DEPARTMENT OF CIVIL AVIATION

DIRECTORATE OF AIRWAYS

AIRWAYS RADIO EQUIPMENT

RECEIVER TYPE A.R. 7

COMMONWEALTH OF AUSTRALIA

DIRECTORATE OF AIRWAYS
DEPARTMENT OF CIVIL AVIATION
MELBOURNE

AIRWAYS RADIO EQUIPMENT

KINGSLEY COMMUNICATION RECEIVER

TYPE A.R. 7

JANUARY, 1947

/47

INSTRUCTION BOOK. = KINGSLEY RECEIVER AR7.

CONTENTS.

COMMUNICATION RECEIVER TYPE AR7.

1. INTRODUCTION.

1.1 The A.R.7 is seven stage communications superheterodyne receiver incorporating two stages of radio-frequency amplification, a converter stage, two stages of intermediate-frequency amplification (including a crystal filter), diode detector, delayed automatic volume control, audio amplifier with A.V.C., and a power output valve. A separate twin high-mu triode valve is used for the beat-frequency oscillator and vacuum voltmeter type signal strength meter.

1.2 Stable operation is provided at all frequencies between 138 KCS., and 25 MCS. with the exception of a gap of 45 KCS., on either side of the I.F. channel (which is 455 KCS.).

1.3 Variable selectivity is made possible in conjunction with a crystal filter. A phasing control permits rejection of heterodyning signals whilst copying C.W.

1.4 In order to eliminate continuous adjustment of the controls, and to obtain a more satisfactory check on signal strength, the sensitivity of the receiver is maintained relatively constant over the entire frequency range. It may, however, be varied as required, by means of a manually operated R.F. Gain Control. Provision is also made for controlling the audio gain. Coupled to this latter control is a "Stand-by" switch, which disconnects the H.T., while allowing the heaters to remain "ON".

1.5 A "Signal Strength" meter gives visual indication of the carrier strength of the received signal.

1.6 A beat frequency oscillator is provided for the reception of C.W. signals. When the B.F.O. is switched "OUT", automatic volume control is automatically switched into the circuit, thus compensating for fading of R/T signals.

1.7 The receiver may be operated from the standard 200/250 volt A.C. mains supply.

1.8 On reference to the circuit, it will be seen that the A.R.7 receiver consists of three panels mounted in a rack. The top unit contains the A.C. Power Supply, with a switch mounted on the front panel. The second unit is the loudspeaker and baffle. A switch is provided on this panel for switching the output to a 600 ohm line when the receiver is used for remote controlled operation, or for other similar purposes. The lower unit is the receiver itself.

2. GENERAL DESCRIPTION.

2.1 Mechanical Construction.

The chassis are constructed of No. 18 gauge sheet metal, spot welded, and heavily reinforced with angle pieces and gusset plates to ensure durability and complete rigidity. The whole is given a heavy coat of copper, not less than one-thousandth of an inch thick to ensure good earthing of the chassis. To guard against corrosion, the chassis are then cadmium plated. The receiver and power chassis are fitted with dust covers thoroughly ventilated.

2.2 Electrical Characteristics.

It is important to note that the figures quoted below represent an average taken over a number of tests on different receiver. Slight variations may therefore be encountered in individual cases.

The receiver is designed to operate over the entire range, with an R.F. input of 1 microvolt absolute, or better. The frequency coverage is 138 Kc/s to 28 Mc/s with the exception of a gap of 45 Kc/s either side of the IF channel.

Sensitivity.

The absolute sensitivity is such that a radio-frequency input voltage of 1 microvolt, modulated to a depth of 30% at 400 c.p.s. applied through a standard dummy antenna, gives an output greater than 50 milliwatts in the 600 ohm line, with a signal-to-noise ratio of 1 : 1 in milliwatts, or better. The specifications demand a minimum sensitivity of 1 microvolt absolute to give an output of 6 milliwatts under such conditions. Actually, the output is as high as 200 milliwatts on some bands. These readings are taken with the volume control adjusted to give a signal-to-noise ratio of 1 : 1 in watts.

With the same input, (1 microvolt), from a signal generator, vertical or doublet antenna, and with the volume control advanced beyond the noise ratio of 1 : 1, maximum undistorted output to the speaker is nearly two watts, of which approximately 1/20th is delivered to the headphones and the 600 ohm line.

Power Output.

From the above remarks it will be seen that if a round figure of 2 watts is taken as the maximum undistorted output the input to the headphones is 1/20th of 2 watts, i.e., 1/20th of 2,000 milliwatts, which equals 100 milliwatts. The same output is delivered to the 600 ohm line. The actual output to the speaker, which has an impedance of 1750 ohms, is 1.8 watts, (undistorted power output).

Image Ratio.

Two stages of radio-frequency amplification are used in the receiver, and these provide the following signal-to-image ratios:-

Band "A"	better than 2000 to 1.
Band "B"	better than 2000 to 1.
Band "C"	better than 2000 to 1.
Band "D"	better than 2000 to 1.
Band "E" at 12 MCS	2000 to 1.
Band "E" at 22 MCS	500 to 1.

2.3 Valve Complement.

Valve layout is as follows :-

No. 1 - 6U7G	First R.F. Amplifier
No. 2 - 6U7G	Second R.F. Amplifier
No. 3 - 6K8G	Converter and First Detector
No. 4 - 6U7G	First I.F. Amplifier, and Crystal Filter
No. 5 - 6U7G	Second I.F. Amplifier
No. 6 - 6G8G	Second Detector, A.V.C., First Audio Amplifier
No. 7 - 6V6G	Power Amplifier
No. 8 - 6C8G	B.F.O., and Vacuum Tube Voltmeter
No. 9 - 5Y3G	Rectifier

3. DETAILED DESCRIPTION.

3.1 Antenna.

The input to the aerial coil is designed for vertical or doublet operation, and has an average input impedance of 400 ohms. If a single wire is used, it should be connected to terminal A1, a jumper wire being connected across earth and A2. The two wires of a doublet type antenna should be connected directly to A1 and A2, no shorting wire being used. If the aerial installation uses a balanced transmission line, the two input leads should be connected as for a doublet.

3.2 Coils.

The frequency range of the receiver, (140 KCS. to 25 MCS.) is covered in five bands. These bands are lettered from "A" to "E" and a plug-in coil unit is provided for each band. The frequency ranges of each band are as under :-

Band "A"	140 KCS. to 405 KCS.
Band "B"	490 KCS. to 1430 KCS.
Band "C"	1420 KCS. to 4.3 MCS.
Band "D"	4.25 MCS. to 12.5 MCS.
Band "E"	12.5 MCS. to 25 MCS.

Note the gap between the end of Band "A" and the commencement of Band "B". This gap, (approximately 45 KCS.) on either side of the I.F. (455 KCS.) is made because it is impracticable for the signal and intermediate tuned circuits to be operated on or near the same frequency.

Each coil unit is clearly marked with the band letter, and each consists of four separate coils, (aerial coil, two R.F. coils, and oscillator coil). Every individual coil is separately shielded, and is mounted inside the coil box with its associated air trimming condensers and iron core slugs which allow adjustment of the coil units. The four coils comprising one complete unit are mounted on a framework which is provided with two handles to facilitate insertion and withdrawal of the unit.

The face of each coil unit has a curve engraved upon it. This curve represents dial reading plotted against frequency, and it allows fairly accurate presetting of the receiver to any predetermined frequency. For greater accuracy, the receiver should be set to the required frequency by means of a signal generator.

Coil connections (which vary with the band in use), are illustrated on circuit diagram. Adjustment to the coils is made through holes provided in the coil shields, and the illustrations show the coil arrangement as seen from under the chassis, in the position where coil adjustments would be made.

The electrical contacts on the coil acceptor unit are constructed of phospor-bronze, silver-plated. These contacts are self-cleaning by friction.

Tuning of the coils is accomplished by means of variable condensers having a capacity of 11 to 420 mmfd. Four of these condensers are ganged, and the whole assembly is then mounted on a 1/8 inch plate to ensure rigidity. The condensers are driven by a high ratio vernier dial having a range of 500 degrees spread over an equivalent length of 12 feet. Parallel tuning is employed on bands "A", "B", "C", and "D", and series capacity tuning on band "E". A modified "H" type gang is used.

The tuning ratio is approximately 2.9 to 1 on bands "A", "B", "C" and "D", and 2 to 1 on band "E". The ratio is reduced on band "E" by parallel tuning, which is used to increase the band spread at the higher frequencies.

The R.F. coils are of conventional design, with tuned grid and resonating primary. The coupling between the two coils is so arranged that uniform gain is obtained over the whole band. The oscillator coil is similar in construction. A padder condenser is mounted inside the oscillator coil shield to enable oscillator tracking to be adjusted.

The oscillator coil is tuned to 455 KCS., higher than the tuning frequency, and this is maintained over the entire range of the band by correct adjustment of the inductance slug and the padder condenser mounted inside the coil shield. This gives the necessary 455 KCS. beat in the frequency converter for intermediate frequency amplification. Band "E" oscillator coil has no padder condenser or variable inductance, but this coil is adjusted in the factory. By spacing the turns of the secondary correctly, and adjusting C8 under the coil housing to 455 KCS. above the tuning frequency, correct tracking is maintained on this band. The adjustment referred to is always made at the low-frequency end of the band.

3.3 Radio-Frequency Circuits.

The function of the radio-frequency amplifiers is to receive from the aerial system all types of signals, select the desired signal by virtue of their variable resonant properties, amplify this signal, and pass it on to the converter stage for frequency conversion. The variable tuning factor is the tuning condenser.

The sensitivity of the R.F. stages is controlled manually by the R.F. Gain Control, or by the A.V.C., as desired.

Two type 6U7G valves are used in the R.F. amplifiers, and stable screen voltage on these valves is obtained by means of a voltage divider system, R3-R4, and R8-R9.

3.4 R.F. Gain Control.

Due to the very high amplification available in the R.F. and I.F. stages of the A.R.7 receiver, it is necessary to adopt some means to control the gain of these stages in order to prevent overloading - particularly on C.W., when the Delayed Automatic Control system is not in operation.

The control of R.F. gain is effected by returning the cathode bias resistors of the second R.F., and first and second I.F. stages, to a point of positive potential with respect to earth. Resistors R18, (a 50,000 ohm, 2 watt resistor), and R19, (a 5,000 ohm wirewound variable resistor), are in series across the H.T. to form a voltage divider through which the current flows. It will be seen that the voltage across R19 will be the product of the current through it, multiplied by the amount of resistance in the circuit.

It can therefore be calculated that the voltage at the common point of the two resistors will vary from zero, (earth potential), to approximately 22.5 volts positive, according to the setting of the moving arm of the variable resistor R19. This voltage is due solely to the current passing through the voltage divider circuit.

However, when the cathode returns of the three valves mentioned are connected to this point, the combined currents through the valves will also flow through that portion of R19 which is in circuit, (according to the setting), and as this increases the total current flow, there will be a greater voltage drop across R19.

On inspection of the circuit diagram, it will be apparent that when the gain control is set to the position marked "10", the only bias on the controlled stages will be that due to the voltage drop across their individual cathode resistors, and therefore the bias will be at a minimum value. Under these conditions, the gain will therefore be at a maximum value.

