RECTIFIERS
KS-15898 L1, L2, AND L3
OPERATING METHODS

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1. GENERAL

1.01 This section covers the operation of the KS-15898 L1, L2, and L3 semiconductor-type rectifiers. Regulation in these rectifiers is obtained by using ferroresonant circuits.

1.02 This section is reissued to add the information for the L2 and L3 rectifiers and to bring the section up to date. Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

1.03 These rectifiers are intended for use in the following systems.

Type B entrance links — TJ radio system (J68851)

83B1 and 83B2 TTY switching system (J70125)

E2 and E3 repeaters (J98612)

1.04 The KS-15898 L1, L2, and L3 rectifiers are interchangeable mechanically and electrically although having different internal components. The rectifying element is germanium in the L1 rectifier and silicon in the L2 and L3 rectifiers.

1.05 The KS-15898 L1, L2, and L3 rectifiers are rated as follows.

AC INPUT

117 or 230 volts, 60 cycle single phase

DC OUTPUT

120 or 130 volts, 1 ampere continuous

1.06 The rectifiers are equipped with screw-type terminals for tap adjustments and for input and output power connections. The ac input fuse and jacks for measuring the output voltage are accessible without removal of the front cover.

1.07 ***Caution: The voltages inside the rectifier case are higher than 117 volts to ground. Avoid all contact with terminals as high voltages may be present. Do not allow a test pick to touch two metal parts at the same time or destructive and dangerous short circuits may occur. Any open or reversed windings on the ferroresonant transformer may cause dangerously high voltages on the other windings. Disconnect the alternating current supply before working on the unit except when necessary to make tests.***

1.08 Keeping the ventilating passages and rectifying elements clean is especially important to avoid excessive heating.

1.09 Routine checks are intended to detect defects particularly in infrequently operated parts of the equipment, and insofar as possible to guard against circuit failures which interfere with service. Checks and adjustments, other than those required by trouble conditions, should be made during a period when there will be a minimum interference with service.

1.10 For more detailed information on the operation and maintenance of individual equipment or apparatus, refer to the appropriate Bell System Practice.

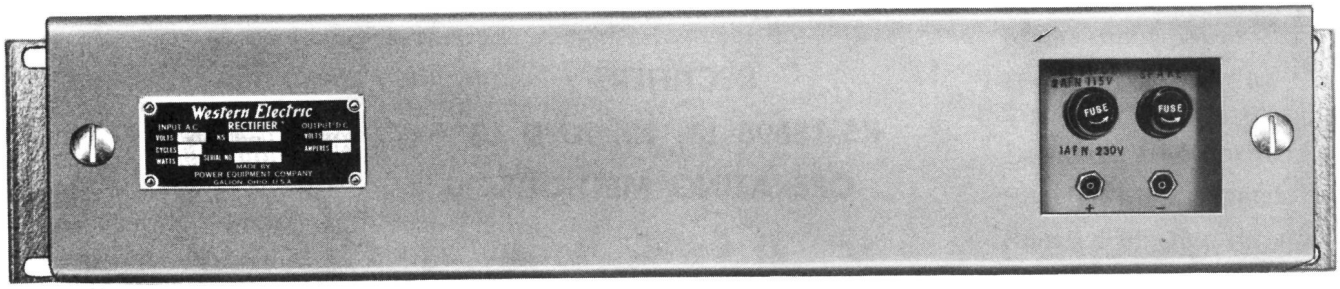

Fig. 1 – KS-15898 L1 Rectifier

2. TOOLS AND TEST APPARATUS

CODE OR SPEC. NO.	DESCRIPTION
TOOLS	
—	3-Inch C Screwdriver
TEST APPARATUS	
KS-14510 L1	Volt-Ohm-Milliammeter
—	Weston Model 281 DC Ammeter or Equivalent
—	Variable Resistance Load Capable of Carrying 1 Ampere or More at 130 Volts

3. OPERATION

How the Rectifier Unit Works

3.01 Sixty-cycle power is connected to the primary of the T1 ferroresonant transformer which provides a substantially constant output voltage with large variations of input line voltage. The direct current output voltage however is unregulated for load current changes and therefore, any increase in the load current will reduce the output voltage. The T1 transformer consists essentially of the primary coil and a nonlinear coil magnetically coupled by being wound on a common portion of the core. The primary and the nonlinear coil are partially separated by a shunt magnetic path of high reluctance. This arrangement serves to partially decouple the primary coil from the nonlinear coil and introduces a high leakage reactance. (The equivalent circuit may be represented as a linear coil connected in series with a nonlinear coil where the high leakage reactance is considered as having the characteristic of a linear coil.) The C1 capacitor is connected across the nonlinear winding of the T1 transformer.

