RECTIFIERS
KS-5928 L5 AND KS-15620 L4
OPERATING METHODS

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1. GENERAL

1.01 This section covers the operation of KS-5928 L5 and KS-15620 L4 automatically regulated semiconductor-type rectifiers using saturable reactor control and voltage reference tubes. The KS-5928 L5 rectifier is initially intended for use in the J86726F coin control supply. The KS-15620 L4 rectifier is initially intended for replacing the KS-15620 L3 rectifier and for use in the O carrier terminals as covered in J86454.

1.02 This section is reissued to amplify the information covering replacement of rectifier stacks 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 The KS-5928 L5 rectifier is designed for single-phase, 60-cycle, 230-volt ac power source and is rated at 120 volts, 0.8 ampere, dc. The KS-15620 L4 rectifier is designed for single-phase, 60-cycle, 115-volt ac power source and is rated at 48-volts, 4-amperes dc. The KS-5928 L5 rectifier uses a capacitor output filter and the KS-15620 L4 rectifier has a capacitor-inductor-capacitor type filter. The output of each rectifier is adjustable and can be measured at the pin jacks provided for the purpose.

Caution: Avoid all contact with terminals, as high voltages are present. Do not allow a test pick to touch two metal parts at the same time, as destructive and dangerous short circuits may occur. Remove the fuse in the rectifier or disconnect the ac power before working on the rectifier.

1.04 Keeping the ventilating passages and rectifier cells clean is especially important to prevent excessive heating.

1.05 Routine checks are intended to detect defects, particularly in infrequently operated parts of the equipment and, insofar as possible, to guard against circuit failures liable to interfere with service. Checks and adjustments, other than those required by trouble conditions, should be made during a period when they will cause the least unfavorable reaction to service.

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

2. LIST OF TOOLS, GAUGES, AND TEST APPARATUS

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
—	3-Inch C Screwdriver (or the replaced 3-inch cabinet screwdriver)
GAUGES	
KS-14510 L1	Volt-Ohm-Milliammeter
—	Ammeter, DC, Model No. 281, Scale 1.5-3-30, Weston Electrical Instrument Corporation, or the Replaced No. 280.
TEST APPARATUS	
—	Variable Resistance Load Capable of Carrying 5 Amperes at 120 Volts.

3. OPERATION

Description of Operation

KS-5928 L5 Rectifier (see Fig. 1 — functional schematic)

3.01 Power is connected to the primary winding of the isolating T1 transformer. The output of T1 transformer is fed to the main RV1 rectifying element through the load windings of the L1 saturable reactor. The voltage which is applied to the RV1 rectifying element will vary according to the degree of saturation of the core of the L1 saturable reactor.

3.02 The saturation of the core of the L1 saturable reactor is controlled by the direct current through the load and control windings. The voltage at no load is controlled by the adjustment of the ADJ VOLTS potentiometer. Increasing the current in the control winding of the reactor in a positive or aiding direction increases the saturation in its core, thereby decreasing the impedance of its load windings. This allows a greater voltage to be applied to the RV1 rectifying element, increasing the output voltage of the rectifier. Conversely, increasing the current in the control winding of the reactor in a negative or bucking direction will decrease the output voltage of the rectifier.

3.03 The control circuit is provided with two voltage reference tubes, V1 and V2. In the normal positions, the TEST V1 and TEST V2 switches and the two voltage reference tubes are connected in parallel thus providing greater reliability. Operation of either the TEST V1 or the TEST V2 switch will disconnect its associated voltage reference tube from the circuit thereby determining if the single voltage reference tube thus connected is functioning properly. Sufficient voltage to operate the voltage reference tubes is developed by the addition of the voltage from the center tap full wave RV2 rectifier. By means of the voltage reference tubes a substantially constant voltage is maintained between the negative lead and one side of the control winding of the L1 saturable reactor. The R1 resistor in series with the ADJ VOLTS potentiometer provides a bucking voltage through the control winding of the L1 saturable reactor. The position of the ADJ VOLTS potentiometer determines the amount and direction of current flow through the control winding of the L1 saturable reactor, thereby adjusting the voltage output. Any change in the output voltage will be reflected as a proportioned current change through the control winding and this will tend to compensate for the output voltage change by changing the impedance of the load windings of the L1 saturable reactor.

