits to exclude Radar interference.

VALVES

22 valves of 9 different types are used.

DESCRIPTION OF EQUIPMENT

The A.R.I.5206 consists of five main assemblies as follow :—

Transmitter and Receiver Assembly

This consists of a chassis mounting four removable units all having the same dimensions. These units are :—

H.F. Transmitter.
H.F. Receiver.
M.F. Transmitter.
M.F. Receiver.

The Receiver Units contain only the H.F. and frequency changing circuits. I.F. and L.F. circuits are common between the two bands and are located in the Modulator Unit.

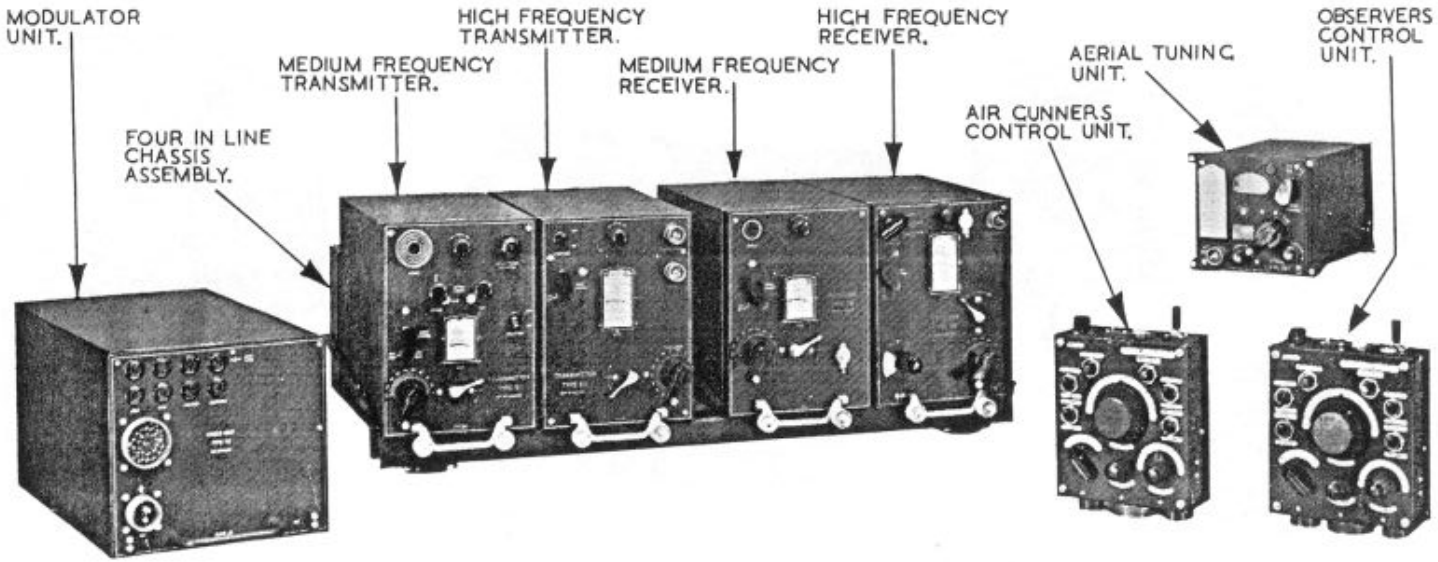
The Main Chassis is obtainable in three models, one in which the H.F. Units are mounted in two pairs one above the other, as shown in the frontispiece, one in which they are mounted horizontally in line, and a third in which two units only are mounted horizontally in line. This assembly should be located in the aircraft so as to permit access to the front panels for setting up to the required working frequencies.

Modulator Unit

This houses the I.F. amplifier and audio amplifier circuits, also the power pack. The unit may be located anywhere in the aircraft as access is not required except for maintenance purposes.

Aerial Tuning Unit

This is used in connection with the H.F. Transmitter and H.F. Receiver only. It must be accessible for setting up the working

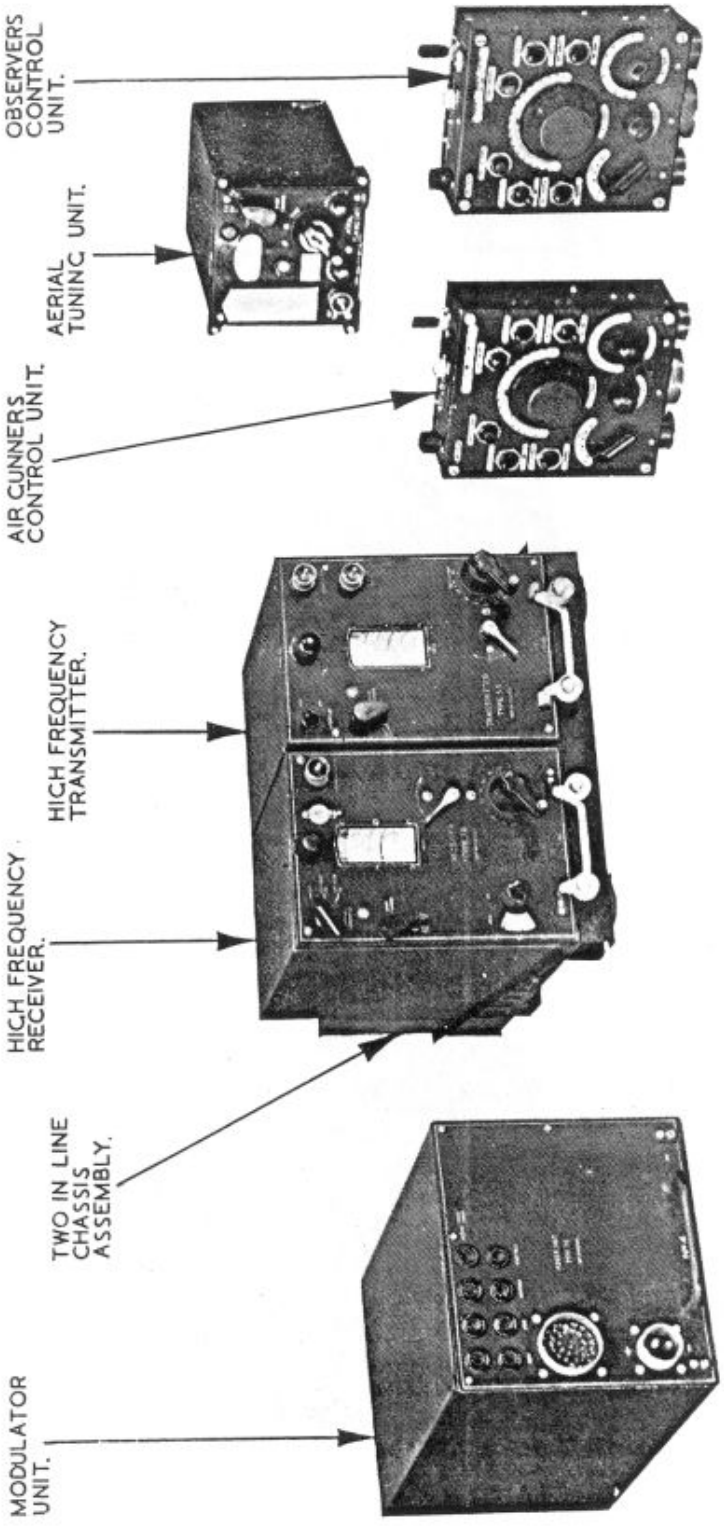


A.R.I.5206

UNITS COMPRISING FOUR-IN-LINE MODEL

PLATE II

PLATE III



UNITS COMPRISING TWO-IN-LINE MODEL

A.R.I.5206

frequencies, and should be close to the aerial lead-in to minimize losses.

Air Gunner's Control Unit
Observer's Control Unit

This unit is supplied in two types according to whether the A.R.I.5206 is used alone or in combination with the TR.1366.

PRINCIPAL TECHNICAL FEATURES

H.F. Transmitter

The H.F. Transmitter uses a VT.60A in a tri-tet oscillator driving an output circuit using two VT.60A's in parallel. For the higher frequency range, the frequency is doubled in the output amplifier.

There are three tuned circuits. The first is the frequency determining circuit covering 1.2 to 3.25 mc/s, the second the oscillator output circuit covering 2.4 to 6.5 mc/s, and the third the amplifier output circuit covering 2.4 to 6.5 and 4.8 to 13 mc/s. Band switching is confined to the output circuit.

Tuning is by rotating coil throughout. All circuits are ganged and driven from one large dial with a spiral scale (with the exception of the aerial circuit which has its own tuning control). The spiral scale on this dial is calibrated in two ranges 2.4 to 6.5 and 4.8 to 13 mc/s. The overall scale length is 46 inches and the law is such that 12 kc/s per millimetre is obtained at the worst part of the scale. The calibration is standard for all sets. Individual final calibration is effected by tracing the calibration line on the cursor.

The use of an output circuit ganged to the oscillator circuits, and a separately tuned aerial circuit, has the advantage that the output stage cannot be overloaded by mistuning the aerial.

The frequency determining circuit is temperature controlled and in addition uses condensers of a balanced temperature coefficient. These measures, together with mechanical rigidity, and with the effect of ganging in securing a constant tuning relationship between oscillator input and output circuits, result in a high degree of frequency stability without the use of crystal control.

The overall frequency tolerance, covering drift and calibration inaccuracy does not exceed $\pm$ 6 kc/s at the worst point.

Medium Frequency Transmitter

This uses a VT.60A valve as an oscillator, driving a similar valve as amplifier which feeds directly into the aerial circuit.

The oscillator is variometer tuned in two ranges : 150 to 280 and 270 to 505 kc/s. Adjustment is by means of a two-position selector switch and a dial having a spiral scale with the two frequency ranges calibrated on it, the method of calibration being similar to that of the H.F. transmitter.

Aerial tuning is by means of a tapped inductance and switch and inter-tap variometer. A neon lamp is provided as tuning indicator.

H.F. Receiver

This consists of a signal limiter, an H.F. amplifier and beating oscillator and first detector.

The beating oscillator is tuned by a separate control. Its frequency determining circuit includes a temperature controlled and temperature compensated rotating-coil unit. This is somewhat similar to that in the H.F. Transmitter and is driven from a large spiral dial. The frequency tolerance is of the same order as that of the transmitter. Exact frequency adjustment in operation is obtained by means of a vernier tuning condenser permitting a frequency variation of $\pm$ .5%. The condenser is electrically remote controlled by means of a " Desynn " electro-magnetically operated device.

The frequency band is covered in two ranges, the controls being a two-way selector switch, oscillator tuning dial, and ganged R.F. tuning control.

Medium Frequency Receiver

The M.F. Receiver consists of a signal limiter, H.F. Amplifier, and triode-hexode frequency changer.

There are three tuned circuits, ganged, each duplicated to cover the ranges 150 to 270 kc/s and 270 to 505 kc/s. Tuning is by a two-position selector switch and double-scale spiral dial similar to those in the M.F. Transmitter.

Vernier frequency adjustment, during operation, is obtained by a similar method to that used for the H.F. Receiver, the motor controlled tuning permitting a frequency variation of $\pm$ .7%.

Modulator Unit

This unit consists of the I.F. Amplifier, C.W. heterodyne oscillator, detector, and L.F. output circuits used with both receivers. It also contains the microphone amplifier, telephone output amplifier, and modulator, together with the rotary transformer and other power supply apparatus.

The I.F. Amplifier has two stages and operates at 560 kc/s. The detector and output stage is a double diode triode. The C.W. heterodyne oscillator operates at a frequency of 561 kc/s.

The microphone amplifier is used for driving the modulator from the microphone, for driving the telephone output amplifier from the receiver output, and for driving the telephone output amplifier from the microphone for sidetone. It is a single-stage resistance-capacity coupled paraphase amplifier, and provides " push-pull " excitation for the modulator, or single-sided excitation for the telephone amplifier.

The modulator is push-pull Class A/B using two VR.503 valves transformer coupled to the anode supply circuit of the output stage of the H.F. transmitter. During reception the modulator is paralysed by cutting in extra cathode bias resistance. The modulator output for low distortion is 10 watts.

The telephone output amplifier delivers the received signals, also side-tone when transmitting, to the telephone circuits. It is a single-stage amplifier using one VR.91 valve, together with an output transformer.

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LIST OF PLATES

LIST OF DRAWINGS

Chapter I

STATEMENT OF AVERAGE PERFORMANCE

1.0 GENERAL

(1.1) Frequency Range

Transmitters		Receivers	
Med. Freq. Range	High Freq. Range	Med. Freq. Range	High Freq. Range
505 to 270 kc/s 280 to 150 kc/s	13 to 4.8 mc/s 6.5 to 2.4 mc/s	505 to 270 kc/s 270 to 150 kc/s	13 to 5.8 mc/s 5.9 to 2.4 mc/s

(1.2) Setting Accuracy (by dials)

Transmitters		Receivers	
Med. Freq. Range	High Freq. Range	Med. Freq. Range	High Freq. Range
± 1 kc/s at worst part of scale	± 6 kc/s at worst part of scale	± 1 kc/s at worst part of scale	± 6 kc/s at worst part of scale

(1.3) Frequency Stability

Transmitters		Receivers	
Med. Freq. Range	High Freq. Range	Med. Freq. Range	High Freq. Range
± .1%	± .03%	± .1%	± .03%

(1.4) Power Consumption

Condition	Consumption
H.F. C.W. Transmission	286 Watts (key down)
H.F. M.C.W. ,,	234 ,, ,,
M.F. C.W. ,,	247 ,, ,,
H.F. R.T. ,,	240 Watts
Reception (Single)	195 ,,
,, (Dual)	198 ,,

(1.5) Audio Frequency Response Characteristic

Transmitting	Receiving
Level within ± 1 dB. from 500 to 11,000 c.p.s.	Level within ± 1 dB. from 600 to 2,000 c.p.s.

(1.6) Altitude

Equipment excluding the M.F. Transmitter operates satisfactorily up to 40,000 feet. The M.F. Transmitter operates up to 30,000 feet.

(1.7) Attitude

Equipment operates satisfactorily in any attitude out of the horizontal but for short periods only.

(1.8) Temperature, Humidity, Acceleration and Vibration

The equipment is suitable for use under full tropical conditions. It will withstand a force that will produce an acceleration of 320 ft. per sec.^{2} at frequencies between 25 and 100 c.p.s.

2.0 TRANSMITTER CHARACTERISTICS

(2.1) R.F. Output Power

Medium Frequency Range		
Frequency	Into Load of 15 ohms 300 $\mu\mu$fd.	
	Full Power	Reduced Power
150 to 280 kc/s 270 to 505 kc/s	8 to 10 Watts 10 to 14 Watts	.32 to .4 Watts .4 to .56 Watts

High Frequency Range			
Frequency	Into Load of 15 ohms		
	Full Power C.W.	Reduced Power C.W.	M.C.W. or R.T.
2.4 to 6.5 mc/s 4.8 to 13 mc/s	33 Watts 29 Watts	1.3 Watts 1.1 Watts	8.25 Watts 7.25 Watts

(2.2) Percentage Modulation and Harmonic Content

Carrier may be modulated up to 100%.

Harmonic content is not greater than 10% at 90% modulation.

(2.3) Noise Level (on R.T.)

At least 40 dB. below level corresponding to 100% modulation.

(2.4) **Keying Speed**

Up to 40 w.p.m. Dot length not reduced by more than 50% at 40 w.p.m.

(2.5) **Modulating Frequency for M.C.W.**

1000 c.p.s.

3.0 RECEIVER CHARACTERISTICS

(3.1) **Sensitivity and S/N Ratio**

Medium Frequency Range		
C.W. at 500 kc/s		
Input	S/N	Output
5 μV	Not less than 14 dB.	Not less than 10 mW.

High Frequency Range					
C.W.			R.T. (at 1000 c.p.s. 30% modulated)		
Input	S/N	Output	Input	S/N	Output
2 μV	Not less than 18 dB.	Not less than 10 mW.	5 μV	Not less than 15 dB.	Not less than 10 mW.

(3.2) **Intermediate Frequency**

560 kc/s.