With the gain control set to the "0" position, the full voltage drop across R19, (approximately 30 volts), will be applied to the valves as bias. Thus, in this case, the bias voltage is at a maximum value, resulting in minimum gain. At all intermediate positions, the bias, and therefore the amplification of the controlled stages, will be in proportion to the amount of resistance of R19 actually in circuit. Note that the R.F. Gain Control is not used on the first R.F. or the Converter stages.

3.5 Converter Stage.

After the radio-frequency amplifiers have selected and amplified the desired frequency, the signal is passed on to the frequency converter, the function of which is to mix the desired signal with the R.F. voltage from the Oscillator stage. Since the latter is tuned to 455 KCS. above the signal frequency, a beat of 455 KCS. is produced. This beat has all the characteristics of the original signal, except that it always appears on a constant frequency, i.e. 455 KCS. irrespective of the actual signal frequency. The signal thus obtained is passed through the intermediate frequency amplifiers for additional amplification.

The converter stage uses a 6K8G valve, which operates efficiently over the full frequency range of the receiver. The oscillator and screen high tension supplies are taken through the same dropping resistance to make use of the frequency compensating characteristics afforded.

No A.V.C. is applied to the converter stage, thus eliminating any possibility of frequency instability or distortion due to varying grid voltages from the A.V.C. circuit produced by fading signals.

3.6 H.F. Oscillator.

The high-frequency oscillator comprises the triode section of the 6K8G converter valve in a fundamental oscillator circuit. As the H.F. oscillator must always be tuned to a frequency 455 KCS. higher than the incoming signal frequency, it is necessary that it be very stable in operation. Any changes of voltage in either the hexode or triode portions of the valve may tend to cause frequency drift. Because of this, a number of precautions have been taken to ensure constant voltages on all electrodes.

Apart from the fact that special attention has been given to the design of this stage in order to ensure rigid construction, neither A.V.C., nor R.F. Gain Control is applied to the hexode. As a further precaution, the hexode screen, and the triode voltages are applied through a special filter (R13 and C18). Bleeder resistors R4, R9, R21 and R27 from screen circuits to earth, also assist in stabilising voltages in all stages.

The 50,000 ohm resistor, (R12) which is rated at $\frac{1}{4}$ watt, is the oscillator grid leak. C14, a .0001 mfd mica condenser, is the oscillator coupling condenser. The .1 mfd condenser (C17), is used as an R.F. bypass.

In some A.R.7 receivers with low serial numbers, R13 is a wirewound resistor, acting as oscillator anode and hexode screen voltage dropping resistor. In later models R13 consists of four 50,000 ohm 1 watt resistors in parallel. The reason for this is merely a matter of available components, and has no technical significance. The necessity of a four watt resistor in this portion of the circuit may be queried, since the combined oscillator anode and hexode screen currents are quite low, (approximately 10 milliamperes). It can be calculated, however, that the maximum current that could be passed without overheating would be approximately 18 milliamperes. A four watt resistance is therefore quite a modest provision.

The oscillator grid current should be within 80 to 200 microamperes on bands "B", "C", "D", and "E" and up to 300 microamperes on band "A".

3.7 Intermediate Frequency Amplifiers.

The function of the I.F. circuits is to amplify the 455 KCS. signal produced by the mixing of the input and oscillator frequencies, and to pass this on to the diode detector for rectification, whence it is fed to the audio stages for amplification. The I.F. circuits are sharply tuned, and thus afford maximum gain at the resonant frequency, with sharp attenuation on either side of resonance, producing the selectivity characteristics of the receiver. By the addition of the crystal filter, considerably greater selectivity may be obtained. It is merely necessary at this stage, to point out that the crystal filter is, in effect, an additional and even more sharply tuned circuit than the I.F. stages themselves. Since it is possible to vary the degree of selectivity provided by the crystal filter, it will be seen that the I.F. Stages as a whole, present not only selectivity of a high order, but a method of controlling this selectivity at will by means of a control on the front panel of the receiver.

The sensitivity of the two I.F. stages is controlled in the same manner as the R.F. stages, i.e., either by A.V.C., or by manually operated R.F. gain control as desired.

The two I.F. valves, both of which are type 6U7G, may be operated at high gain, and with separate decoupling and bypassing of their elements. Voltage divider systems consisting of resistances R20-21, and R26-R27, stabilise the screen voltages on these stages, besides giving greater control for the A.V.C.

The Intermediate-Frequency transformers are designed for high gain, and have permeability tuned primary and secondary windings. The use of silvered-mica condensers across the primaries and secondaries ensures the utmost stability under all operating conditions, and assists materially in maintaining correct alignment.

These two I.F. transformers (I.F.T.3 and I.F.T.4) are wound with litz wire.

The I.F. Crystal Input and Output, transformers (I.F.T. 1 and I.F.T. 2), are specially wound, high impedance transformers, and they are treated separately.

3.8 Crystal Filter.

The Crystal Filter is in the first stage of the I.F. amplifier, and is unique in that practically all the disadvantages of the more conventional crystal filter circuits have been avoided.

There is practically no loss of signal strength with the crystal in or out of circuit, regardless of the setting of the selectivity control. Casual users of the A.R.7 may dispute this fact, but failure to obtain such a result can generally be traced to incorrect use of the crystal filter.

Continuously variable selectivity is possible by means of a control mounted on the front panel of the receiver. A variable phasing control allows the rejection of any portion of either of the two sidebands. The rejection remains constant at any position of the selectivity control.

The "tinny", singing sound common to many crystal filters is totally absent when the filter is properly used. It is quite stable in operation, and the selectivity curve is practically symmetrical with the phasing control set to zero. It is simple to operate, but its value cannot be realized unless the proper procedure is followed.

The quartz crystal is a special "AT" cut, having a high "Q" and low frequency drift. It is fitted into a high dielectric-constant holder, sandwich fashion, between two ground stainless steel plates, and has mounting pins to fit a standard 5 pin socket. Approximately 1/1000th of an inch air gap is allowed between the crystal and the plates. The resonant frequency of the crystal is 455 KCS. (plus or minus 100 cycles).

The action of a crystal filter is somewhat complex, and therefore no attempt will be made in this Instructional Manual to enter into a detailed mathematical discussion on the subject. Nevertheless, the functioning of this portion of the receiver is not generally understood as well as are other portions of the A.R.7, so that a somewhat more lengthy description is given hereunder. This discussion will therefore be devoted mainly to the theoretical requirements, and a comparatively simple explanation of how these requirements are met by the use of a crystal filter in the A.R.7 receiver.

When receiving C.W. signals, the operator often finds that there are one or more offending signals operating on frequencies close to that of the signal to which he wishes to listen. If the desired signal is weak, it may easily become lost or confused in the resulting interference. Some device is therefore necessary to increase the selectivity of the receiver under such conditions.

The crystal filter provides a solution to the problem, and for that reason is often incorporated in good communications receivers. The crystal behaves like a series resonant circuit having a very high "Q". It is not unusual for a crystal to have a "Q" of 20,000, but in the case of the A.R.7 receiver, the "Q" is very high indeed (50,000). Hence, the selectivity of the receiver increases, and the interfering signal is either eliminated or considerably reduced.

The two metal plates between which the crystal is mounted, form a small condenser, the capacitance of which depends on the size of the plates, their distance from each other, and the S.I.C. (Specific Inductive Capacity) of the material separating the plates. It is well known that a condenser offers an easy path to radio frequency, and the crystal holder will therefore act as a small condenser which will tend to pass frequencies other than that of the crystal. This defeats the main object of the crystal filter, which is to allow an easy path for signals of one frequency only. Hence it becomes necessary to cancel the capacitative effect of the quartz crystal holder by using a voltage which is equal but opposite in phase to that applied to the crystal holder, and applying this voltage to the output side of the crystal. The "out-of-phase" voltage is obtained by centre-tapping the secondary winding of the first I.F. transformer, and connecting this centre-tap to earth.

Since it is difficult to obtain an exact centre-tap mechanically, i.e., by actually tapping the coil itself, this operation (in the case of the crystal filter), is performed electrically, by connecting two silvered-mica matched condensers (C1 and C2) in series across the secondary winding, and earthing the point of contact. The secondary winding is thus accurately electrically centre-tapped, and equal voltages opposite in phase will appear at the extremities. The voltage used to cancel the crystal holder capacity is applied via a variable condenser to the output side of the crystal.

The crystal phasing condenser is a differential condenser, i.e., two condensers in parallel, but with one set of plates (the variable), common to both condensers, and so arranged that when the capacity of one (which for the purpose of this explanation will be termed Ca), is increased, the other (Cb) is decreased.

Consider for the moment that Cb is not in circuit. As Ca is variable, and as it is in parallel with the tuned circuit of the I.F. transformer, any variation in the capacity of Ca will vary the resonant frequency of that circuit. Since the I.F. transformer is preset to 455 KCS., and the resonant frequency must not be altered if the gain and selectivity is to be maintained, some provision must be made to prevent this occurring when the variable condenser (known as the "phasing control") is adjusted, as otherwise th I.F. stage will no longer be resonant at the correct I.F. frequency.

Use is therefore made of the differential condenser, which introduces Cb, a capacity which is also in parallel with the I.F. transformer. Since the condenser is constructed so that when Ca is at maximum capacity Cb is at minimum, any increase in capacity afforded by Ca is automatically offset by a decrease in Cb, and thus the resonant frequency of the I.F. transformer is kept practically constant.

The selectivity of the crystal filter may be varied as desired by adding resistance in series with the tuned circuit of the I.F. transformer. The Selectivity Control (R16) is a 3.500 ohm carbon type potentiometer having a change of resistance which is approximately 1.5 times the relative rotation (known as a log-log-taper potentiometer). This variable resistance is connected in series with I.F.T.2, permitting a variation of the "Q" of this resonant circuit. This variation causes a change in the load impedance, and it is the ratio of the load impedance of I.F.T.2 to the impedance of the crystal which determines the degree of selectivity. It is apparent that I.F.T.2 must be accurately tuned to frequency, since a departure from resonance of only 1 K.C. will considerably reduce the broad position of the crystal selectivity. To maintain this accuracy silvered-mica condensers are used, the characteristics of which are particularly stable. Although silvered-mica condensers have a positive temperature coefficient, this is much lower than the temperature coefficient of standard mica or paper condensers.

With the crystal filter in circuit, and the variable selectivity control on "0", the full sensitivity of the receiver is preserved, i.e., there will be no loss of signal strength provided the receiver is exactly tuned to the required frequency. This latter is most important if the advantages of the filter are to be realised in practice, and the point is stressed because it is one which the operator (if not the technician) often fails to remember.

The selectivity of the crystal filter may be defined as the ratio of the output voltage at the resonant frequency to the output voltages of frequencies slightly off resonance. Therefore the selectivity of the filter may be expressed as the ratio of the "Q" of the crystal, to the "Q" of its output circuit (the second I.F. transformer).

A simple example of these ratios will help to make this clearer. If the "Q" of the crystal is 50,000 and the "Q" of the second I.F. transformer is 200, the selectivity of the filter will be 50,000/200. However, if the "Q" of the second I.F. transformer is varied by the selectivity control until it is reduced to 20, the selectivity of the filter will be 50,000/20.

