

WIRELESS SET NO. 22.

TECHNICAL DESCRIPTION

Receiver:- P.A. tank circuit a "SEND" is the L.F. tuned grid circuit on "RECEIVE".

The L.O. is inverted Hartley type coupled via heater circuit. The R.F. chokes L2A-B prevent the L.O. voltages from being short circuited by the H.T. Delayed AVC is fed to V1A, V1D, V1E, the delay voltage being obtained from a variable potentiometer (R15A) across a tapping on R16A which is connected between H.T. - and earth. This variable delay substitutes for an R.F. gain control. B.F.O. is a Colpitts oscillator with coupling winding and variable resistance (R19A) to vary the "HIT" note.

Injection to the I.F. is via the spare pin of V1D. L.F. gain control R9A is also detector diode load.

Note dual roles of:-

- (a) V1E - I.F. Amplifier on "RECEIVE", and Modulator pre-amplifier on "SEND"
- (b) V2A - signal and A.V.C. detector on "RECEIVE" and Modulator (triode portion only) on "SEND".
- (c) V3A - Output on "RECEIVE", and sidetons on "SEND".

Sender:

M.O. is Tuned Grid Oscillator operating at $\frac{1}{2}$ with the anode circuit tuned

to the 2nd. harmonic. The small variable condenser in the M.O. circuit compensates for "SEND-RECEIVE" tracking. Neutralising condenser C9A supplies negative feedback from anode to grid to prevent oscillation at spurious frequencies.

Bias for the P.A. on R/T and H.C.W. is provided by having grids to negative end of R16A (-42 volts) and on C.W. to tapping on R16A (-30 volts).

The drive voltage is also fed to the drive control cathode of V3A (diode acts as "LIMITER") by coupling coils for each frequency band in the M.O. anode tuned circuit. Delay voltage (42 volts) is provided by taking the anode to H.T. - and cathode to earth. When the delay voltage is overcome the diode presents a low impedance which will reflect into the anode circuit of M.O. and limit the amplitude of oscillations.

The Modulation compressor diode of V3A has 32 volts delay by having cathode returned to L.T.+. On the A.F. fed from V3A exceeding this delay, the voltage developed across R4H is fed as bias to V1E thereby controlling the amount of modulation to the P.A. grid.

The netting switch S6 supplies reduced H.T. to M.O. and P.A. via a resistor R20. The drive to P.A. is effectively short-circuited to earth as in the normal way this output would overload the receiver. The netting trimmer C5A is in parallel with the main tuning condenser of M.O.

Two relays are incorporated:

- (a) S5 for Send/Receive switching operated by L6A (This is a delayed relay having a time constant to cover groups of marking waves - holds the set on "SEND").
- (b) A high speed relay S9 operated by L7A. On depressing the key or pressel switch the L.T. Circuit through L7A is completed and S9 closes. S9B completes circuit through L6A and S5 closes. Hence the Send/Receive switching operates a fraction of a second after the contacts have been made or broken on the keying relay. To ensure a continuous H.T. supply all Sender valves S9C and S9D are in parallel. On spacing waves on C.W. or H.C.W. the high speed relay only breaks the keyed circuit, the slugged relay holding the set on "SEND". On C.W. the screen of V4A is keyed. On H.C.W. the H.T. feed to anode of audio oscillator V2A is keyed.

Meter Circuit:

- Aerial: Consists of aerial transformer, bridge rectifier and overload Westector
- A.V.C. Measures volts drop across R6A (screen of V1E). As A.V.C. is increased, screen current decreases, volts drop across R6A rises and meter reading rises.
- H.T.R. Measures screen volts on V3A.
- H.T.C. Across main H.T. line.
- Drive: Measures cathode bias voltage of P.A.

The heater of V5A is used to drop 6 volts of the 12v. L.T. supply. An external switch (S7A) in the L.T. supply to the Sender enable the Sender to be switched off during long periods of "RECEIVE".

N.B. No calibrated overlap is given although there is considerable overlap. The sensitivity falls off rapidly in those regions, which are, therefore, unreliable.

Power supply: Primary source is 12v.75 Ah. accumulator when used as ground station, or truck or Duceo Car and 12v.25 AH. when used as Man pack. Battery drives vibrator unit developing 325 volts at 80 mA on "SEND". This voltage is dropped to 150 volts by series resistances for Receiver valves.