(3.3) **I.F. Bandwidth**

	Bandwidth	
	For 6 dB. down	For 60 dB. down
H.F. Receiver	Not less than ± 3 kc/s	Not more than ± 17.5 kc/s
M.F. Receiver	Not less than ± 5 kc/s	Not more than ± 15.0 kc/s

(3.4) **Second Channel Suppression**

Medium Frequency Range = 45 dB.
High Frequency Range = 30 dB.

(3.5) **Automatic Gain Control**

Medium Frequency Range C.W.		High Frequency Range R.T.	
Rise in Input	Rise in Output	Rise in Input	Rise in Output
80 dB. above 10 μV	6 dB.	80 dB. above 10 μV	6 dB.

(3.6) **Range of Fine Tuning Control**

C.W. medium frequencies ± .7%.
C.W. high frequencies ± .5%.

(3.7) **Audio Output Load**

Equipment is capable of delivering an output of 100 mW. per pair of telephones, without distortion. The level is not changed by connection or disconnection of other telephones to a total number of three pairs.

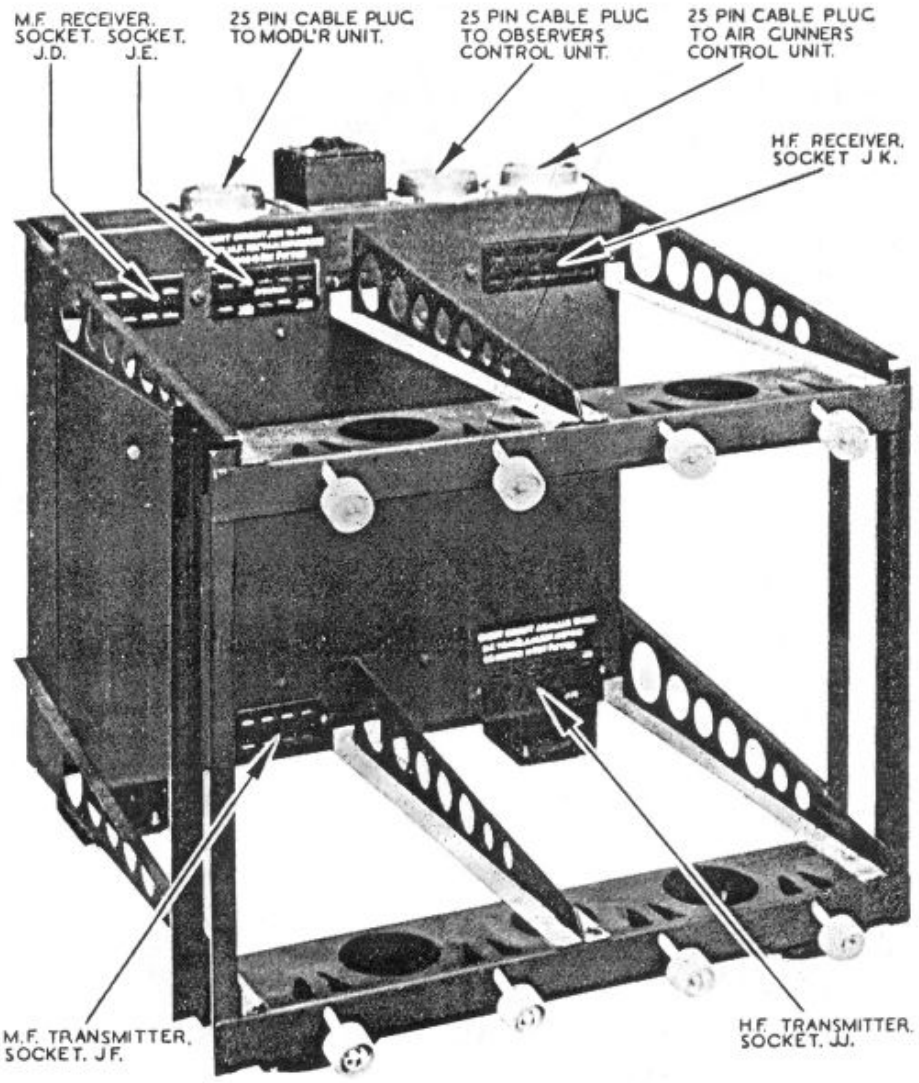
(3.8) **Output Impedance**

The equipment is designed to operate into an impedance of 8000 to 20,000 ohms, or by alteration of tappings in the output transformer, into an impedance of 50 to 150 ohms.

4.0 WEIGHTS AND DIMENSIONS

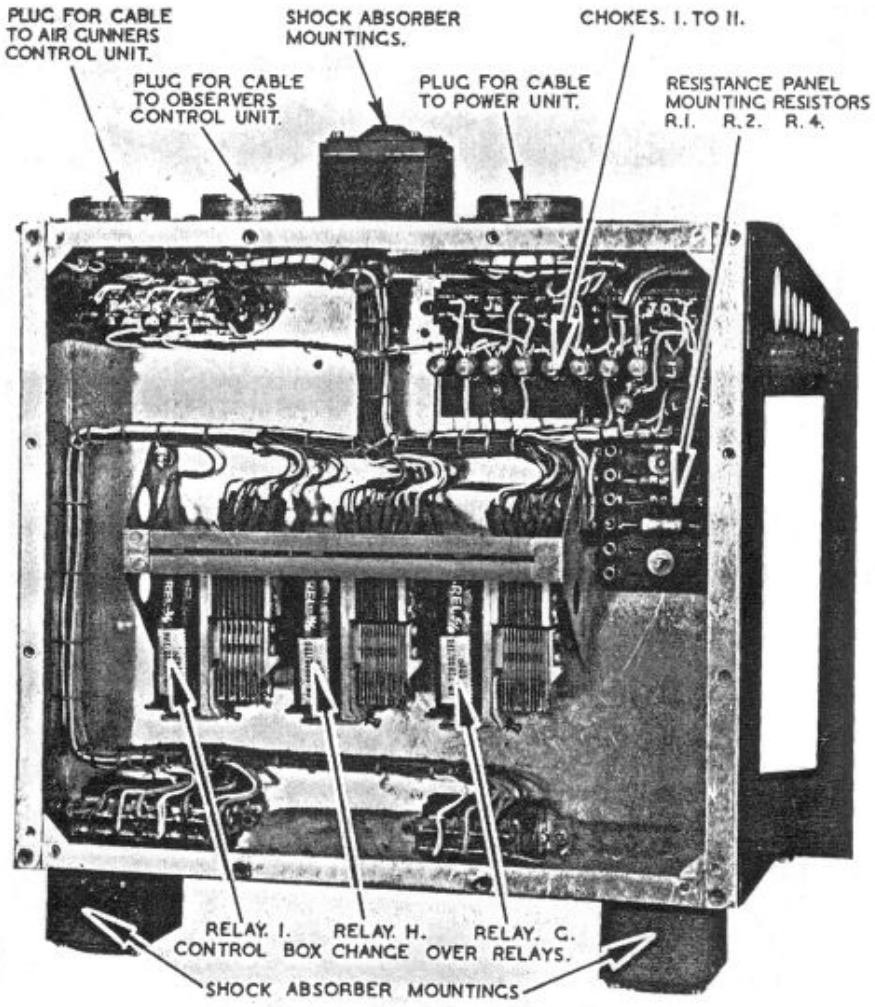
			Approx. overall dimensions in inches		
			Height	Width	Depth
Medium Frequency Receiver	=	9 lb. 6 oz.	8.25	6.26	12.3
Medium Frequency Transmitter	=	8 lb. 14 oz.	8.25	6.26	12.3
High Frequency Receiver	=	10 lb. 5 oz.	8.25	6.26	12.3
High Frequency Transmitter	=	12 lb. 2 oz.	8.25	6.26	12.3
Modulator Unit	=	26 lb. 14 oz.	7.5	8.5	17.5
Aerial Tuning Unit	=	3 lb. 9 oz.	4.8	5.3	11
Chassis Assembly	=	8 lb. 11 oz.	16.75	13.7	12.7
Two Control Units	=	7 lb. 10 oz.	8.2	5.75	3.3 each
Modulator Unit Tray	=	2 lb. 3 oz.	1.75	8.75	15.4
H.F. Aerial Link	=	4 oz.			
Total		89 lb. 4 oz.			

PLATE IV



A.R.I.5206 CHASSIS ASSEMBLY FOUR-SQUARE MODEL

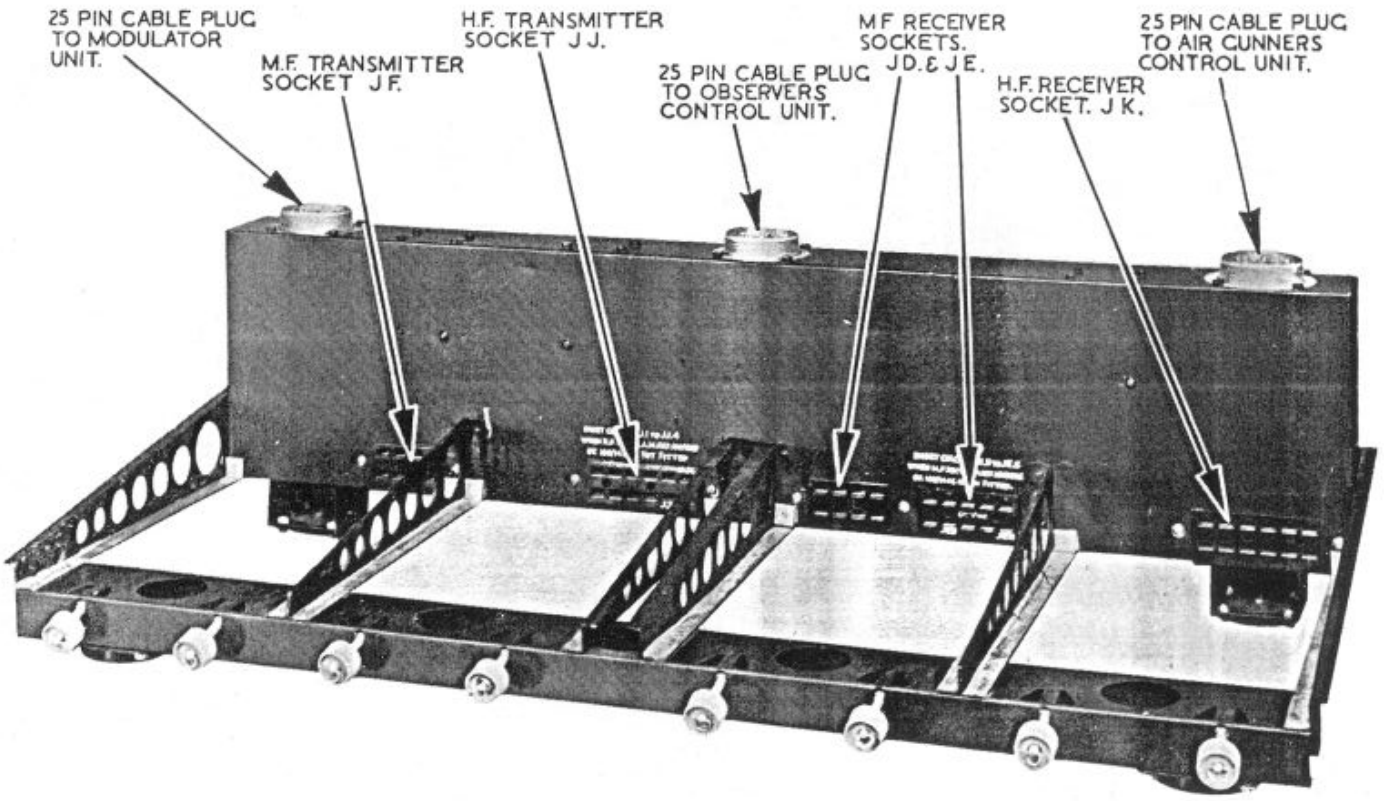
PLATE V



A.R.I.5206

CHASSIS ASSEMBLY
(Rear cover removed)

FOUR-SQUARE MODEL



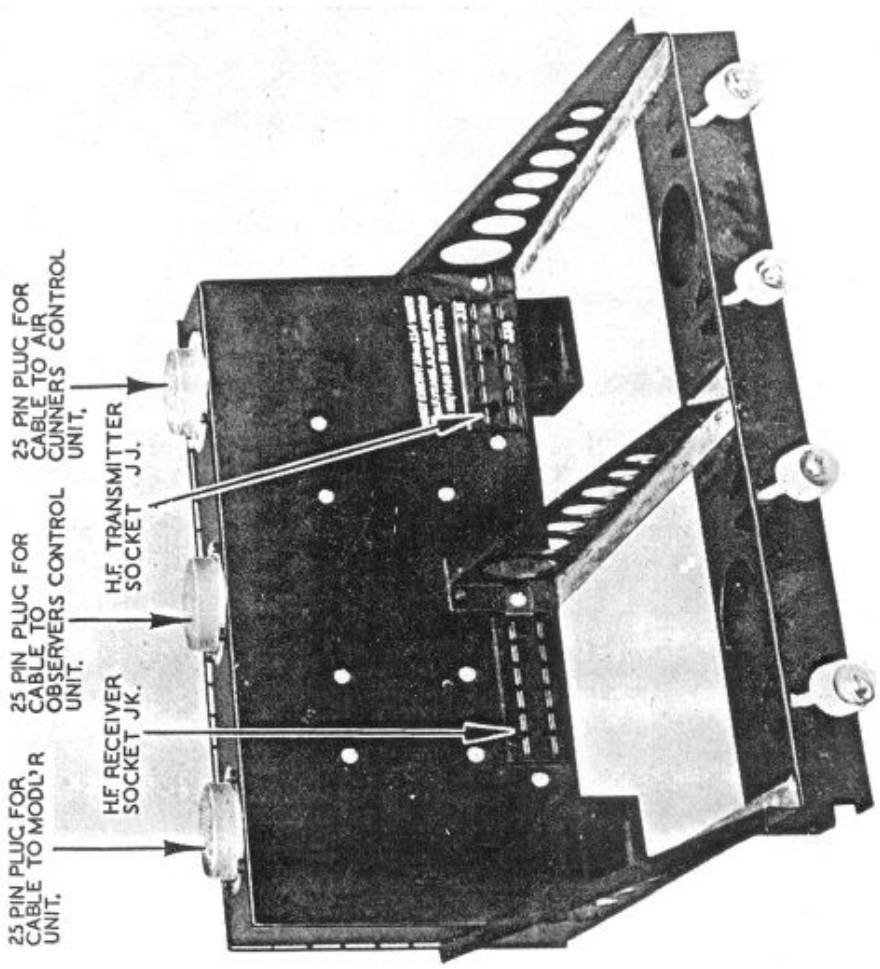
A.R.I.5206

CHASSIS ASSEMBLY

FOUR-IN-LINE MODEL

PLATE VI

PLATE VII



CHASSIS ASSEMBLY

TWO-IN-LINE MODEL

A.R.I.5206

Chapter II

DETAILED DESCRIPTION

1.0 DESCRIPTION OF EQUIPMENT

The A.R.I.5206 incorporates the following :—

Item	*Consisting of*
Main Assembly	Chassis Assembly containing four R.F. Units (H.F. Transmitter, H.F. Receiver, M.F. Transmitter and M.F. Receiver).
Modulator Unit	Intermediate frequency amplifier, audio amplifier and power pack.
Aerial Tuning Unit	An aerial loading inductance for use with the H.F. Transmitter and H.F. Receiver only.
Two Control Units.	

2.0 DESCRIPTION OF UNITS

NOTE.—All illustrations referred to in the chapter are of the 26-volt model. (Circuit diagrams of the 13-volt model are denoted by the suffix A and printed in blue.)

(2.1) Main Assembly

(1) Chassis Assemblies

Plates IV to VII illustrate the Chassis Assemblies.

(*a*) **Construction**

The Chassis Assemblies are supplied in three alternative forms. The Four-Square model takes the four R.F. Units in two pairs, one pair above the other. The horizontal models mount the units side by side, one carrying four R.F. units and the other two units.

The R.F. units slide into the Chassis Assembly from the front and are secured by clamps. Sockets mounted on the assembly and connected to a cable-form, engage with plugs at the rear of the units, and complete the electrical connections. The rear of the Chassis Assembly is constructed in the form of a screened compartment with removable cover plate. This compartment houses control change-over relays, chassis wiring and associated chokes.

Shock absorber mountings are provided for securing the chassis to the aircraft.