From these examples it will be seen that if the "Q" of the second intermediate frequency transformer is DECREASED, the selectivity of the filter is INCREASED. This change is achieved by the variable resistance which is in series with the secondary of the second I.F. transformer (the selectivity control), and thus, by increasing the value of resistance (R16), the impedance decreases, and the selectivity of the filter increases.

Unless the correct procedure is followed when using the crystal filter, the value of the selectivity control will not be apparent. Consequently, all operators should receive practical instruction from the wireless maintenance mechanic, so that proper use may be made of this important feature of the A.R.7. The tuning procedure to be followed is detailed under section 4.1

It was necessary, in the foregoing discussion, to refer briefly to the phasing control. This control is a variable condenser of the differential or opposed stator type, and its function is to effect neutralization of the capacity offered by the crystal holder and wiring in order to obtain a symmetrical selectivity curve, or to vary the phase of the neutralizing voltage either way from 180 degrees, to produce a rejection dip at any desirable position plus or minus off resonance.

While the capacity between the rotor and each stator varies as a normal straight-line-capacity condenser, the capacity between the rotor and two stators in parallel remains constant for any setting of the control.

The crystal input transformer (I.F.T.1), is a Litz-wound, permeability-tuned step-down transformer having a high impedance primary to provide efficient loading in the anode circuit, and a relatively low impedance secondary to deliver a constant voltage to the crystal and the load. In order to supply a voltage 180 degrees out of phase with the crystal voltage (for neutralization purposes), the secondary is electrically centre-tapped to earth in accordance with the description given above.

The crystal output coil (I.F.T.2), is also Litz-wound, and is permeability-tuned. This coil has an impedance at resonance of approximately 50,000 ohms. The return of this coil is through the selectivity control, which varies the impedance of the circuit, and thus produces the variable selectivity characteristics already outlined. An 80 mmfd. silvered-mica condenser tunes this coil to 455 KCS.

3.9 Beat Frequency Oscillator.

For the reception of C.W., it is necessary to provide a signal to beat with the I.F. signal. There must be a difference of frequency between the I.F., and Beat Frequency Oscillator (B.F.O.) signals, equivalent to an audible frequency, so that the signal may be heard in the headphones or on the loudspeaker.

In the A.R.7 Receiver, the B.F.O. is so adjusted that with the control knob set at zero (i.e., in the central position), it is tuned to the intermediate frequency, i.e., 455 KCS. This position is that known as "zero beat". By turning the B.F.O. note control to the left or right, the B.F.O. signal may be varied from 457 to 453 KCS., thus giving a beat note of plus or minus 2,000 c.p.s. It will be seen from this, that when the B.F.O. note control is in the central position, the receiver itself should be tuned to the zero beat of the signal, and the B.F.O. should THEN be adjusted for the required note. If the receiver is retuned to give the desired beat note, interference from nearby signals may result.

One half of a twin triode 6C8G valve is used in a series-electron-coupled Hartley circuit as the beat frequency oscillator. R25 is a $\frac{1}{2}$ watt 50,000 ohm resistor which acts as a voltage dropping resistance for the anode. This resistance also prevents the anode current from exceeding a safe value when the B.F.O. is switched out of circuit by means of the B.F.O./A.V.C. switch. A paper condenser (C25), maintains the anode at the same A.C. earth potential as the bottom end of the coil for beedback purposes. C42 is a semi-variable trimmer condenser, and this feeds a certain proportion of the developed H.F. to the detector diode. The adjustment of this condenser is preset, and is sealed at the factory.

When the B.F.O. is in use, the A.V.C. line is shorted to earth. This prevents A.V.C. from operating during reception of C.W., whilst allowing the B.F.O. to operate. On switching to A.V.C., the A.V.C. short to earth is removed, and the B.F.O. is earthed instead.

The heterodyne signal is fed into the rectifier diode through condenser C42, which is adjusted to approximately 15 mmfd. The grid condenser has a capacity of 100 mmfd., and the grid leak is 50,000 ohms.

The B.F.O. coil is Litz-wound, and has a high "Q". It is permeability-tuned, and has a fixed tuning capacity of 100 mmfd., across the winding.

B.F.O. Note Control.

This is a two plate midget type variable condenser (C41) mounted on the front panel of the receiver. By variation of this capacity, the beat note may be adjusted to 455 KCS. plus or minus 2,000 cycles, which is the central point.

3.10 Signal Strength Meter.

One half of the 6C8G valve is used for the B.F.O., and the other half of this valve is used as a vacuum tube voltmeter for operating the Signal Strength Meter ("S" Meter).

The "S" Meter is basically a 0 to 1 milliampere meter having a linear scale. It is calibrated in "S" units, each unit representing approximately 6 db. change in signal strength.

The "S" Meter is in series with a 5,000 ohm variable wire-wound resistor (R32), acting as a variable cathode bias on the valve. The normal functions of a cathode bypass condenser are performed by C26 (.05 mfd.).

Under no signal conditions, i.e., with the grid at earth potential through the A.V.C. network resistors, R32 is adjusted so that just sufficient current flows through the valve to give full scale reading on the "S" Meter. It must be realised that the scale on the "S" Meter is reversed, so that when maximum current is flowing through it, the pointer is at zero, and with minimum current, the pointer indicates maximum. As the grid of the "S" Meter valve becomes more negative by the action of the A.V.C. less current will flow, and therefore greater signal strength will be indicated, in proportion to the amplitude of the received signal.

Any alteration of the R.F. gain control will affect the voltage applied to the A.V.C. diode, and this will therefore cause changed readings in the "S" Meter, although there may be no apparent difference to the ear, owing to the A.V.C. action of the receiver.

The "S" Meter adjustment control is a 5,000 ohm variable resistor which is wired in series with the "S" Meter and the cathode of the vacuum tube voltmeter. Its function is to adjust the anode current of the V.T.V.M. until the meter needle shows zero with no signal input. This necessitates that the R.F. gain control be placed at minimum before making this adjustment.

In some A.R.7 Receivers, a resistance (R47), varying in value from 50 to 200 ohms, has been shunted across the meter so that the setting of the "S" Meter by the adjustment control will be correct in all cases, and that the results are standard for all receivers. This takes care of individual variations in meter sensitivity.

3.11 Second Detector and Audio Gain Control.

One diode section of the duo-diode 6G8G valve is used for signal rectification, thus providing the audio component, whilst the other diode is used for rectification of the signal to provide a D.C. voltage for automatic volume control purposes.

The secondary detector diode load resistance consists of R33, which is a $\frac{1}{4}$ watt 100,000 ohm resistor, and R34, a 1 megohm tapered carbon potentiometer (in some cases a .5 megohm potentiometer is used). Voltages pulsating according to the beat note (in the case of C.W. signals), or to audio frequency (in the case of R/T signals), will be developed across the two resistors. However, R33, in conjunction with C29 and C32 (the latter each of .0001 mfd.), is used merely as a filter to remove the I.F. component from the rectified signal voltage. An examination of these points will show that a proportion of the developed voltages are thus sacrificed for the purpose of increasing the stability.

The automatic volume control voltage, developed between the A.V.C. diode and earth, is applied through R30 in series with R31. At the junction of these two resistors, a voltage which is half the value of the A.V.C. volts developed, is fed to the first audio stage through resistance R36.

It can now be considered that between the diode end of R33/R34 and cathode, there is developed a D.C. voltage which is pulsating according to the audio frequency component. Between any point on R34 and cathode, there will be a voltage which is directly proportional to the amount of resistance in the circuit. The low impedance of C31 to audio frequency will maintain the bottom end of R34 at A.C. earth potential.

Thus a greater or lesser proportion of the A.C. component is applied through condenser C33 (.01 mfd.), to the grid of the A.F. amplifier, simply by adjustment of the moving arm of the audio gain control.

3.12 Delayed Automatic Volume Control.

Automatic Volume Control (abbreviated A.V.C.), is a system which automatically adjusts the sensitivity of a radio receiver in proportion to the strength of the received carrier wave, thus allowing its output to be maintained substantially constant with a varying input. Any varying signal on the A.V.C. diode changes the bias voltage to the previous stages, and therefore varies the overall sensitivity. A.V.C. prevents overloading and blasting of the loudspeaker when tuning the receiver over strong local signals.

In simple A.V.C., a certain amount of control takes place even on the weakest signals. Normal "noise level" is also sufficient to set the A.V.C. action into operation. This is undesirable, since any A.V.C. voltage increase causes a decrease in the sensitivity of the receiver. A decrease in receiver sensitivity on weak signals cannot be tolerated in a communications receiver, and the method used to overcome this drawback is to apply a system commonly known as "Delayed A.V.C." In this type of control, a separate diode is used, biassed in such a way that it will not operate until the received signal exceeds a certain voltage amplitude. Weak signals are therefore unaffected by A.V.C. action, or, more precisely, weak signals cause no A.V.C. action, and the sensitivity of the receiver is therefore not reduced.

The signal for the D.A.V.C. voltage is taken from the anode of the second I.F. amplifier valve through a 250 mmfd., condenser (C30). By feeding the signal direct to a separate diode, the detector load diode is reduced, and there is a consequent reduction in distortion.

In the A.R.7 Receiver, diode No. 2 of the 6G8G valve is used as the D.A.V.C. diode, being returned to earth through the resistors R30 and R31, each of .5 megohm, and rated at $\frac{1}{4}$ watt. The cathode of the 6G8G is at .8 volt positive potential with respect to earth, due to the current through the cathode bias resistor, R35, and the diode is thereby placed at .8 volt negative potential with respect to the cathode.

When, therefore, the signal input to the diode exceeds .8 volt, rectification will occur, and a D.C. voltage will be developed across R30 and R31. This voltage will be in proportion to the signal strength, and it will be negative in polarity at the diode end of the load resistor.

The A.V.C. voltage is supplied to the grids of the controlled valves (V1, V2, V4 and V5) by connecting the low potential ends of their respective coils to the A.V.C. circuit through coupling resistors R1, R6, R15, R16, R23 and R29. As the coils themselves cannot be physically connected to earth without automatically removing the A.V.C. voltage from the valves, condensers C5, C9, C19, C23 and C15 are included to provide in each case a low reactance path to earth for R.F. and I.F. voltages which otherwise would appear in the A.V.C. circuit. These condensers and resistors also operate as filter circuits which improve the regulation of the A.V.C. voltage applied to the valves. Their values are determined by the necessity of ensuring that the time constant of each individual circuit (C x R = T secs.) does not exceed an optimum value of approximately .5 seconds, otherwise the A.V.C. would tend to be sluggish in its operation.

Approximately half of the A.V.C. voltage is tapped off from the junction of R30-R31, which form a voltage divider, and passed on to the pentode first audio stage as audio A.V.C. This A.V.C. action is applied to the pentode section of the 6G8G through the grid load resistor, R36, which is a $\frac{1}{4}$ watt resistance rated at 500,000 ohms. Filtering is accomplished by C34 (.1 mfd.). The purpose of audio A.V.C. is to reduce the gain of the audio amplifier when high signal inputs are applied to the receiver.

The A.V.C. system in the A.R.7 Receiver maintains the output constant to within plus or minus 3 db. from a given setting.

3.13 Audio Amplifier.

The function of the audio amplifier is to increase the rectified voltage that has been developed across the audio gain control from the diode of the 6G8G valve, to a degree sufficient to operate a loudspeaker or headphones, or to supply sufficient power for a 600 ohm line.