3.04 The input to the rectifier is protected by a fuse and is interrupted by a cover switch for safety in maintenance.

KS-15620 L4 Rectifier (See Fig. 2 — functional schematic)

3.05 Power is connected to the primary winding of isolating T1 and T2 transformers. The output of T1 transformer is fed to the RV1 rectifying element through the load windings of an L1 saturable reactor. The voltage which is applied to the main rectifying element will vary according to the degree of saturation of the core of the saturable reactor.

3.06 The saturation of the core of the L1 saturable reactor is controlled by the direct current through the load and control windings. The voltage at no load is controlled by the adjustment of the ADJ VOLTS (R2) potentiometer. Increasing the current in the control winding of the reactor in a positive or aiding direction increases the saturation in its core, thereby decreasing the impedance of its load windings. This allows a greater voltage to be applied to the RV1 rectifying element which increases the output voltage of the rectifier. Conversely, increasing the current in the control winding of the reactor in a negative or bucking direction will decrease the output voltage of the rectifier.

3.07 The control circuit is provided with two voltage reference tubes, V1 and V2. In the normal positions of the TEST V1 and TEST V2 switches, the two voltage reference tubes are connected in parallel, thus providing greater reliability. Operation of either the TEST V1 or the TEST V2 switch will disconnect its associated voltage reference tube from the circuit thereby determining if the single voltage reference tube thus connected is functioning properly. Voltage to operate the voltage reference tubes is provided from the output of the full wave bridge RV2, RV3 rectifier. An additional adjustable voltage is provided by the use of the full-wave bridge comprising RV4 and RV5. The out-

put of this supply is connected across the ADJ VOLTS (R2) potentiometer. The output voltage of the main rectifier is connected in series with the control winding of the L1 saturable reactor and in series with the substantially constant adjustable voltage at the slider of R2. The position of the ADJ VOLTS (R2) potentiometer determines the amount and direction of current flow through the control winding of the L1 saturable reactor thereby adjusting the voltage output. Any change in the output voltage will be reflected as a proportioned current change through the control winding and this will tend to compensate for the output voltage change by changing the impedance of the load windings of the L1 saturable reactor.

3.08 The input to the rectifier is protected by a fuse and is interrupted by a cover switch for safety in maintenance.

Preparing to Start Initially

3.09 When preparing to put the rectifier into service initially, check that:

(a) Proper size ac supply fuse has been provided in the rectifier.

(b) The proper input voltage terminal has been selected for the service voltage available.

(c) The ADJ VOLTS potentiometer is set at the midposition.

Initial Adjustments

3.10 After the checks suggested in 3.09 are completed, connect the voltmeter to the (+) and (−) test jacks and connect the test load, a switch, and ammeter in series across the output terminals of the rectifier. Insert the ac fuse and note output voltage and current values at full load or maximum office load. The ADJ VOLTS potentiometer must be adjusted to bring the output voltage to the desired full-load value. Allow the rectifier to operate at full load for at least 30 minutes and then repeat the full-load checks. Readjust if necessary.

(a) With the KS-5928 L5 rectifier output adjusted to 120 ±1 volt at 0.8 ampere load, and with nominal input of 230 volts ac, the output voltage shall remain within the limits of 117 and 123 volts for any load between 0.1 ampere and 0.8 ampere and with any input voltage between 210 and 250 volts ac, 60 cycles.

(b) With the KS-15620 L4 rectifier adjusted at nominal input of 115 volts ac for an output of 48 ±1 volt at 3.5 amperes, the output voltage shall remain within the limits of 45 and 50 volts for any load between no load and 3.5 amperes and with any input voltage between 105 and 125 volts ac, 60 cycles.

Routine Adjustments (normal operation)

3.11 The rectifier has no disconnecting switches except the cover switch and is connected to both ac power and the load when the associated fuse is in place. If it is necessary to take a rectifier out of service, remove the ac fuse or ac plug. To restart, replace the ac fuse or ac plug.

4. ROUTINE CHECKS

4.01 The following should be performed.

(a) The output voltage should be checked to be sure the load voltage is within the limits specified in 3.10(a) or (b), as applicable.