Tests on sender.

Conditions: Sender "ON-OFF" switch "ON". Set at H/T. Microphone pressed switch pressed.

<u>T.O.T.</u>	<u>INDICATION.</u>
1. Meter in "No Current" position.	No reading shows set not sending.
2. Meter in "L.T." position.	No reading shows no L.T. being supplied to set.
3. Meter in "H.T.C." position.	No reading shows no H.T. being supplied to set.
4. Meter in "Drive" position.	No reading shows P.A. valves are not conducting. Low reading (2½ divs.) shows H.C. is not driving the P.A. Normal reading is 4-5 divs.
5. Meter in "L.T." position and S4A in "Test" position.	No reading shows filament of V5A is dis. and thus no L.T. path to V1E and V2A.
6. Meter in "AVC" position. (Speak loudly into microphone)	No flicker shows fault in V1E stage.
7. Meter in "No Current" position (Speak loudly into microphone)	Tests 1-6 O.K. but no flicker, now shows fault in V2A stage.

On H.C.W. If all the above tests are O.K. but no sidetone obtained with key pressed then fault is in oscillator circuit of V2A.

On C.W. Do tests 1 - 5 above with key pressed.

Telephone J. V.

Used for speech or Morse communication and can be called by magneto generator or anti-sidetone device is also included.

The bell is connected permanently across line and operated by distant magneto generator. The impedance of bell at buzzer speech frequencies is high, and causes little loss of signal strength at these frequencies. On Speech. The buzzer has three primary and one secondary winding on each of two bobbins. Two of the primary windings from each bobbin are in series with the microphone, pressel switch, battery thus completing the primary speaking circuit. Speech currents are induced into the secondary. The current from one winding passes to L1 through distant circuit to L2, through 2 mfd. condenser, receiver and back to winding. The current from the second winding passes through the receiver, 2 mfd. condenser to L2, thence through the anti-sidetone circuit (400 ohms and 5 mfd. condenser back to secondary winding.

If the impedance of anti-sidetone circuit compares with the impedance of the line then the current from one secondary winding through the receiver is practically cancelled out by the current through the receiver from the secondary winding. This tends to make the operator speak more clearly.

Reception of speech or Morse.

The current comes to L1 from outside, passes through secondary winding and takes the path of low impedance through the receiver and 2 mfd. condenser and to L2.

Morse transmission.

When the key is pressed, the current passes alternately through one pair of primary windings and then through the second pair as the armature is attracted and completes the circuit through the armature contacts. The alternating currents are induced into the secondary windings, which are joined together in series with the line. To enable the operator to hear his own signals, the receiver in series with the 2 mfd. condenser and 20000 ohm. resistance are placed across the line.

Telephone J.

Can be used on C.B.S. switchboards and has facilities for ringing and receiving ring, buzzing and receiving buzz. When the handset is removed a circuit of low impedance to D.C. and of high to A.C. is placed across the line. The latter facility is required to C.B.S. installations.

Incoming Calls.

With the handset at rest, the bell in series with a 2 mfd. condenser is connected across the line by the switch. In parallel with this is the .1 mfd. condenser in series with a 2 mfd. condenser when the call is by magneto generator the current passes through the bell or condenser. The impedance of the .1 mfd. condenser preventing the current from passing through the 'phone. When call is by buzzer the high impedance of the bell at buzzer frequency prevents the current from passing through it and the buzzer current passes through the receiver. The condenser in the bell circuit stops any D.C. path across line when telephone at rest to enable C.B.S. operation.

Buzzer Circuits.

This is the same as buzzer calls except the .1 mfd. condenser is short-circuited. The Anti-sidetone circuit is similar to the D.V.

Telephone 1

Can be used in C.B.S. switchboards and has facilities for receiving and calling by magneto generator. Responds to buzzer calling. The instrument is very similar to the Telephone 2 in design. The CB switch short circuits a 2 mfd. condenser so that the bell is directly across the line terminals and also places 600 ohm. resistor in series with the secondary windings across the line terminals.

Switchboards U.C. 10 & 6 line.

Facilities. Designed to respond to and provided with magneto generator and buzzer calling. Built on Unit principle. Leaps provided for calling and clearing. Operator's telephone circuit incorporates anti-sidetone circuit. Operator protected from acoustic shock by crash limiter. Has a Night alarm circuit.