3.02 In operation, when an alternating voltage of low value is impressed upon the circuit, the parallel combination of the nonlinear inductor of the T1 transformer and the C1 tuning capacitor acts as a capacitive reactance in series with the inductive reactance. This effective capacitive reactance is smaller than the inductive reactance. As the impressed voltage is increased, the series combination of the linear inductive reactance and the nonlinear inductor in parallel with the capacitor passes through resonance due to the decreasing inductance of the nonlinear inductor. This causes a further reduction of the nonlinear inductance which carries the series-parallel combination further from resonance in a continuing process so that the nonlinear coil approaches saturation. After the series-parallel circuit passes through resonance, the voltage across the parallel combination rises to a very much higher value than the voltage developed before resonance. Variations of the impressed voltage change the degree of saturation of the nonlinear coil so that the variation in the effective capacitive reactance of this portion of the circuit tends to maintain an essentially constant voltage across its terminals. The output consists of a portion of the nonlinear winding voltage.

3.03 This type of circuit has an inherent output current limiting characteristic. As the load is increased, the effective capacitive reactance of the parallel circuit is reduced and the resultant change in voltage across the parallel combination is comparatively small until the point is reached where the capacitive reactance of the circuit falls below the value required to maintain the series-parallel combination above the resonant value. When this happens, the nonlinear coil comes out of saturation and the high voltage developed across the parallel combina-

(c) The external loads are disconnected.

3.10 ***Initial Adjustments:*** Proceed as follows.

(a) Connect the external loads.

(b) Connect the ac alarm taps.

(c) Connect the battery.

(d) Connect the ac input taps.

4. ROUTINE CHECKS

4.01 The following should be performed:

(a) Electrolytic capacitors should be maintained in accordance with Section 032-110-701.

(b) Check R1 and R2 to see that proper output voltage is maintained.

5. TROUBLES

5.01 In general, the only items likely to become defective with use are the electrolytic capacitors and the rectifiers which are subject to aging.

5.02 At time troubles may be caused by faulty relay operation.

5.03 If the vibrator or power oscillator is replaced or the RECT1 rectifier stack has aged, R1 and R2 resistors should be readjusted in accordance with 3.08.

5.04 Should any of the following troubles develop, it is suggested that the possible causes listed be checked. If the trouble is not found, look for loose or open connections or short circuits due to foreign matter lying across wiring terminals. A loose connection generally causes heating. Any one of the following troubles may be caused by an open or short circuit, or by an aging or drift in the constants of some faulty component. If one of the following possible causes or the use of the point-to-point voltage table does not lead to the location of the trouble, it is advisable to make point-to-point resistance measurements with the circuit completely de-energized, comparing the measurements with the values shown on the SD-81298-01 circuit drawing so that such faults may be found.

TROUBLE	POSSIBLE CAUSE
No dc current	Power Failure
	Blown fuses
	Relays not operated
	Vibrator failure
Low dc current	Low line voltage
	Shorted capacitors
	Incorrect transformer taps used
	Rheostat or resistors out of adjustment
High dc current	High line voltage
	Rheostat or resistors out of adjustment
	Incorrect transformer taps used
Erratic dc current or voltage	Loose connections at rheostats or resistors

6. POINT-TO-POINT VOLTAGES

6.01 As long as the rectifier unit operates satisfactorily, point-to-point voltage values are not needed and are not operating requirements to be checked in routine. In case the rectifier output cannot be obtained, they may be useful in locating defective conditions.

6.02 High voltages to ground are present within the rectifier unit and every precaution should be observed to avoid any contact with exposed metal parts or terminals when the rectifier unit is in operation, or when not in operation but connected to either line or battery.

Caution: When using any portable instrument, the leads should be carefully examined to make sure the insulation is undamaged. The leads should be connected at the instrument before making contact

with the circuit to be tested. If connections are to be changed from one instrument range to another, the alternating current should first be disconnected from the equipment being tested, or if test picks are being used, they should be removed from the equipment under test.

6.03 Readings should be made with a ▶KS-16979◀ voltmeter. The output of the rectifier will not be appreciably affected by connecting the voltmeter leads to the circuit elements.

6.04 ***Table of Point-to-Point Voltages***

TEST POINT	120 VOLT AC INPUT 0.5 AMP LOAD	48 VOLT DC INPUT 0.5 AMP LOAD
T1 term 4 to 5	134	125
term 7 to 9	90	89
term 21 to 23	410	400

	VOLTAGE
T2 term 4 to RECT 2 (Common term)	10.6 dc