(b) Periodically check the operation of both voltage reference tubes by alternately operating the TEST V1 and TEST V2 switches. The output voltage should remain within the limits specified in 3.10(a) or (b) as applicable, for either or both tubes. Both test switches may be operated together without injuring the rectifier.

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

5. TROUBLES

General

5.01 The components most likely to become defective with use are the voltage reference tubes, electrolytic capacitors, and semiconductor stacks. The rectifying element will age with use and after a period of years may require readjustment of the ADJ VOLTS potentiometer.

5.02 The output voltage may rise as a result of aging of the voltage reference tubes. Check these tubes as covered in 4.01(b).

5.03 The ADJ VOLTS potentiometer requires no maintenance. If operation indicates a defective sliding contact, use the 3-inch C screwdriver to turn it back and forth a few times to clean the surfaces. If the potentiometer becomes defective, replace it.

5.04 ***Selenium Rectifier Stack:*** Selenium rectifier cells may fail due to aging, which is an increase in the resistance of the cells. The replacement of only the defective stack in the rectifying element that consists of more than one stack may result in an unbalanced condition in the rectifying element. To avoid unbalance, replace stacks as follows.

(a) When replacing a defective stack or stacks in a multiple stack element, replace all other stacks in the element that have been in service 2 years or longer.

(b) Do not combine stacks of different list numbers or different manufacturers.

(c) Never attempt to replace part of the rectifier cells in a stack or bolt assembly. Always replace the entire stack.

Trouble Chart

5.05 Should any of the following troubles develop, it is suggested that the possible causes be checked. If the trouble is not found, look for open or loose connections or short circuits due to foreign material lying across wiring terminals.

TROUBLE	POSSIBLE CAUSE
No dc output voltage	Failure or disconnection of the input power
	Blown ac supply fuse
Low dc output voltage	ADJ VOLTS potentiometer out of adjustment
	Open circuit in voltage reference tube
	Line voltage more than 8 per cent low
	Aged rectifying element
	High resistance at some contact in line circuit
	Overload
High dc output voltage	ADJ VOLTS potentiometer out of adjustment
	Failure of voltage reference tube
	Line voltage more than 8 per cent high