The audio amplifier consists of the pentode portion of the 6G8G valve, which is resistance-capacity-coupled to the output valve. a 6V6G beam pentode. Both valves operate under self bias conditions.

After the audio component has been rectified, it is filtered by the network C29, R33 and C32, and then placed across the audio gain control (R34). The contact arm of this potentiometer is used to select the required amount of audio voltage to give the requisite output. This voltage is then passed to the grid of the 6G8G valve, where it is amplified, and passed through the coupling condenser C37 to the grid of the 6V6G for power amplification.

The output of the 6V8G is fed to the output transformer.

The condensers C29, C32, C35 and C40, and the resistances R33 and R40, are R.F. filters inserted to prevent the R.F. voltage from feeding back from the audio output, and thus causing instability. Condenser C34, prevents any out-of-phase audio voltage from the A.V.C. line cancelling out the audio voltage on the grid of the 6G8G valve. R36 is the grid leak for the first audio stage.

As mentioned when dealing with A.V.C. action, a portion of the A.V.C. is fed to the grid of the 6G8G valve in order to avoid overloading on strong signals.

The audio amplifier has a fairly constant gain between 70 and 10,000 c.p.s. delivering 1.8 watts to the loudspeaker (undistorted output). Some attenuation of the high frequency response is brought about by the selective circuits in the radio frequency amplifier, and the intermediate frequency amplifier, but this attenuation is not excessive.

3.14 Noise Limiter.

Owing to the fact that noise voltages developed by atmospherics, electric motors, etc., are often of considerably greater amplitude than the signal being received, it is desirable to provide some means of limiting the amplification of such noise peaks.

At first, this appears a formidable problem, yet the solution is quite simple. If the noise voltage has an amplitude of say ten volts, and the signal has an amplitude of two volts, it is merely necessary to limit the amplifying capabilities of the valve to two volts, and the signal-noise ratio is improved to a ratio of 1 : 1, instead of 1 : 5.

This is accomplished by lowering the saturation point of the first audio-frequency amplifier, and thus limiting the amplifying capabilities of that stage. By varying the screen voltage of the 6G8G to a value somewhat lower than normal, a point will be reached where the valve is just capable of handling the incoming signal without overloading. At this point, the characteristics of the valve are such that positive noise peaks cannot be amplified more than the incoming signal, even though the amplitude of the former are usually much greater. As a result, the signal-noise ratio cannot exceed 1 : 1 on positive peaks. This is especially valuable when listening to C.W. signals.

Use of the noise limiter on R/T is possible, but a certain amount of distortion may be introduced.

In the circuit diagram, R38 is a 1 megohm ¼ watt resistor, and this is the normal screen voltage dropping resistor. It is used in conjunction with a .5 megohm tapered carbon potentiometer. A variable voltage divider system is thus formed, enabling the screen voltage to be varied. The variable portion of the voltage divider is the .5 megohm potentiometer (R37), known as the "Noise Limiter" control.

3.15 Tone Control.

One of the characteristics of the 6V6G beam tetrode, its high amplification of the higher portion of the audio-frequency spectrum, is liable to cause parasitic oscillation. The inductive reactance of the speaker transformer primary winding increases with an increase in frequency, and a condenser is therefore required in parallel with the inductance to compensate for this effect. Hence, C40, a .005 mfd., mica condenser is incorporated in the circuit to bypass all frequencies above the required audio frequency limit.

The tone control system consists of C38, a .1 mfd., paper condenser, and R43, a 50,000 ohm tapered carbon potentiometer. The resistor and condenser are connected in series, and are wired between the anode of the output valve and earth. The impedance of this circuit is therefore effectively in parallel with the impedance presented by the transformer primary. A greater or lesser proportion of the higher frequency audio spectrum may be considered bypassed to earth, according to the setting of the moving arm on the potentiometer.

In the "0" position of the tone control, a fairly wide range of high audio frequency will be so bypassed, and for this reason, position "0" is generally termed the "bass" position. On position "10", the impedance of the tone control circuit will be very high compared with the impedance of the transformer primary, so that the tone control may then be considered to be inoperative. This position is known as the "treble" position.

The tone control, when in the minimum position, will decrease the total output or "volume" of the receiver, due to the loss of the higher frequencies. It is generally used at some intermediate setting, depending on conditions of interference, and the tonal quality desired.

3.16 Output Circuits.

It is the function of the output circuits to aupply the audio output to the headphone jacks, 600 ohm line, or speaker terminals in the correct proportion of volume and at the necessary impedance.

Two output impedances are available from the output transformer, T5, viz., 1750 ohms, and 600 ohms. These windings are independent. The main output is fed to the loudspeaker, and a portion of the output is fed to the 600 ohm winding. If a round figure of 2 watts is taken as the maximum undistorted output, the input to the headphones is 1/20 or 100 mw. The same output is delivered to the 600 ohm line. The output to the speaker is 1.8 watts at 1750 ohms.

The 1750 ohm winding is connected to the filament pins of a five pin valve socket, which is used as an output socket.

Two headphone jacks are provided. The input to the headphones is taken from the loudspeaker winding through a resistor network. "J1" is the master jack. This jack controls the switching of the speaker, and connects "J2" into the circuit. If only one pair of headphones are used, they should be placed in "J1" jack, as no output is available at "J2" until the master jack is in use. "J2" jack is provided in case it should be necessary to use an additional operator on the watch for instructional purposes, message reading, log keeping, etc.

It should be noted that when the headphones are inserted into "J1" jack, the loudspeaker circuit is opened, and an internal dummy load is connected in place of the speaker. It is this resistive load that acts as a divider network for the headphones, and it also performs the function of keeping the line output constant, by keeping the loading constant.

3.17 Power Supply.

The original R.A.A.F. unit was designed to allow switching from A.C. to a 12 volt battery source, and used 6X5GT rectifiers. The D.C.A. version uses an orthodox circuit with a 5Y3G rectifier, and a double section choke input filter. A fuse is provided in the negative H.T. lead from the transformer centre tap. The 12 volt heater winding of the original transformer is used and the heaters are connected in a series arrangement as shown. An additional transformer is provided for heating the rectifier filament.

The input circuit includes a double pole switch and an R.F. filter.

It should be observed that the H.T. negative lead does not go direct to earth but is earthed by the standby switch in the receiver unit.

The receiver requires a H.T. current of 100 ma and a L.T. current of 1.35 amps at 12 volts.

4. OPERATION AND MAINTENANCE.

4.1 Use of Crystal Filter.

With the R.F. gain control at a low setting, and the B.F.O. note control set to "0", tune the desired signal to zero beat by adjusting the tuning control. The A.V.C./B.F.O. switch should be in the B.F.O. position so that the beat note may be heard and then reduced to zero beat. It is stressed that the zero beat must be found with the tuning control, and that the B.F.O. note control must be set to the central position. Zero beat must not be located with the B.F.O. note control.

Switch in the crystal filter, and adjust the selectivity control for medium selectivity (about 3 or 4). Rotate the phasing control either side of centre scale until a minimum amount of interference from the undesired signal is evident. This adjustment of the phasing control shifts the rejection dip of the crystal to a value plus or minus that of the actual tuned frequency, and this enables the operator to reject either side, or any portion of the side-band of a carrier.

Having now rejected the undesired signal, the B.F.O. note control should be adjusted to heterodyne at a frequency most suitable for the receiving conditions experienced. The operator should make sure to choose the side of the carrier which is opposite to the side on which interference is being experienced, i.e. if the desired signal frequency is lower than the undesired signal frequency, the B.F.O. note control should be adjusted so that the heterodyne is on the lower frequency side of the desired signal. When the correct setting of this control has been made, reception may be further improved by increasing or decreasing the selectivity of the crystal.

It is usually desirable to keep the selectivity of the receiver at a minimum, because of increasing difficulty of tuning as the selectivity is increased. With maximum selectivity, shifting carriers, frequency drift of the receiver or transmitter, etc., may make it necessary to correct the dial setting occasionally to avoid loss of signal strength. After some hours of operation, operators frequently blame conditions as the signal appears to become weaker, whereas the tuning should be checked frequently if signals are at all weak. It is therefore a big help to use no greater degree of selectivity than is found absolutely necessary.

4.2 Alignment Procedure.

I.F. Amplifier.

Extreme accuracy is required in the alignment of the I.F. circuits. Unless there is very good reason to suspect incorrect alignment, and the mechanic has all the necessary facilities for this work, it should not be attempted.

Slight misadjustment of the I.F. transformers will have a marked effect on the sensitivity and selectivity of the receiver. As the I.F. transformers are of an extremely stable type using permeability tuning and silver mica fixed condensers, it will usually be found that one or two turns of the iron core slug is all that is necessary to bring them to their original state of alignment.

The following instructions should be read through carefully, and they must be thoroughly understood before commencing adjustments.

Disconnect the aerial leads and power and speaker cables. Take the dust cover off, and remove the receiver from the rack. Stand the receiver on its side, with the underneath facing to the right, and away from the rack.

Reconnect the power and speaker cables, but not the aerial leads. Connect an output meter adjusted to 600 ohms across the 600 ohm output terminals. An ordinary 0 - 5 volt copper oxide rectifier type A.C. meter with a 600 ohm, 1 watt carbon resistance connected across it is quite suitable for the purpose. To use the V.C.T. test set as an output meter, it must first be connected to the mains supply, in order that the meter rectifier can be placed into use. Turn the left-hand switch on the meter to the "Output Volts" position, and connect the output terminals to the output of the receiver.

Remove the grid lead from the cap of the 6K8G valve. Connect the output lead of a calibrated signal generator to the grid cap of the 6K8G through a condenser of approximately .005 mfd. The grid of the valve should be returned to earth through a dummy load consisting of a 100,000 ohm 1 watt carbon resistor.

Connect the earthed lead of the signal generator output to the chassis of the receiver, then set the "S" meter to zero reading with no signal by means of the "S" meter adjust control.

Place the crystal switch in the "IN" position, selectivity control on "8," phasing control to centre scale, B.F.O./A.V.C. switch to A.V.C., tone control and noise limiter controls on "10," and the audio gain and R.F. gain to approximately "5".

Rotate the signal generator frequency control slowly over 455 KCS. (having previously adjusted modulation to 30% at 400 cycles), and adjust the attenuator until a reading of half scale is indicated on the "S" meter when tuned to maximum peak of I.F. amplifier. In doing this it should be noted that the "S" meter reading will gradually increase until a very sharp peak of the highest amplitude is passed. (Ignore minor peaks.) Return the signal generator setting to the highest-sharpest peak. This point indicates that the signal generator is tuned to exactly

455 KCS, the crystal frequency, and ensures that the signal generator is now adjusted to the correct alignment frequency irrespective of any error in calibration of the signal generator. It is essential that the signal generator is tuned to the exact crystal frequency.

Switch the crystal "OUT", and with other controls set as above, adopt the following procedure. Using a lining tool, e.g., a screwdriver of insulating material, or one with only a small tip of metal, adjust the iron core slug screws, which will be found on the top and bottom of the I.F. transformers. Those appearing above the chassis are for tuning the grid circuits to resonance, whilst the slugs below the chassis are for adjusting the anode circuits (except in the case of I.F.T.2, the crystal filter circuit, which also will be found below the chassis near the chassis side, i.e., the one which is the greatest distance from the 6K8G valve). The I.F.T.2 (below chassis) and I.F.T.4 grid (above chassis) adjustments should not be altered at this stage.