(*b*) **Electrical Description of the Chassis Assembly** (the circuit diagrams are given in Figs. 12 and 12B)

All inter-unit cable connections are carried out via the assembly, and wiring to the H.F. Units is terminated at Jones sockets.

Relays G, H, and I mounted in the assembly permit the change over from one control point to the other by the process of switching all connections. Chokes have been incorporated in wiring associated with the M.F. Receiver for suppression of Radar interference.

(2) H.F. Transmitter Unit

Plates VIII and IX illustrate the unit with dust cover removed.

(*a*) Construction

All apparatus is mounted on a chassis provided with a front panel. The chassis slides into a dust cover which is secured by a DZUS fastener.

The rotating tuning inductances are ganged and driven from a front panel control via a backlash-free mechanism. The associated dial is calibrated in frequency at 10 kc/s points. The calibration takes the form of a spiral line, giving an effective scale length of 46 inches. This gives 12 kc/s per millimetre at the worst point, permitting a setting accuracy of $\pm$ 6 kc/s.

The Master Oscillator components are assembled in a heat lagged compartment fitted with heaters and a thermostat.

The chassis is constructed of zinc sprayed semi-silver steel. The dust cover is of aluminium. The front panel and dust cover are finished in matt black. Bright metal parts on the front panel are finished in polished nickel.

(*b*) Front Panel Fittings

These are shown on Plate X and are :—

Controls	*Other Fittings*
Band Change Switch	Aerial Socket
Tuning Control and Lock	H.F. Link Socket
Intertune Switch	
Panel Light Dimmer	

(*c*) Circuit (the circuit diagrams are given in Figs. 3 and 3A)

The transmitter consists of a VT.60A valve V.1 connected as an electron coupled Colpitts Oscillator driving a power amplifier using two similar valves in parallel. The power amplifier has a tuned anode circuit which is capacitively coupled to a low impedance 15 ohm line. All circuits are inductively tuned, and ganged.

The frequency determining circuit of the Master Oscillator (L.1 and C.1 to C.8) covers a frequency range of 1.2 to 3.23 mc/s, while the oscillator anode

H.F. TRANSMITTER UNIT
(Cover removed)

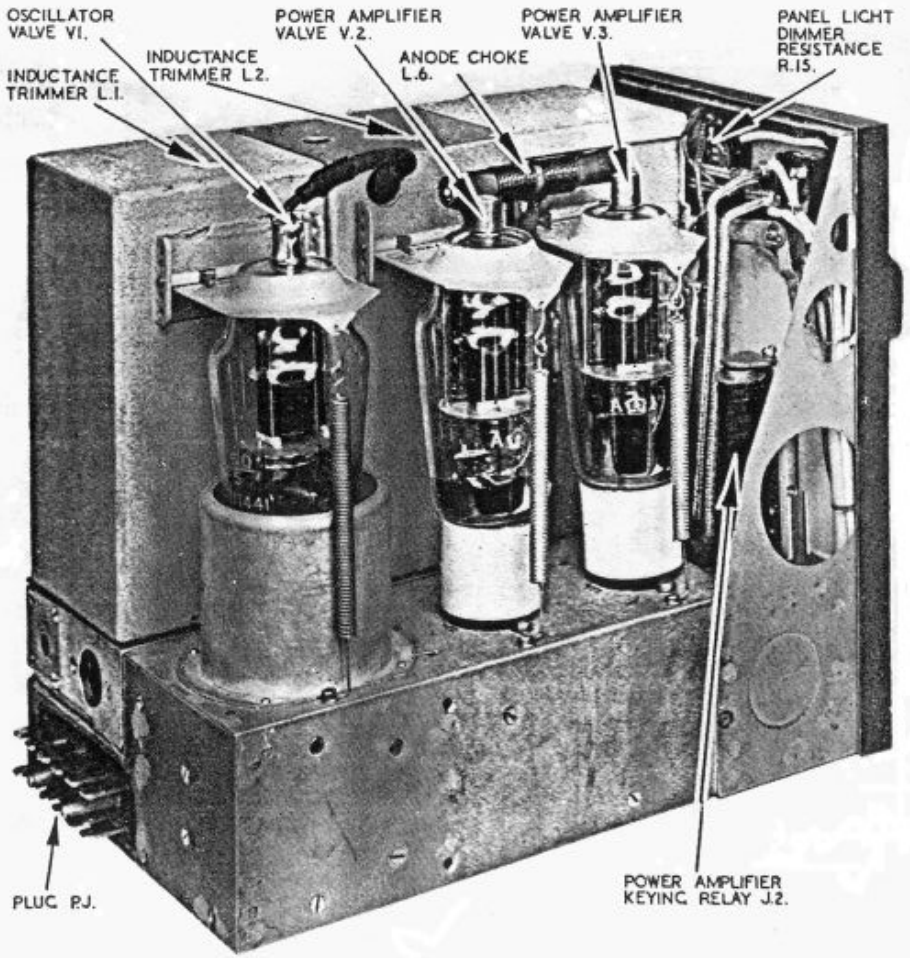
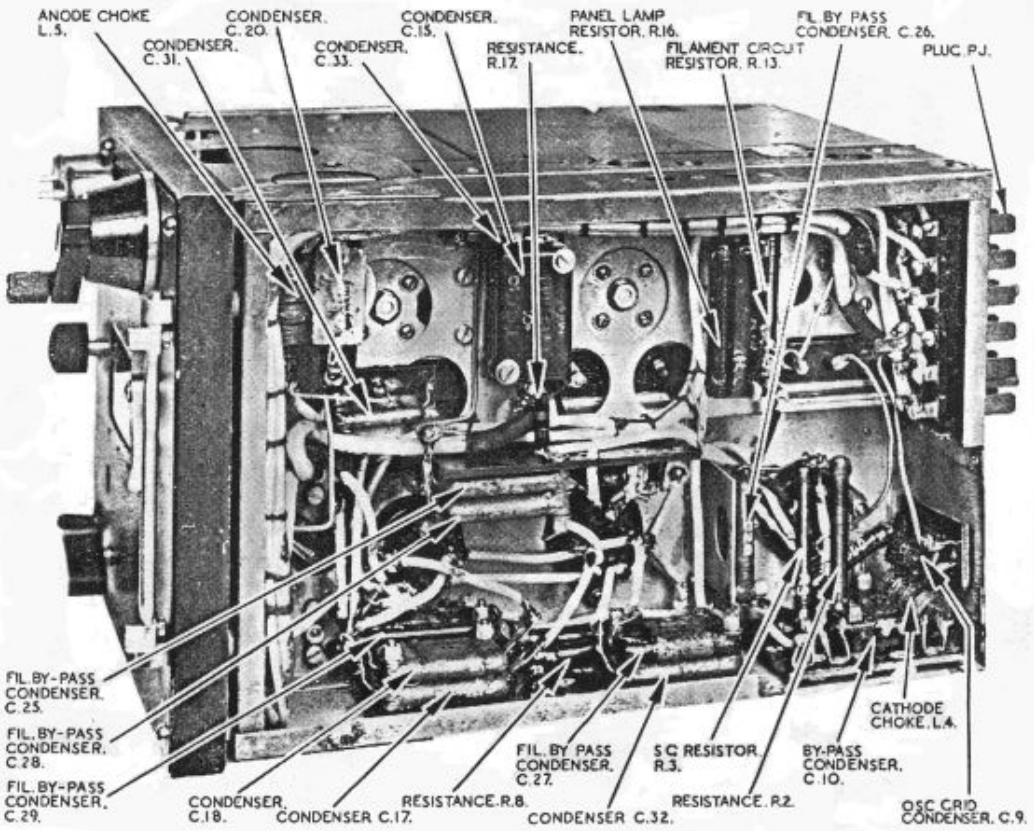


PLATE VIII

A.R.I.5206

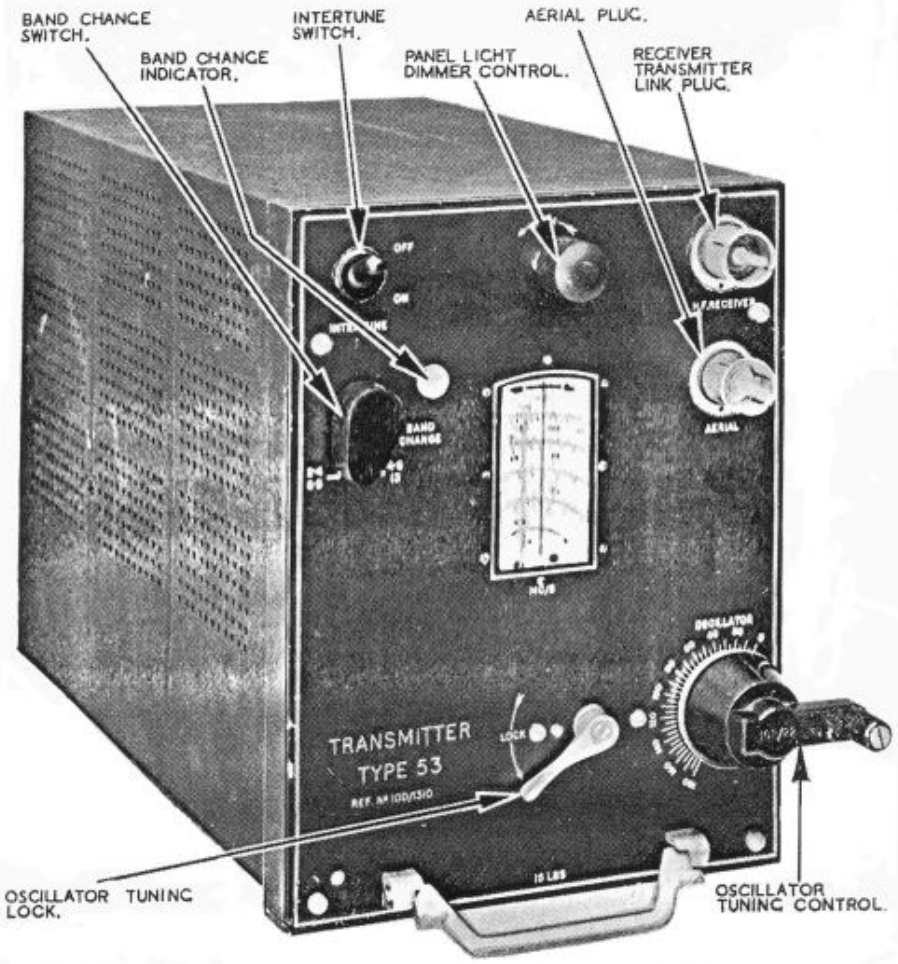
PLATE IX

H.F. TRANSMITTER
UNIT
(Underside view)



A.R.I.5206

PLATE X



A.R.I.5206 H.F. TRANSMITTER UNIT

circuit (L.2 and C.11 to C.13) is tuned to double this frequency range. An arrangement of silvered mica and ceramic condensers with balanced temperature coefficients combined with a thermostatically controlled heater ensure high stability of the master oscillator circuit.

The power amplifier functions as a straight amplifier between 2.4 and 6.5 mc/s and as a doubler between 4.8 and 13 mc/s. The change is brought about by switching the effective tuning capacity of the circuit. For the 2.4 to 6.5 mc/s band condensers C.22, 23, 24 and 30 are coupled into circuit via switch S.1 and withdrawn from circuit in the 4.8 to 13 mc/s band.

Capacitive coupling is provided between the power amplifier tank circuit (L.3, C.19 to 24 and C.30) and the 15 ohm line. The line is tapped across part of the tuning capacity so as to obtain the correct match. The tuning capacities C.19 to C.21 for the high frequency band are always in circuit. Changing to low frequency is effected by switching in extra capacities C.22, C.23, C.24, C.30. The switch is incorporated in the amplifier coil and coupled by a link-fitting to a knob on the front panel of the unit.

Keying is effected by two relays J.1 and J.2, mounted in the transmitter. These relays perform the following operations :—

(*a*) Change the aerial connection from receiver to transmitter.

(*b*) Earth the receiver input connection.

(*c*) Mute the receiver.

(*d*) Short out a high resistance (R.49) in series with the normal cathode resistance on the modulator valves. (See circuit diagram Figs. 7 and 7A.)

(*e*) Apply H.T. to the oscillator.

(*f*) Apply H.T. to the screens of the power amplifier valves.

(*g*) Apply H.T. to the tone oscillator in the Modulator Unit.

When the relays are in the de-energized position the screens on the power amplifier are disconnected from the H.T. supply and earthed, thus limiting the H.T. drain to a minimum.

A switch on the front panel of the transmitter provides independent control of H.T. to the master oscillator and enables the oscillator to be " Whistled In " on the H.F. receiver, which in turn may at any time be checked against a built-in Crystal Calibrator.

(3) H.F. Receiver Unit

This unit with dust cover removed is shown in Plate XI.

(*a*) **Construction**

The general construction and finish of this unit are similar to that of the H.F. Transmitter, see paragraph 2.1 (2) (*a*).

The beating oscillator components are mounted in a heat lagged box forming an easily replaceable sub-chassis. It contains the oscillator coil, heater elements and a thermostat.

The rotating coil in this sub-chassis is driven by a backlash-free mechanism from the front panel control and the associated dial is calibrated at 10 kc/s points. The spiral scale has an effective length of 46 in. giving 10 kc/s per millimetre at the worst part of the scale. The setting accuracy is approximately $\pm$ 6 kc/s.

A Desynn motor for vernier frequency control is mounted on the chassis. The mounting takes a form similar to that used for a normal valve, and permits immediate withdrawal of the motor.

The motor and associated trimmer condenser are entirely enclosed in a small oil-filled and sealed container.

(*b*) **Front Panel Fittings**

These are shown in Plate XII and are :—

Controls	*Other Fittings*
Band Change Switch	Aerial Link Socket
Oscillator Tuning Control and Lock	Preset noise adjuster behind mask
R.F. Tuning Control	
Panel Light Dimmer	

(*c*) **Circuit** (the circuit diagrams are given in Figs. 4 and 4A)

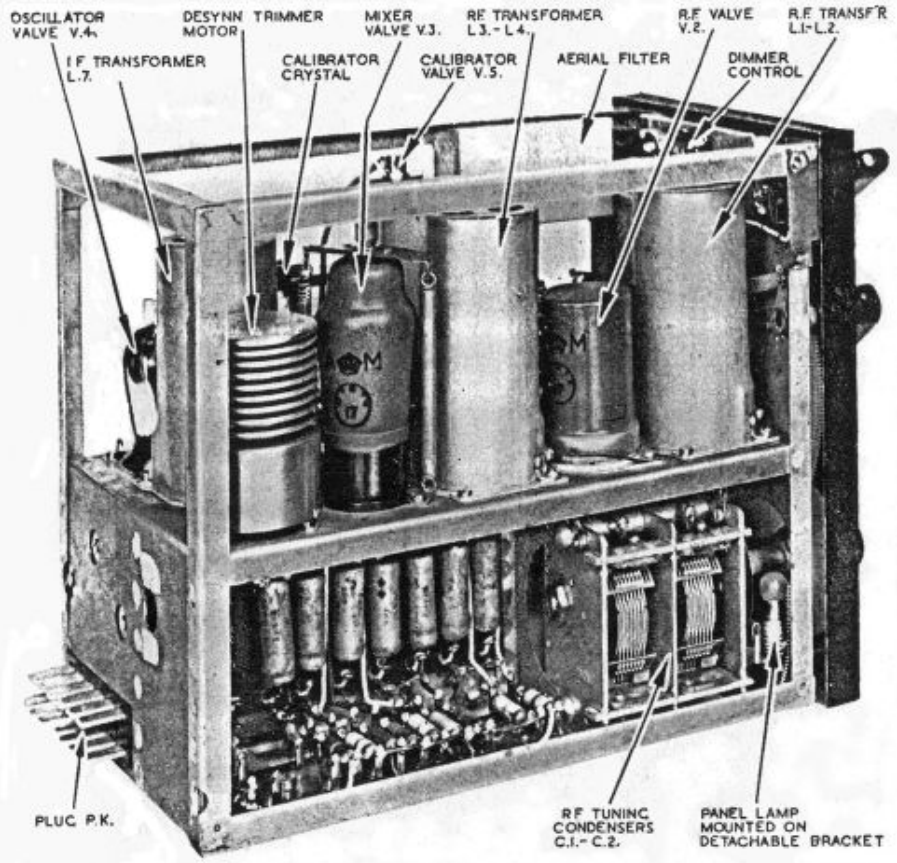
The receiver consists of a diode limiter, an R.F. amplifier, a mixer and a beat oscillator. There is a Radar suppressor unit in the aerial lead.

