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DEPARTMENT OF TRANSPORT

RADIO DIVISION

REFERENCE DIAGRAMS
AND
OPERATING INSTRUCTIONS
FOR

MODEL AR-8600 AUTO-ALARM

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D E P A R T M E N T O F T R A N S P O R T
Radio Division

INSTALLING AND OPERATING INSTRUCTIONS

for

MODEL AR-8600 AUTO-ALARM

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DIAGRAMS

PHOTOGRAPHS

DEPARTMENT OF TRANSPORT
Radio Division

INSTALLING AND OPERATING INSTRUCTIONS

MODEL AR-8600 AUTO-ALARM

AUTO-ALARM SPECIFICATIONS

The model AR-8600 auto-alarm has been designed to meet the following requirements.

Madrid, 1932, Telecommunication Convention, Paragraph 21 of Article 22 of the General Radio Regulations. Federal Communications Commission auto-alarm requirements and type tests, October 1, 1935, Document 14247. Federal Communications Commission Order No. 28, March 10, 1937.

FUNCTION OF AUTO ALARM

The fundamental purpose of the auto-alarm is to stand a watch on the 500 K.C. distress frequency at all times when the radio operator is not on duty. The international auto-alarm signal consists of a series of dashes four seconds in length, separated by spaces having a duration of one second. Twelve such dashes and spaces can be transmitted in one minute. Auto alarms designed to meet the requirements of the Federal Communications Commission are arranged to actuate warning bells when three correct dashes and spaces have been received. In cases of distress, transmission of the auto-alarm signal is usually accomplished by using a radio room clock with a sweep second hand, this clock being designed with suitable markings on the dial to facilitate transmission of the correct dashes and spaces. This clock is also to be used by the radio operator when he tests the auto-alarm before going off watch.

COMPONENT UNITS

A complete auto-alarm installation comprises the following component units.

Radio receiver and selector unit.
Junction box.
Master switch.
Bridge bell and warning light.
Operator's room bell and warning light.
Six volt 75 ampere hour storage battery. (1 amp rate)
Spare parts:
5 Type 1611 tubes
2 Type 6-K-7 tubes
1 Type 6-H-6 tube
1 Type 6-A-8 tube
3 Warning lights ($7\frac{1}{2}$ watt 120 volt)
1 Oven pilot light (6.3 volt)
9 Glass 6 ampere fuses
6 Glass $\frac{1}{2}$ ampere fuses
6 Standard 10 ampere fuse links
2 Standard 10 amp cartridge fuses
1 9 volt C Battery
1 Filament resistor (30 ohms)
1 Relay contact burnisher.

POWER SUPPLY REQUIREMENTS

The main power supply for the AR-8600 auto-alarm is the shipboard 110 volt D.C. line. A current of approximately 1.5 amperes is required. This 110 volt supply is used for all filament circuits, screen circuits, oven heater and warning lights of the auto-alarm. A six volt storage battery is also used. This battery furnishes energy for ringing the alarm bells and for energizing the stepping relay and auxiliary relay in the auto-alarm. The normal current required from the six volt battery is .4 amperes, except when all alarm bells are ringing when a current of approximately 3 amperes is required.

CONSTRUCTION OF RADIO RECEIVER-SELECTOR UNIT

The radio receiver-selector unit is constructed on a single panel which is hinged to a metal cabinet, the latter being designed for mounting vertically on the bulkhead. A hinged cover is also provided for the front panel to enclose the radio receiver, vacuum tubes, selector relays, and other parts. The receiver-selector unit is 26 1/16" high, 15 1/8" wide and 11¾" deep. The weight is 63 pounds.

Five radio frequency transformer units are mounted in a row at the upper section of the front panel. Each of these units is constructed with impregnated Litz coils, and air dielectric tuning condensers. The coupling between the various R.F. coils is adjusted at the factory to secure the specified band width and selectivity. The first transformer unit in the upper left section of the panel contains the R.F.-oscillator circuits. The next unit to the right is the 500 K.C. input transformer. The next three units are the intermediate frequency transformers.

Directly beneath the R.F. units, viewed from left to right, are the following. One-half ampere plate fuse, 6-A-8 mixer-oscillator tube. 6-K-7 first intermediate amplifier. 6-K-7 second intermediate amplifier. 6-H-6 diode detector.

The next row of tubes, five type 1611, reading from left to right, are as follows: Voltage regulator tube. Radio relay tube. First selector tube. Second selector tube. Third selector tube.

Three selector relays are mounted in a thermostatically controlled oven which is located beneath the tubes. A suitable heater and bi-metallic thermostat are used inside this oven to maintain a temperature of approximately 55 degrees Centigrade. The electric heater in this oven which is controlled by the thermostat, is permanently connected to the 110 volt line and operates at all times, whether or not the auto-alarm is in use. The heat from this oven is also used to maintain the component units of the auto-alarm dry under marine conditions.

To the right of the oven there is located the stepping relay. This relay advances one position each time a correct dash and space are received. When the stepping relay reaches the third position, after three correct dashes and spaces, the bells are energized.

There are four relays mounted beneath the oven. The first relay to the left is the radio relay, which is actuated by incoming signals. The next relay to the right is the filament burnout relay and is used to ring the warning bells in case the filament of any vacuum tube should burn out. The next relay to the right of the filament burnout relay is known as the bell ringing relay. This relay closes upon receipt of an alarm signal and stays closed, causing the bells to ring continuously until the reset button is depressed. The next relay (underneath the stepping relay) is known as the auxiliary relay.

The reset push button will be seen below the radio relay. This push button is used to stop the bells from ringing after the correct alarm signal has been received. To the right of the reset button there is mounted a 0-15 D.C. milliammeter and below this meter a "current" selector switch. Positions 1, 2 and 3 of the current selector switch are used to read respectively the plate currents of selector tubes 1, 2 and 3. Position 4 of the current switch will permit the milliammeter to read the current through the coil of the radio relay. Position 4 is to be used, as hereinafter described, when adjusting the sensitivity control for optimum setting. Position 5 of the current switch is not used.

A test buzzer is mounted between the two meters. This buzzer is actuated by means of the test button so that a local signal may be induced into the auto alarm receiver for testing overall operation. To the right of the buzzer there is located a 0-150 D.C. voltmeter and beneath this meter a "voltage" selector switch. Position 1 of the voltage switch

will permit the voltmeter to read grid charging voltage from the voltage regulator tube. Position 2 of this switch reads bias voltage on the grids of selector tubes 1 and 2. Position 3 reads bias voltage on selector tube No. 3. Position 4 indicates the heater or filament voltage across all tubes, while position 5 permits the shipboard line voltage to be read.

Typical readings of the milliammeter and the voltmeter for average shipboard conditions are given further in these instructions.

A sensitivity control is mounted beneath the test buzzer. This control adjusts the amplification of the radio receiver so that the optimum setting for the prevailing noise level may be obtained.

A push button switch to temporarily disconnect the bridge and operator's room bells is provided at the left of the current switch. This switch may be used by the operator to keep the bells from ringing during routine checking of the auto-alarm.

A jack for the telephone receivers is mounted below the test button. Incoming signals may be monitored in this manner.

OPERATION OF RADIO RECEIVER-SELECTOR UNIT

The radio receiver circuits of the auto-alarm utilize a five tube superheterodyne circuit. The antenna circuit after passing through the master switch connects to a tuned trap circuit, (mounted back of the panel) which is adjusted at the factory for a frequency of 1100 K.C. This is the intermediate frequency of the receiver and the trap circuit is provided to suppress interfering signals having a frequency of 1100 K.C. After passing through the trap circuit the incoming signal is connected through a small condenser (50 mmfd) to a pair of broadly tuned circuits, which are adjusted to respond to 500 K.C. plus or minus 12.5 K.C. In other words signals having a frequency from 487.5 to 512.5 K.C. are accepted. The first tube in the radio receiver is a type 6-A-8 mixer-oscillator. The oscillator portion of this tube is connected to a circuit which oscillates at a frequency of 1600 K.C. This 1600 K.C. energy is mixed with the incoming 500 K.C. signal, and produces in the plate circuit of the 6-A-8 the intermediate frequency of 1100 K.C.

The 6-A-8 mixer-oscillator tube is followed by two stages of intermediate frequency amplification, each stage using a 6-K-7 pentode amplifier tube. The intermediate amplifier uses a total of six tuned circuits which are so coupled to enable the incoming signal to vary between 487.5 and 512.5 K.C., without attentuation.

The fourth tube in the radio receiver is a type 6-H-6 diode detector. This tube has two plates which are connected in parallel and two cathodes which are connected in parallel. The radio signal, now at intermediate frequency, is rectified in the 6-H-6 detector stage and produces a D.C. voltage which appears across a one megohm registor connected between the cathodes and one side of the third I.F. transformer secondary. This D.C. voltage from the diode stage is applied as a negative voltage to the grid of the fifth tube in the receiver, type 1611, which is known as the radio relay tube. The relay tube has connected in its plate circuit the coil of the radio relay. Any incoming signal between 500 and 90,000 microvolts, and within the specified frequency band, will actuate the armature of the radio relay. The type 1611 relay tube, in the absence of signals, has a steady current (about 7.5 M.A.) flowing through its plate circuit. This current is reduced upon the receipt of a signal. This relay then initiates the timing action of the selector tubes in a manner to be described below.

An auto-alarm selector to operate efficiently with the international alarm signal, and to reject interfering signals, must perform three main functions. It should reject signals having a duration less than approximately 3.5 seconds. It should reject signals having a duration greater than 4.5 seconds. It should also be designed to recognize spaces between signals provided these spaces do not exceed 1.5 seconds. In the model AR-8600

auto-alarm three selector tubes, with appropriate relays, are used.

As pointed out above, correct incoming signals will lower the plate current of the 1611 relay tube, causing the armature to make a contact. This applies a positive voltage to the grid of number 1 selector tube, type 1611, through a suitable resistance capacity network. This network causes a time delay so that no plate current will flow in the number 1 selector tube plate circuit until approximately 3.5 seconds have elapsed. At the end of this time the plate current of selector tube number 1 energizes the coil of the first selector relay and closes its contacts. These contacts then energize the "notch" coil of a stepping relay, which advances this latter relay one position. At the same time that the notch coil on the stepping relay is energized, voltage is also applied to the coil of the auxiliary relay. One pair of contacts on this auxiliary relay energizes the grid of the second selector tube, type 1611, which also uses a resistance capacity network in its grid circuit. If the incoming signal lasts for more than 4.5 seconds current will flow in the plate circuit of the second selector tube and will energize selector relay number 2. This in turn will cause contacts to close on selector relay number 2, which will energize the "restore" coil on the stepping relay. When the signal ceases, under these conditions, the stepping relay returns to its zero or starting position.

From the foregoing it may be seen that signals having a duration between 3.5 and 4.5 seconds will cause the stepping relay to advance one position. It is now necessary to provide means for checking that the spaces between dashes are not excessive. This is accomplished by means of the third selector tube, type 1611, and the third selector relay. The contacts on selector relay number 3 also energize the "restore" coil of the stepping relay. Spaces are checked as follows. At the end of any dash lasting between 3.5 and 4.5 seconds, the auxiliary relay coil is de-energized and a pair of back contacts apply voltage to the grid of selector tube number 3 through a resistance capacity network. After a time interval (approximately 5 seconds) plate current begins to build up in selector tube number 3. However, if any subsequent dash after the first one is completed within 3.5 seconds, the auxiliary relay closes again de-energizing selector tube number 3. If the second or subsequent dashes are not completed in time, selector relay number 3 closes, energizing the "restore" coil on the stepping relay.

The above explanation of selector operation may be somewhat difficult to understand at the first reading. However, if the auto-alarm is operated with the test buzzer and the action of the various relays observed, as explained further in these instructions, it is possible to secure a clear understanding of the overall operation.

A voltage regulator tube, type 1611, is used in the auto-alarm. The purpose of this tube is to supply a regulated source of voltage for the grid circuits of the three selector tubes. Constants of the voltage regulator circuit are so designed to permit a small change in grid voltage to take place on the selector tubes, under conditions of changing line voltage, so that timing of the selector circuits is not impaired.

The warning lights are used to indicate when heavy static or other interference impairs operation. Each time the stepping relay advances one position a circuit is closed to the warning lights. These lights will remain lighted unless the static decreases or until a new adjustment is made on the sensitivity control.

CONSTRUCTION OF JUNCTION BOX

The junction box used with the AR-8600 auto-alarm is 14 7/16" high, 12 7/16" wide and 5 9/16" deep. The weight is 23 pounds. The following units are mounted in the junction box. Two sockets are located at the top of the unit into which are screwed the six volt battery charging resistors. Below these sockets are two 30 ohm enameled resistors which are used in series with the filament circuits of the tubes. There are four radio frequency chokes below the filament resistors. One pair of these chokes is

connected in series with the 110 volt line for filtering the power input to the auto-alarm. The second pair of chokes filter the input to the oven in the auto-alarm. Four small mica filter condensers are mounted below the chokes. To the left of the filder condensers there is located a pair of fuse blocks for the incoming 110 volt line. Six ampere glass fuses are used in these fuse blocks. To the right of the filter condensers there is a single fuse block which uses a six ampere glass fuse and which connects to the positive side of the six volt storage battery. A special "C" battery delivering nine volts is mounted in the bottom of the junction box and held in place by means of a metal clamp. Numbered terminal blocks are provided for all incoming and outgoing circuits.