Starting from I.F.T.I., turn the iron slug screws in or out until a maximum reading appears on the "S" meter with a minimum input from the generator. As the "S" Meter reading increases, the input from the signal generator should be decreased, thus keeping the "S" meter reading at approximately half scale. Having adjusted both grid and anode circuits to resonance (with the exception of I.F.T.2 and I.F.T.4 grid) as indicated by maximum reading on the "S" meter (with minimum signal input from the signal generator), check these alignments and the correct setting of the signal generator as follows :-

Switch the crystal filter into circuit, and with the selectivity control set on "10", and the phasing control in the central position, adjust the attenuator on the signal generator until a reading of approximately half scale on the "S" meter is observed. At the same time, keep the audio gain control in a position which allows approximately 6 milliwatts (1.9 volts) on the 0-5 volt range of the A.C. voltmeter.

Rotate the signal generator frequency control slowly backwards and forwards over 455 KCS., noting the peak on the "S" meter. If only one sharp maxima is observed, the slignment is correct. Should, however, two peaks occur, incorrect adjustment of the iron slugs, or incorrect setting of the signal generator, is indicated, and the procedure outlined in paragraphs 91 to 96 should be repeated. The correct peak is the highest, and at the same time, the sharpest one. It will thus be seen that the "S" meter and the 455 KCS. crystal play a very important part in correct alignment of the A.R.7 receiver, and in this respect the lining of the I.F. transformers in the A.R.7 follows a procedure which differs from normal practice.

Now adjust T4 grid circuit for maximum peak on the output meter. After checking these circuits several times, only one sharp peak should appear on the "S" meter, and the sensitivity should be of the order of 10 microvolts. Under these conditions, with a 10 microvolt input and 6 milliwatts output, the indicated output should drop to 3 milliwatts when the generator modulation is switched off. This reading is taken with the crystal in the "out" position.

With the crystal in circuit, the signal-to-noise ratio should be improved. Test to see if this is so, and if this is not the case, it will generally be found that the I.F. frequency is not the same as the crystal frequency, i.e. 455 KCS.

If the test is successful, the signal-to-noise ratio will be further improved on alignment of I.F.T.2 crystal filter grid circuit. The method of accomplishing this is detailed in the next two paragraphs.

Insert coil unit "B" and tune in a broadcast station. Switch the crystal into circuit and set the selectivity control to "O." Adjust I.F.T2 for the best tonal quality on music, ignoring the volume level. When the tuning control is rotated over the station's carrier, the effect noticed should be the same as with the crystal out of circuit, except for a slight additional sharpness.

On either side of the correct adjustment of the iron slug in I.F.T.2, the tonal response will be low and drummy, and as the dial is rotated over the station, a distinct hollowness, due to the crystal filter cutting the sideband, will appear on either side of the station. The reason for this adjustment is to obtain a symmetrical and variable selectivity curve. Where possible, this adjustment should be made with the aid of a signal generator and a cathode ray oscilloscope, although the instructions given in the previous paragraphs are satisfactory for normal service use.

B.F.O. Adjustment.

The beat frequency oscillator should be tuned to 455 KCS., with the B.F.O. note control set at centre scale.

A simple method which can be used to check the setting, is to switch off the signal generator, set the selectivity control to "10", then switch in the crystal filter. Rotating the B.F.O. note control, a distinctive sound (similar to that of a "zero beat") will be heard as the B.F.O. passes over the crystal frequency and reaches 455 KCS. This should occur when the B.F.O. note control is at central scale position. If this setting is out, it may be corrected by adjusting the iron core in the B.F.O. shield can under the chassis.

R.F. and H.F. Oscillator Circuits.

As with the I.F. amplifier, extreme accuracy is required for the R.F. and H.F. Oscillator circuit alignments. The components employed in these circuits are of an extremely stable type, having been baked and treated with trolitol solution, and as air trimmer condensers of high quality insulating materials are used, it will be found that adjustments required are fewer than is usually the case with the standard receivef. Only a fraction of a turn of the trimmer condensers, and a very small adjustment of the iron core slugs, will be required. These adjustments should be sufficient to restore the living of the circuits to their original accuracy. Such adjustments should only be made if the mechanic is certain that they have been made necessary through valve replacements, rough handling, or extreme temperature changes, etc., and that he has the facilities and experience to make the adjustments correctly.

The adjustments are made through the holes in the coil acceptor housing, and are marked L1, L2, L3, L4, C1, C2, C3, C4, C5, C6, C7, and C8.

L1 is the inductance adjustment on the aerial coil, L2 the inductance adjustment on the first R.F. coil, L3 the inductance adjustment on the second R.F. coil, L4 the inductance adjustment on the H.F. oscillator coil, C1 is the H.F. trimmer condenser on the aerial coil, C2 the series trimmer on coil band "E", C3 the H.F. trimmer condenser on the second R.F. coil, C4 the series trimmer condenser on coil band "E", C5 the H.F. trimmer condenser on the second R.F. coil, C6 the series trimmer condenser on coil band "E", C7 the H.F. trimmer condenser on the H.F. oscillator coil, and C8 is the padder condenser on the H.F. oscillator coil.

To align the R.F. and H.F. circuits connect a signal generator through a standard dummy antenna to the aerial terminal A1, the earth terminal of the dummy antenna being connected to A2, which should be bridged across to the earth terminal.

Plug in the coil units, from Band "A" to Band "E" in turn, and check the dial readings against the calibration curves drawn on the face of the coil unit under test. Note that the B.F.O. should be "ON", and that in conformity with the procedure outlined previously, the B.F.O. note control should be set to "0", i.e., 455 KCS. This should be tested in accordance with instructions detailed previously, before checking the receiver coil calibrations.

Observe whether zero beat occurs at the correct dial setting on the receiver. Should this be so, the calibration is correct, and there will be no necessity for adjustments to the H.F. oscillator circuit. If the calibration is incorrect, i.e., if the dial reading does not agree with the calibration given on the face of the coil, a small adjustment to C7 will correct the situation at the high frequency end of the band, and an adjustment of L4 will correct for the low frequency end (except in the case of Band "E", where there is no inductance adjustment). In the case of Band "E" coil, the series trimmer C8 is adjusted in place of L4.

To check the R.F. grid circuits alignment, switch off the B.F.O., and, using a 400 c.p.s. modulated signal from the signal generator, tune in a signal at approximately 15 degrees on the dial. The frequency at which the signal generator should be set for each band may be read approximately from the calibration curve on the coil unit.

Adjust the trimmer condensers C1, C3, and C5 for maximum peak on the "S" Meter, with minimum input from the signal generator. As there will be a certain amount of interlocking between the R.F. circuits and the H.F. oscillator at the highest frequencies, it will be necessary to rotate the tuning dial to and fro over the signal to obtain the greatest peak. If this peak is obtained in the incorrect position of the dial, it will be necessary to re-check the oscillator calibration.

If Band "A" will not follow the calibration curve, condenser C8, the series padder condenser should be adjusted, re-setting C7 and L4 after this has been done. As these settings mutually affect each other, they may have to be checked several times.

Some difficulty may be experienced on this band with oscillation, especially if the receiver is very far out of alignment. This will occur when the R.F. circuits are resonating at too high a frequency, or too near the intermediate frequency, causing instability, and therefore difficulty in alignment. If the oscillator section is corrected as above, and the grid circuits are adjusted individually by connecting the signal generator to the grid cap of the second and first R.F. valves in that order, the difficulty will be overcome provided precautions are taken to see that the receiver is not set to a higher frequency than 409 KCS.

After checking the high frequency end of each band, adjust inductances L1, L2 and L3 for maximum peak at the lowest frequencies. Each adjustment should be checked several times.

If the receiver is properly aligned, it should have a sensitivity of approximately 1 microvolt when modulated 30%. The signal-to-noise ratio should be 1 : 1 (in watts) or better, and the signal-to-image ratio should not be less than 400 to 1 at the highest frequencies.

If the receiver will not line up properly, the coils should be checked. The circuit shows how the coils are wired, and shows coil positions with the receiver chassis in the inverted position. The dotted line around the "A" and "B" coil units indicates the series of coils included in one complete unit.

It should be noted that a small variable mica condenser tunes the primary of Band "A" to approximately 120 KCS., and that some of the R.F. secondaries have a 100,000 ohm resistance shunted across them to reduce their gain to a constant level. Also, note the reduced tuning ratio of Band "E" by the series tuning method. This series condenser has a capacity of 250 mmfd., plus or minus 1%, and is shunted by a 65 mmfd. variable condenser.

Each coil is set at the factory for correct coverage, tracking and sensitivity, and in no circumstances should it be necessary to open and readjust the coils. In an emergency, however, the final adjustments should be made with a signal generator which is capable of measurements at 1 microvolt or better. In most emergencies, coil units from other A.R.7 receivers are available, and these may be used. Although the calibration curves may not be reliable, they will be sufficiently accurate to set the receiver to the correct portion of the band. Final tuning adjustments may be completed with a signal generator.

VOLTAGE AND RESISTANCE TESTS.

Voltage Tests.

1. The D.C. voltages listed below should be checked with a 1,000 ohmsvolt meter, using the scale indicated in brackets. The actual tests were made with a V.C.T. Test Set (Palec.), this instrument being standard test equipment in the R.A.A.F.

2. The R.F. Gain Control should be placed on "0", the Noise Limiter on "10", the B.F.O./A.V.C. Switch on A.V.C. and the aerial removed. Except when carrying out resistance tests, the grid of the 6K8G should be shorted to earth, so that noise or signal voltages will not cause the A.V.C. to become operative and thus give readings which differ considerably from those listed below.

Socket Pin No. to Earth	6U7G 1st R.F.	6U7G 2nd R.F.	6K8G Osc. 1st Det.	6U7G 1st I.F.	6U7G 2nd I.F.	6G8G 2nd Det. 1st Aud.	6V6G Output	6C8G "S" Met. B.F.O.	Scale to be used for 6G8G reading
3	200	200	205	200	200	32	215	240	(1000 V.D.C.)
4	95	80	100	95	80	-	240	-	-
6	-	-	120	-	-	18	-	-	(100 V.D.C.)
8	2.5	2	3	2.5	2	.8	13	-	(10)

Resistance Tests

3. The resistances indicated below should be made with a 1,000 ohms per volt meter. All controls should be set at maximum, and the aerial and earth leads (including the link between A1 and A2) should be removed. The B.F.O./A.V.C. switch should be on A.V.C., and the crystal filter should be switched out of circuit. The receiver should not be connected to the power mains.

Aerial Circuits (Measured at Aerial Terminals A1 and A2)

4.	A1 to A2 on "A" Band Coil unit	17 ohms
	A1 to A2 on "E" Band Coil unit	1.5 ohms

Note :- All other resistance tests are made with "C" Band Coil in the receiver.