V.1, the diode limiter (Type VR.92) is connected across the secondary windings of L.1, L.2 and is arranged to limit excess voltages developed across them and so overcome blocking or cross modulation from strong signals.

V.2, the radio frequency amplifier (Type VR.53) is coupled to V.3 (Type ARTH.2) the frequency changer, via the tuned R.F. transformer L.3 and L.4. Two sets of coils are provided for each tuned circuit and are switched by means of a band switch located on the front panel of the unit. Ganged condensers are employed for tuning the circuits.

The anode circuit of V.4, the beat oscillator valve tuned by L.6 is coupled to the mixer grid of V.3. A balanced combination of silvered mica and ceramic

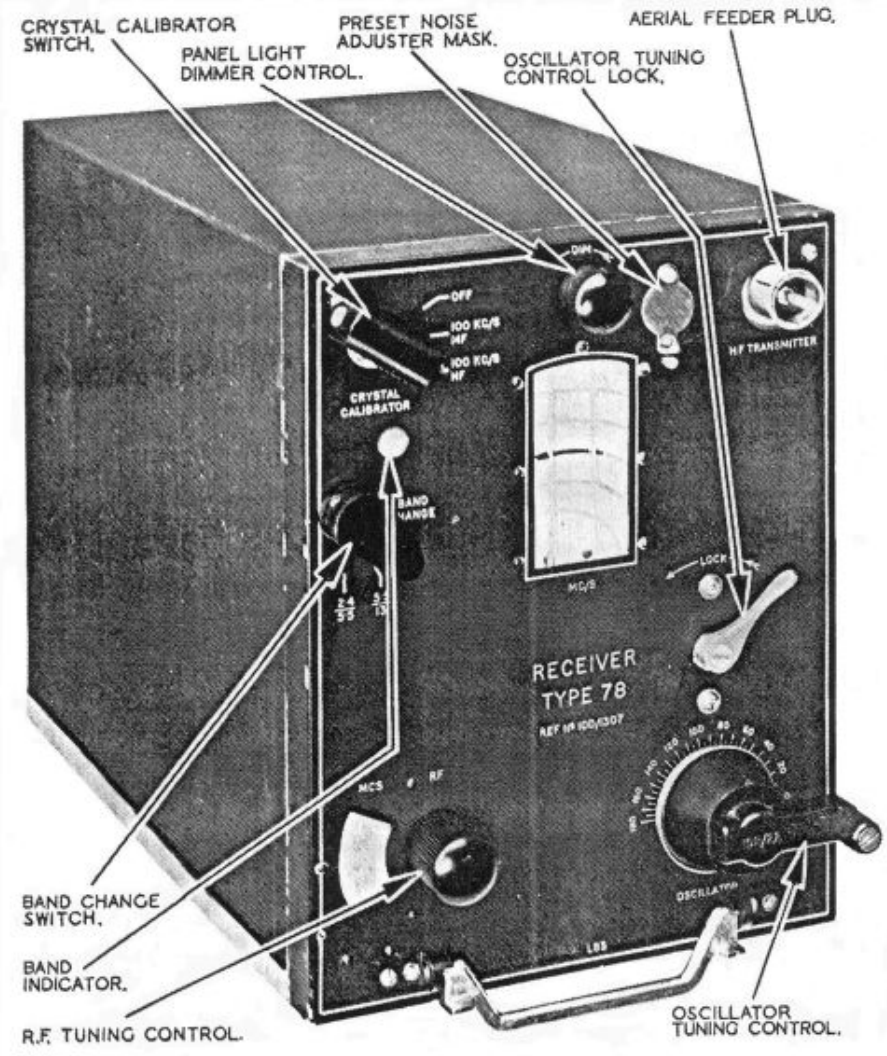
PLATE XI



A.R.I.5206

H.F. RECEIVER UNIT
(Cover removed)

PLATE XII



A.R.I.5206 H.F. RECEIVER UNIT

M.F. TRANSMITTER UNIT
(Cover removed)

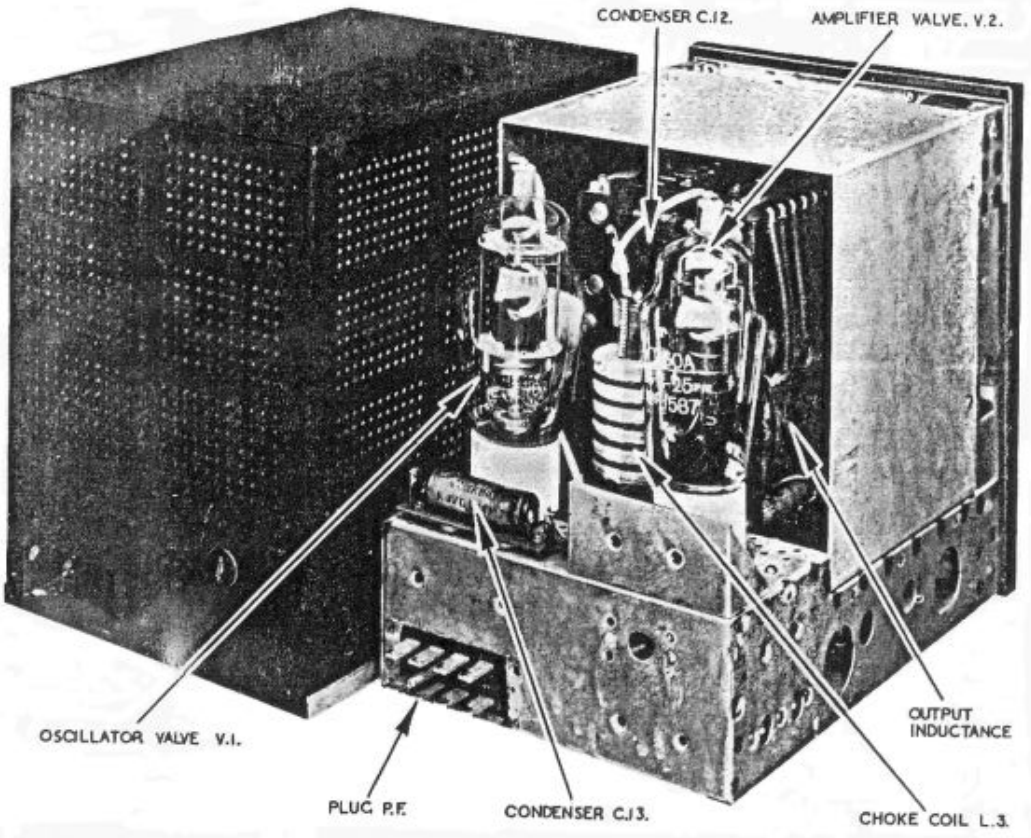
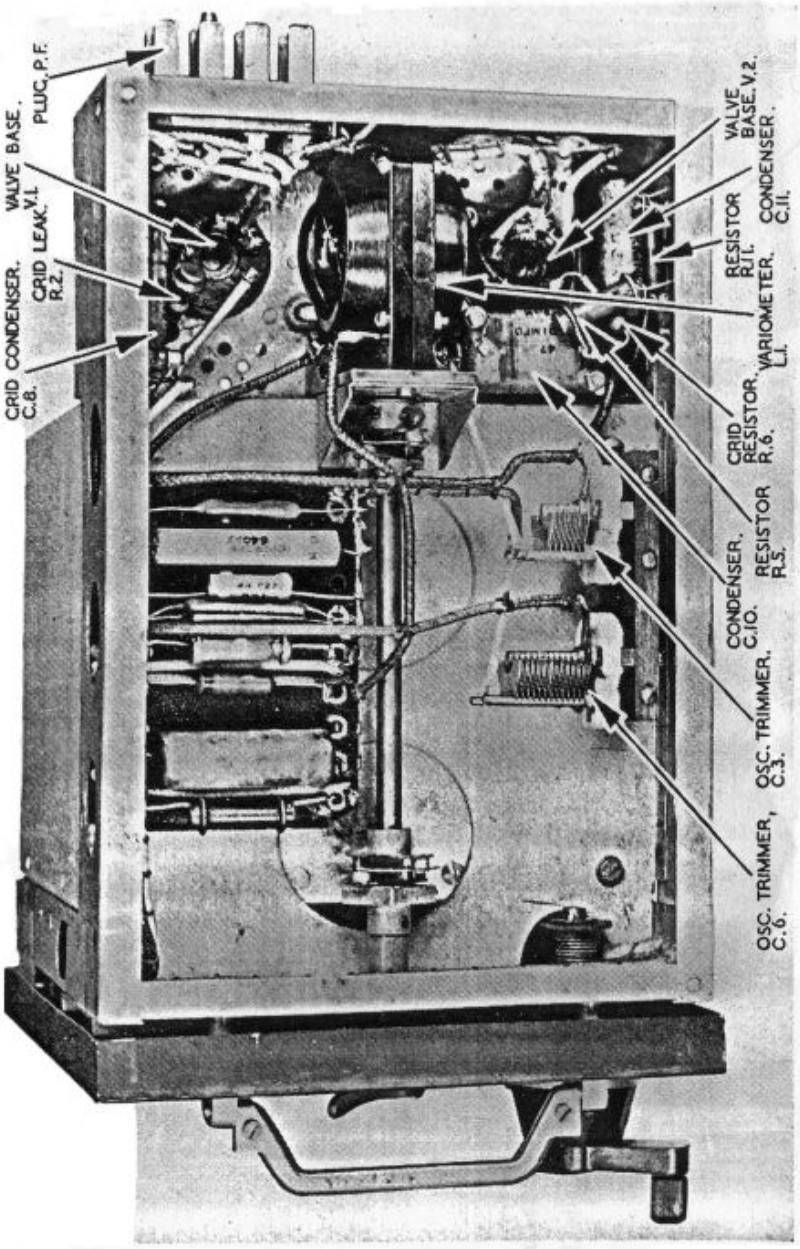


PLATE XIII

PLATE XIV



M.F. TRANSMITTER UNIT
(Underside view)

A.R.I.5206

condensers is employed in the beat oscillator circuit to ensure stability. Thermostatically controlled heater elements maintain a constant temperature of 30 degrees centigrade in the oscillator compartment.

Across the tuning circuit of the beat oscillator is a Desynn motor controlled condenser. The motor (R.T.1) is controlled electrically from a remote point, and enables a frequency variation of $\pm$ .5% to be obtained over the whole band. Transformer L.7 in the anode circuit of V.3 is tuned at intermediate frequency (560 kc/s) and feeds the receiver output via co-axial line to the intermediate frequency amplifiers in the modulator unit. Automatic gain control is applied to V.2 and V.3 from the I.F. modulator circuits of the Modulator Unit.

Included as part of the receiver is a crystal calibrator fitted with a single crystal and giving harmonics of 100 kc/s for the calibration of both medium and high frequency receivers. The calibrator consists of a Hartley circuit with the crystal (X.1) across the grid-cathode circuit. Valve V.5 operates under Class C conditions, autogrid bias being obtained by means of the voltage drop across R.30 and R.32. Provision is made for connecting a milliammeter in circuit when initially setting up the calibrator.

(4) M.F. Transmitter Unit

Plates XIII and XIV show the unit with dust cover removed.

(*a*) Construction

The general construction and finish of the unit is somewhat similar to that of the H.F. Transmitter and Receiver units already described, except that no special arrangements exist for temperature control of the oscillator circuit.

The master oscillator is variometer tuned, and is driven by a backlash-free mechanism from the front panel via a 51.2 to 1 reduction gear. The associated dial is calibrated at 1 kc/s points. The spiral scale has a total length of 26 inches, giving 1 kc/s per millimetre at the worst part of the scale. The setting accuracy is approximately $\pm$ 1 kc/s.

(*b*) Front Panel Fittings

These are shown in Plate XV and are :—

Controls	*Other Fittings*
Band Change Switch	Neon Aerial Tuning Indicator
Oscillator Tuning Control and Lock	Aerial Socket
Aerial Inductance Tuning Controls	
Intertune Switch	
Panel Light Dimmer	

(*c*) **Circuit** (the circuit diagrams are given in Figs. 5 and 5A)

The transmitter consists of two stages, a master oscillator and a power amplifier stage, both using VT.60A valves.

Coil L.1 with associated condensers (C.1 to C.6) forms the oscillating circuit which is capacitively coupled to the grid of the R.F. amplifier valve V.2, via condenser C.10 and resistance R.6.

By operation of the Intertune switch (S.3) H.T. supply may be fed individually to valve V.1 via terminal 4 and supply line. This permits operation of the oscillator only, for frequency checking.

The anode of V.2 is capacitively coupled via C.12 to the output coil L.2 in the aerial circuit. Coil L.2 is provided with a series of tappings for coarse tuning of the aerial circuit and a variometer for fine tuning. The inductance of L.2 is chosen so that the unit will operate for emergency working into a fixed aerial of any capacity down to 50 $\mu\mu$F. and for normal working into a trailing aerial of 300 $\mu\mu$F. Under emergency conditions the frequency range of transmitter will be restricted to a band covering approximately 505 to 300 kc/s.

(5) **M.F. Receiver Unit**

This unit with dust cover removed is shown in Plates XVI and XVII.

(*a*) **Construction**

The construction and finish of the M.F. Receiver is similar to that of the H.F. Transmitter, see paragraph 2.1 (2) (*b*), but no special arrangements for temperature control of the oscillator circuit exist.

Tuning of the circuits is effected by ganged condensers driven via a backlash-free mechanism from the front panel.

The dial is calibrated at 1 kc/s points and the spiral scale having an effective length of 18 inches gives approximately 700 c.p.s. per millimetre at the worst part. The setting accuracy is $\pm$ 1 kc/s.

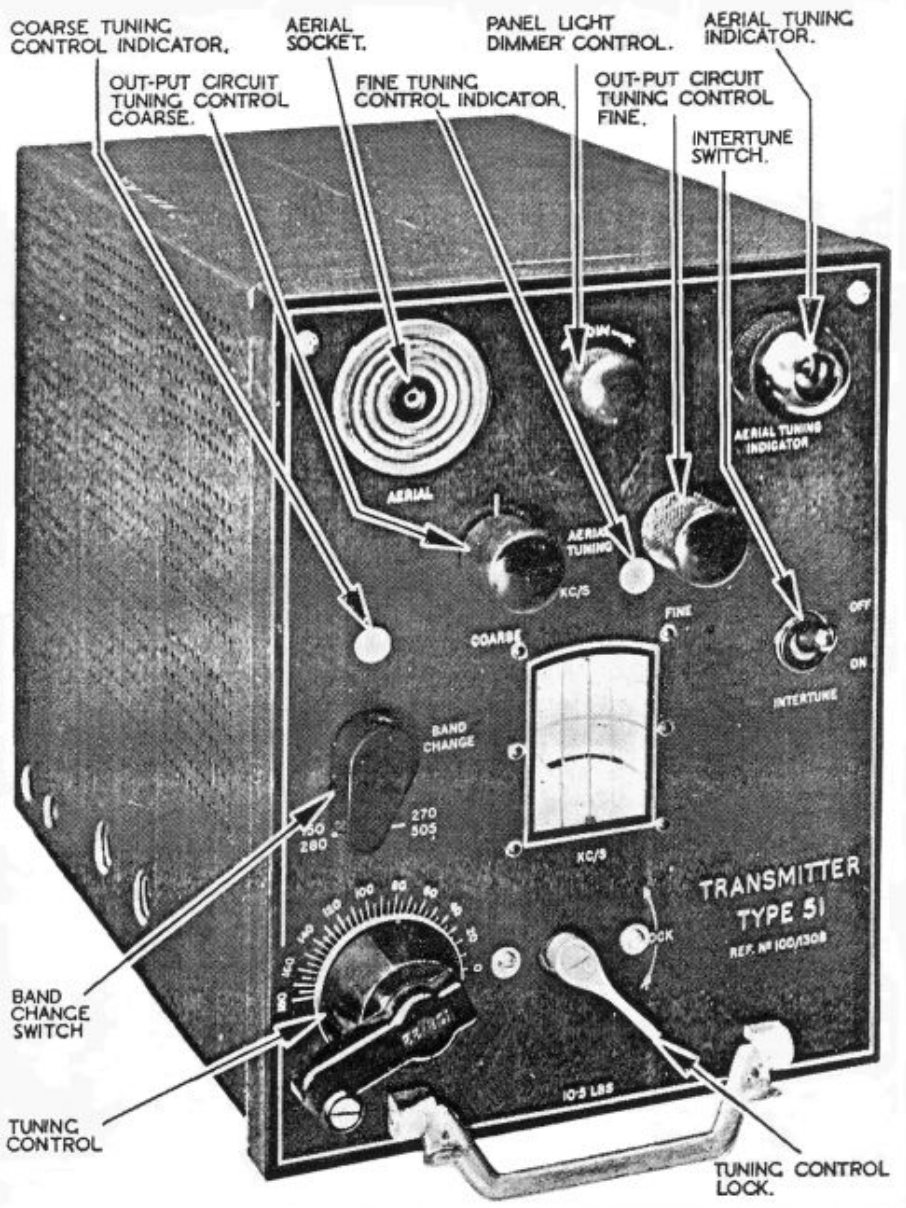
A Desynn motor for vernier control of frequency is mounted on the chassis. The construction of the motor is similar to that used in the H.F. Receiver, see paragraph 2.1 (3) (*a*).