The following units are mounted on the inside of the door of the junction box.

Radio room bell and warning light.
Oven thermostat pilot light.
Line voltage relay.
Six volt battery relay.

Internal connections of the units in the junction box are shown on schematic diagram. External connections of the junction box as well as the complete auto-alarm installation are shown on schematic diagram. A special 15 conductor lead covered cable, color coded, is used to connect the radio receiver-selector unit to the junction box. A special 10 conductor, color coded, lead covered cable connects the junction box with the master switch. The incoming bell and warning light circuits from the bridge and operator's room, as well as the incoming 110 volt and 6 volt circuits are also brought into appropriate terminals in the junction box.

The line voltage relay which is mounted on the rear of the cover of the junction box, to the left of the bell, is used to provide a warning whenever the shipboard line voltage is below or above predetermined values. If the line voltage falls below normal the "low" or back contacts of the line voltage relay close. This will cause all three bells to ring until the line voltage has been restored to its normal value. The same action takes place if the line voltage exceeds 120 volts D.C. To provide a warning in case the six volt storage battery approaches discharge, a second relay mounted to the right of the bell on the back cover of the junction box is provided. The coil of this relay is connected across the six volt battery. If the battery voltage drops below approximately 4.5 volts, the bells will ring and will continue ringing until the battery voltage is restored to normal.

The high and low contacts on the line voltage relay are used to short circuit the coil of the six volt relay. In other words low or high 110 volt line voltage supply or low voltage from the six volt battery will cause the six volt relay contacts to close, ringing the bells.

CONSTRUCTION OF MASTER SWITCH

The master switch is mounted on a base whose dimensions are approximately 6" wide and $8\frac{1}{2}$" long. Weight is 6 pounds. A large Isolantite insulator (7 1/8" high) is mounted on the base of the switch and is designed to withstand the full voltage from the radio room transmitters. A contact arrangement is used at the top of the insulator to enable the antenna to be connected either to the auto-alarm or to the other radio room equipment. When the master switch is placed in the "on" position, for auto-alarm operation, the antenna circuit is carried through the long arm on the switch to the terminal marked AA and thence into the auto-alarm receiver. A static leak and an adjustable spark gap are provided on the master switch between antenna and ground to prevent excessive voltages from reaching the auto-alarm receiver. The spark gap should be adjusted so as not to exceed a spacing of one-thirty-second inch. In the "on" position the master switch performs the following additional functions. Connects positive 110 volt line to the auto-alarm. Connects positive and negative of the six volt storage battery to the auto-alarm. When the master switch is placed in the "off" position it disconnects the antenna from the auto-alarm receiver and connects the antenna to the other radio room equipment. It also places the six volt storage battery on charge and in addition closes an interlock circuit in

series with the main transmitter key. This interlock circuit is to prevent the main transmitter from being used unless the auto-alarm has been taken out of circuit.

BRIDGE BELL AND WARNING LIGHT

The bridge bell and warning light are mounted in a metal box 7" high, 6 5/16" wide and 3 3/8" deep. The weight is 5 pounds 4 ounces. The bell unit is designed to operate from the six volt storage battery. The warning light is a standard 7½ watt 120 volt lamp. The operator's room bell and warning light unit is similar to the bridge bell and warning light unit.

ADJUSTMENTS TO BE MADE BY RADIO OPERATOR BEFORE GOING OFF WATCH

"TO TEST ALARM: Close master switch. Set sensitivity control to approximately 40. Using radio room clock transmit alarm signal with test push button on auto-alarm. Bells will ring after four correct dashes and spaces."

"TO ADJUST SENSITIVITY CONTROL: Set scale at 0. Set current switch at 4. Meter will read about 7.5 M.A. Turn sensitivity control to right until average meter reading due to noise, static, etc., is about 1 M.A. less than maximum value. Listen with phones. Incoming signals will cause signal relay to chatter slightly and meter reading to fall toward zero. If sensitivity is set too high for prevailing noise level, warning lights will indicate need for lower setting. Do not set sensitivity control lower than necessary as weak distress calls may not be received."

When testing the auto-alarm with the test buzzer and push button the operator should observe that the milliammeter reading falls to zero or nearly so each time the test button is depressed. Close this button quickly several times and observe that the radio relay, whose armature click may be heard, follows the keying speed. Each time a correct four second dash and space are sent with the test buzzer, it may be observed that the stepping relay advances one position. If there is considerable radio interference or static during the time the alarm is being tested, it will be observed that the restore coil on the stepping relay is also energized, thereby preventing the stepping relay from advancing further. This condition will occur during testing whenever static or interference completely fills the spaces between dashes so that the normal auto-alarm signal is distorted. The position of the sensitivity control, during the test of the auto-alarm, may be used as an approximate check on the sensitivity of the receiver and the correct performance of all tubes. If it is found necessary to advance the sensitivity control beyond approximately 40 to 50 on the scale, it may be inferred that one of the tubes in the radio receiver part of the circuit is defective. After a little experience with the alarm, using the headphones plugged into the jack and by observing the operation of the radio relay on incoming signals, the operator may reach an approximate determination as to whether or not the receiver sensitivity is normal. In other words on the average shipboard antenna it should not be necessary to advance the sensitivity control to the extreme right in order to make the radio relay operate with the average incoming signal.

SENSITIVITY CONTROL ADJUSTMENT

A clear understanding of the results to be expected from various settings of the sensitivity control is necessary in order to adjust this control to the optimum or most favorable position. For example if the sensitivity control is turned to the extreme right (100 on the dial) or nearly so, it may be found that the average noise level and static will cause relay to hold over for long periods of time, or to chatter or vibrate steadily. When this occurs the adjustment is not a favorable one, for not only will the warning light be illuminated frequently whenever static or noise persists for 3.5 seconds or more, but also a real alarm signal will be more apt to have its dashes prolonged and its spaces filled in, with such an adjustment. On the other hand if the sensitivity control is adjusted too far to the left, that is toward zero on the scale, then only very strong signals will operate the auto-alarm, and a distress call from a distant ship might be missed. The

optimum adjustment will be found to be that which gives a reading on the milliammeter (with no incoming signals) which is approximately one milliampere less than the reading obtained when the volume control is at zero. With such an optimum adjustment the radio relay may close occasionally from short burst of static or from ordinary code signals. The operator should keep in mind that if the sensitivity control is set too high the radio relay will vibrate constantly, which is an undesirable adjustment. The officers on the bridge will have instructions to summon the radio operator whenever the warning light on the bridge is illuminated for periods of five minutes or more. When the sensitivity is set at 100 or maximum, a signal strength of approximately 200 microvolts will operate the auto-alarm. At a dial setting of 50 (midscale) a signal of approximately 1000 microvolts is required. At 0 setting of the sensitivity control a signal strength of 20,000 microvolts is required.

FAULTS WHICH WILL CAUSE SOUNDING OF THE AUDIBLE ALARM

1.-False alarm. Accidental combination of static or other interference may occasionally cause the stepping relay to advance to its fourth position, which will lock in the bell ringing relay and cause the bells to ring continuously. Bells will stop when reset push button is depressed on auto alarm panel.

2.-Filament burnout. If any one of the vacuum tube filaments (heaters) should burn out, or if one of the 30 ohm series filament resistors in the junction box should burn out, the filament burnout relay on the auto-alarm panel will have its coil de-energized, which will close the back contacts, and cause the bells to ring. Bells can only be stopped from ringing by replacing the defective tube, or resistor or by opening the master switch.

3.-Low or high line supply voltage. If the 110 volt shipboard supply is reduced below normal or increased above 120 volts, the line voltage relay in the junction box will operate, which will short out the coil on the six volt relay, causing the bells to ring. The bells will continue ringing until line voltage is restored to normal or until master switch is opened.

4.-If the six volt battery approaches discharge and its voltage falls below about 4.5 volts, the back contacts will close on the six volt relay, causing the bells to ring continuously until a suitable charged battery is placed in circuit or until the master switch is opened.

5.-If the one-half ampere fuse on the auto-alarm panel or any of the fuses in the junction box should be blown, the bells will ring continuously until the fault is corrected or unless the master switch is opened. The one-half ampere fuse will blow in case of tube shorts or condenser breakdown in the receiver-selector unit.

OPERATION OF WARNING LIGHTS

The purpose of the warning lights as explained previously is to provide a visual indication whenever prolonged static or other interference holds the radio relay open. After 3.5 seconds the stepping relay will advance one position and remain there as long as the interference is continuous. An auxiliary set of contacts on the stepping relay will close a circuit to the three warning lights to indicate this condition. The remedy is to readjust the sensitivity control to a slightly lower setting so that the stepping relay drops back to its normal or zero position.

PROCEDURE TO BE FOLLOWED WHEN ALARM BELLS RING

1-If alarm bells ring momentarily, then stop ringing, and repeat this cycle frequently, the difficulty is most likely due to low, high or variable line voltage. Go to the radio room, open the door of the junction box and observe the line voltage relay contacts. Also measure the line voltage by placing the voltmeter switch in position five on the auto-alarm panel. If the voltage is much below 100 volts, it will be observed that the line voltage relay "left" contact is closed, causing the bells to ring. Higher

than normal line voltage will cause the "right" contact to make on the relay, also ringing the bells. This condition of low, variable, or high line voltage should be brought to the attention of the proper ship's officer.

2-Alarm bells ringing continuously. Go to the radio room and depress the reset button on the auto-alarm. If this stops the bells from ringing a pair of phones should be immediately plugged into the phone jack to determine if an alarm signal has been transmitted by a vessel in distress. If the bells do not stop ringing when the reset button is depressed the fault may be low line voltage, high line voltage, low six volt battery supply, filament burnout, or blown fuses. Filament burnout may be immediately determined by placing the voltmeter switch in position four, where a reading of 100 volts or more will be obtained instead of the normal reading of approximately 60 volts. A blown one-half ampere plate fuse or 110 volt line fuse may be quickly determined by observing if any reading is obtained on the voltmeter with the switch in position five. No reading will be obtained if these fuses are blown. If the six volt battery is low this should be checked with the three scale voltmeter carried in the radio room as a part of standard safety of life at sea equipment.

3-When troubles which cause the bells to ring continuously cannot be located quickly, it is desirable to disconnect the bridge bell and operator's bell temporarily to avoid undue annoyance to the ship's personnel. This may be done by removing the lead (blue with red tracer) which will be found on terminal 28 on the vertical right hand terminal block of the junction box. After the trouble has been corrected the operator should make certain that the lead to terminal 28 is firmly reconnected, and he should make a test with the bridge and the operator's room to insure that the bells are again functioning normally.

LOG ENTRIES

The following instructions with regard to log entries should be carefully observed as they are required by the Federal Communications Commission.

1-While the ship is at sea the auto-alarm shall be tested by means of the testing device supplied, at least once every 24 hours, the timing of the dashes to be made by reference to the sweep seconds hand of the station's clock. Bridge bell and warning light and operator's room bell and light must show correct operation when this test is made. A statement that the foregoing has been fulfilled must be inserted in the ship's official deck log and the radio log daily.

2-If the warning light is illuminated for a continuous period of five minutes or more, the operator shall record in the radio log the time when he was called by the bridge, the time when he goes to the radio room to investigate the difficulty, the reason for the warning lights burning, and a statement as to the adjustments found necessary to restore normal operation.

3-If the bells ring, the operator should record in the radio log the time of the occurrence and the time when he arrives at the radio room to investigate the reason for the bells ringing. A record should also be made in the log to explain what caused the bells to ring, such as actual alarm, false alarm, filament burnout, low line voltage, low battery voltage, blown fuses, etc.

4-Vacuum tube and battery information to be entered in log. Each vacuum tube initially supplied in the auto-alarm is dated at the time of installation. If any tube becomes defective the operator should remove the tube and make an entry in the log to indicate the date the tube was removed and replaced and the tube socket from which it was taken. The defective tube should not be destroyed, but should be returned to the radio company responsible for the maintenance of the auto-alarm. The new tube which is used to replace the defective tube should be dated by the

operator. This may be done by scratching the date on the metal shell of the tube with the point of a knife or other sharp tool.

The 9 volt "C" battery (type D6BP) mounted in the junction box is provided with a label to record the date when installed, and also the date when it should be replaced. If for any reason the operator finds it necessary to replace the "C" battery with his spare "C" battery, he should enter this fact in the log, recording when the old "C" battery was taken out, when the new one was replaced and on the label of the new battery he should write the date when installed. The "C" battery should be replaced when it falls below 8.5 volts.

GENERAL MAINTENANCE AND REPAIRS AT SEA

If normal operation of the auto-alarm cannot be obtained, the radio operator should proceed as follows:

IMPORTANT: Do not remove relay cover or oven cover on the auto-alarm panel or work with tools around any of the parts unless the master switch is in the "off" position.

1.-Check with three range radio room voltmeter to determine if the 110 volt line voltage and six volt battery power exists across the appropriate input terminals in the junction box. If correct readings are obtained make similar measurements across the proper terminals of the receiver-selector unit.

2.-Make certain that all leads on the junction box terminals from number 1 to 32 inclusive are tight and making good connections.

3.-Relay contacts should be checked and cleaned, if necessary, to insure proper contact. To clean contacts use the special burnishing tool which is furnished, taking care not to remove too much contact material with the burnisher.

