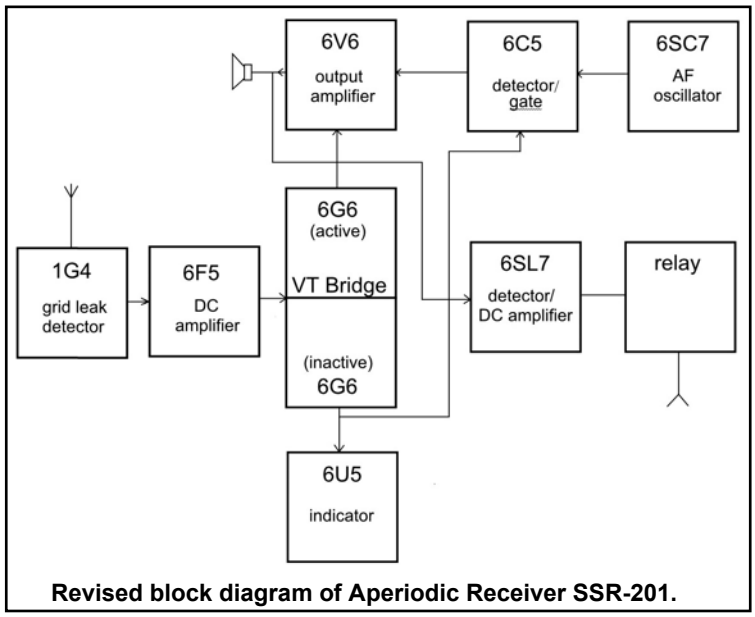
Aperiodic Receiver type SSR-201

Country of origin: USA

Aperiodic Receiver series K (with serial No. K3) was fitted in a wooden box with a detachable wooden lid. It was otherwise similar to the SSR-201 and saw use with the Radio Intelligence Division of the FCC.

Aperiodic Receiver type SSR-201 (with serial number 45) was housed in a metal case, fitted with a detachable metal lid (not shown here). It was similar to the Aperiodic Receiver series K (below, with serial No. K3) which was fitted in a wooden box.
The SSR-201 was originally used by OSS. This surviving set came from the Dutch PTT (Radio Controle Dienst) and is now in the collection of the Dutch Amateur Radio Museum 'Jan Corver' in Budel near Eindhoven.
http://www.jancorver.org

The data plate shown right was attached to the inside of the wooden lid.



Revised block diagram of Aperiodic Receiver SSR-201.

Long after the publication of WftW Volume 4, two SSR-201s (actually series 'K' FCC variants) were found in the USA. One receiver came with its original Operating Instructions and a data plate inside the front lid (shown above left). The scans of the text and circuit diagram of the Operating Instructions were enhanced and processed by means of an OCR program to obtain a much better printing quality for this Amendment. Although a bit embarrassing, they showed that the block diagram which had been drawn years ago and published in Volume 4 was not fully correct.
With more than 200 of these receivers built, only three appear to have been survived. If you own an OSS SSR-201 or FCC series K, or know its whereabouts e.g. in a museum, please contact me by email on louis@wftw.nl
Those who are interested in a historical background of this receiver are strongly advised to read Brian Harrison's excellent article published in *Electric Radio*.

Please note that this Supplement chapter is a follow up and should be read in conjunction with the 'SSR-201' section in the '*RDF Equipment and Intercept Sets'* chapter of WftW Volume 4.

Acknowledgements:

With thanks to Brian Harrison KN4R who alerted me to his Aperiodic Receiver series K and slightly later to the second receiver owned by Jim Kreuzer. Brian kindly allowed me to publish the photos he took of his receiver.
I am very grateful to Jim Kreuzer N2GHD, AWA Librarian and Assistant Curator, for his permission to use the picture of the data plate of his series K receiver, and for publishing the text and circuit diagram of his Operating Instructions.

References:

- Aperiodic Receiver, Operating Instructions, Series K.
- The SSR-201 "Watch-dog" Aperiodic Receiver, Brian Harrison KN4R, *Electric Radio*, August 2014.