(*b*) **Front Panel Fittings**

These are shown in Plate XVIII and are :—

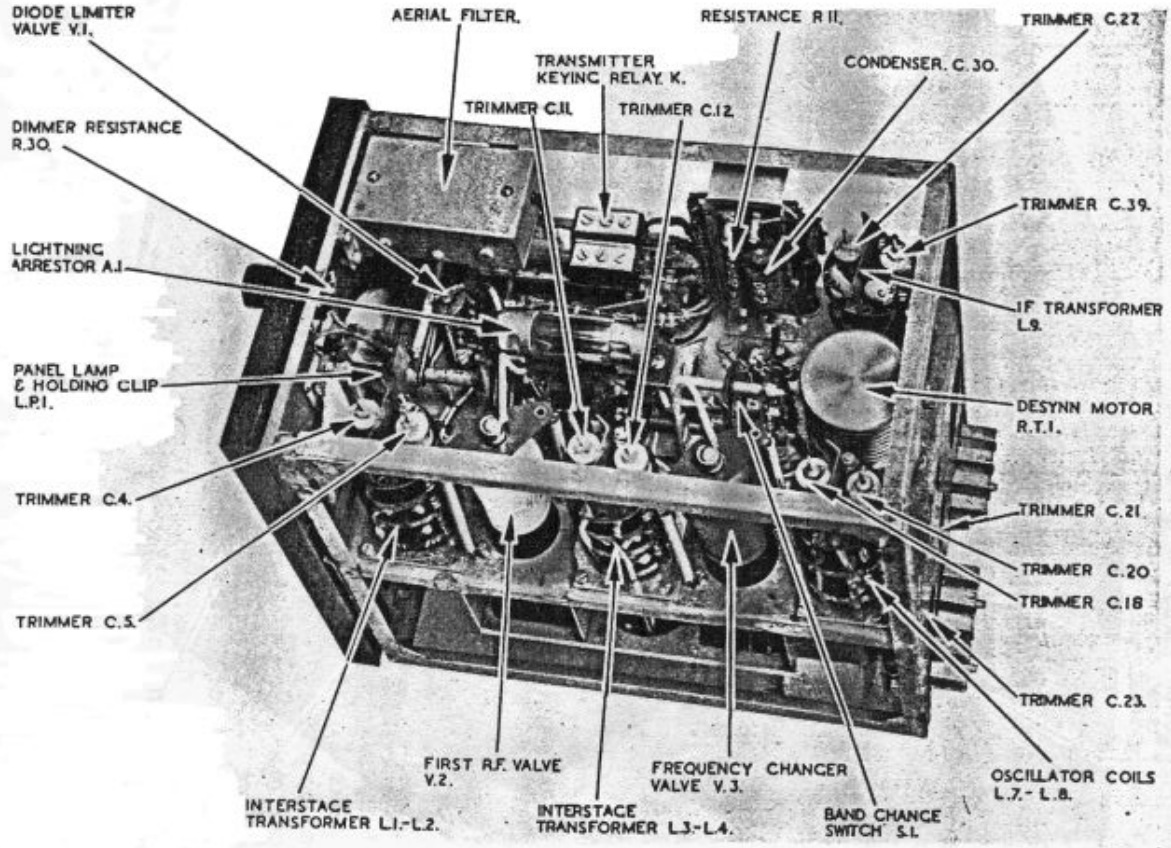
Controls	*Other Fittings*
Band Change Switch	Aerial Socket
Tuning Control and Lock	Preset Noise Adjuster behind mask
Panel Light Dimmer	

PLATE XV



A.R.I.5206 M.F. TRANSMITTER UNIT

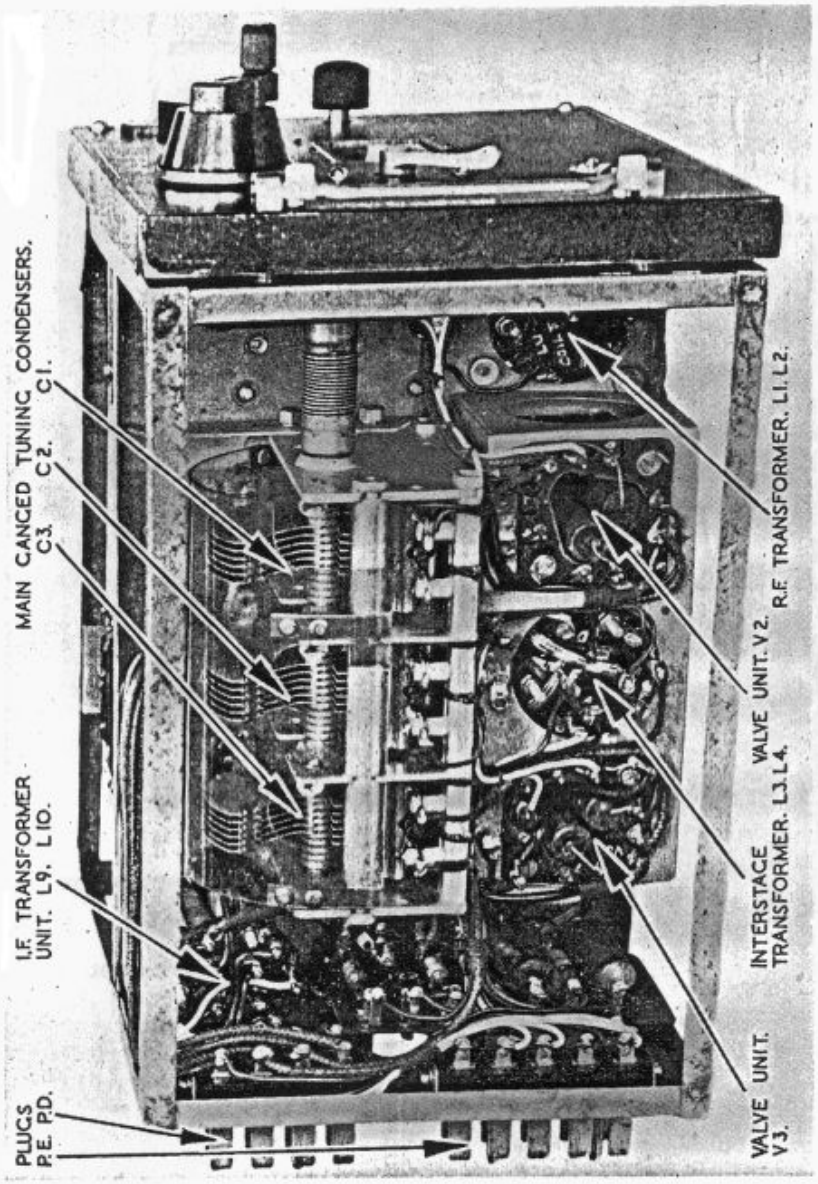
PLATE XVI



A.R.I.5206

M.F. RECEIVER UNIT
(Coil-Cans Removed)

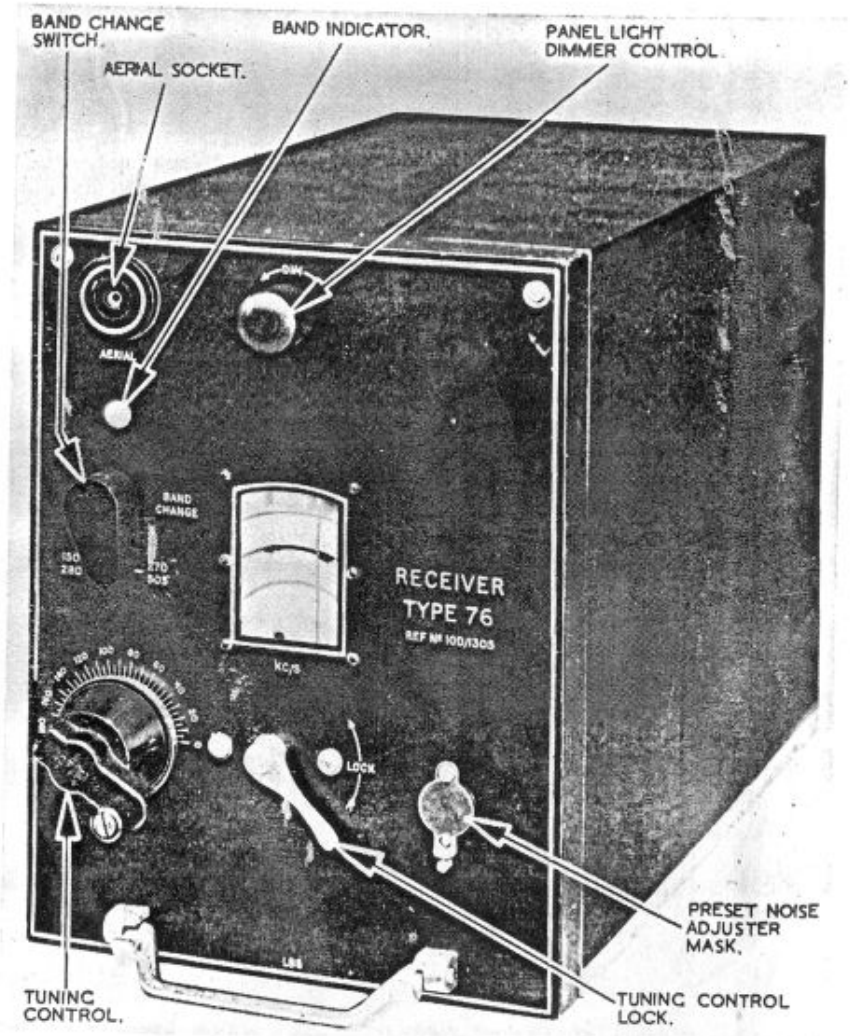
PLATE XVII



A.R.I.5206

M.F. RECEIVER UNIT
(Underside view)

PLATE XVIII



A.R.I.5206 M.F. RECEIVER UNIT

(c) **Circuit** (the circuit diagrams are given in Figs. 6 and 6A)

The medium frequency receiver consists of a diode limiter, a radio frequency amplifier and a frequency changer.

V.1, the diode limiter valve, Type VR.92, is connected across the secondary windings of the aerial transformer L.1 and L.2, and is arranged to limit excessive voltages developed across them.

The diode limiter acting as a rectifier, by-passes a portion of strong incoming signals. Automatic bias is obtained by the drop across R.16, and since the drop is proportionately low for weak incoming signals the limiter under these circumstances becomes a high impedance and has negligible demodulation or detuning effects on the carrier.

V.2, the radio frequency amplifier, Type VR.53, is coupled to V.3 a Triode-Hexode frequency changer, Type ARTH.2, via the tuned R.F. transformers L3, L.4.

The triode section of the frequency changer is used as the beat oscillator, L.7 and L.8 and condensers C.17 to C.24 and C.3, 33 and 34 forming the oscillatory circuit.

Transformer L.9 in the anode circuit of V.3 is tuned at I.F. frequency (560 kc/s) and feeds the receiver output to the intermediate amplifier stages in the Modulator Unit via a low impedance line.

Automatic gain control is applied to V.2 and V.3 the source of supply being the A.V.C. diode in the Modulator Unit.

Relay K keys the H.T. supply to the medium frequency transmitter, at the same time muting the receiver by breaking the H.T. supplies to V.2 and V.3 and earthing the signal input.

A Desynn motor controlled condenser is connected across the beat oscillator circuit. The motor (R.T.1) is controlled electrically from the remote point and permits a frequency variation of approximately $\pm$ .7% over the whole band.

(2.2) Modulator Unit

Plates XIX and XX illustrate the Modulator Unit with dust cover removed.

(1) Construction

All the Modulator Unit components are mounted on a chassis constructed of zinc sprayed semi-silver steel and fitted with a front panel. The front panel is finished with matt black and the panel fittings are of polished nickel.

The power pack, mounted in the unit, may be easily withdrawn, all electrical connections being effected via Jones plugs and sockets.

The chassis is provided with an aluminium dust cover which is retained in position by a DZUS fastener.

(2) **Front Panel Fittings**

These are shown in Plate XXI and are :—

1 Control Circuit Fuse
1 L.T. Circuit Fuse
1 500-volt Fuse
1 250-volt Fuse
1 Set Spare Fuses
1 Main Incoming Supply Connection (2-pin)
1 Outgoing Power Connection (25-pin)

(3) **Circuits** (the circuit diagrams are given in Figs. 7 and 7A)

The Modulator Unit performs three main functions as follow :—

Provides intermediate and audio frequency amplification for the receiver units.

Provides modulation for the H.F. Transmitter.

Provides power for the complete equipment.

In the following electrical description of the unit the circuits responsible for the above functions will be dealt with separately.

(*a*) **Circuit description of the Intermediate Frequency Amplifier and Signal Rectifier**

Low impedance screened lines couple the H.F. and M.F. receiver circuits to the amplifier via transformer L.1. Valves V.1 and V.2 (Type VR.53) and L.2 and L.3 which are I.F. transformers, complete the circuit of the amplifier.

One diode of V.3 (Type VR.55) forms the signal rectifier and has its associated load circuit connected in the secondary of L.3.

The signal, after filtering of the H.F. component, is taken via an attenuator network to the grid of the first microphone amplifier valve V.5. A volume control R.17 forms part of the attenuator, and a note filter which gives a sharp characteristic can be switched in by relay F. The circuit is so designed that the output level does not change appreciably when the filter is put into circuit.

The triode portion of V.3 is arranged as a tone oscillator, L.6 and associated condensers forming the oscillatory circuit. The output from the tone oscillator is fed via a volume control R.30 to the grid of the microphone amplifier valve V.5. Part of this output is rectified and fed to the grid of V.9, reducing its gain by 9 dB. when the key is pressed.