4.-If defective tubes are suspected, they should be replaced one at a time, starting with the 6-A-8 tube, always returning good tubes to the same socket from which they were removed. This will avoid confusion in locating a defective tube. Type 1611 tubes may be checked for emission by placing them successively in the second socket from the left in the lower row of tubes. This is the radio relay tube socket and the plate current of this tube may be read by the milliammeter with the switch in position number four. Normal tubes with 100 volts line should show a plate current with no incoming signal of approximately 7 milliamperes or more. When checking tubes all tube sockets must be filled, otherwise bells will ring.

5.-Each selector circuit may be checked by sending a test signal through the auto-alarm and successively placing the "current" switch in position 1, 2 and 3. In position 1 after a long dash a current of approximately 8 to 10 milliamperes will be obtained. In position 2 after a long dash a similar value will be obtained. To check selector number 3 place the switch in position 3, send a 4 second dash with the test buzzer and then observe after about 5 seconds that the meter reads momentarily a value of approximately 6 milliamperes. The third selector tube shuts off its own plate current after it checks a space and for this reason only a momentary meter reading will be obtained.

6.-It is possible to check various voltages in the junction box and on the various component units back of the auto-alarm panel by referring to diagram T-351, and by using the three range voltmeter which is carried in the radio room. Such a voltage analysis will enable the operator to determine if open circuits or poor connections exist in various parts of the circuits.

7.-The switch contacts on the master switch should be checked occasionally to insure that they are making good connection, removing any corrosion or oxidation which may have taken place.

8.-Normal operation of the oven heater will be indicated by intermittent operation of the small pilot light mounted on the back of the junction box cover. This pilot light is provided to enable the radio operator to determine that the oven circuit is operating normally whether or not the auto-alarm is on watch.

9.-If for any reason the auto-alarm 6 volt battery becomes discharged the operator should substitute one of the radio room 6 volt storage batteries temporarily. The auto-alarm battery should then be placed on charge from the standard radio room "A" battery charger. The operator should determine why the auto-alarm battery became discharged. The auto-alarm master switch is arranged to place the 6 volt battery on charge at a rate of approximately 2 amperes whenever the master switch is in the "off" position. This charging rate is sufficient to keep the alarm battery fully charged if the alarm is "on watch" for a period of 18 hours daily. In other words 6 hours charging in each 24 hours will keep the battery in good condition. If either or both battery charging resistors at the top of the junction box should become defective, standard 110 volt 100 watt lamps may be used as a substitute.

10.-When replacing the 9 volt "C" battery, make certain that the green lead connects to the negative terminal and the brown lead to the positive terminal. No current is taken by the "C" battery, therefore if early "C" battery replacement is necessary look for shorts or leakage. A voltmeter connected in series with one of the "C" battery leads should show no reading for normal operation.

11.-If plate current is obtained through each selector relay as explained under "5" above and the stepping relay does not operate, inspect the contacts on the selector relay in the oven. Remove oven cover screws and carefully withdraw the oven cover straight out to prevent breakage of the thermometer. Relay contacts may now be examined and cleaned if necessary.

12.-Note that the 6 volt storage battery has two fuses in the positive side of the circuit, a 6 ampere glass fuse in the junction box and also an external 10 ampere fuse installed near the battery. Short circuits in the 6 volt circuits in the auto-alarm or junction box will normally cause the 6 ampere glass fuse to blow. Short circuits in the wiring to the warning bells will cause blowing of the external 10 ampere fuse. This arrangement allows the warning bells to ring when the 6 ampere fuse is blown. Both fuses should be inspected in case of trouble. Always use the specified ratings when replacing fuses.

13.-The line voltage relay will also cause the bells to ring if the polarity of the 110 volt shipboard line is reversed. The voltmeter on the receiver-selector unit in switch position 5 will also indicate this condition by reading in the reverse direction.

TYPICAL READINGS OF CURRENT AND VOLTAGE FOR NORMAL AUTO ALARM OPERATION

The following readings are based on an average line voltage of 100 volts. Higher line voltages will give slightly higher readings.

CURRENT SWITCH

Position 1-First selector relay closes at approximately 4 M.A.
Position 2-Second selector relay closes at approximately 6.5 M.A.
Position 3-Third selector relay closes momentarily at approximately 6.5 M.A.
Position 4-Signal relay plate current is 7.5 M.A. with no incoming signal. With signals, lower values, down to zero, will be obtained.
Position 5-Not used.

VOLTMETER SWITCH

Position 1-Grid charging voltage 52 volts.
Position 2-Grid bias on selector tubes 1 and 2, 29 volts.
Position 3-Grid bias on third selector tube, 29 volts.
Position 4-Heater voltage 60 volts.
Position 5-Reads ship's line voltage.

When going off watch the operator should always leave the "current" switch in position 1 and the "voltage" switch in position 5. If the current switch is left in position 4 the milliammeter will follow all incoming signals, causing unnecessary wear and tear on the instrument.

TESTING AUTO-ALARM UNDER SEVERE STATIC CONDITIONS

Occasionally when static is very severe the sensitivity control cannot be advanced far enough to permit the test buzzer to actuate the receiver without causing the radio relay to "block" from the static. To test the alarm under these conditions place a temporary short circuit between the AA terminal and ground terminal on the master switch. After the test the short circuit should be removed and the sensitivity control adjusted to optimum for the prevailing noise level.

UNDERSTANDING SELECTOR ACTION BY OBSERVING RELAYS

1.-Transmit "V"s or other code signals with test buzzer. Radio relay will follow keying and milliammeter in position 4 will show a lower reading each time buzzer is operated. No other relays will operate.

2.-Transmit one four second dash. Radio relay will operate instantly and after 3,5 seconds number 1 selector relay in oven will close, auxiliary relay will close, "notch" coil will be energized and stepping relay will advance one position. This checks if dash is long enough.

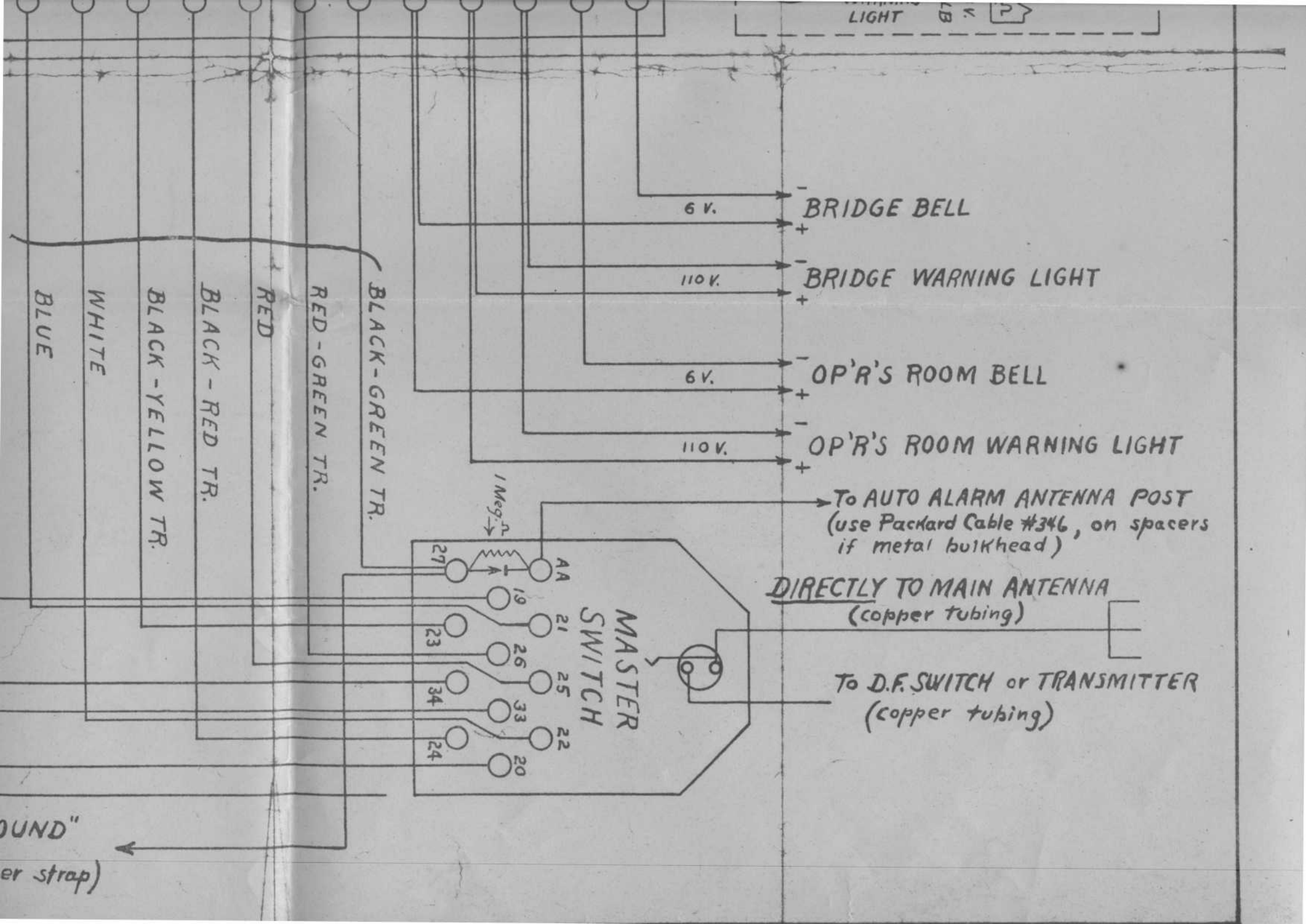
3.-Transmit one dash of 5 seconds or more. Same action as under "2" above will take place and in addition number two selector relay in oven will close and "restore" coil on stepping relay will be energized. When long dash is broken stepping relay will return to zero or normal position. This checks overlong dashes.

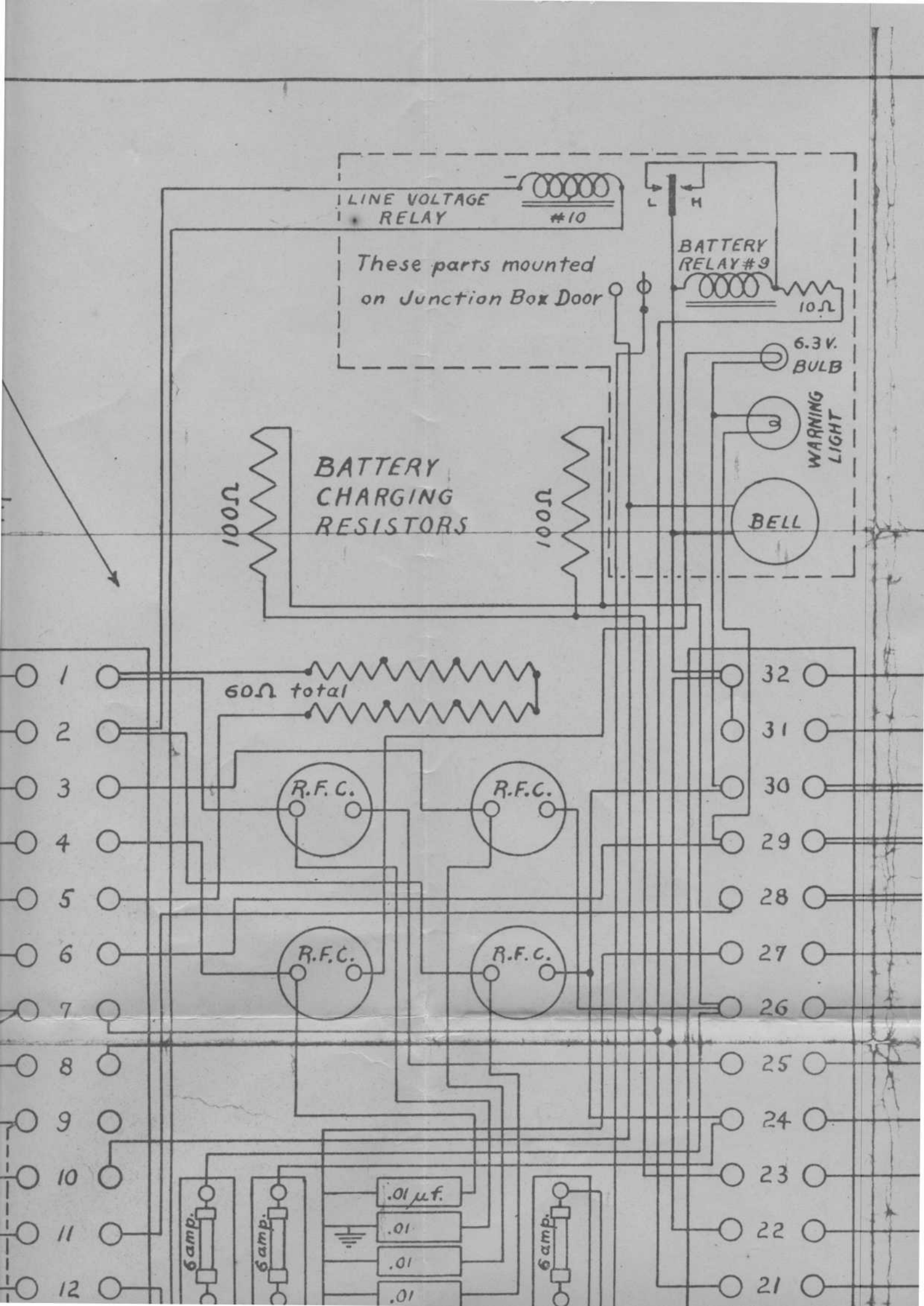
4.-Transmit one four second dash to advance stepping relay one position and then break this dash. After approximately 5 seconds "restore" coil will click and stepping relay will return to zero. This checks spaces.