APERIODIC RECEIVER

OPERATING INSTRUCTIONS FOR SERIES K

APPLICATION

The Aperiodic Receiver is a device suitable for intercepting radio signals within the frequency range of approximately 50 kc. to 60 mc. when the signal input to the receiver exceeds 10 millivolts.

This receiver is unusual as compared to other types of radio receivers in that no tuning is required. The Aperiodic receiver is therefore suitable for detecting the operation of transmitters operating on any frequency within the limits indicated without any tuning adjustments except for sensitivity.

While the device requires a signal input of greater than 10 millivolts to produce an audible indication, a signal input of 2 millivolts can be detected visually in an Electron Ray Tube.

As in the case of ordinary radio receivers, the sensitivity of the Aperiodic Receiver is dependent upon the physical dimensions of the antenna used. For example, if the effective height of the antenna is 10 meters, audible indication will be obtained on signals having a field intensity of 1 millivolt per meter.

THEORY

The Aperiodic Receiver consists of a grid leak type untuned detector, directly coupled to an antenna and using a type 1G4 tube. The change in plate current caused in this tube by the application of a signal to its grid results in a voltage change across its plate load resistor R4 which, in turn, is applied to the grid of a DC amplifier, using the type 6F5 tube. Following the DC amplifier is a vacuum tube bridge consisting of two type 6G6 tubes. The amplified signal appearing across the plate load resistor R8 of the DC amplifier is applied to the grid of the Active tube in the V. T. Bridge. The plate of the Bridge Detector tube is connected to the Active Bridge tube plate while the cathode of the Bridge Detector tube is connected to the plate of the Inactive Bridge tube. At balance the plates of the V. T. Bridge tubes are at the same potential and hence there is no current flow between the plate and the cathode of the type 6C5 tube. The circuit is arranged so that when a signal is applied to the grid of the 1G4 tube, the plate of the Active Bridge tube becomes positive with respect to the plate of the Inactive Bridge tube and the type 6C5 tube functions as an amplifier. When this occurs, an audio frequency voltage that is applied to the grid circuit of the type 6C5 Detector tube from the audio oscillator (Type 6SC7 tube) through capacitor C7 is amplified and appears across the primary of the Bridge Detector tube output transformer Tl. This audio voltage appears across the secondary winding of the transformer and is applied through a volume control (R25) to the grid of the output audio stage (type 6V6 tube) and can be heard in the loudspeaker coupled to the plate circuit. In the absence of a signal, as for instance when S4 is closed, it is necessary that the V. T. Bridge be balanced, otherwise, voltage appears in the plate circuit of the type 6C5 tube and thus causing a continuous tone to be heard in the loudspeaker. Balance of the bridge is accomplished by adjustment of R5 (Course) and R6 (Vernier). Accomplishment of balance can be observed by noting that the shadow angle of the type 6U5 Electron Ray tube is almost closed. Manipulation of the balance controls beyond this point will cause type 6U5 tube to overlap and a continuous audio tone will be heard in the speaker. On the other hand, if the balance control is turned in the opposite direction, type 6U5 tube will open to a 90° angle and cause the bridge to have lower sensitivity for all applied signal voltages. For maximum sensitivity the balance controls must be adjusted so that the Electron Ray tube indicates an angle between 0° and 10°. The V. T. Bridge can be balanced so as to enable reception of type Al or A2 emission signals operating in the presence of a modulated carrier signal such as those emitted by near-by broadcast stations. Under such operation, the audio modulation could be annoying but can be greatly attenuated by applying the audio component to both V. T. Bridge tube grids. This is accomplished by manipulation of the "Phase" control resistor R10. If reception of type A3 signals is desired, the Audio oscillator should be made inoperative and for maximum sensitivity, signal is applied only to the Active Bridge tube grid, by reducing "Phase" control.