Receiving call. The A.C. from subscriber enters switchboard at line terminals L1 and L2 and passes through the contacts of the A Jack and line Unit to bridge rectifier. The rectified current operates relay 1, through the operating winding O. Relay contacts close and completes lamp circuit. The relay 1, in operating has brought in its holding coil H, which holds the relay up when the current has ceased.

When the operator inserts plug into A Jack the lamp circuit is broken through the holding winding and the lamp is extinguished. The other end of operator's plug goes to his own telephone circuit which is similar to an ordinary telephone. The operator can connect two subscribers together by connecting A Jack of one line unit to B Jack of the other. The operator can call a subscriber by buzzer or magneto generator by inserting his plug in A Jack and operating the necessary controls on own unit.

Night alarm relay. When the holding circuit of relay is completed, current from battery passes through the night-alarm relay R1.2 which operates. The closing of the contacts provide a path for the ringing current of the bell from the positive pole of the battery through the "Battery-pull-on" switch the winding of the N.A. relay contacts back to the negative pole of the battery. The bell will cease to ring when the operator's plug is inserted in the 'A' Jack, because this action breaks the circuit of the holding winding H of the relay R1.1 and current ceases to flow through the windings of Relay 1 which releases.

General

The Wireless set No.17 is a transceiver with provision for R/T only, designed for communication between searchlight section H.I. and Searchlight detachments. The frequency coverage of the set is from 46-64 Mc/s. and under normal conditions a range of 5 miles should be obtained. Using the Special dipole aerial and reflector a "directional" range of 8 miles can be obtained.

Power Supply

Filament Heating is obtained from a 2V.75 a.h. accumulator if set is stationary, but for portable use a 2V.16 a.h. accumulator is supplied. H.T. supply is from a standard 120V dry battery, or alternatively from 2-30V. service type H.T. batteries.

Receiver

Input from the dipole is fed to a single turn coupling coil which is mutually coupled to the input of a triode A.R.6 valve. This triode is working as a self-quenching super-regenerative detector, quenching being effected by C1, R1 and R2. Tuning is obtained by condenser C2. The rectified output from the detector is fed via a R.F.C. (decoupled by C4 and C5) to the primary of an intervalve transformer, the other end of the primary winding being connected via a variable resistance (R3) to H.T. positive. R3 controls the H.T. applied to the anode of the detector valve, consequently controlling the regeneration of the valve. The audio voltage, developed in the secondary of the intervalve transformer is fed direct to the grid of a tetrode, type (A.R.P.18). Choke capacity coupling is used for the output to high resistance phones employing a high inductance audio frequency choke. Automatic bias for the output valve is obtained by using the voltage dropped across resistors in the negative H.T. lead (R5 and R7)

Sender

On switching to "send" the circuit of the detector is changed by the switching to a "split Hartley" type oscillator. This then becomes the H.O. of the sender and tuning is accomplished by C2 as on "receive". The output valve of the receiver is now used as the modulator in an anode choke modulation circuit. The microphone is of the carbon granule type and the H.T. accumulator is used as the energizing voltage. The speech currents are fed through a second primary winding of the modulation transformer, which is the intervalve transformer of the receiver. The A.F. voltages in the secondary are fed direct to the grid of the A.R.P.18 and an A.F. voltage is obtained across the A.F. choke in the anode circuit. This A.F. choke is in series with the H.T. supply to the H.O., consequently the H.O. output is modulated by the amplified speech voltages developed across the choke. A neon lamp is connected across the A.F. choke to prevent over modulation. A proportion of the A.F. voltage developed across the choke is fed through the phones as sidetone, and is reduced to reasonable limits by the insertion of R3. Bias for the A.R.P.18 valve is reduced on "send" by cutting out R6 and leaving only R7 as bias resistor. Across the A.F. choke is fitted a shunting switch which temporarily short circuits the A.F. choke when switching from "send" to "receive" or vice versa. This is incorporated to reduce the audio shock due to switching from one service to another.

H.2. The coupling and oscillator coil forms are made of trolital, which is easily damaged by heat. It is, therefore, essential that when re-soldering any connections to these coils they be made with hot iron as quickly as possible and without touching the actual trolital. The dial of this set is not calibrated in frequency but has a degree scale of 0-100. The set may be set up to a given frequency with the aid of an absorption type wavemeter which is provided.