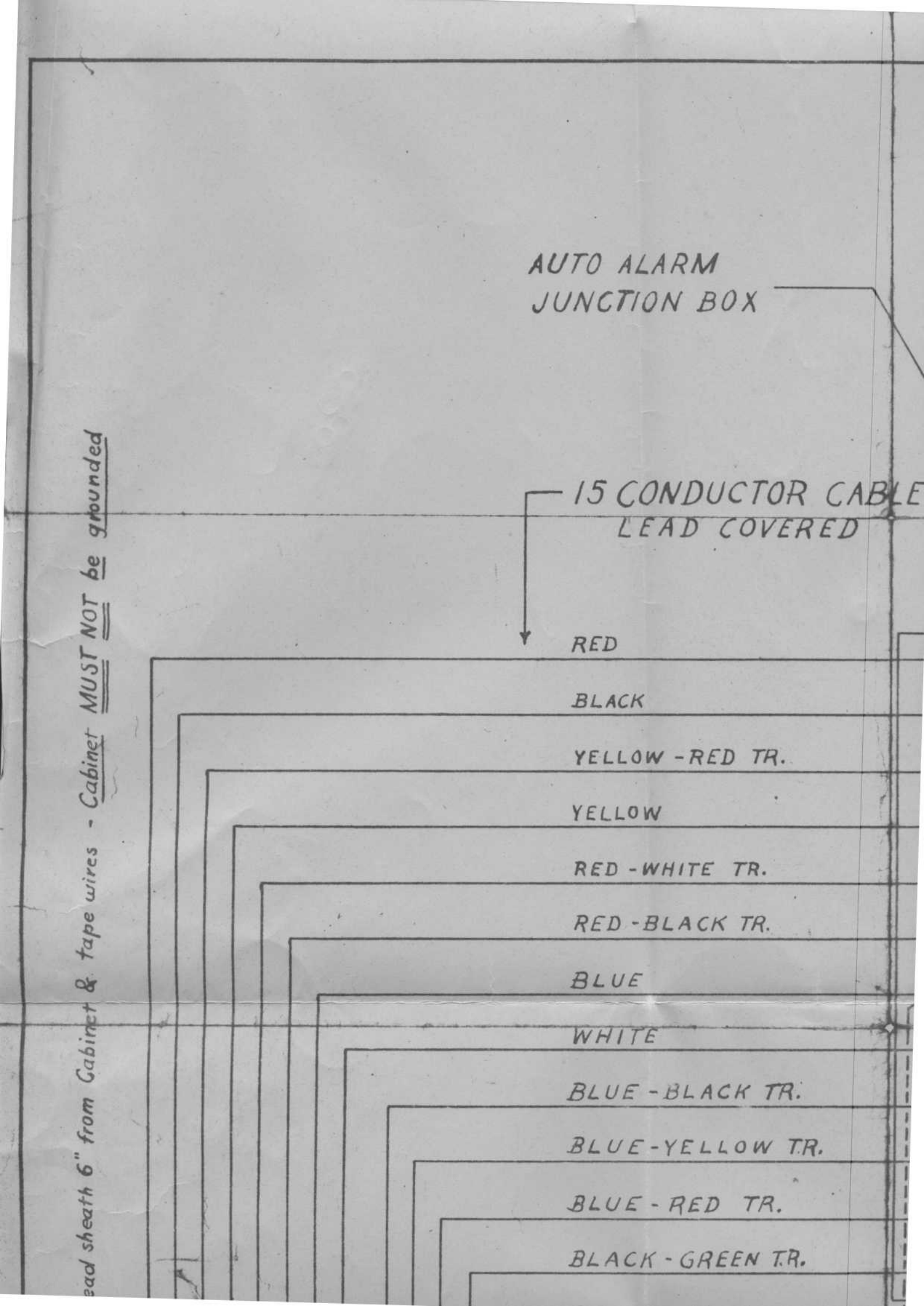
5.-Transmit three correct 4 second dashes separated by 1 second spaces and watch the stepping relay move up with each dash, finally causing the bell ringing relay to lock in when the third dash is broken. Note that each dash, including the third dash must be followed by a space to lock in the bell ringing relay. If the third dash (or any other dash) is too long the restore coil is energized on the stepping relay.

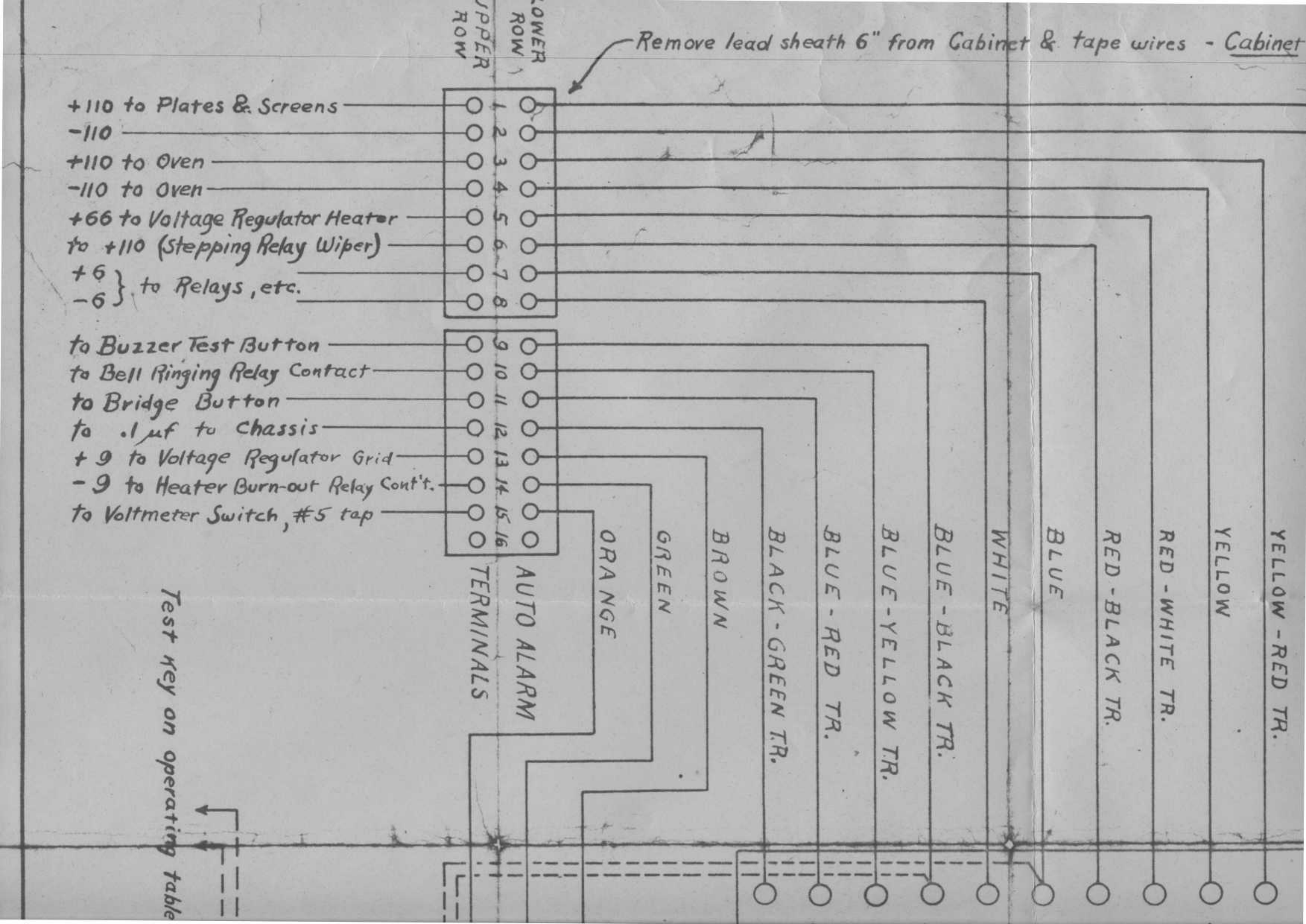
PREVENTING OVERCHARGE OF 6 VOLT BATTERY

When the ship is in port or drydock or if the auto-alarm is in use for only a few hours each day, the 6 volt storage battery may become overcharged. To avoid this use one charging resistor if the alarm is in use only a short time daily. In port or in drydock remove both charging resistors by unscrewing from sockets.

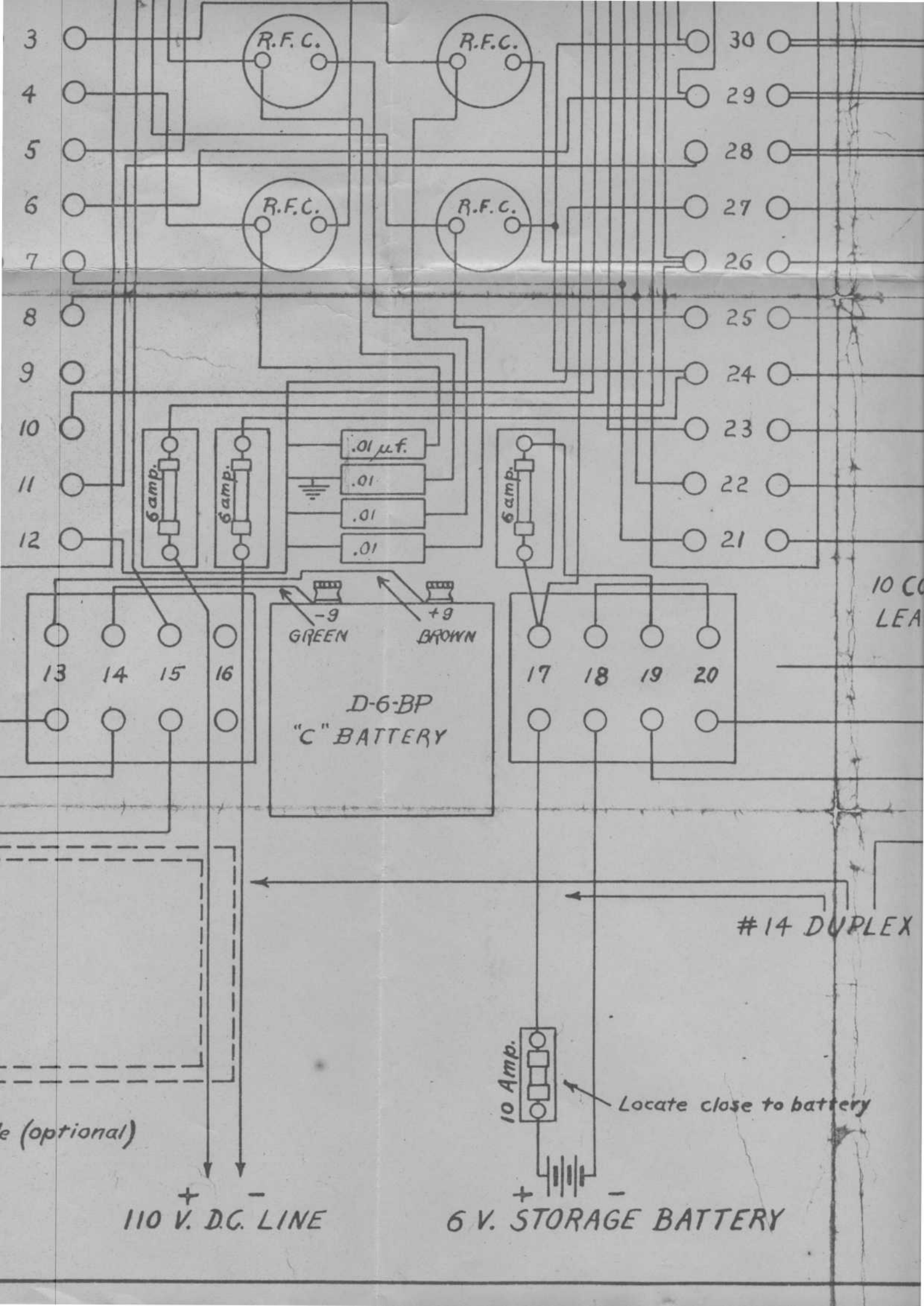

LIGHT
6 V.
BRIDGE BELL
110 V.
BRIDGE WARNING LIGHT
6 V.
OP'R'S ROOM BELL
110 V.
OP'R'S ROOM WARNING LIGHT
To AUTO ALARM ANTENNA POST
(use Packard Cable #346, on spacers if metal bulkhead)
DIRECTLY TO MAIN ANTENNA
(copper tubing)
To D.F. SWITCH or TRANSMITTER
(copper tubing)
MASTER SWITCH
1 Meg.
BLUE
WHITE
BLACK-YELLOW TR.
BLACK-RED TR.
RED
RED-GREEN TR.
BLACK-GREEN TR.
27
AA
19
21
23
26
25
34
33
22
24
20
OUND"
er strap)