A1 to Earth	Infinity
A2 to Earth	Infinity

Grid Circuits

5.	Grid of V1 to Earth	1,300,000 ohms
	Grid of V2 to Earth	1,300,000 ohms
	Grid of V3 to Earth	2 ohms
	Grid of V4 to Earth	1,300,000 ohms
	Grid of V5 to Earth	1,400,000 ohms
	Grid of V6 to Earth	1,110,000 ohms
	Grid of V7 to Earth	600,000 ohms
	Grid of V8 to Earth	1,200,000 ohms

Valve Sockets

6. For socket connections see Fig. 27. Point to point resistance tests on valve sockets follow in order from V1 to V8.

V1 First R.F. Stage

Pin 1 to Earth	26,000 ohms
Pin 2 to Earth	7 ohms
Pin 3 to Earth	21,000 ohms
Pin 4 to Earth	26,000 ohms
Pin 5 to Earth	260 ohms
Pin 6 to Earth	Infinity
Pin 7 to Earth	Zero ohms
Pin 8 to Earth	260 ohms

V2 Second R.F. Stage

Pin 1 to Earth	27,000 ohms
Pin 2 to Earth	5 ohms
Pin 3 to Earth	21,000 ohms
Pin 4 to Earth	27,000 ohms
Pin 5 to Earth	270 ohms
Pin 6 to Earth	Infinity
Pin 7 to Earth	7 ohms
Pin 8 to Earth	270 ohms

V3 Oscillator and First Detector Stage

Pin 1 to Earth	Infinity
Pin 2 to Earth	5 ohms
Pin 3 to Earth	26,000 ohms
Pin 4 to Earth	27,000 ohms
Pin 5 to Earth	56,000 ohms
Pin 6 to Earth	27,000 ohms
Pin 7 to Earth	6 ohms
Pin 8 to Earth	270 ohms

V4 First I.F. Stage

Pin 1 to Earth	26,000 ohms
Pin 2 to Earth	7 ohms
Pin 3 to Earth	21,000 ohms
Pin 4 to Earth	26,000 ohms
Pin 5 to Earth	310 ohms
Pin 6 to Earth	.5 ohms
Pin 7 to Earth	5 ohms
Pin 8 to Earth	310 ohms

V5 Second I.F. Stage

Pin 1 to Earth	26,000 ohms
Pin 2 to Earth	Zero ohms
Pin 3 to Earth	20,000 ohms
Pin 4 to Earth	26,000 ohms
Pin 5 to Earth	320 ohms
Pin 6 to Earth	.5 ohms
Pin 7 to Earth	7 ohms
Pin 8 to Earth	320 ohms

V6 Second Detector and First Audio Stage

Pin 1 to Earth	400,000 ohms
Pin 2 to Earth	Zero ohms
Pin 3 to Earth	26,000 ohms
Pin 4 to Earth	1 Megohm
Pin 5 to Earth	1,200,000 ohms
Pin 6 to Earth	400,000 ohms
Pin 7 to Earth	6 ohms
Pin 8 to Earth	1,100 ohms

V7 Power Output Stage

Pin 1 to Earth	16,000 ohms
Pin 2 to Earth	5 ohms
Pin 3 to Earth	17,000 ohms
Pin 4 to Earth	16,000 ohms
Pin 5 to Earth	580,000 ohms
Pin 6 to Earth	Infinity
Pin 7 to Earth	Zero ohms
Pin 8 to Earth	300 ohms

V8 B.F.O. and "S" Meter Stage

Pin 1 to Earth	1,200,000 ohms
Pin 2 to Earth	5 ohms
Pin 3 to Earth	15,000 ohms
Pin 4 to Earth	36 ohms
Pin 5 to Earth	55,000 ohms
Pin 6 to Earth	70,000 ohms
Pin 7 to Earth	5 ohms
Pin 8 to Earth	1.5 ohms

7. Note that all resistance readings shown in the foregoing tables were those actually obtained, and thus take into account the usual tolerances for the resistances used.

8. Coils.

	I.F.1	I.F.2	I.F.3	I.F.4	T.7
Primary	11	9	8.5	8.5	8.5
Secondary	5		8.5	8.5	

	Aerial Pri.	Aerial Sec.	R.F.1 Pri.	R.F.1 Sec.	R.F.2 Pri.	R.F.2 Sec.	Osc. Pri.	Osc. Sec.
Band "A"	18	20	220	20	230	32	8	15
Band "B"	5	4	218	4	220	4	1.5	2.5
Band "C"	2 14	2	4	2	4.5	2	1	2
Band "D"	.5	.25	.75	.25	1	.25	.25	.25
Band "E"	.5	.25	.5	.5	1	.25	.5	.25

Output Transformer

Primary 450 ohms
Sec. 1 (1750) = 200 ohms
2 (600) = 25 ohms

9. Stage gain for 50 MW output.

Aerial Terminal .5uV)
Grid 1st R.F. 5uV) 325 kc/s standard
" 2nd R.F. 20 uV) dummy aerial used
" 6K8 210uV)
" 6K8 65uV) 455 kc/s. (.02 mfd
" 1st I.F. 120uV) in series with
" 2nd I.F. 10,000uV) generator

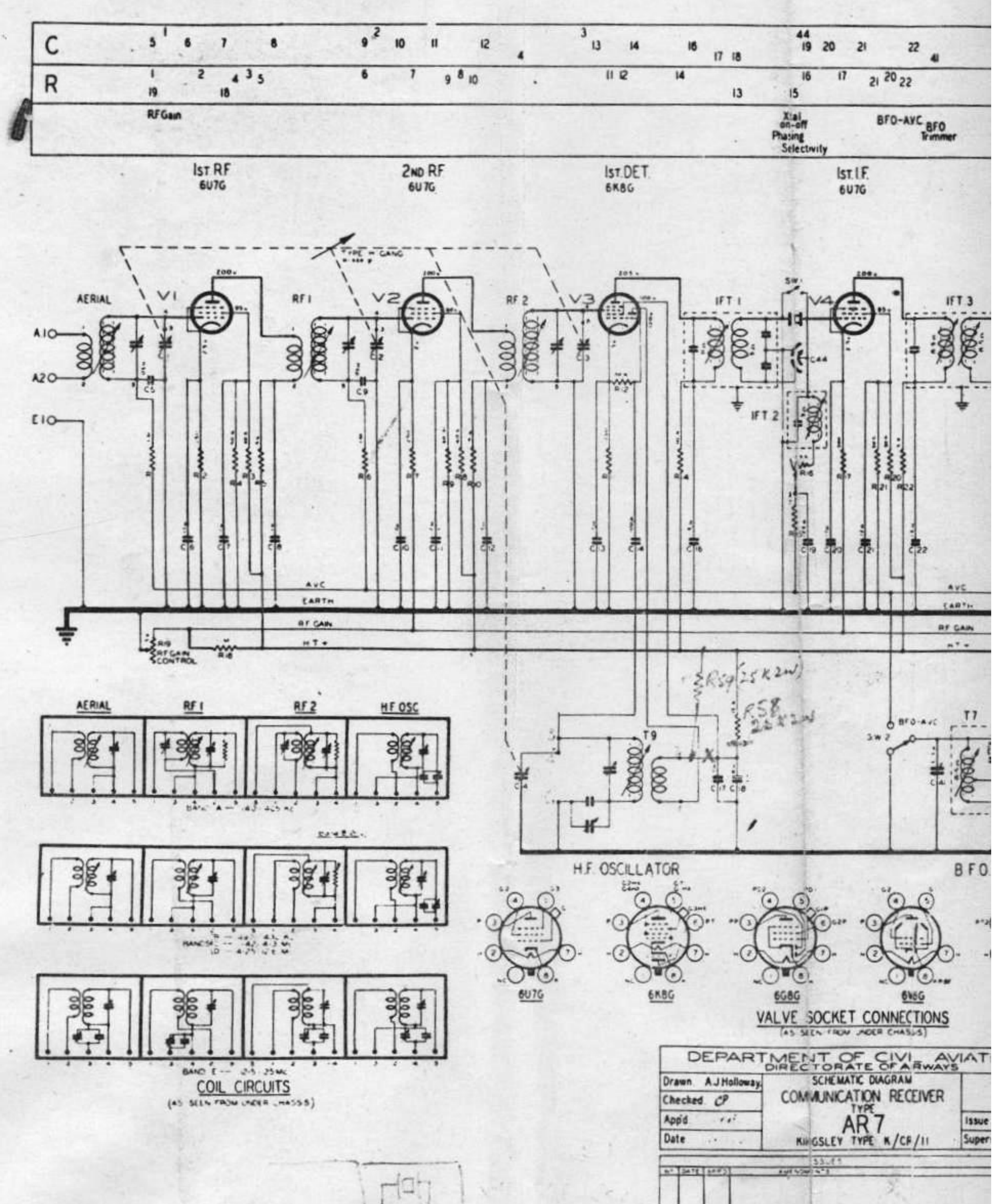
R.F., audio , tone and noise limiter controls fully clockwise.
Selectivity anti-clockwise.

SCHEDULE OF COMPONENTS FOR RECEIVER TYPE A.R.7.