The purpose of the type 6SL7 tube is to provide an electrical means for starting a signal recorder whenever a transmission occurs. Audio voltage is taken from across the primary of the output transformer T2 and through the "Relay Sensitivity" control R23 is applied to one grid and plate of the type 6SL7 tube, these elements serving to rectify the Audio signal. The rectified voltage is passed through the time constant circuit R29, Cl3 and then applied to the second grid of the type 6SL7 tube. The signal appearing in the plate circuit of this portion of the tube actuates a relay whose contacts may be made to start and stop a signal recorder inserted in receptical Pl. The time constant circuit has been designed so that the relay closes instantly with the first element of the input signal and remains closed as long as the transmission of signal occurs. The time delay in the drop out of the relay is variable and is controlled by the adjustment of the Relay Sensitivity control R23. The power supply of the Receiver consists of Power Transformer T3, rectifier tube type 5Z3. Filtering is obtained by suitable chokes and condensers. Regulation of important voltages is accomplished by Voltage Regulator tubes type VR105 and VRl50 connected in series.

OPERATION

Assuming that the Aperiodic Receiver has been connected to a source of AC power with all controls in the "Off" position and that an antenna and ground has been connected to the posts appropriately marked, advance "Volume" control knob to midway position. This applies filament power to all tubes. After 15 seconds warm-up period, turn "Plate Volts" to "On" position. Turn "Oscillator Control" to "On" position and manipulate the Balance and Balance Vernier controls until the Electron Pay Tube indicates balance. The Aperiodic Receiver is now ready for operation if the "Ant. Sw." is turned to the "On" position. If this last operation causes the Electron Ray Tube to overlap and an audio tone is heard, from the speaker, this is an indication that an R.F. carrier is being received. If this is not the signal desired, readjust "Balance" and "Balance Vernier" until balance is restored as indicated by the Electron Ray Tube. If the undesired R.F. carrier is modulated, manipulate the "Phase" control for maximum attenuation of modulation. Large changes in power line voltage will cause V. T. Bridge unbalance and will immediately be indicated by the Electron Ray Tube. Under this circumstance the bridge should be rebalanced in order to maintain maximum sensitivity. For headphone operation, insert the phone plug in jack marked. "Phones". This jack may be used for feeding the output of the Aperiodic Receiver into the input terminals of a signal recorder such as a dictaphone.