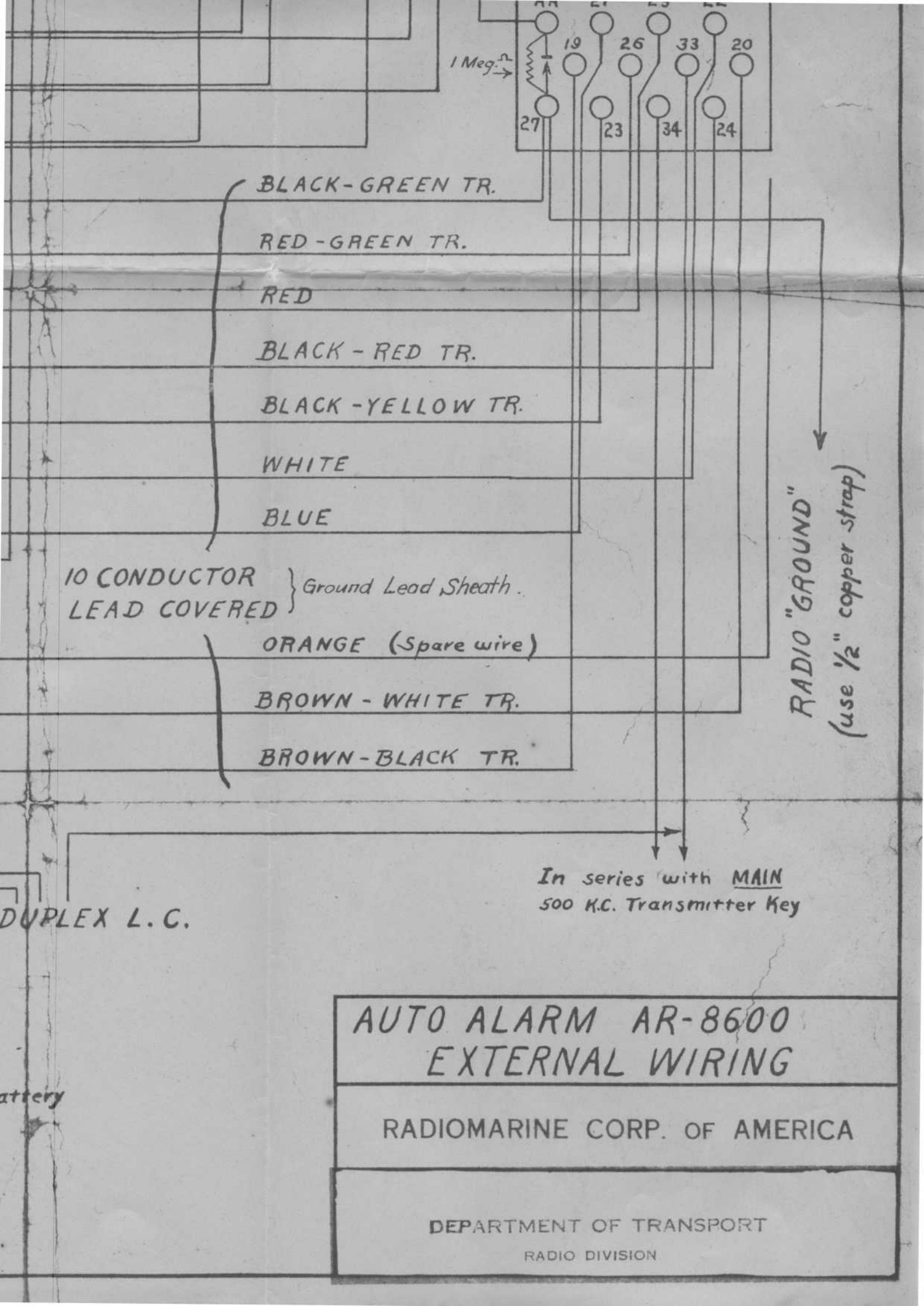

LINE VOLTAGE RELAY
#10
These parts mounted on Junction Box Door
L
H
BATTERY RELAY #9
10Ω
6.3V. BULB
WARNING LIGHT
BELL
BATTERY CHARGING RESISTORS
100Ω
100Ω
60Ω total
R.F.C.
R.F.C.
R.F.C.
R.F.C.
1
2
3
4
5
6
7
8
9
10
11
12
32
31
30
29
28
27
26
25
24
23
22
21
6 amp.
6 amp.
6 amp.
.01 μf.
.01
.01
.01


AUTO ALARM
JUNCTION BOX
15 CONDUCTOR CABLE
LEAD COVERED
RED
BLACK
YELLOW - RED TR.
YELLOW
RED - WHITE TR.
RED - BLACK TR.
BLUE
WHITE
BLUE - BLACK TR.
BLUE - YELLOW TR.
BLUE - RED TR.
BLACK - GREEN TR.
ead sheath 6" from Cabinet & tape wires - Cabinet MUST NOT be grounded



Remove lead sheath 6" from Cabinet & tape wires - Cabinet
UPPER ROW
LOWER ROW
+110 to Plates & Screens
-110
+110 to Oven
-110 to Oven
+66 to Voltage Regulator Heater
to +110 (Stepping Relay Wiper)
+6
-6
to Relays, etc.
to Buzzer Test Button
to Bell Ringing Relay Contact
to Bridge Button
to .1 μf to Chassis
+9 to Voltage Regulator Grid
-9 to Heater Burn-out Relay Cont't.
to Voltmeter Switch, #5 tap
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
TERMINALS
AUTO ALARM
ORANGE
GREEN
BROWN
BLACK-GREEN T.R.
BLUE-RED TR.
BLUE-YELLOW T.R.
BLUE-BLACK TR.
WHITE
BLUE
RED-BLACK TR.
RED-WHITE TR.
YELLOW
YELLOW-RED TR.
Test key on operating table


3
4
5
6
7
8
9
10
11
12
R.F.C.
R.F.C.
R.F.C.
R.F.C.
30
29
28
27
26
25
24
23
22
21
6 amp.
6 amp.
6 amp.
.01 μf.
.01
.01
.01
-9
GREEN
+9
BROWN
13
14
15
16
17
18
19
20
D-6-BP
"C" BATTERY
10 CO
LEA
#14 DUPLEX
10 Amp.
Locate close to battery
e (optional)
+
−
110 V. D.C. LINE
+
−
6 V. STORAGE BATTERY