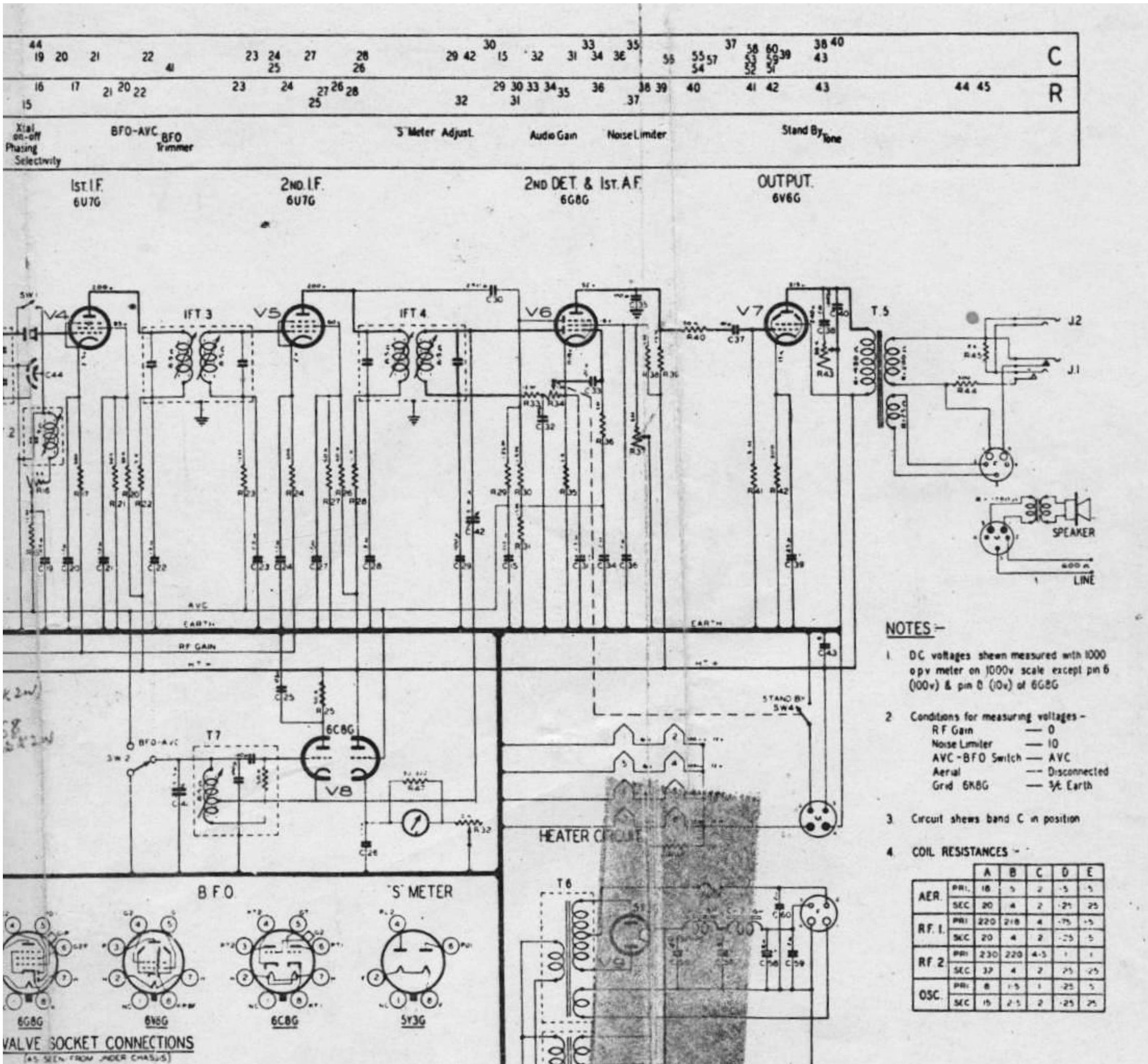
Circuit Ref. No.	Nomenclature	Detail	Function	Kingsley Part No.	R.A.A.F. Ident. No.
	RESISTANCES -				
R1	100,000 ½ watt type RM1042	Carbon Pigtail	Grid return 1st R.F. De-coupling	KR224	Y10C/66062
R2	250 ohms ¼ watt type RR2512	Carbon Pigtail	Cathode 1st R.F.	KR231	Y10C/66066
R3	30,000 ohms ¼ watt type RR3032	Carbon Pigtail	Screen 1st R.F.	KR237	Y10C/66072
R4	50,000 ohms ¼ watt type RR5032	Carbon Pigtail	Screen 1st R.F.	KR239	Y10C/66074
R5	5000 ohms ¼ watt type RR5022	Carbon Pigtail	Plate 1st R.F. De-coupling	KR235	Y10C/66070
R6	100,000 ohms ½ watt type RM1042	Carbon Pigtail	Grid Ret. 2 R.F. De-coupling	KR224	Y10C/66062
R7	250 ohms ¼ watt type RR2512	Carbon Pigtail	Cathode 2nd R.F.	KR231	Y10C/66066
R8	40,000 ohms ¼ watt type RR4032	Carbon Pigtail	Screen 2nd R.F.	KR238	Y10C/66073
R9	50,000 ohms ¼ watt type RR5032	Carbon Pigtail	Screen 2nd R.F.	KR239	Y10C/66074
R10	5000 ohms ¼ watt type RR5022	Carbon Pigtail	Plate 2nd R.F. De-coupling	KR235	Y10C/66070
R11	250 ohms ¼ watt type RR2512	Carbon Pigtail	Cathode mixer	KR231	Y10C/66066
R12	50,000 ohms ½ watt type RM5032	Carbon Pigtail	Gridleak Oscillator	KR226	Y10C/66061
R13	12,500 ohms 5 watt	Wire wound	Screen mixer Plate Oscillator supply	KR241	Y10C/66076
R14	10,000 ohms ¼ watt type RR1032	Carbon Pigtail	Plate mixer De-coupling	KR236	Y10C/66071
R15	100,000 ohms ½ watt type RM1042	Carbon Pigtail	Grid Ret. 1st I.F. De-coupling	KR224	Y10C/66062
R16	3500 ohms Potentiometer type KR95	Potentiometer wire wound	Crystal Selectivity Control	KR95	Y10C/66080
R17	300 ohms ¼ watt type RR3012	Carbon Pigtail	Cathode 1st I.F.	KR232	Y10C/66067
R18	100,000 ohms 1 watt type HV1042	Carbon Pigtail	R.F. Gain Control Divider	KR242	Y10C/66077
R19	5,000 ohms 2 watt type MDC7	Potentiometer wire wound	R.F. Gain Control	KR99	Y10C/65453
R20	30,000 ohms ¼ watt type RR3032	Carbon Pigtail	Screen 1st I.F.	KR237	Y10C/66072
R21	50,000 ohms ¼ watt type RR5032	Carbon Pigtail	Screen 1st I.F.	KR239	Y10C/66074
R22	5,000 ohms ¼ watt type RR5022	Carbon Pigtail	Plate 1st I.F. De-coupling	KR235	Y10C/66070
R23	100,000 ohms ½ watt type RM1042	Carbon Pigtail	Grid Ret. 2nd I.F. De-coupling	KR224	Y10C/66062
R24	300 ohms ¼ watt type RR3012	Carbon Pigtail	Cathode 2nd I.F.	KR232	Y10C/66067
R25	50,000 ohms ¼ watt type RR5032	Carbon Pigtail	B.F.O. Plate	KR239	Y10C/66074
R26	40,000 ohms ¼ watt type RR4032	Carbon Pigtail	Screen 2nd I.F.	KR238	Y10C/66073
R27	50,000 ohms ¼ watt type RR5032	Carbon Pigtail	Screen 2nd I.F.	KR239	Y10C/66074
R28	5,000 ohms ¼ watt type RR5022	Carbon Pigtail	Plate 2nd I.F. De-coupling	KR235	Y10C/66070
R29	250,000 ohms ½ watt type RM2542	Carbon Pigtail	A.V.C. line De-coupling	KR2542	Y10C/66063
R30	500,000 ohms ½ watt type RM5042	Carbon Pigtail	A.V.C. Diode Load	KR228	Y10C/66064
R31	500,000 ohms ½ watt type RM5042	Carbon Pigtail	A.V.C. Diode Load	KR228	Y10C/66064
R32	5000 ohms 2 watt Potentiometer type MDC7	Wire wound	"S" meter adjustment	KR99	Y10C/65453
R33	100,000 ohms ½ watt type RM1042	Carbon Pigtail	Det Diode De-coupling	KR224	Y10C/66062
R34	1 megohm type PSAR10510	Carbon Potentiometer with Switch	Audio gain control and stand-by switch	KR98	Y10C/65444
R35	1000 ohms ¼ watt type RR1022	Carbon Pigtail	Cathode 1st Audio	KR233	Y10C/66068
R36	500,000 ohms ½ watt type RM5042	Carbon Pigtail	Grid Return 1st Audio	KR228	Y10C/66064
R37	500,000 ohms 1 watt type PMAR50410	Carbon Potentiometer	Noise Limiter Control	KR97	Y10C/66079
R38	1 megohm ½ watt type RM1052	Carbon Pigtail	Screen 1st Audio	KR229	Y10C/66065
R39	250,000 ohms ¼ watt type RR2542	Carbon Pigtail	Plate 1st Audio	KR240	Y10C/66075
R40	50,000 ohms ½ watt type RM5032	Carbon Pigtail	R.F. Blocking 1st Audio	KR226	Y10C/66061
R41	500,000 ohms ½ watt type RM5042	Carbon Pigtail	Grid Leak Output	KR228	Y10C/66064
R42	300 ohms 3 watt type KR244	Wire wound Pigtails	Cathode Output	KR244	Y10C/66078
R43	50,000 ohms 1 watt type PMA50310	Carbon Potentiometer	Tone Control	KR96	Y10C/65469
R44	500 ohms ½ watt type RM5012	Carbon Pigtail	Phones Output Divider	KR225	Y10C/66060
R45	2000 ohms ¼ watt type RR2022	Carbon Pigtail	Phones Output Divider	KR234	Y10C/66069
R46	42 ohms 3 watt type KR243	Wire wound Pigtail	Filament Equalizer	KR243	Y10C/65445
R47	50 ohms ½ watt type resistor (see text)	Carbon Pigtail type All carbon resistors are plus or minus 5%	"S" meter Sensitivity Adjustment		Y10C/
	CHOKES -				
CH1	15 Henry type TZ57	200 ohm Filter	H.T. Filter Choke Power Supply	KR21	Y10C/66033
CH2	15 Henry type TZ57	200 ohm Filter	H.T. Filter Choke Power Supply	KR21	Y10C/66033
RFC1	RF Filter type KR24	160 turn 24 SWG B. Bobbin WD.	Line Filter Choke	KR24	Y10C/66052
RFC2	RF Filter type KR24	160 turn 24 SWG B. Bobbin WD.	Line Filter Choke	KR24	Y10C/66052
	CONDENSERS -				
C1 C2 C3 C4	11-420 MMFD. type KR270	4 gng. assembly "H" type Variable - complete with Vernier Dial	Aerial Tuning, 1st R.F. tuning, 2nd R.F. tuning, oscillator tuning	KR270	Y10C/6605