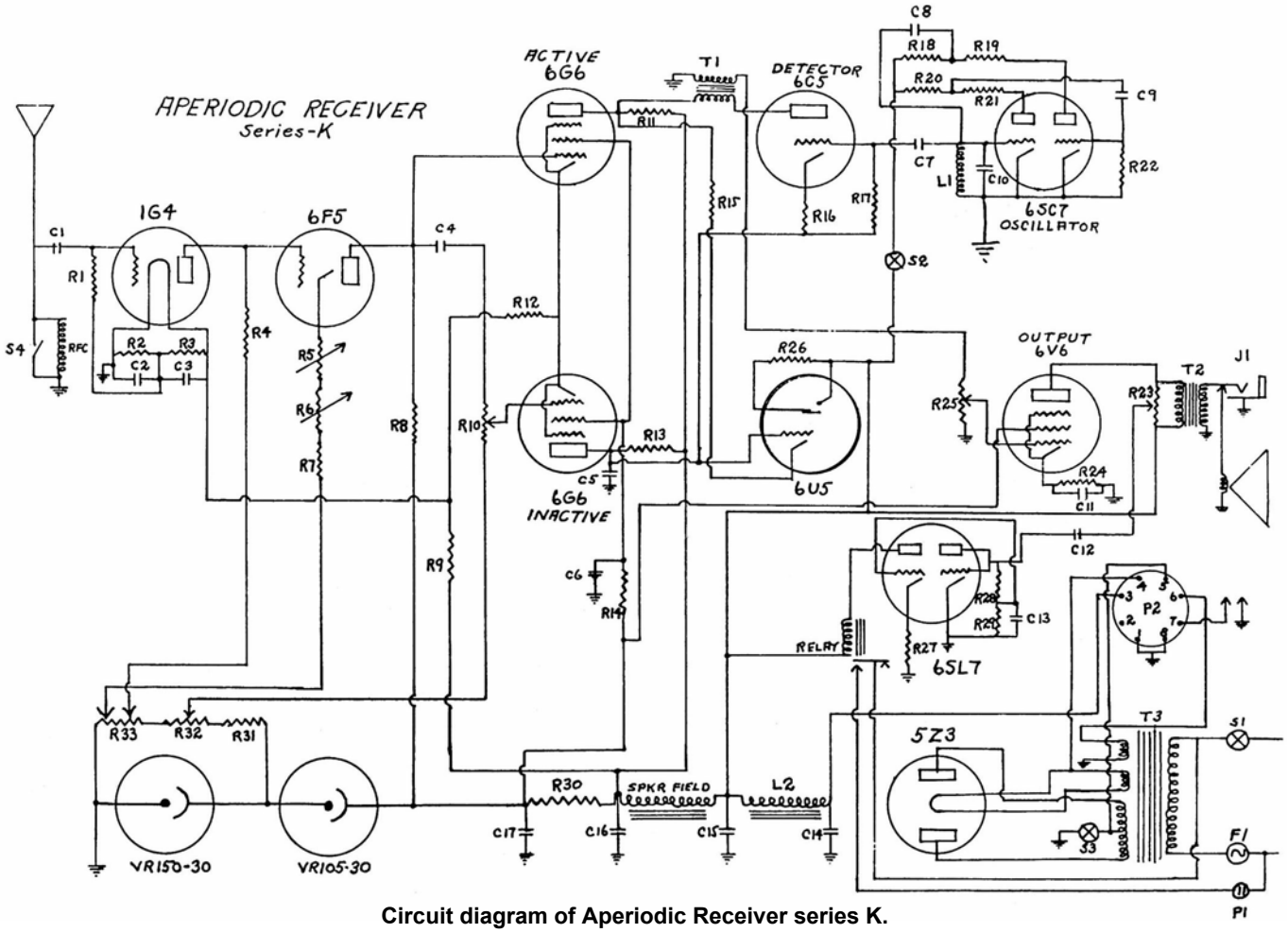
If it is necessary to operate the Aperiodic Receiver near a strong Interfering radio station, it is recommended that a Series Type Wave Trap be connected between the antenna and ground binding posts and tuned to the operating frequency of the interfering station. A Parallel Type Wave trap will not be effective because of the high input impedance of the Aperiodic Receiver. The Aperiodic Receiver can be operated from a storage battery in a manner similar to that used in the Hallicrafter Type SX28 receiver. The octal plug on the rear of the chassis is wired in a fashion similar to the Hallicrafter plug. It is pertinent, however, to point out the Aperiodic Receiver will not operate satisfactorily with the type VP-2 vibrapack because the input high voltage supply required is 375 volts, whereas, the vibrapack is capable of furnishing approximately 300 volts.

The type A. T. R. converter can be used successfully provided the filament voltage for the Aperiodic Receiver is obtained directly from the storage battery instead of the filament winding on the power transformer T3. This is necessary because the power required for the Aperiodic Receiver is approximately 80 watts and with this load the type A. T. P. converter is not capable of furnishing 110 volts.

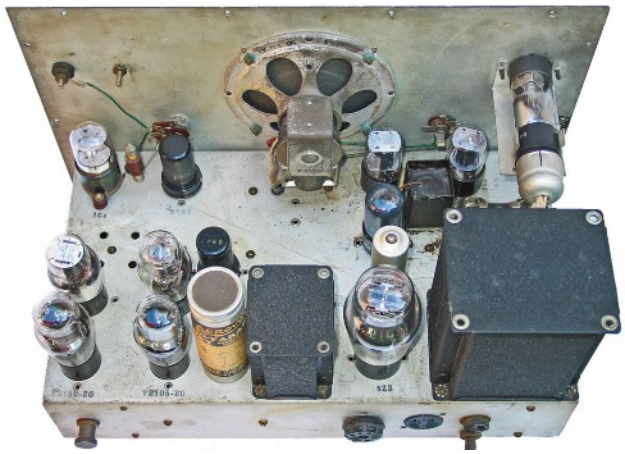
MAINTENANCE

The voltages taken from the adjustable resistors R32 and R33 are critical as to adjustment and have been carefully set by the manufacturer. In the event V. T. Bridge cannot be balanced by manipulating the Balance Controls R5 and R6, it may be necessary to readjust the variable tap furnishing bias to the cathode of the type 6F5 DC amplifier. This adjustment is critical and should not be made without a complete understanding of the circuit functions. The tap on the resistor R32 furnishes fixed bias to the grid of the Inactive Bridge tube. This adjustment is not critical but should be made for 60 volts to 70 volts. The tap on the resistor which furnishes plate voltage to the type lG4 tube is also not critical but should be roughly 30 volts to 40 volts. The position of the tap on R33 furnishing fixed bias to the 6F5 amplifier tube is critical in adjustment and depends upon the electrical characteristics of both the type lG4 tube and the type 6F5 tube. If it is necessary to adjust the last mentioned tap, set the "Balance Control" resistors to mid position and adjust the tap until the Electron Ray tube just closes or until a weak audio signal is heard in the speaker.