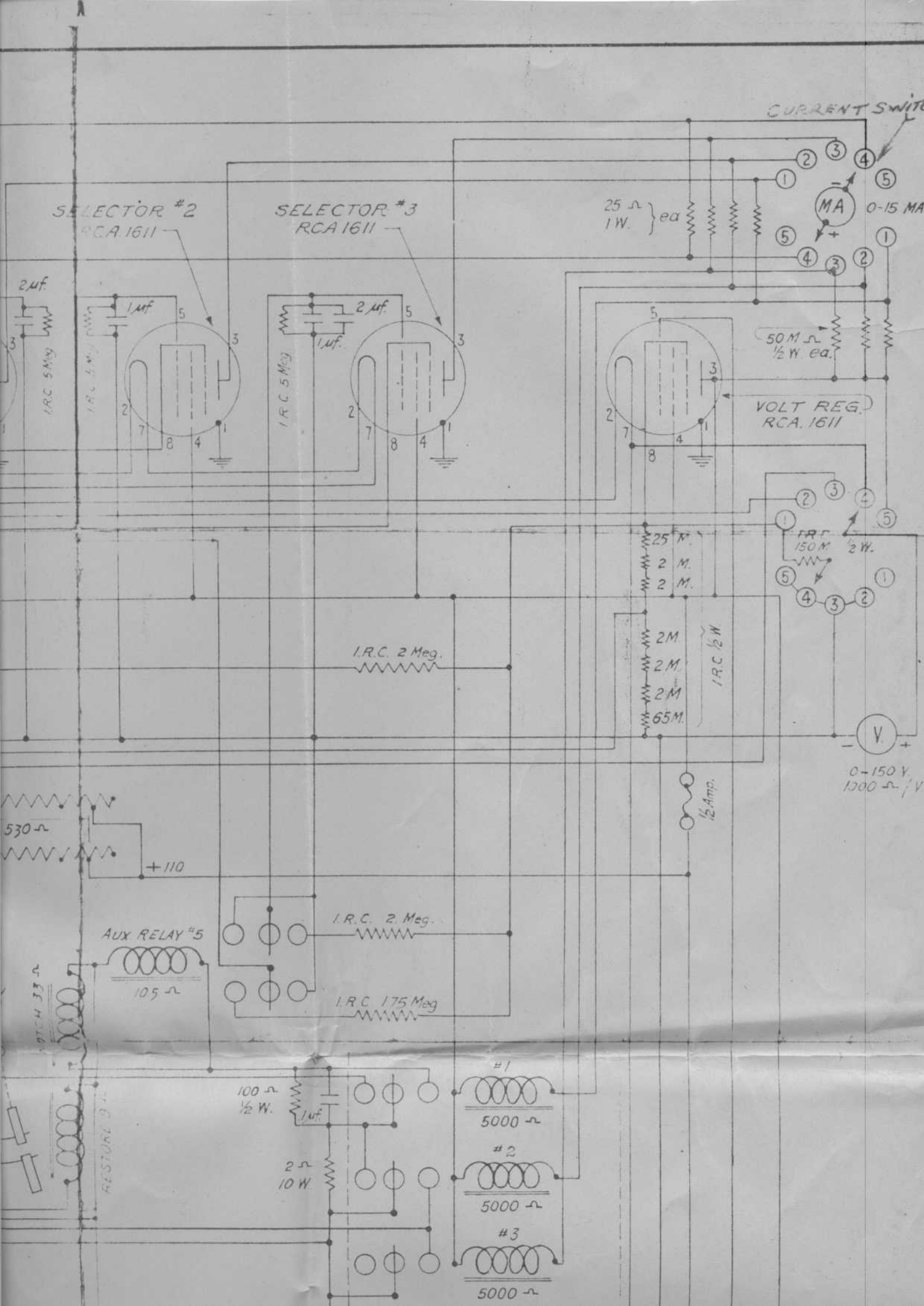


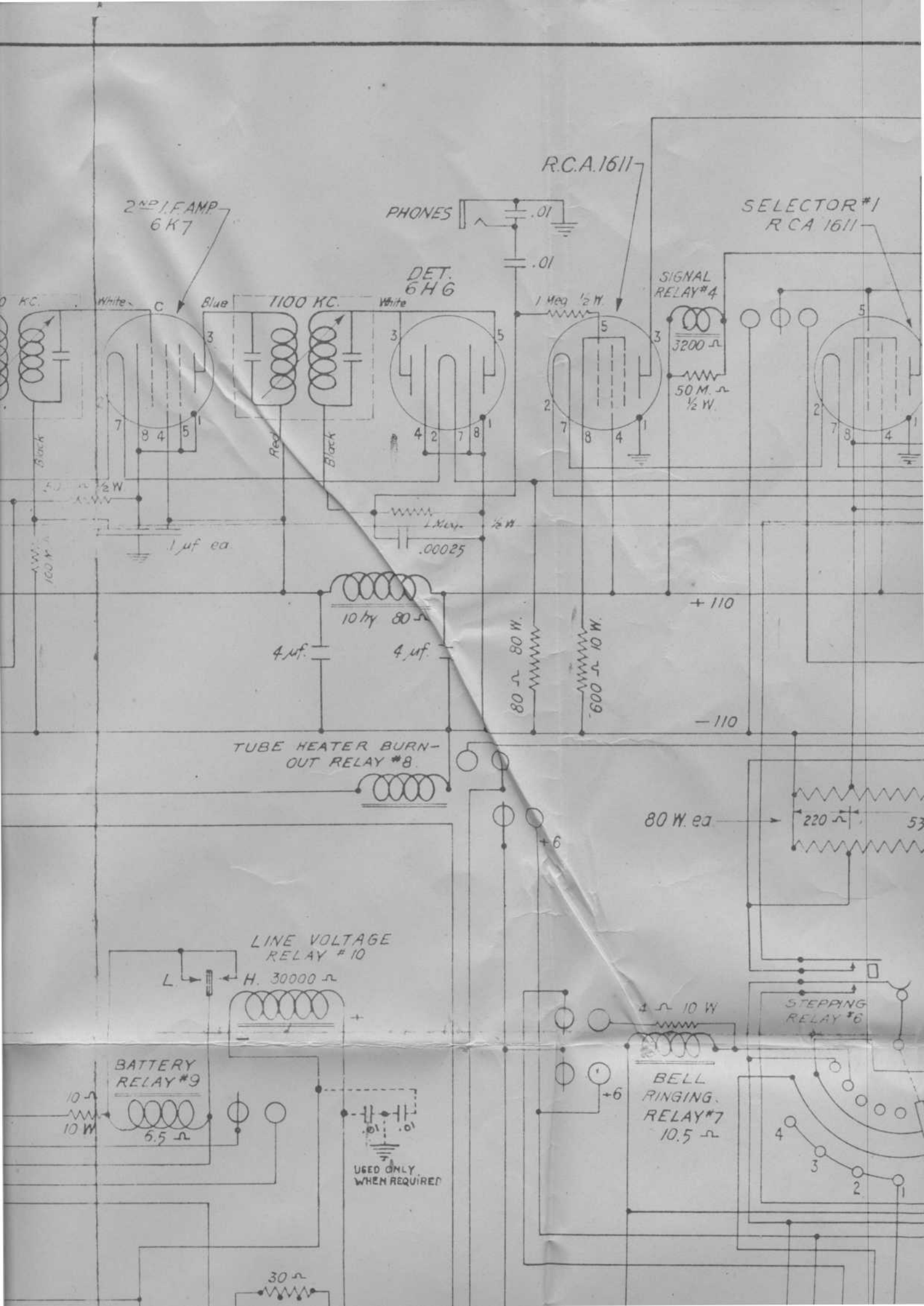
AUTO ALARM AR-8600 EXTERNAL WIRING

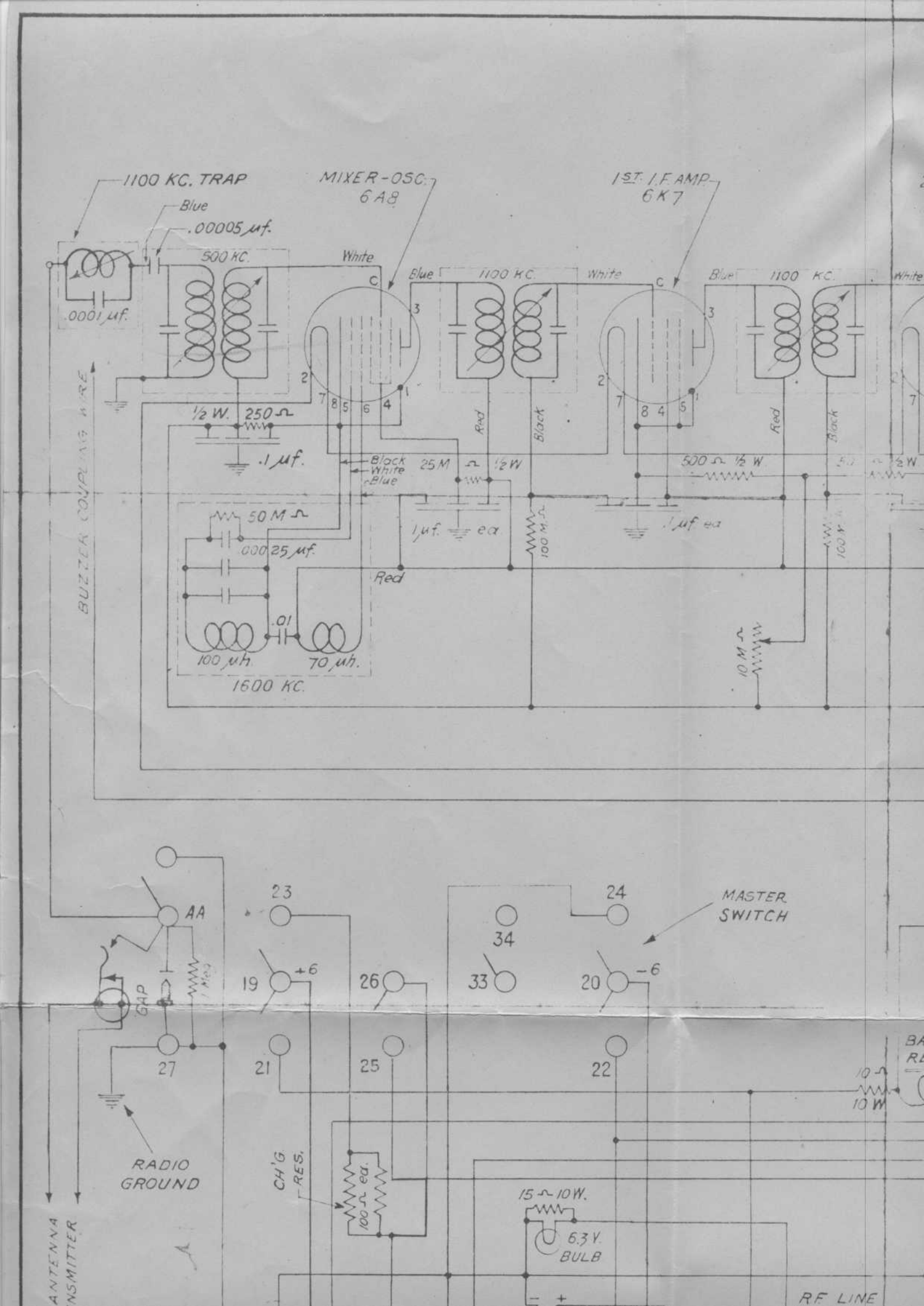
RADIOMARINE CORP. OF AMERICA

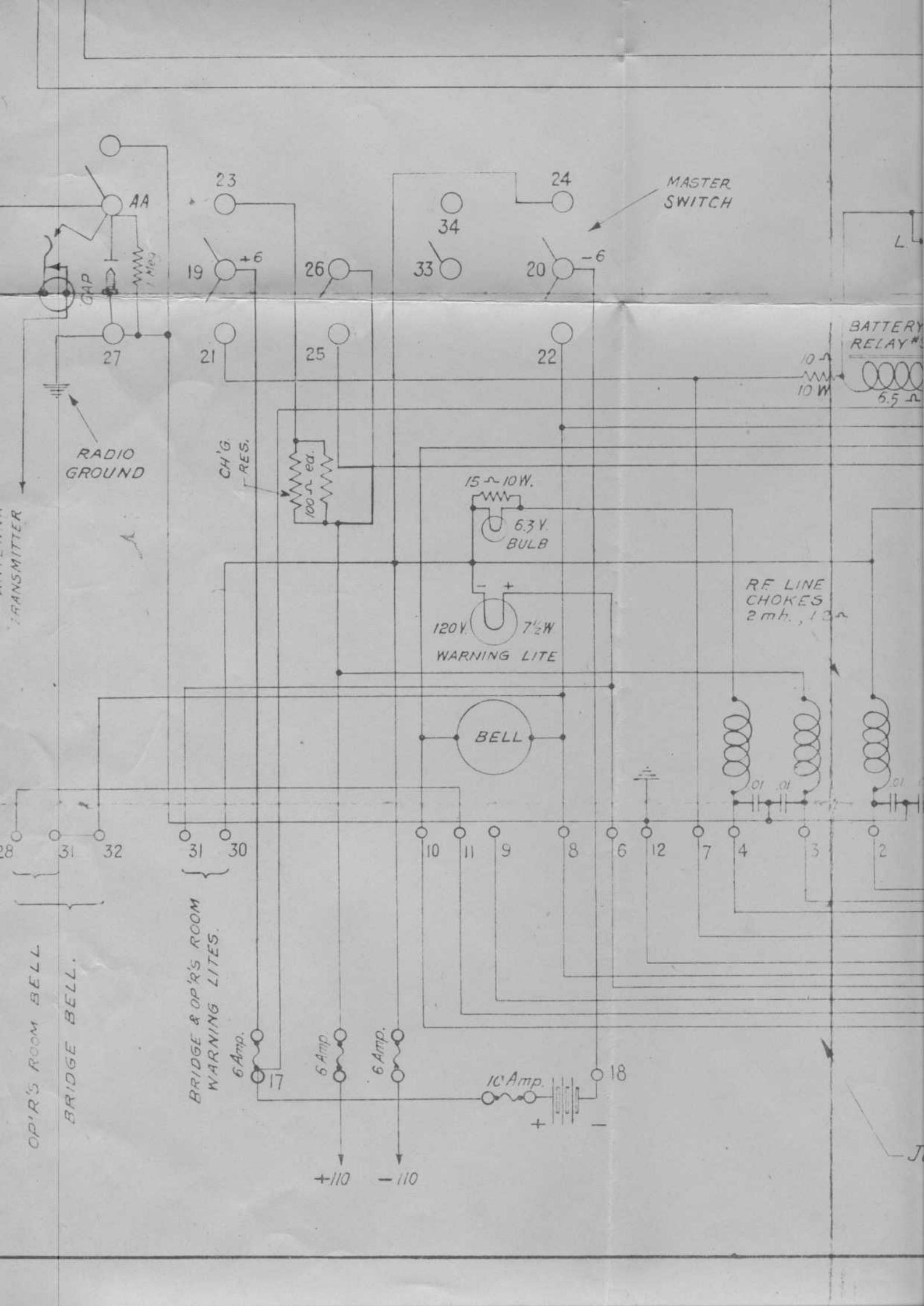
DEPARTMENT OF TRANSPORT

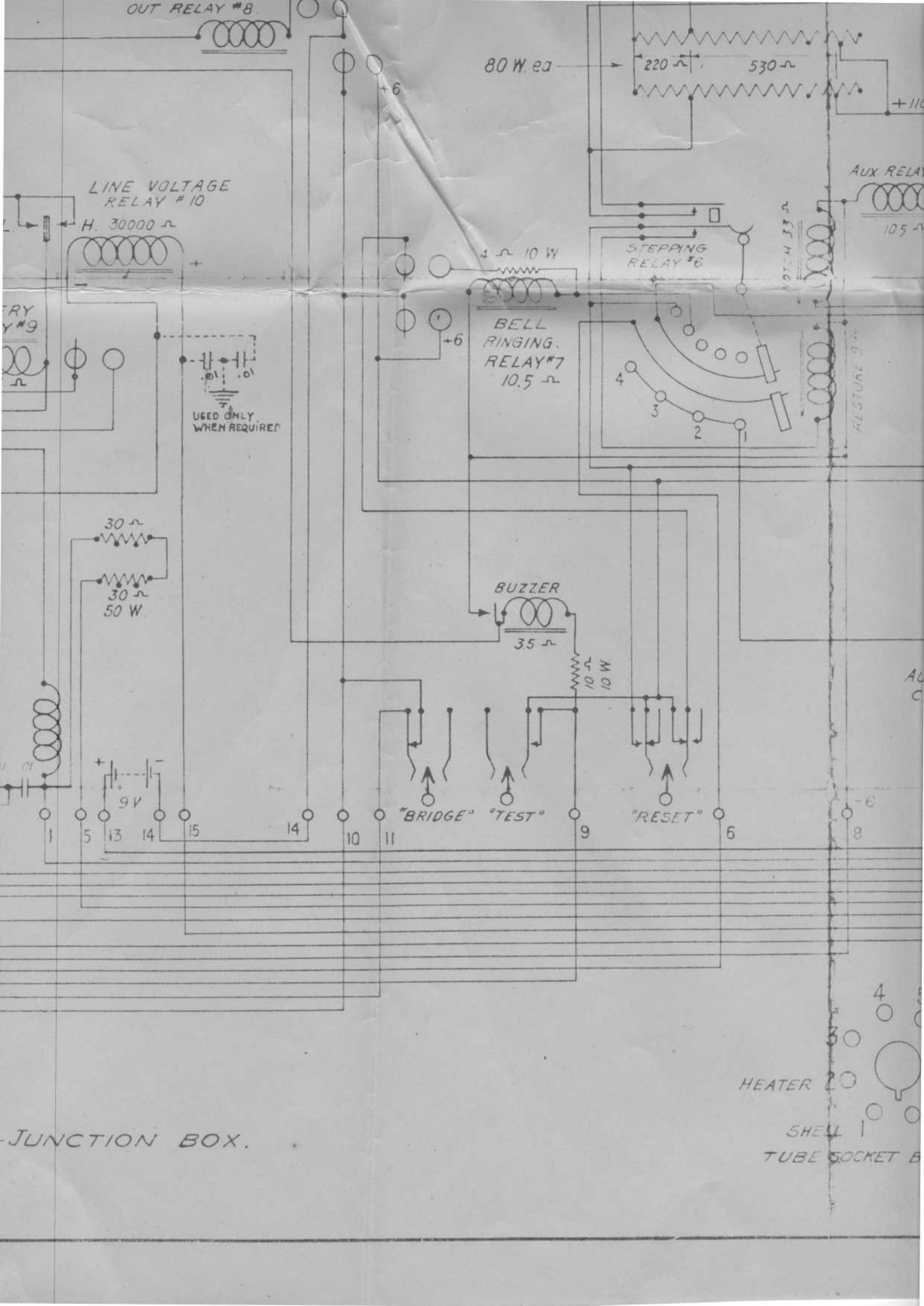
RADIO DIVISION

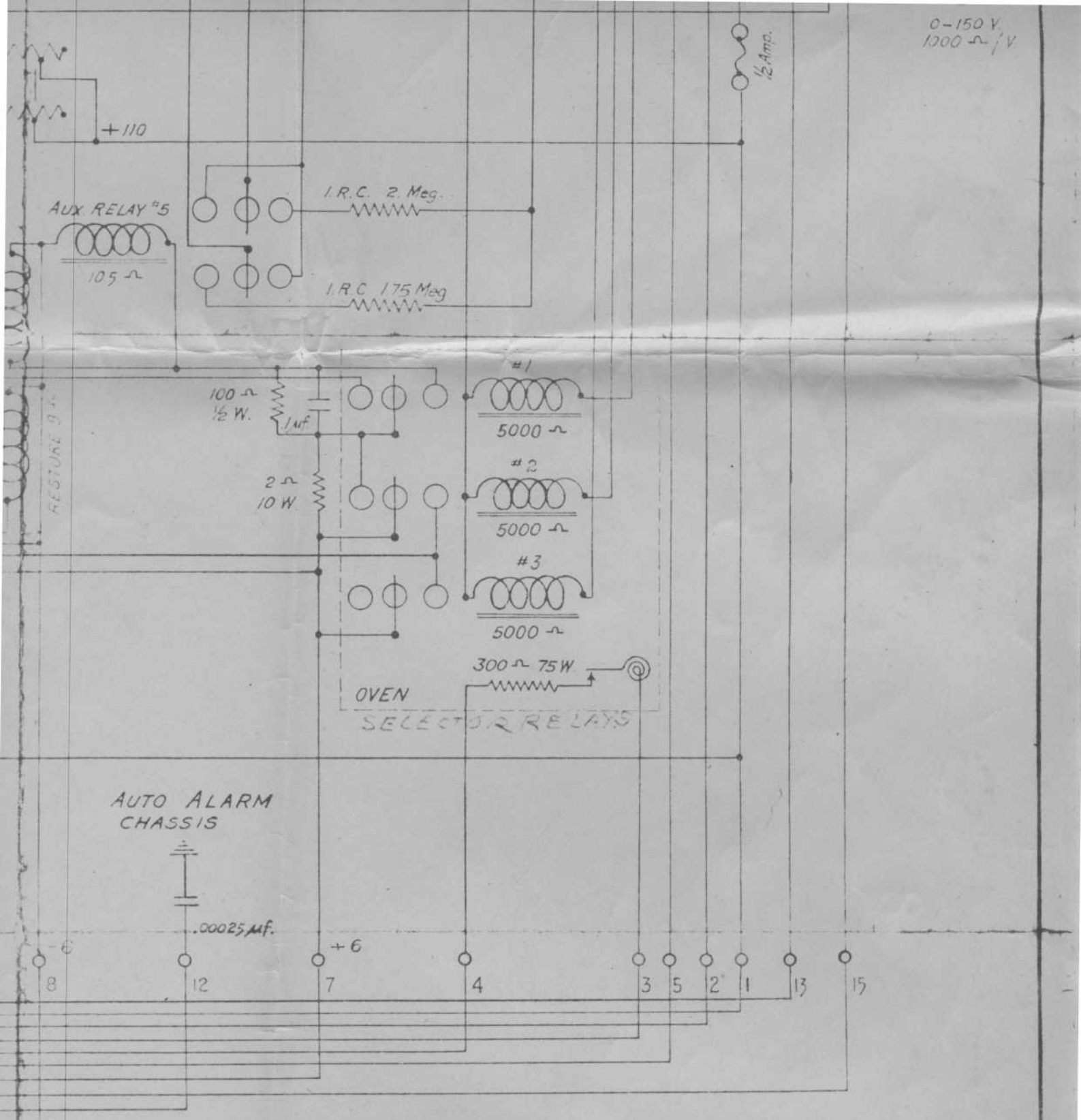

SELECTOR #2
RCA 1611
SELECTOR #3
RCA 1611
CURRENT SWITCH
MA
0-15 MA
25 Ω 1 W. } ea
50 M Ω ½ W. ea.
VOLT REG.
RCA. 1611
2 μf.
1 μf.
I.R.C. 5 Meg
25 M.
2 M.
2 M.
I.R.C. 2 Meg.
2M
2M.
2M
65M.
I.R.C ½ W
I.R.C 150 M ½ W.
V.
0-150 V.
1000 Ω / V
½ Amp.
530 Ω
+110
AUX. RELAY #5
105 Ω
I.R.C. 2 Meg.
I.R.C 1.75 Meg
100 Ω ½ W.
1 μf.
2 Ω 10 W.
#1
5000 Ω
#2
5000 Ω
#3
5000 Ω

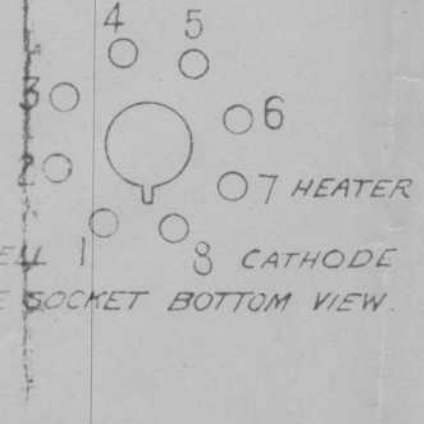

R.C.A. 1611
2ND I.F. AMP. 6K7
PHONES
.01
.01
DET. 6H6
SELECTOR #1 R.C.A. 1611
SIGNAL RELAY #4
3200 Ω
50 M. Ω ½ W.
1 Meg ½ W.
White
Blue
1100 KC.
White
Black
Red
Black
.5 Ω ½ W
1 μf ea
1 Meg ½ W.
.00025
10 hy 80 Ω
4 μf.
4 μf.
80 Ω 80 W.
600 Ω 10 W.
+110
−110
TUBE HEATER BURN-OUT RELAY #8.
80 W. ea
220 Ω
+6
LINE VOLTAGE RELAY #10
L
H. 30000 Ω
1 Ω 10 W
STEPPING RELAY #6
BATTERY RELAY #9
10 Ω 10 W
6.5 Ω
.01
.01
USED ONLY WHEN REQUIRED
+6
BELL RINGING RELAY #7 10.5 Ω