MODULATOR UNIT
(Cover removed)

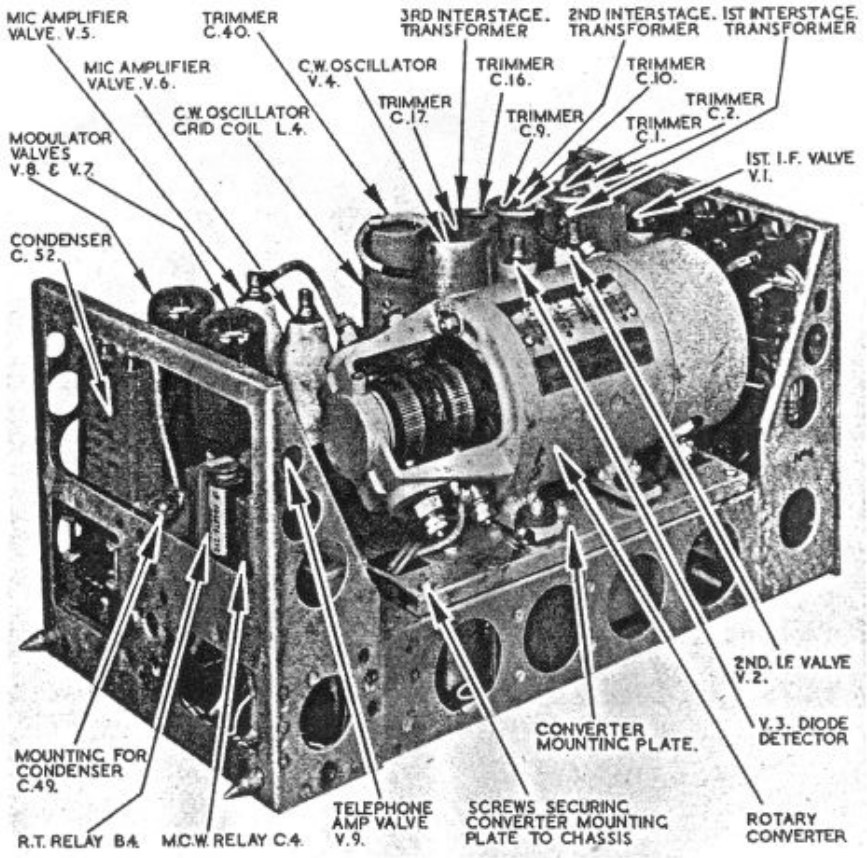
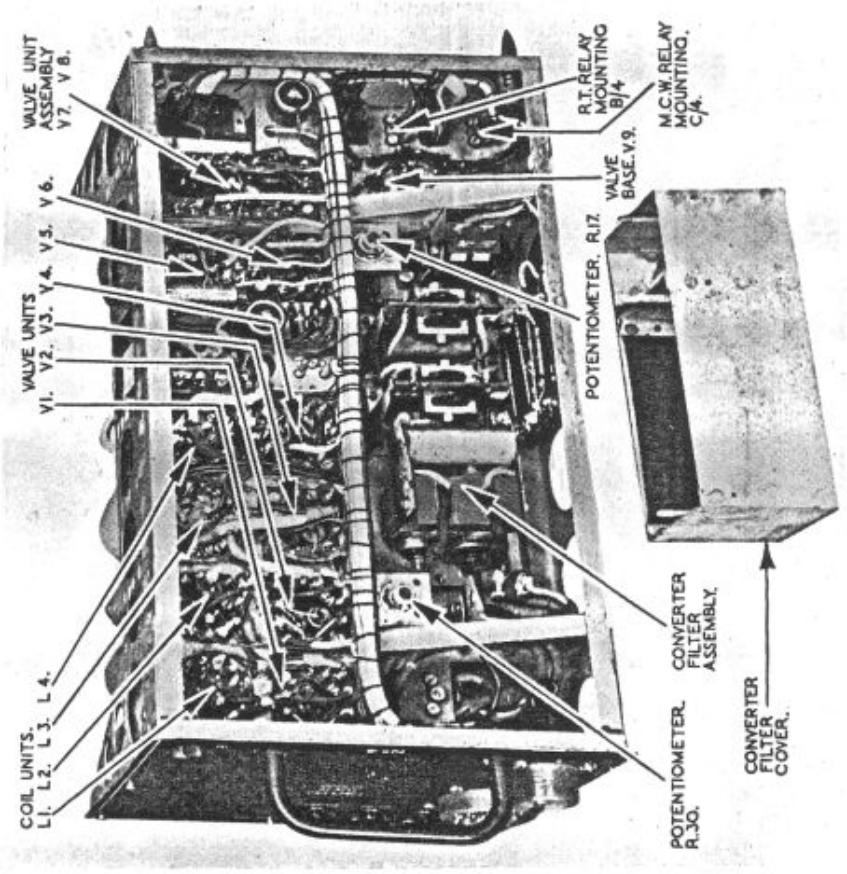


PLATE XIX

PLATE XX



MODULATOR UNIT
(Underside view)

A.R.I.5206

MODULATOR UNIT

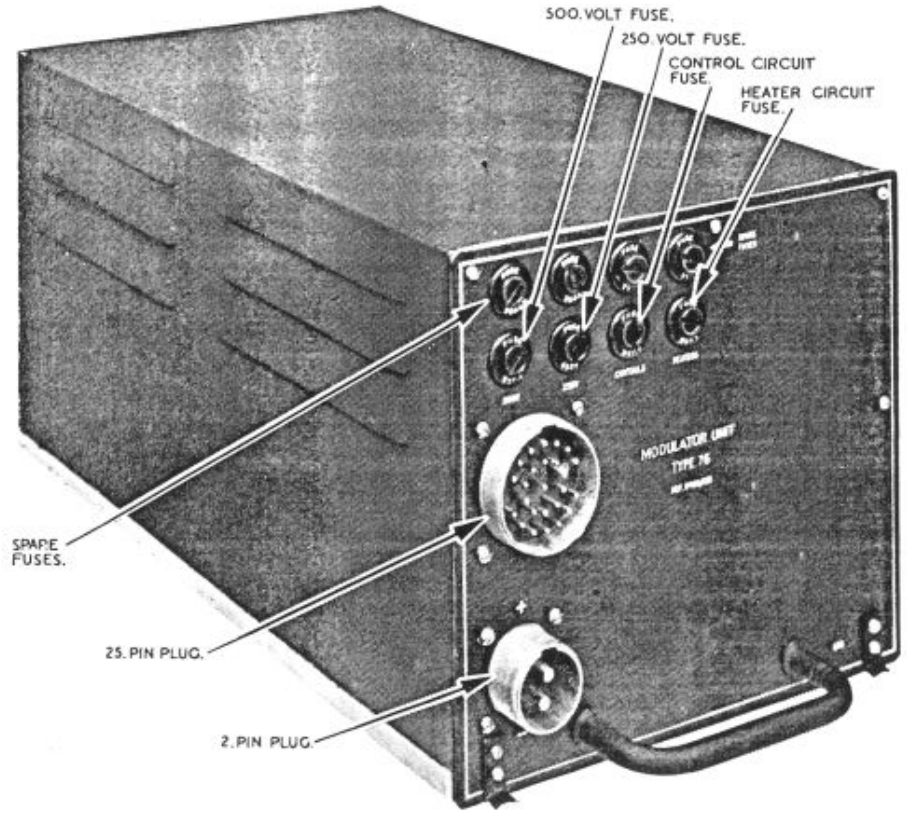


PLATE XXI

A.R.I.5206

V.4, an H.F. Pentode (Type VR.53) is used as a C.W. oscillator, the coil L.4 and associated condensers forming the oscillatory circuit. A small coil L.3 in the anode circuit of the valve couples the output to the rectifier circuit of V.3, this arrangement minimizing variation of beat note due to high input pulling the oscillator.

The cathode of V.1 has a small voltage applied to it from the 250-volt supply line via a potentiometer of which variable resistance R.2 in the Control Unit forms a part. This control gives a 30 dB. variation in I.F. gain.

A small bias voltage is fed to the cathode of V.2 and is normally shorted out by a 50 ohm resistance in series with the break contact of each transmitter keying relay. The I.F. amplifier is thus muted when the key is pressed and key clicks reduced to a minimum (see Fig. 15).

(*b*) Circuit Description of the Sidetone Channel

The sidetone channel amplifies signals from the receivers and completes the receiver audio circuits. It also provides M.C.W., C.W., and R.T. sidetone. Signals at audio frequency are fed from the attenuator network of the signal rectifier directly to the grid of valve V.5. Speech input from the microphone is fed via transformer T.1 to the grid of the same valve.

V.5 and V.6 are two VR.56 valves operating in a push-pull phase splitting circuit, the grid of V.5 being driven directly, and the grid of V.6 driven from a balanced potentiometer R.42, R.43 across the respective anodes.

The anode circuits of V.5 and V.6 are capacitively coupled to the grid of V.9, the telephone amplifier valve, Type VR.91. A filter consisting of R.50 and C.50 in the grid circuit of V.9 cuts down the high note response.

The anode of V.9 is connected to the primary of transformer T.3, and the cathode to a 600-ohm tap on the secondary of T.3, this method of feedback maintaining almost constant output with varying output impedance.

(*c*) Circuit Description of the Modulator Channel

As described in paragraph 2.2 (3) (*b*) M.C.W. signals or alternatively speech input is fed to valves V.5 and V.6. The anodes of these valves are resistance capacity coupled to V.7 and V.8, Type VR.503 valves operating in class A/B.1.

The grid input to valves V.7 and V.8 is fed at the correct level by connecting the grids to a point down their respective resistors (R.44, R.45 and R.46, R.47).

The secondary of transformer T.2 is in series with the H.T. supply to the transmitter output circuits, modulation taking place at the transmitter amplifier valve anodes when the service is switched to R.T. or M.C.W.

When the service is switched to C.W., Relay C short circuits the secondary winding of transformer T.2 and suppresses the modulator valves V.7 and V.8 by inserting a series resistance, R.49, in their cathode circuit, thus increasing the bias beyond cut-off.

(*d*) Circuit Description of the Power Pack

The power pack consists of a rotary converter with associated starting relays, filter circuits and fuses.

Depending on the input voltage for which the equipment is designed, i.e. 13 or 26 volts, the converter is supplied in two types.

The converter delivers H.T. output voltages of 250 and 500 volts. (Two secondary windings of the converter, separately commutated, each develops 250 volts, these outputs being series connected for the 500-volt supply.)

The filter circuits for the suppression of radio frequency interference are fitted to the base of the converter. The converter complete with filter circuits can be detached from the modulator unit by releasing four holding screws and unplugging the assembly.

The input lines are not earthed in the modulator unit, therefore filtering is necessary in both lines. On the secondary of the converter, the negative pole of the converter is connected to earth and there is a single stage filter in both lines.

Power is supplied to the L.T. winding of the converter via contacts of Relay A, which is in turn operated by Relay C or D when the equipment is switched on.

(2.3) Aerial Tuning Unit

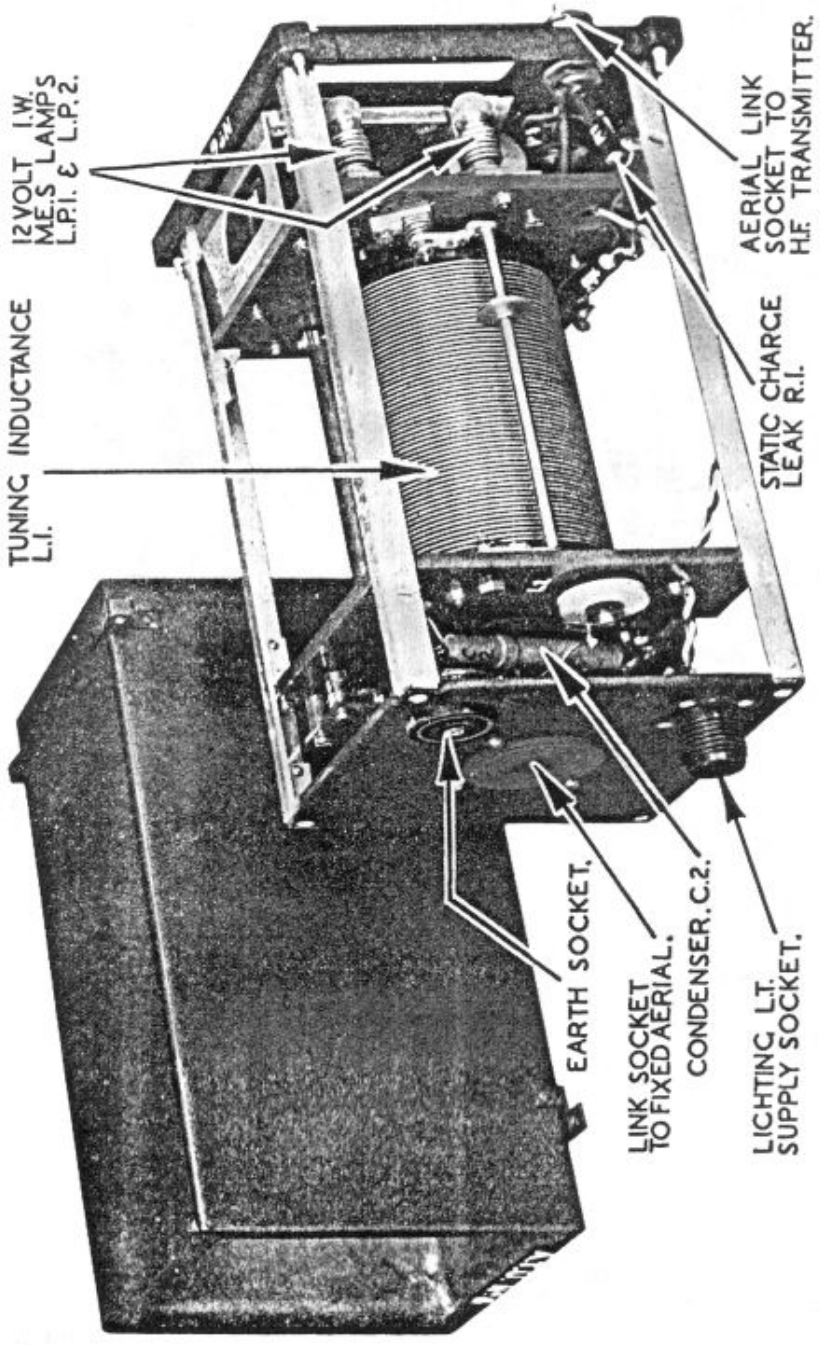
Plate XXII shows the Aerial Tuning Unit with the cover removed.

(1) Construction

The aerial tuning unit consists of variable inductance suitably geared to a front panel tuning control and enclosed in a dust cover. A revolution counter fitted to the front panel indicates the position of a roller contact on the inductance.

The revolution counter is not calibrated in frequency, but a chart is provided to enable the number of revolutions for a given frequency to be recorded. A semi-fixed capacity which consists of a fixed tubular ceramic and a small variable trimmer connected in

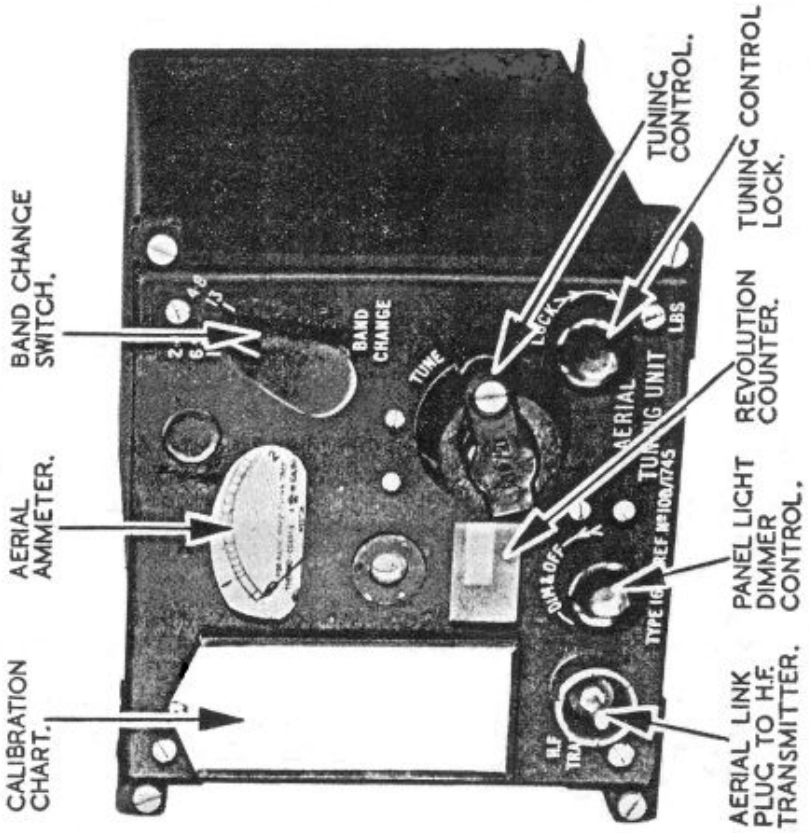
PLATE XXII



AERIAL TUNING UNIT
(Cover removed)

A.R.1.5206

PLATE XXIII



AERIAL TUNING UNIT

A.R.I.5206

parallel, is mounted in close proximity to the variable inductance and is controlled by a switch on the front panel of the unit.