CAUTION--Care should be exercised in adjusting the resistor clamp. Rough treatment may damage the resistance wire.



Circuit diagram of Aperiodic Receiver series K.



Top chassis view of SSR-201.

Rear view of Aperiodic Receiver series K.

R1	5 Meg. ½ watt
R2	300 ohm ½ watt
R3	300 ohm ½ watt
R4	300M ohm ½ Watt
R5	2000 ohm pot. Balance Control
R6	200 ohm pot. Balance Control
R7	1250 ohm ½ Watt
R8	300M ohm ½ Watt
R9	20M ohm 10 Watt
R10	500M ohm pot. Phase Control
R11	10M ohm 10 Watt
R12	2000 ohm 10 Watt
R13	10M ohm 10 Watt
R14	15M ohm 10 Watt
R15	40M ohm ½ Watt
R16	1500 ohm ½ Watt
R17	100M ohm ½ Watt
R18	25M ohm ½ Watt
R19	25M ohm ½ Watt
R20	25M ohm ½ Watt
R21	25M ohm ½ Watt
R22	10M ohm ½ Watt
R23	25M ohm pot. Relay Sensitivity
R24	750 ohm 10 Watt
R25	100M ohm pot. Volume Control
R26	1 Meg. ½ Watt
R27	750 ohm ½ Watt
R28	50M ohm ½ Watt
R29	20 Meg. ½ Watt
R30	3M ohm 10 Watt
R31	10M ohm 10 Watt
R32	5M ohm 10 Watt Adj.
R33	10M ohm 10 Watt Adj.

C1	100 mmf mica
C2	100 mmf mica
C3	100 mmf mica
C4	.01 mf 600V. paper
C5	.1 mf 600V. paper
C6	.1 mf 600V. paper
C7	.03 mf 600V. paper
C8	.006 mf 600V. paper
C9	.006 mf 600V. paper
C10	.2 mf 400V. paper
C11	50 mf 25V Electrolytic
C12	.01 mf 600V. paper
C13	.25 mf 600V. paper
C14	8 mf 600V. Electrolytic
C15	8 mf 450V. Electrolytic
C16	8 mf 450V. Electrolytic
C17	8 mf 450V. Electrolytic

T1	3 to 1 interstage Transformer
T2	Output Transformer
T3	Power Transformer
L1	.035 Hy.
S1	S.P.S.T. Switch
S2	S.P.S.T. Switch
S3	S.P.S.T. Switch
S4	S.P.S.T. Switch
P1	A.C. Receptical
P2	Octal Plug
F1	2 Amp Fuse

Terminal Voltages

Potentials measured with 1000 ohm per volt voltmeter and with V. T. Bridge in balance.

Tube	Pin No.	PLATE to GND.	Pin No.	SCREEN to GND.	Pin No.	CATH. to GND.	Pin No.	GRID to GND.	Pin No.	FIL. to GND.
1G4	3	.7					5	0	2	1.4 DC.
6F5	4	4.3			8	8.5	CAP	.7	2	6.3 AC
6G6 ACTIVE	3	250	4	180	8	65	5	50-60	7	6.3 AC
6G6 INACTIVE	3	250	4	180	8	65	5	58	7	6.3 AC
6C5	3	245			8	245	5	200	7	6.3 AC
6SC7	5 2	210 240			6 6	0 0	4 3	0 -.5	8	6.3 AC
6SL7	5 2	0 400			6 3	0 2	4 1	0 0	8	6.3 AC
6V6	3	400	4	250	8	17	5	0	7	6.3 AC
5Z3	3	420							4	5 AC

List of components and voltages of Aperiodic Receiver series K.