4
3
2
1
30 Ω


1100 KC. TRAP
Blue
.00005 µf.
500 KC.
.0001 µf.
MIXER-OSC. 6A8
White
Blue
1100 KC.
White
1ST. I.F. AMP. 6K7
Blue
1100 KC.
White
BUZZER COUPLING WIRE
½ W. 250 Ω
.1 µf.
Black
White
Blue
25 M Ω
½ W
Red
Black
500 Ω ½ W.
50 M Ω
.00025 µf.
.01
100 µh.
70 µh.
1600 KC.
1 µf. ea
.1 µf ea
100 M Ω
100 M Ω
10 M Ω
Red
AA
GAP
23
24
MASTER SWITCH
34
19
+6
26
33
20
-6
27
21
25
22
10 Ω
10 W
RADIO GROUND
CH'G. RES.
100 Ω ea.
15 Ω 10 W.
6.3 V. BULB
ANTENNA
RF LINE


AA
23
24
MASTER SWITCH
34
19
+6
26
33
20
-6
GAP
1 Meg
27
21
25
22
BATTERY RELAY
10 Ω
10 W
6.5 Ω
RADIO GROUND
CH'G. RES.
100 Ω ea.
15 Ω 10 W.
6.3 V. BULB
RF LINE CHOKES
2 mh., 1
120 V.
7½ W
WARNING LITE
BELL
.01
.01
.01
28
31
32
31
30
10
11
9
8
6
12
7
4
3
2
OP'R'S ROOM BELL
BRIDGE BELL.
BRIDGE & OP'R'S ROOM WARNING LITES.
6 Amp.
6 Amp.
6 Amp.
17
10 Amp.
18
+
-
+110
-110


OUT RELAY #8
80 W. ea
220 Ω
530 Ω
+6
LINE VOLTAGE
RELAY #10
H. 30000 Ω
4 Ω 10 W
STEPPING
RELAY #6
BELL
RINGING.
RELAY #7
10.5 Ω
+6
.01
.01
USED ONLY
WHEN REQUIRED
30 Ω
30 Ω
50 W
BUZZER
35 Ω
.01 MFD
9V
"BRIDGE"
"TEST"
"RESET"
1
5
13
14
15
14
10
11
9
6
8
HEATER
JUNCTION BOX.





Sub. 5 10-4-37 Corrections

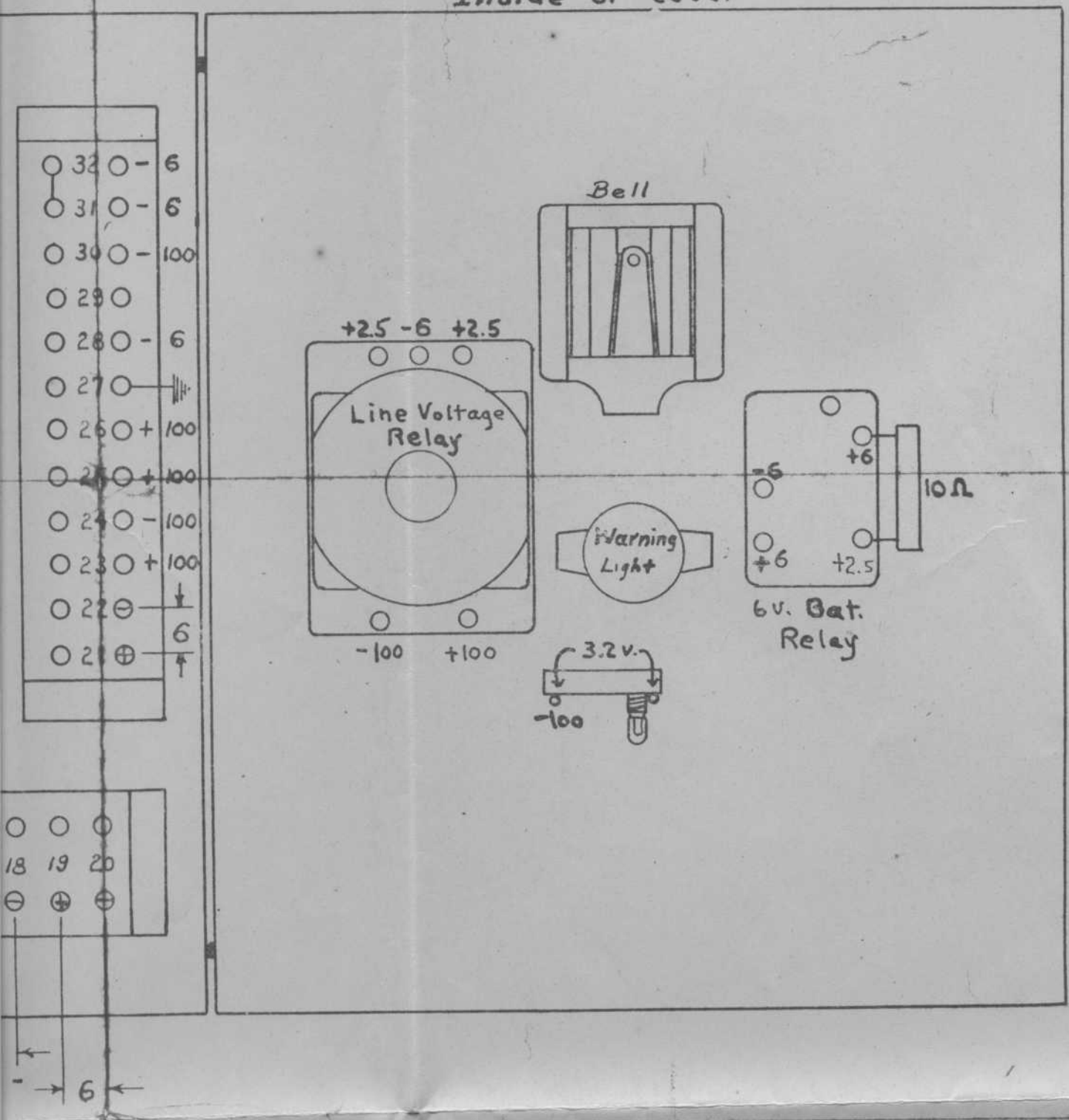
AUTO ALARM
SCHEMATIC AR-8600.