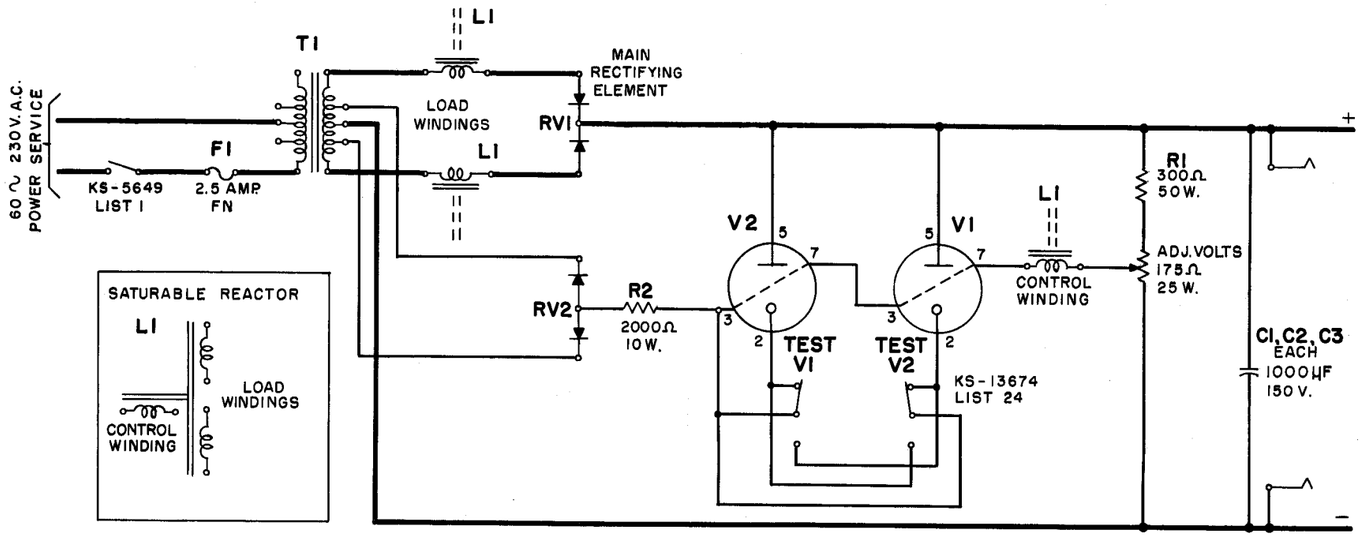

Fig. 1 – Functional Schematic — KS-5928 L5 Rectifier

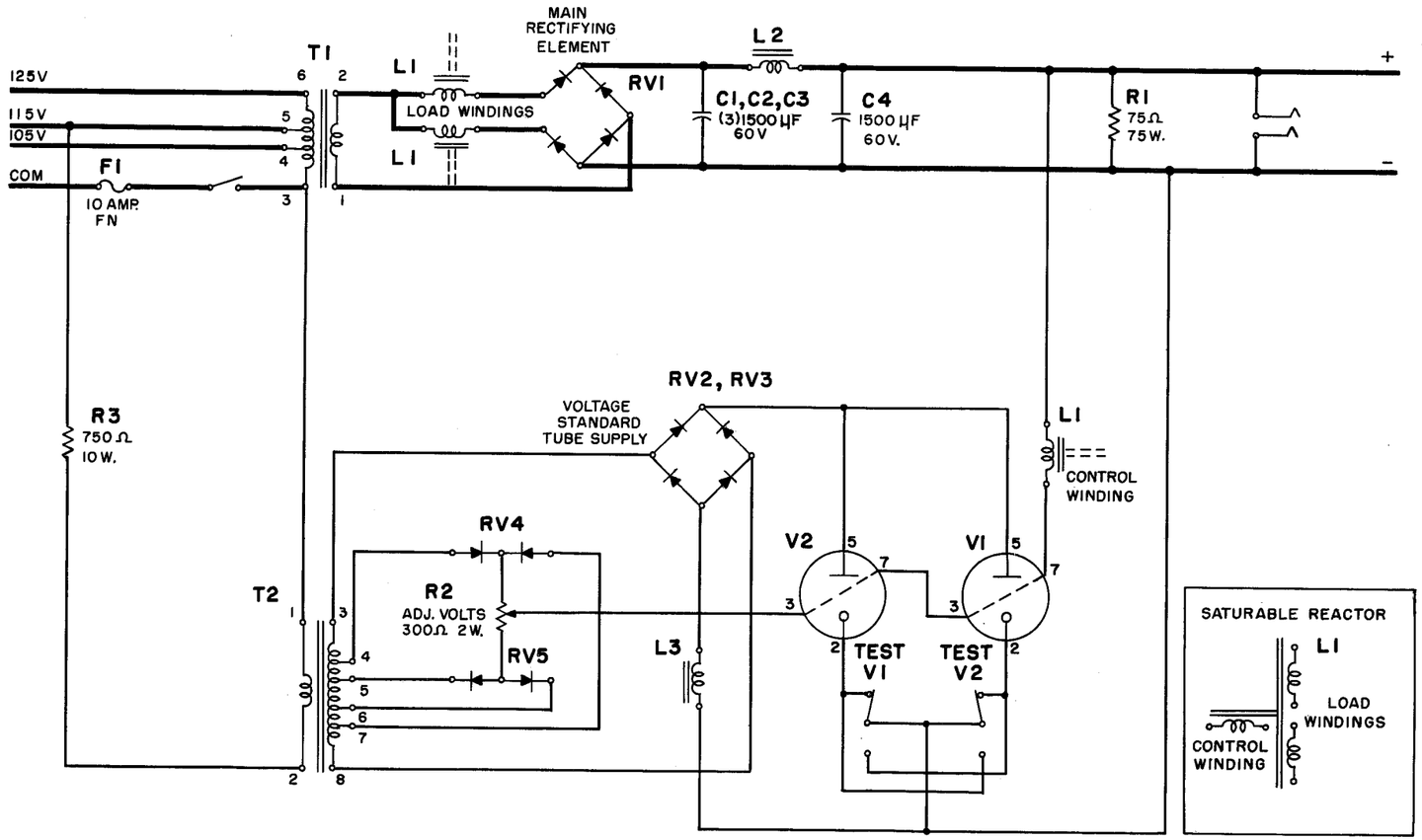

Fig. 2 – Functional Schematic—KS-15620 L4 Rectifier