Circuit Ref. No.	Nomenclature	Detail	Function	Kingsley Part No.	R.A.A.F. Ident. No.
	CONDENSERS - contd.				
C5	.05 mfd. type PP259	600V wkg. Paper Dielectric Pigtail Con.	Grid Ret. 1st R.F. Bypass	KR219	Y10C/6587
C6	.1 mfd. type PP273	600V wkg. Paper Dielectric Pigtail Con.	Cathode 1st R.F. Bypass	KR220	Y10C/65882
C7	.1 mfd. type PP273	600V wkg. Paper Dielectric Pigtail Con.	Screen Bypass 1st R.F.	KR220	Y10C/65882
C8	.5 mfd. type PP294	400V wkg. Paper Dielectric Pigtail Con.	Plate Supply 1st R.F. Bypass	KR221	Y10C/65845
C9	.05 mfd. type PP259	600V wkg. Paper Dielectric Pigtail Con.	Grid Ret. 2nd R.F. Bypass	KR219	Y10C/65877
C10	.1 mfd. type PP273	600V wkg. Paper Dielectric Pigtail Con.	Cathode 2nd R.F. Bypass	KR220	Y10C/65882
C11	.1 mfd. type PP273	600V wkg. Paper Dielectric Pigtail Con.	Screen 2nd R.F. Bypass	KR220	Y10C/65882
C12	.5 mfd. type PP294	400V wkg. Paper Dielectric Pigtail Con.	Plate Supply 2nd R.F. Bypass	KR221	Y10C/65845
C13	.1 mfd. type PP273	600V wkg. Paper Dielectric Pigtail Con.	Cathode mixer Bypass	KR220	Y10C/65882
C14	100 mmfd. type MX924	400V wkg. mica Dielectric Pigtail - 5%	Grid oscillator coupling	KR207	Y10C/66055
C15	.05 mfd. type PP259	600V wkg. Paper Dielectric Pigtails	A.V.C. Line Bypass	KR219	Y10C/65877
C16	.5 mfd. type PP294	400V wkg. Paper Dielectric Pigtails	Plate Supply mixer Bypass	KR221	Y10C/65845
C17	.1 mfd. type PP273	600V wkg. Paper Dielectric Pigtails	Plate Supply oscillator Bypass	KR220	Y10C/65882
C18	8 mfd. type ET10554	600V wkg. Electrolytic with Pigtails	Plate Supply oscillator Filter	KR222	Y10C/65522
C19	.05 mfd. type PP259	600V wkg. Paper Dielectric Pigtail	Grid Ret. 1st I.F. Bypass	KR219	Y10C/65877
C20	.1 mfd. type PP273	600V wkg. Paper Dielectric Pigtail	Cathode 1st I.F. Bypass	KR220	Y10C/65882
C21	.1 mfd. type PP273	600V wkg. Paper Dielectric Pigtail	Screen 1st I.F. Bypass	KR220	Y10C/65882
C22	.5 mfd. type PP294	400V wkg. Paper Dielectric Pigtail	Plate Supply 1st I.F. Bypass	KR221	Y10C/65845
C23	.05 mfd. type PP259	600V wkg. Paper Dielectric Pigtail	Grid Ret. 2nd I.F. Bypass	KR219	Y10C/65877
C24	.1 mfd. type PP273	600V wkg. Paper Dielectric Pigtail	Cathode 2nd I.F. Bypass	KR220	Y10C/65882
C25	.05 mfd. type PP259	600V wkg. Paper Dielectric Pigtail	Plate supply BFO Bypass	KR219	Y10C/65877
C26	.05 mfd. type PP259	600V wkg. Paper Dielectric Pigtail	Cathode S meter Bypass	KR219	Y10C/65877
C27	.1 mfd. type PP273	600V wkg. Paper Dielectric Pigtail	Screen 2nd I.F. Bypass	KR220	Y10C/65882
C28	.5 mfd. type PP294	400V wkg. Paper Dielectric Pigtail	Plate supply 2nd I.F. Bypass	KR221	Y10C/65845
C29	100 mmfd. type MX924	400V wkg. mica Dielectric Pigtail	Diode Load Det. Bypass	KR207	Y10C/66065
C30	250 mmfd. type MX927	- 5% mica Dielectric Pigtail	A.V.C. Diode Coupling	KR206	Y10C/66056
C31	25 mfd. type ET10769	25V wkg. Electrolytic Pigtails	Cathode 1st Audio Bypass	KR223	Y10C/65448
C32	100 mmfd. type MX924	400V wkg. mica Dielectric Pigtail	Diode load Det. Bypass	KR207	Y10C/66055
C33	.01 mfd. type MX968	400V wkg. mica Dielectric Pigtail	Audio Coupling 1st Audio	KR212	Y10C/66058
C34	.1 mfd. type PP273	600V wkg. Paper Dielectric Pigtails	Grid net 1st Audio Bypass	KR220	Y10C/65882
C35	100 mmfd. type MX924	400V wkg. mica Dielectric Pigtails	Plate 1st Audio Bypass	KR207	Y10C/66055
C36	.1 mfd. type PP273	600V wkg. Paper Dielectric Pigtail	Screen 1st Audio Bypass	KR220	Y10C/65882
C37	.01 mfd. type MX968	400V wkg. mica Dielectric Pigtail	Audio coupling output	KR212	Y10C/66058
C38	.1 mfd. type PP273	600V wkg. Paper Dielectric Pigtail	Tone control	KR220	Y10C/65882
C39	25 mfd. type ET10769	25V wkg. Electrolytic Pigtail	Cathode output Bypass	KR223	Y10C/65448
C40	.005 mfd. type MX958	400V wkg. mica Dielectric Pigtail	Plate output Bypass	KR209	Y10C/66057
C41	3-15 mmfd. type KR218	Air Trimmer	BFO note control	KR218	Y10C/66048
C42	3-30 mmfd. type MBC	Mica Trimmer set 15 mmfd.	BFO coupling	KR162	Y10C/66049
C43	.5 mfd. type PP294	400V wkg. Paper Dielectric Pigtail	H.T. line Bypass	KR221	Y10C/65845
C44	40-0-40 mmfd. type KR204	Air Trimmer	Crystal Filter Phasing	KR204	Y10C/66050
C51	.01 mfd. type MX968	400V wkg. mica Dielectric Pigtail	A.C. Line Filter Bypass	KR212	
C52	.01 mfd. type MX968	400V wkg. mica Dielectric Pigtail	A.C. Line Filter Bypass	KR212	
C53	.01 mfd. type MX968	400V wkg. mica Dielectric Pigtail	A.C. Line Filter Bypass	KR212	Y10C/66058
C54	.01 mfd. type MX968	400V wkg. mica Dielectric Pigtail	A.C. Line Filter Bypass	KR212	
C55	.01 mfd. type MX968	400V wkg. mica Dielectric Pigtail	A.C. Line Filter Bypass	KR212	

Circuit Ref.No.	Nomenclature	Detail	Function	Kingsley Part No.	R.A.A.F. Ident. No.
	CONDENSERS - contd.				
C56	8 mfd. type ET10554	600V wkg. Electrolytic Pigtails	Spare	KR222	Y10C/65525
C57	8 mfd. type ET10554	600V wkg. Electrolytic Pigtails	H.T. Filter	KR222	Y10C/65525
C58	8 mfd. type ET10554	600V wkg. Electrolytic Pigtails	H.T. Filter	KR222	Y10C/65525
C59	.1 mfd. type PP273	600V wkg. Paper Pigtails	H.T. Positive Bypass	KR220	Y10C/65882
C60	.1 mfd. type PP273	600V wkg. Paper Pigtails	H.T. Negatives Bypass	KR220	Y10C/65882
	SPEAKERS -				
-	Rola type 6-11	1750 ohms permag.	-	-	Y10A/55622
	TRANSFORMERS -				
IFT1	I.F. type KR30	455 Kc. crystal	Crystal input transformer	KR30	Y10A/55729
IFT2	I.F. type KR31	455 Kc. Grid	Crystal output transformer	KR31	Y10A/55730
IFT3	I.F. type KR157A	455 Kc. Grid	Couple I.F. to 2nd I.F.	KR157A	Y10A/55731
IFT4	I.F. type KR157B	455 Kc. Grid	Couple 2nd I.F. to Det.	KR157B	Y10A/55732
T5	Audio type TA270	5,000 ohms PP1. 1750 ohms. 600 ohms Secs.	Couples output to Speaker phones and line	KR160	Y10A/55503
T6	Power type TA737	0-200-230-250V Primary	230V A.C. Power Supply	KR158	Y10A/55486
T7	I.F. type KR29	455 Kc. Grid	BFO Coil	KR29	Y10A/55733
T8	Rectifier Filaments	230V ac. primary 5V sec. 600V insul.	Rectifier filaments		
T9	Speaker transformer 1750 ohms	For Rola Speaker 6-11	Matching speaker Rola 6-11 to output transformer		Y10A/55529
	TERMINALS -				
A1	Aerial type KR155	Bakelite spring red	Aerial input	KR155	Y10A/55734
A2	Aerial type KR155	Bakelite spring red	Aerial input	KR155	Y10A/55734
E1	Earth type KR156	Bakelite spring black	Earth	KR156	Y10A/55735
	CRYSTALS -				
	455 Kcs. type K	Quartz crystal	Crystal filter	KR36	Y10Z/95010
	FUSES -				
F1	Fuse lamp .5 amp.	.45 to .6 amp. 2-8 volts min. E.S. lamp	H.T. safety fuse	KR72	05A/25251
	SWITCHES -				
SW1	Toggle Type A	S.P.D.T. 250V. .5 amp.	Crystal on-off switch	KR129	Y10F/80214
SW2	Toggle Type A	S.P.D.T. 250V. .5 amp.	AVC-BFO switch	KR130	Y10F/80214
SW3	Flush type power switch	250 volt 10 amp D.P.	Main A.C. Switch		
	JACKS -				
J1	Telephone type KR69A	1 make 1 break contact	Phone Jack No.1	KR69A	Y10H/90298
J2	Telephone type KR69B	2 make contacts	Phone Jack No.2	KR69B	Y10H/90299
	PLUGS -				
P1	Type GP4	4 pin amphenol	Power Plug on receiver	KR160	Y10H/90111
P2	Type KR104	5 pin plug	Speaker Plug	KR104	Y10H/90303
	METER -				
M	"S" type RE/E17	1 MA movement rescale 0-10 "S" units	Signal strength indicator	KR75	Y10A/55506
	VALVES -				
V1	Type 6U7G	-	1st R.F. Valve	KR165	Y10E/55249
V2	Type 6U7G	-	2nd R.F. Valve	KR165	Y10E/55249
V3	Type 6K8G	-	Mixer	KR167	Y10E/55250
V4	Type 6U7G	-	1st I.F. Valve	KR165	Y10E/55249
V5	Type 6U7G	-	2nd I.F. Valve	KR165	Y10E/55249
V6	Type 6B8G	-	2nd Det. AVC 1st Audio	KR168	Y10E/75025
V7	Type 6V6G	-	Output Valve	KR166	Y10E/55248
V8	Type 6B8G	-	BFO S meter Valve	KR169	Y10E/55251
V9	Type 5Y3G	-	1st Rect. Valve		


C
R
RF Gain
Xtal on-off
Phasing
Selectivity
BFO-AVC
BFO Trimmer
Ist RF 6U7G
2ND RF 6U7G
Ist DET. 6K8G
Ist I.F. 6U7G
AERIAL
A1
A2
E1
V1
RF 1
V2
RF 2
V3
IFT 1
V4
IFT 2
IFT 3
C44
AVC
EARTH
RF GAIN
HT+
RF GAIN CONTROL
R19
R18
AERIAL
RF 1
RF 2
HF OSC
T9
T7
SW 2
H.F. OSCILLATOR
B F O.
COIL CIRCUITS
(AS SEEN FROM UNDER CHASSIS)
6U7G
6K8G
6G8G
6N6G
VALVE SOCKET CONNECTIONS
(AS SEEN FROM UNDER CHASSIS)
DEPARTMENT OF CIVIL AVIAT
DIRECTORATE OF AIRWAYS
Drawn A.J Holloway
Checked
Appd.
Date
SCHEMATIC DIAGRAM
COMMUNICATION RECEIVER
TYPE
AR7
KINGSLEY TYPE K/CR/11
Issue
Super

C 537/47-4



NOTES:–

1. DC voltages shewn measured with 1000 o.p.v meter on 1000v scale except pin 6 (100v) & pin 8 (10v) of 6G8G
2. Conditions for measuring voltages –
   - R F Gain — 0
   - Noise Limiter — 10
   - AVC-BFO Switch — AVC
   - Aerial — Disconnected
   - Grid 6K8G — 3/c Earth
3. Circuit shews band C in position
4. COIL RESISTANCES –

		A	B	C	D	E
AER.	PRI.	18	5	2	·5	·5
	SEC	20	4	2	·25	25
RF. I.	PRI	220	218	4	·75	·5
	SEC	20	4	2	·25	·5
RF. 2.	PRI	230	220	4·5	1	1
	SEC	37	4	2	·25	·25
OSC.	PRI	8	1·5	1	·25	·5
	SEC	15	2·5	2	·25	·25

VALVE SOCKET CONNECTIONS
(AS SEEN FROM UNDER CHASSIS)

TMENT OF CIVIL AVIATION
DIRECTORATE OF AIRWAYS
SCHEMATIC DIAGRAM
COMMUNICATION RECEIVER
TYPE
AR 7
KINGSLEY TYPE K/CR/11

Issue No
Supersedes Plan
ISSUES
AMENDMENTS