(2) **Panel Fittings**

These are shown in Plate XXIII and are :—

Controls

Band Change Switch
Tuning Control with Lock and Revolution Counter
Aerial Ammeter
Panel Light Dimmer

Other Fittings

Co-axial Socket (for transmitter feeder line)
Frequency band indicator window

Fittings at rear of unit

Aerial Socket
Panel Light supply plug
Earth Socket

(3) **Circuit** (the circuit diagrams are given in Figs. 14 and 14A)

The circuit consists of a variable inductance in series with a semi-fixed capacity. The capacity is short-circuited on the 2.4 to 6.5 mc/s band by operation of the bandchange switch on the front panel of the unit.

A R.F. ammeter is incorporated in the circuit to indicate output current.

A D.C. path to earth is provided to avoid damage due to a static charge on the tuning condensers. The path is from the aerial socket J.1 via Choke L.2 and Resistance R.1 to earth.

A panel light with dimming circuit is provided in the unit.

(2.4) **Control Units**

Plates XXIV to XXVII illustrate the control units.

(1) **General**

The control circuits are so designed that once the equipment has been lined up it can be fully controlled from either of two control units.

The control units, Types 260 and 271, are intended for operation by Air Gunner and Observer respectively or equivalent members of the aircrew.

The Air Gunner's Control Unit is arranged as the master control. Switching facilities are provided on both units enabling control of the equipment to be taken over by either operator at will.

In some installations the A.R.I.5206 is used in combination with the TR.1366, and in these cases an alternative model of Observer's Control Unit, Type

276, is fitted. This control unit has special wiring and facilities, not available in the Type 271 unit, which enable the Observer to operate the TR.1366 in addition to the A.R.I.5206.

The Type 260 (Air Gunner's) Control Unit is installed in both cases, i.e. when the A.R.I.5206 is used with or without the TR.1366, since control of the TR.1366 is in neither instance available from this unit. However, an external plug fitting is supplied for attachment to the unit when it is to be operated with the A.R.I.5206 only, the plug serving to complete audio circuit connections.

A detailed circuit description of these units is given in paragraphs 2.4 (4) (*a*) to 2.4 (4) (*c*).

(2) Mechanical Construction

The component parts of the units are mounted in a metal case finished in matt black. Designation of controls is carried out by black lettering on a translucent background. Illumination is effected internally and the strength of illumination is controllable.

The rear cover plates of the units are removable to afford access to the components and to facilitate mounting.

Cable termination to the units are " W " plugs.

(3) Panel Fittings

These are shown in Plates XXIV, XXVI and XXVII, and are :—

Legend	Purpose
ON-OFF	Main switch for starting and stopping equipment
FULL POWER, REDUCE	Variation of C.W. output power of transmitters
M.F. / H.F. (C.W. / C.W. M.C.W. R.T.)	Service switch for selecting type of reception or transmission
PRESS TO TRANS.	Operating button for R.T. transmission
TAKE CONTROL	To take control of equipment from alternative control unit
FILTER IN-OUT	C.W. Note filter to reduce interference during reception
REC. SINGLE DUAL	To operate H.F. and M.F. receivers singly or jointly
M.F. TUNE	Vernier tuning control (electrical) for M.F. receiver
NOISE ADJUST.	For adjusting gain of receivers
H.F. TUNE	Vernier tuning control (electrical) for H.F. receiver
DIM	Dimmer control for internal panel light
TR.1366—ISOLATE	For reception or isolation of intercommunication via TR.1366. (Fitted on Type 260 Control Units only)
TRANS.—REC.—G.P.	For transmission and reception on TR.1366 and listening in on A.R.I.5206 audio channel. (Fitted on Type 276 Control Units only)

CONTROL UNIT TYPE 260

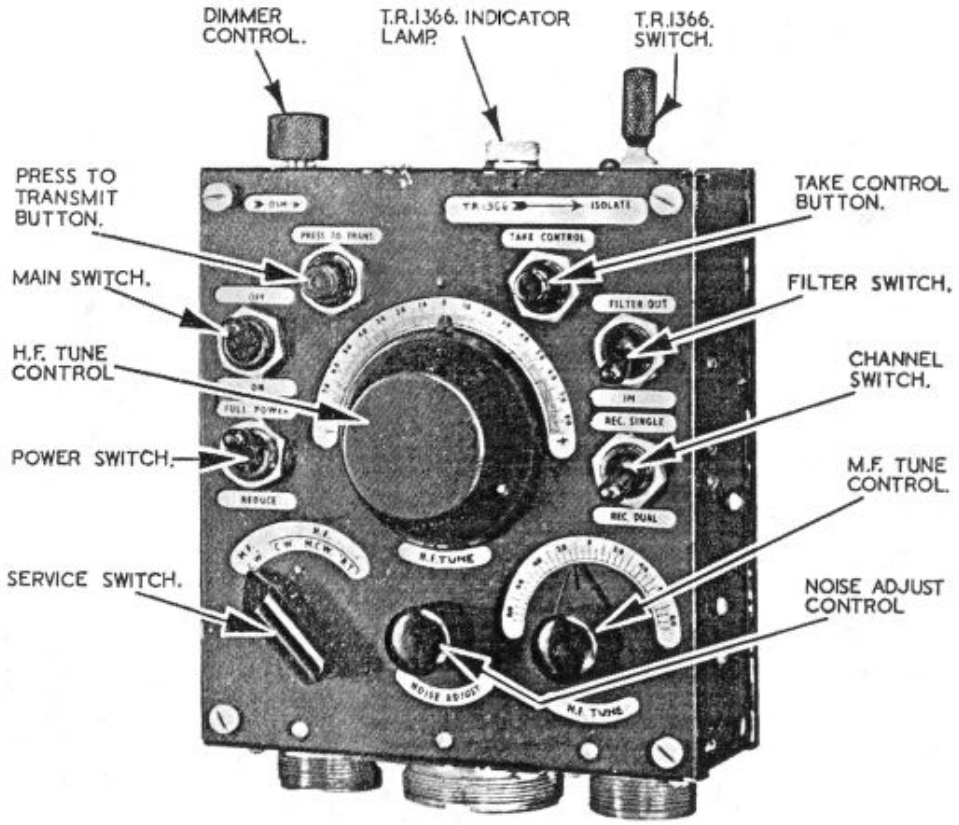
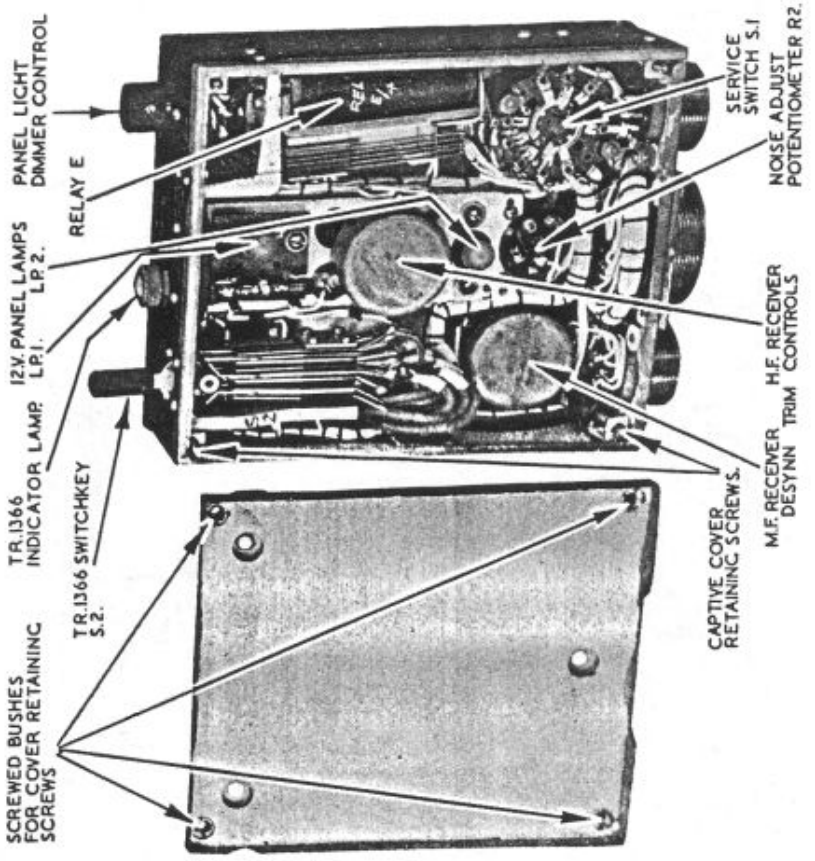


PLATE XXIV

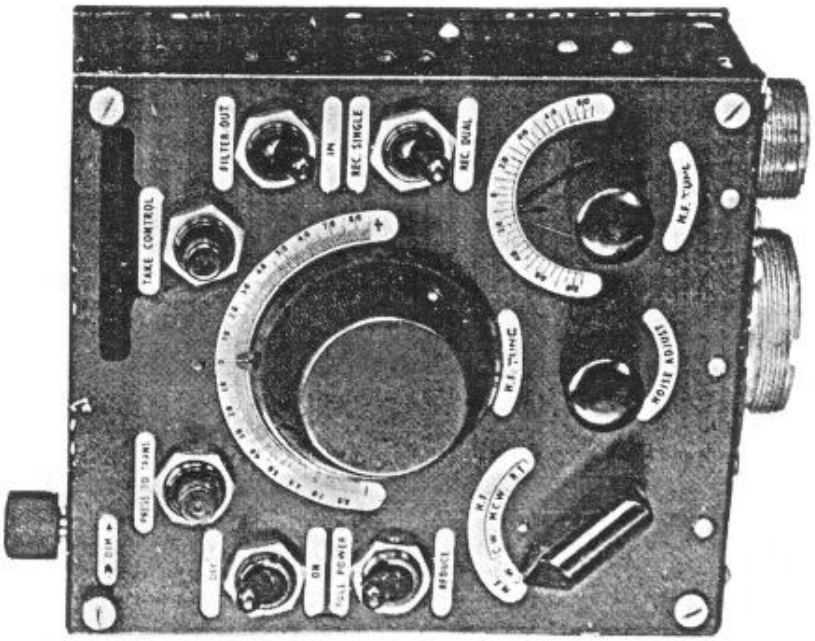
PLATE XXV



CONTROL UNIT TYPE 260
(Cover removed)

A.R.I.5206

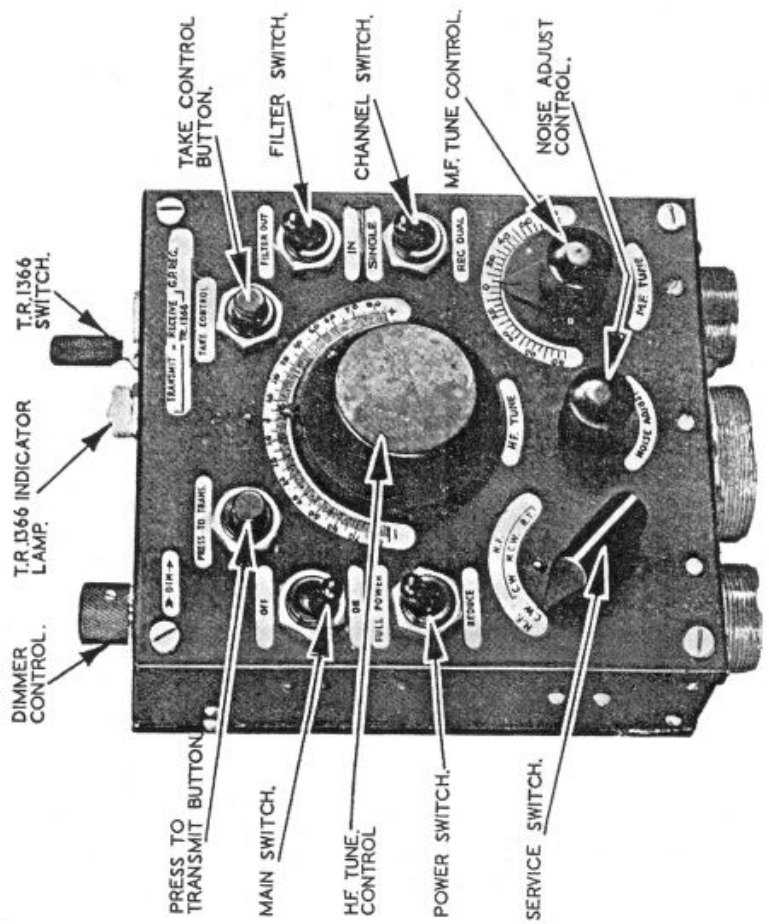
PLATE XXVI



CONTROL UNIT TYPE 271

A.R.I.5206

PLATE XXVII



CONTROL UNIT
TYPE 276

A.R.I.5206

(4) Circuit Description of Individual Control Units

(*a*) Type 276 Control Unit (the circuit diagram is given in Fig. 10)

The Type 276 Control Unit is supplied for the use of the Observer when the A.R.I.5206 and TR.1366 are installed in combination.

In this unit the Observer's microphone is normally connected via plug terminals PP.1 and 2 to the audio channels of the TR.1366 (see Fig. 13) enabling the Observer to use these channels for intercommunication, or R.T. transmission on the TR.1366.

The TR.1366 is placed in the transmitting condition by throwing the switch (S.2) to TRANSMIT. This action completes the circuit of Relays B and C (in the TR.1366) via Terminal PP.3.

When the Observer has control of the A.R.I.5206 and wishes to transmit on that equipment his microphone connections are transferred from the normal TR.1366 channel to the A.R.I.5206 audio channels by the operation of Relay E. This relay is energized by the closing of the " Press to Transmit " button S.8 and connects the microphone via Relay contacts E.2 and E.3 to PB.6 and 7.

The telephones are normally connected via the TR.1366 switch S.2, Terminal PB.25, Relay H (see Fig. 12) and PB.13 to the Observer's audio channel of the TR.1366 in order that he may receive incoming signals from the TR.1366 (which are confined to this channel) as well as intercommunication. If, however, the Observer has control of the A.R.I.5206, the telephones will be automatically connected via Relay H and PC.25 (see Fig. 12) to the Air Gunner's channel of the A.R.I.5206 permitting him to receive incoming signals from the A.R.I.5206 (confined to the Air Gunner's Audio Channel of the TR.1366 audio circuits) and intercommunication. However, the Observer may, by throwing switch S.2 to G.P. Receive, connect the telephones directly to the Air Gunner's audio channel of the TR.1366. This operation permits the Observer to listen to incoming signals or sidetone from the A.R.I.5206 without taking control of that equipment.

The Desynn Tune Controls, R.3 and R.4 are series fed from the L.T. supply via PB.3 and 24. During the process of tuning the position of the L.T. feeders relative to points 1, 2 and 3 on R.3 or R.4 are altered and consequently the potentials across PB.14, 15 and 16 or PB.17, 18 and 19, depending upon the control in use. Since these points are connected to the motor fields in the receivers the armature position varies in sympathy with the changing potentials and the

movement is applied to the rotor of a small variable condenser.

(*b*) **Type 271 Control Unit** (the circuit diagrams are given in Figs. 9 and 9A)

The Type 271 Control Unit is fitted for the use of the Observer where the A.R.I.5206 is installed by itself.

In general principle its operation and circuit is similar to that of the control unit described in the previous paragraph, except that all wiring and controls necessary for operating the TR.1366 are deleted.

The microphone connections PS.5 and 6 are permanently linked via PB.6 and 7 to the microphone amplifier in the A.R.I.5206 Modulator Unit, intercommunication being carried on via the sidetone channel, or R.T. transmission effected with the Control Unit switched to the H.F.R.T. condition.

The telephones are connected via PB.12 to PC.25 (see Fig. 11) on the Type 260 Control Unit, the telephone output from the Modulator Unit of the A.R.I.5206 being conveyed to this point via PC.12 (see Fig. 11) and PA.10 (see Fig. 7).

The Desynn controls and the lamps LP.1 and LP.2 are connected in series in the Type 271 Control Unit and in parallel in the Type 271A Control Unit.

(*c*) **Type 260 Control Unit** (the circuit diagrams are given in Figs. 11 and 11A)

The Type 260 Control Unit fitted for the use of the Air Gunner is similar in circuit design to the unit described in paragraph 2.4 (4) (*a*).

When the A.R.I.5206 and TR.1366 are used in combination the microphone is normally connected via PM.5 and 6, S.2 and PL.1 and 2 to the Air Gunner's channel of the TR.1366 audio circuits for intercommunication purposes.

When the Air Gunner has control of the A.R.I.5206 and operates the Press to Transmit button S.8, he will energize Relay E (providing the Service switch S.1 is in the H.F.R.T. position) and transfer his microphone connections from PL.1 and 2 to PC.6 and 7 which are connected to the microphone amplifier of the A.R.I.5206, modulation of the H.F. transmitter signal will then take place.

By throwing the switch S.2 to Isolate, the Air Gunner may also connect his microphone directly to PC.6 and 7 without operating the Press to Transmit button.

The telephones are normally connected via PM.1 and 2, the switch S.2 and terminal PL.5 to the Air Gunner's channel of the TR.1366 Audio circuits, and

intercommunication is received on this channel. Sidetone and incoming signals from the A.R.I.5206 are also fed into the channel but not the output from the TR.1366 transmitter or receiver. By throwing switch S.2 to Isolate, the Air Gunner can connect his telephones via PC.12 to the sidetone and receiver output circuits of the A.R.I.5206 only, but in this condition he will not be in a position to use the normal intercommunication facilities of the TR.1366.

When the A.R.I.5206 is used alone the Type 260 Unit is still supplied, but as connections to the TR.1366 are no longer required a special terminating fitting is supplied for plug PL. This termination short circuits Terminals PP.5 and 3, and connects the telephones to the A.R.I.5206 at all times. The switch S.2 is permanently kept at Isolate to enable the microphone circuit to be completed via PC.6 and 7.

Keying is carried out via PM.3 and 4, Terminal PC.2 (LT +) and PC.9 or 10 according to transmitter in service.

The reduced power relay D (see Fig. 7) is operated via the LT + line and Reduce Power switch S.5 and Terminal PC.23.

The Dual Reception switch S.6 short circuits the connections to PC.8 and 11 thus placing H.T. on both receivers simultaneously.

The L.T. supplies are fed to the Desynn Tune Controls and the lamps LP.1 and 2 in a series arrangement in the Type 260 unit and a parallel arrangement in the Type 260A unit.

3.0 KEYING SYSTEM

(3.1) M.F. Transmitter

Keying of the medium frequency transmitter is carried out by the operation of a relay (K) mounted in the M.F. Receiver (see Figs. 6 and 6A).

This relay keys the power supply to the transmitter oscillator valve V.1 (see Fig. 6) and also to the screen of the power amplifier valve V.2, at the same time disconnecting the screen of the power amplifier, which is normally kept earthed, from earth.

During transmission periods earthing of the M.F. aerial and muting of the receivers and I.F. amplifier is also carried out via this relay (see Fig. 15).

A detailed description of the operation of Relay K will be found in paragraph 4.3 (12).

(3.2) H.F. Transmitter (see Figs. 3, 7 and 15)

The H.F. Transmitter is keyed by Relays J.1 and J.2 situated in the unit itself. Relay J.1 changes over the

aerial from the H.F. Receiver to the transmitter, at the same time earthing the input circuit to the H.F. Receiver. It also completes the H.T. circuit to the oscillator valve V.1 of the transmitter and effects muting of the receivers and the I.F. Amplifier. (See Fig. 15.)

Relay J.2 disconnects the screens of the power amplifier valves V.2 and V.3 from earth (these screens are normally earthed during non-transmission periods), connects them to the H.T. supply and short circuits a suppressor in the form of a high resistance inserted in the cathode circuits of the modulator valves V.7 and V.8. This resistor is short circuited during Speech or M.C.W. transmission but brought back into circuit during C.W. transmissions via Relay C (Modulator Unit).

A detailed description of the operation of Relays J.1 and J.2 is given in paragraphs 4.3 (10) and (11).

4.0 CONTROL SYSTEM

(4.1) General

A detailed description of the functions of the manual controls on the control units is given in paragraph 4.2. Some of these controls directly operate relays in the equipment. Accordingly, references to relay operations are made in the following explanation, but in a general sense only, a more detailed explanation of relay operation being given in paragraph 4.3.

The two control units used in the system, in so far as the A.R.I.5206 is concerned, operate in a similar manner. The Type 260 Control Unit is, however, the master control and connections from the Modulator and H.F. Units are made to this point via relays normally in the de-energized position. The relays become energized when control is effected from the Type 271 or 276 Control Unit (whichever is installed) and the external connections are transferred accordingly. This feature is dealt with at the beginning of the explanation on Functions of Controls.

(4.2) Functions of Controls (the circuit diagrams are given in Figs. 8 and 8A)

(1) S.7 Take Control Button on Types 271 or 276 Control Units

With S.3 (On-Off Switch) closed, S.7 when operated supplies L.T. to Relay G. Relay G closes and completes the L.T. supplies to Relays H and I via the first contact group. Relays G, H and I then change over the connections from the Type 260 Unit to the Type 271 or 276 Unit (whichever is installed). Since all control connections change over, the equipment will adopt the switching conditions existing on the Type 271 or 276 Control Unit at the time. It will be

seen that the equipment cannot be switched on from this point unless control is established by pressing the Take Control Button. If S.3 on the Type 276 or 271 unit is opened, Relay D or C is released and the L.T. circuits to Relays G, H and I broken. All control connections then revert to the Type 260 Unit.

(2) **S.7 Take Control Button on Type 260. Control Unit**

It is unnecessary to press the Take Control Button in the Type 260 Unit to switch on the equipment, but it must be pressed to regain control from the Type 276 or 271 unit (whichever is installed). S.7 is a normally closed series switch in the L..T. circuit of Relay G (this relay is operated with the Type 276 or 271 unit in control). Therefore when S.7 is pressed, i.e. opened, Relay G and subsequently H and I are released and all external connections revert to the Type 260 Unit. The equipment will then adopt whatever switching conditions are existing on the Type 260 Unit at the time.

(3) **S.3 ON/OFF Switch**

Operates either Relay C or D according to the position of the Service Switch S.1.

Relay C (third contact group) or Relay D (second contact group) on closing completes the circuit to Relay A which closes, and starts the rotary transformer.

(4) **S.1 Service Switch**

In M.F. C.W. position

Applies L.T. to the M.F. keying relay K via the telegraph key.

Applies H.T. to the M.F. Receiver via Relay I (fifth contact group).

Operates Relay C via Relay G (fifth contact group).

In H.F. C.W. position

Applies L.T. to the H.F. keying relays J.1 and J.2 via the telegraph key and Relay G (eighth contact group).

Applies H.T. to the H.F. Receiver via Relay I (sixth contact group).

Operates Relay C via Relay G (fifth contact group).

In H.F. M.C.W. position

Applies L.T. to H.F. keying relays J.1 and J.2 via the telegraph key and Relay G (eighth contact group).

Applies H.T. to the H.F. Receiver via Relay I (sixth contact group).

Operates Relay D via Relay G (fourth contact group).

In H.F. R.T. position

Applies L.T. to Relay E via S.8 (when pressed) or via the telegraph key when closed.

Applies H.T. to the H.F. Receiver via Relay I (sixth contact group).

Operates Relay B via Relay G (sixth contact group).

Operates Relay D via Relay G (fourth contact group).

(5) **S.4 Filter Switch**

Operates Relay F via Relay G (third contact group) but not with Service Switch S.1 in H.F.R.T. position.

(6) **S.5 Reduced Power Switch**

Operates Relay D via Relay G (fourth contact group).

(7) **S.6 Dual Reception Switch**

Applies H.T. to M.F. and H.F. Receivers simultaneously via Relay I (fifth and sixth contact groups).

(8) **S.8 Press to Transmit Button**

When pressed, applies L.T. to Relay E (with S.1 in H.F.R.T. position). The telegraph key when closed also operates Relay E.

(4.3) **Functions of Relays**

(1) **Relay A (Starter Relay)**

Completes L.T. circuit to rotary converter and to all filaments. The relay has four groups of contacts in parallel.

(2) **Relay B (R.T. Relay).** See Figs. 7 and 7A.

First contact group B/1.—Disconnects the H.T. supply to the screen of the C.W. Oscillator valve V.4.

Second contact group B/2.—Disconnects the H.T. supply to the anode of the sidetone oscillator valve V.3.

(3) **Relay C (M.C.W. Relay).** See Figs. 7 or 7A.

First contact group C/1.—Short circuits the secondary winding of the modulation transformer T.2.

Second contact group C/2.—Removes a short circuit from Resistance R.59 in the H.T. supply circuit.

Third contact group C/3.—Completes the L.T. circuit of Relay A . This relay then closes.

Fourth contact group C/4.—Removes the short circuit from a high resistance R.49 in series with the cathode resistance of valves V.7 and V.8, increasing the bias of these valves beyond cut-off and suppressing the modulator.

(4) **Relay D (Reduced Power Relay).** See Figs. 7 and 7A.

First contact group D/1.—Changes the H.T. supply circuit to V.7 and V.8 from the 500-volt line to the 250-volt line. A series resistor R.59 for reduced power working is incorporated in the 250-volt line.

Second contact group D/2.—Completes the L.T. circuit to Relay A thus closing this relay.

(5) **Relay E (Control Unit Relay).** See Figs. 10, 11 and 11A.

First contact group E/1.—Completes the L.T. circuits to Relays J.1 and J.2 in the H.F. Transmitter, operating these relays.

Second and third contact group E/2 and E/3.—Change the microphone connections from the TR.1366 to the A.R.I.5206.

(6) **Relay F (Filter Input Coil Relay).** See Figs. 7 and 7A.

First contact group F/1.—Connects filter L.5, C.26 into circuit.

(7) **Relay G ("Take Control" Relays).**—See Figs. 8 and 8A.

First contact group G/1.—Completes the L.T. circuit to Relays H and I.

Second to eighth contact groups.—Change over leads from one control unit to the other.

(8) **Relay H ("Take Control" Relay).** See Figs. 8 and 8A.

First contact group and third to eighth contact groups.—Change over connections from one control unit to the other.

(9) **Relay I ("Take Control" Relay).** See Figs. 8 and 8A.

Second, third, fifth, sixth, seventh and eight contact groups.—Change over connections from one control unit to the other.

Fourth contact group I/4.—Complete L.T. holding circuit of Relay G.

(10) **Relay J.1 (H.F. Aerial Keying Relay)**

First contact group J.1/1.—Mutes the receivers and the I.F. Amplifier (see Fig. 15).

Second contact group J.1/2.—Completes the H.F. circuit to the oscillator valve V.1 (see Fig. 3).

Third contact group J.1/3.—Disconnects the transmitter output circuit from earth, connects the receiver aerial circuit to earth, and changes the aerial from the receiver to the transmitter (see Fig. 3).

(11) **Relay J.2 (H.F. Auxiliary Keying Relay)**

First contact group J.2/1.—Completes the H.T. circuit to the screens of valves V.2 and V.3, disconnecting the screens from earth (see Fig. 3).

Second contact group J.2/2.—Short circuits R.49 (Cathode bias resistance) via the fourth contact group of Relay C (see Fig. 7).

(12) **Relay K (M.F. Keying Relay)**

First contact group K/1.—Mutes the receivers and I.F. Amplifiers (see Fig. 15).

Second contact group K/2.—Disconnects the screen of the power amplifier valve V.2 in the M.F. Transmitter from earth (see Figs. 5 and 6).

Third contact group K/3.—Earths the receiver aerial (see Figs. 5 and 6).

Fourth contact group K/4.—Applies H.T. to the screen of the power amplifier valve V.2 in the M.F. Transmitter (see Figs. 5 and 6).

Fifth contact group K/5.—Applies H.T. to the Oscillator Valve V.1 in the M.F. Transmitter (see Figs. 5 and 6).

5.0 OVERALL AUDIO CIRCUITS

(5.1) General

The overall audio circuits of the A.R.I.5206 are designed to cater for two conditions as follow :—

(1) When the A.R.I.5206 is to be used alone.

(2) When the A.R.I.5206 and TR.1366 are to be used in combination.

A description of the facilities available in both instances is given in the following paragraphs.

(5.2) The A.R.I.5206 used alone

When the A.R.I.5206 is used alone control normally rests with the operator of the Type 260 (Air Gunner's)

Control Unit. However, the operator of the Type 271 (Observer's) Control Unit may by throwing his control switch to "ON" and pressing his "Take Control" button, take complete control of the equipment and carry out full operation in a normal manner.

There is only the sidetone channel of the A.R.I.5206 available for intercommunication and this is carried on between members of the crew via the microphone and telephone amplifiers in the Modulator Unit. Under this condition sidetone from the transmitters and received signals are conveyed to both control points.

(5.3) **The A.R.I.5206 and TR.1366 in combination.** (See Figs. 13 and 23)

The microphones from the Type 276, Type 260 and TR.1366 (Pilot's) Control Units are normally connected to the common TR.1366 Microphone Amplifier. The telephones from the Type 260 (Air Gunner's) Control Unit are connected to the Air Gunner's Output Amplifier of the TR.1366 and those from the TR.1366 (Pilot's) Control Unit and Type 276 (Observer's) Control Unit to the Observer's and Pilot's Output Amplifier.

With the A.R.I.5206 switched to the R.T. condition and the "Press to Transmit" button operated on the Type 276 or 260 Control Unit (according to the unit from which the A.R.I.5206 is being operated), the microphone on that unit will be transferred from the TR.1366 intercommunication channel to the A.R.I.5206 Microphone Amplifier.

The sidetone and receiver output from the A.R.I.5206 is fed from the A.R.I.5206 Telephone Amplifier to the Air Gunner's Intermediate Amplifier in the TR.1366 Audio Channel, therefore the Air Gunner will normally hear this output whether he has control of the A.R.I.5206 or not. Since the telephones on the Type 276 (Observer's) Control Unit are not normally connected to the Air Gunner's Output Amplifier, the Observer will not receive the signals from the A.R.I.5206 unless he has control of that equipment, when, under this condition his telephones will be automatically connected via a relay to the Air Gunner's Output Amplifier.

Should the operator of the Type 260 Control Unit wish to listen to the output of the A.R.I.5206 without being subject to interference from the intercommunication channel, he may do so by throwing his TR.1366 switch to ISOLATE. This action connects his telephones directly to the Telephone Amplifier of the A.R.I.5206.

The operator of the Type 276 Control Unit may listen to the output of the A.R.I.5206 without taking control of that equipment by throwing his TR.1366 switch

to G.P. RECEIVE. This action connects his telephones directly to the Air Gunner's Output Amplifier in the TR.1366.

When the TR.1366 switch on the Type 276 Control Unit is thrown to TRANS., the microphone circuit of this unit is automatically switched to the microphone input circuit of the TR.1366 Transmitter.

Similarly the microphone circuit from the Pilot's (TR.1366) Control Unit is switched from the common microphone amplifier to the microphone input circuit of the TR.1366 Transmitter when transmission is to be carried out from this point.

6.0 STAGES AND VALVES USED

The following table summarises the arrangement and location of the stages and shows the valves used :—

Unit	Stage	Type of Valves	No.
R.F. (Med. Freq. Transmitter)	R.F. Osc.	VT.60A	1
	R.F. Amp.	VT.60A	1
R.F. (High Freq. Transmitter)	R.F. Osc.	VT.60A	1
	R.F. Amp.	VT.60A	2
R.F. (Med. Freq. Receiver)	Diode Limiter	VR.92	1
	R.F. Amp.	VR.53	1
	Freq. Changer	ARTH.2	1
R.F. (High Freq. Receiver)	Diode Limiter	VR.92	1
	R.F. Amp.	VR.91	1
	Mixer	ARTH.2	1
	Beat Oscillator	6J.5G.	1
	Crystal Calibrator Osc.	VR.53	1
Modulator Unit	1st I.F. Amp.	VR.53	1
	2nd I.F. Amp.	VR.53	1
	Signal and A.G.C. Diodes and Tone Osc.	VR.55	1
	C.W. Oscillator	VR.53	1
	Microphone Amplifier	VR.56	2
	Modulator Amplifier	VR.503	2
	Telephone Amplifier	VR.91	1

Total Number of Valves used	22
Number of different types of valves used	9