RADIOMARINE CORP. OF AMERICA

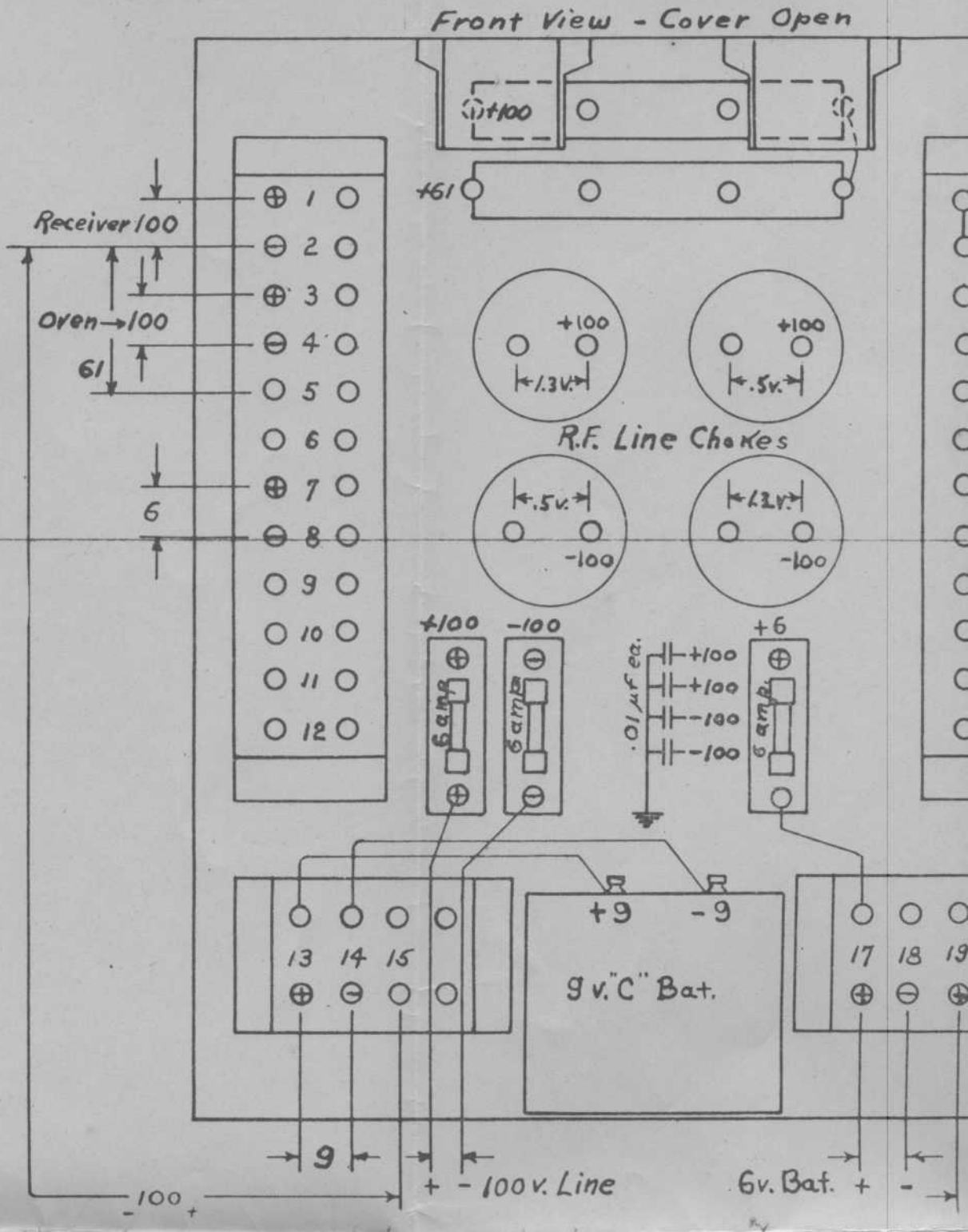
DEPARTMENT OF TRANSPORT

RADIO DIVISION

TION BOX

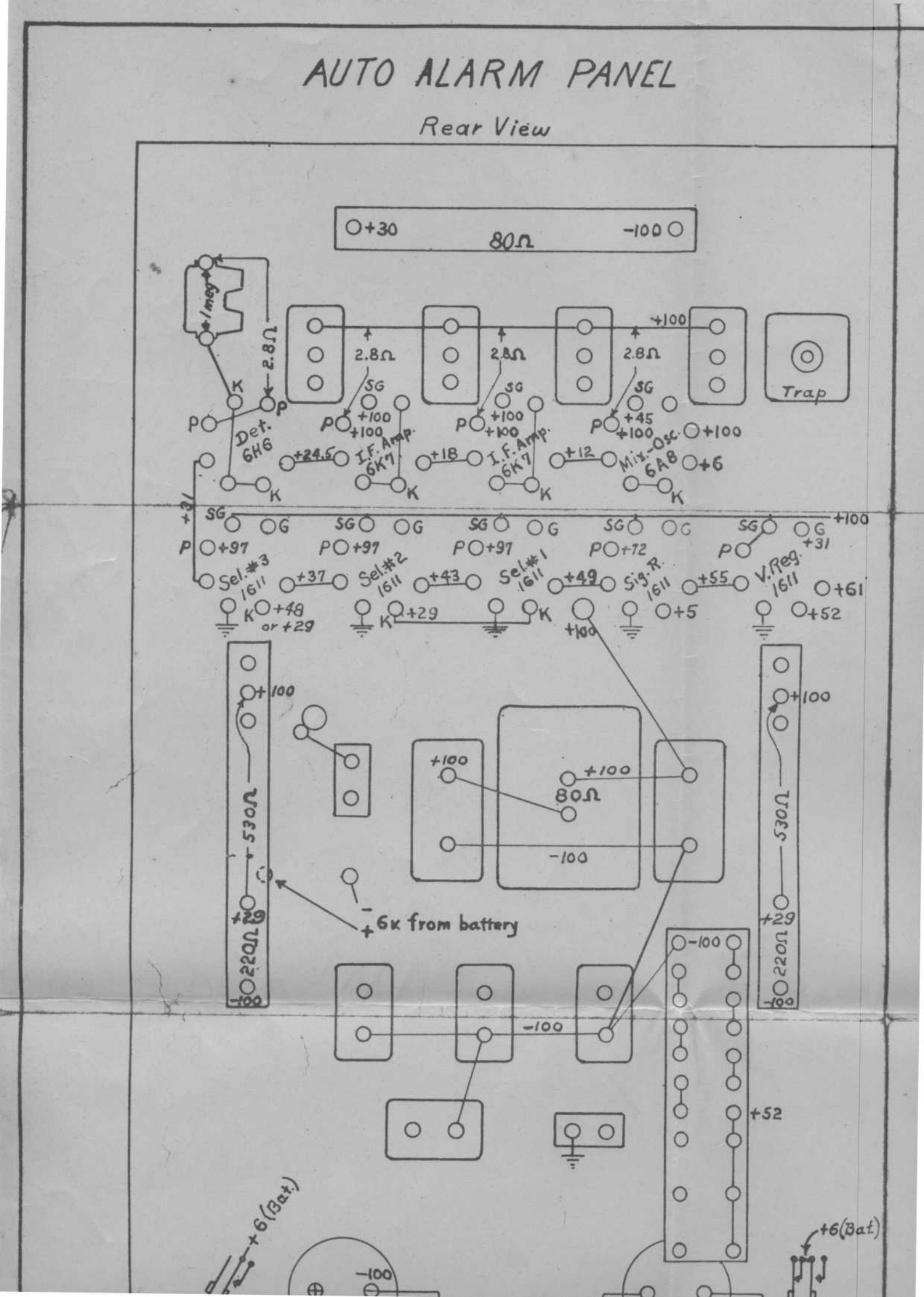

Inside of Cover
32 - 6
31 - 6
30 - 100
29
28 - 6
27
26 + 100
25 + 100
24 - 100
23 + 100
22 ⊖
21 ⊕
6
18 19 20
⊖ ⊕ ⊕
-
6
Bell
+2.5 -6 +2.5
Line Voltage Relay
-100 +100
Warning Light
3.2 v.
-100
-6
+6
+6
+2.5
10 Ω
6 v. Bat. Relay

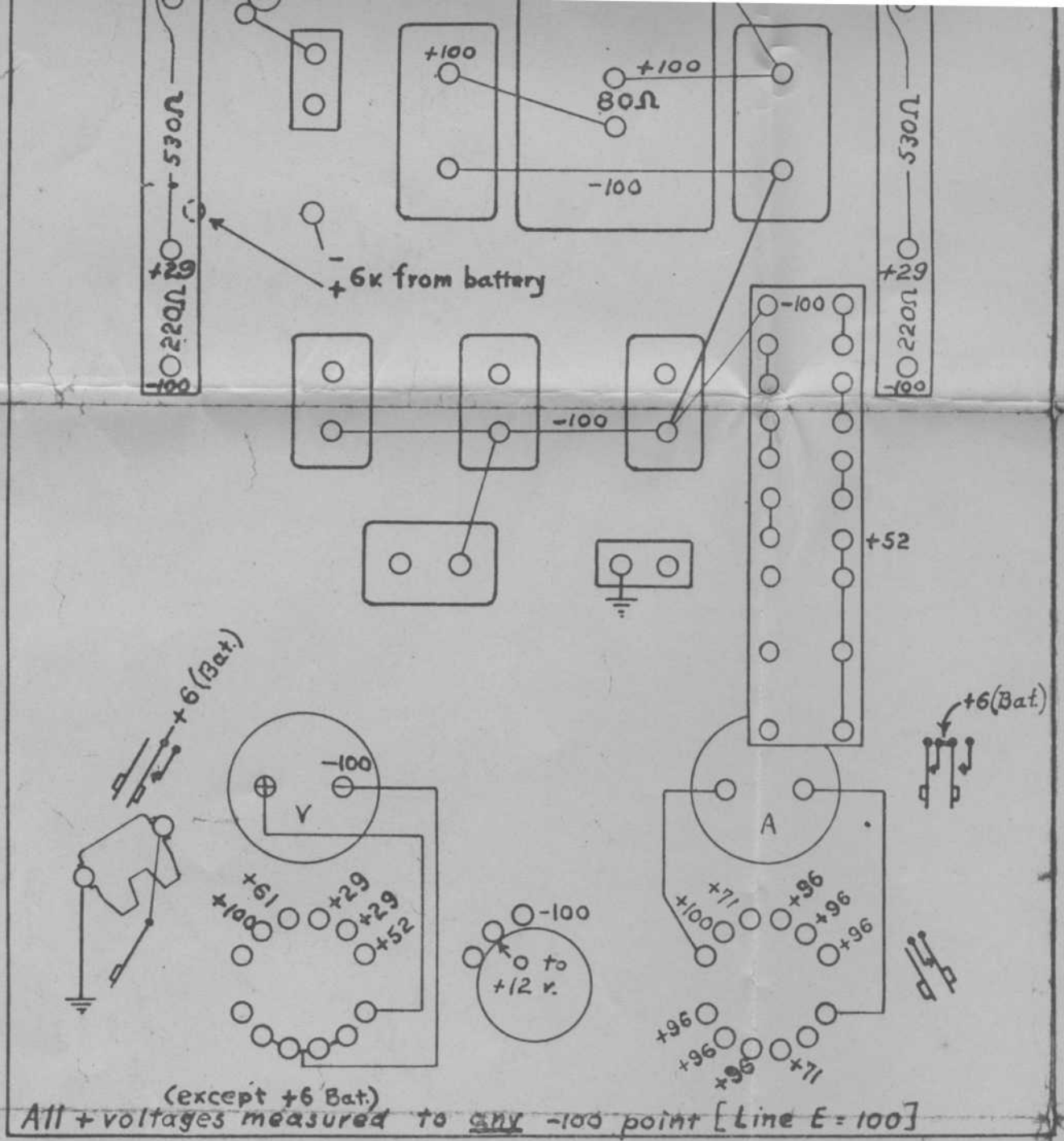
AUTO ALARM JUNCTI



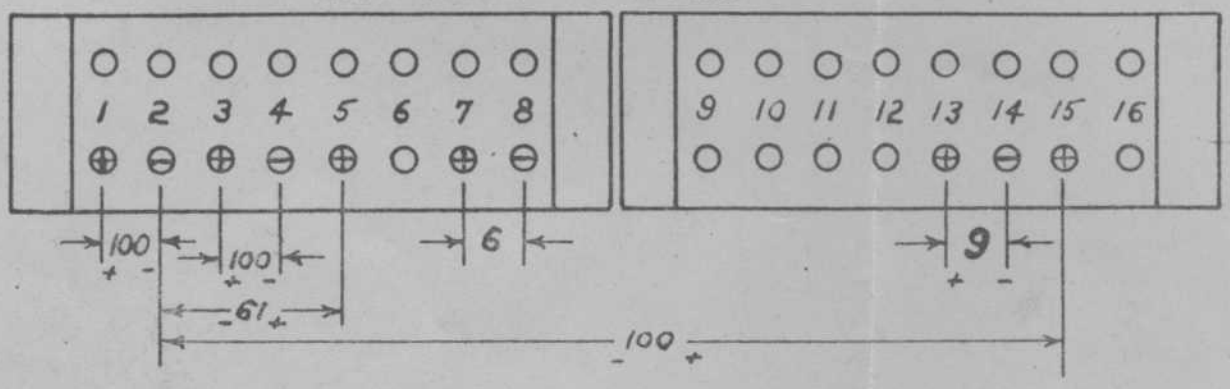
AUTO ALARM PANEL

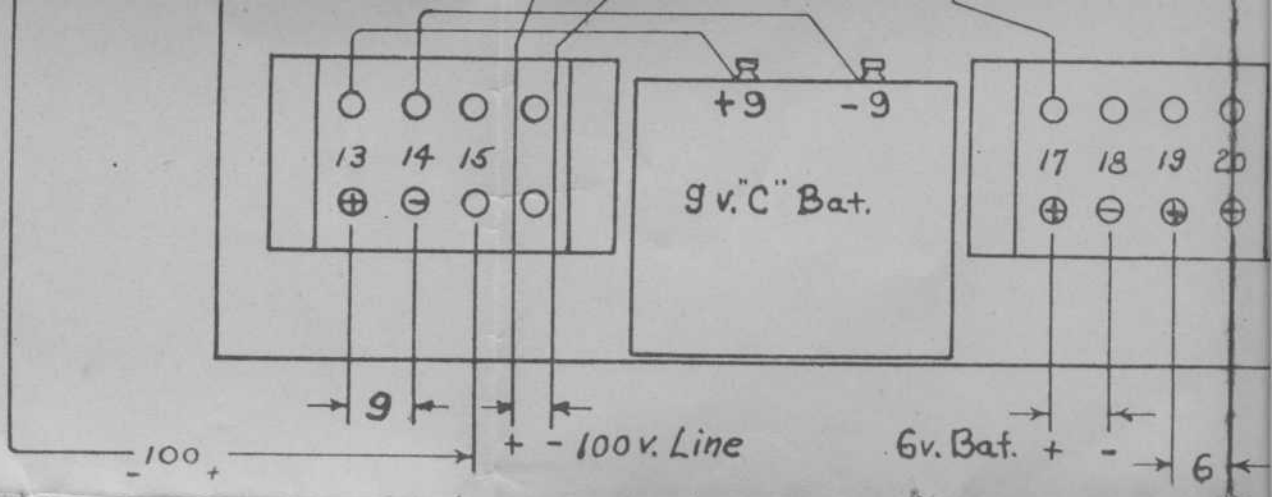
Rear View





Auto Alarm Terminals




13 14 15
+9 -9
9 v. "C" Bat.
17 18 19 20
9
+ - 100 v. Line
- 100 +
6v. Bat. + -
6

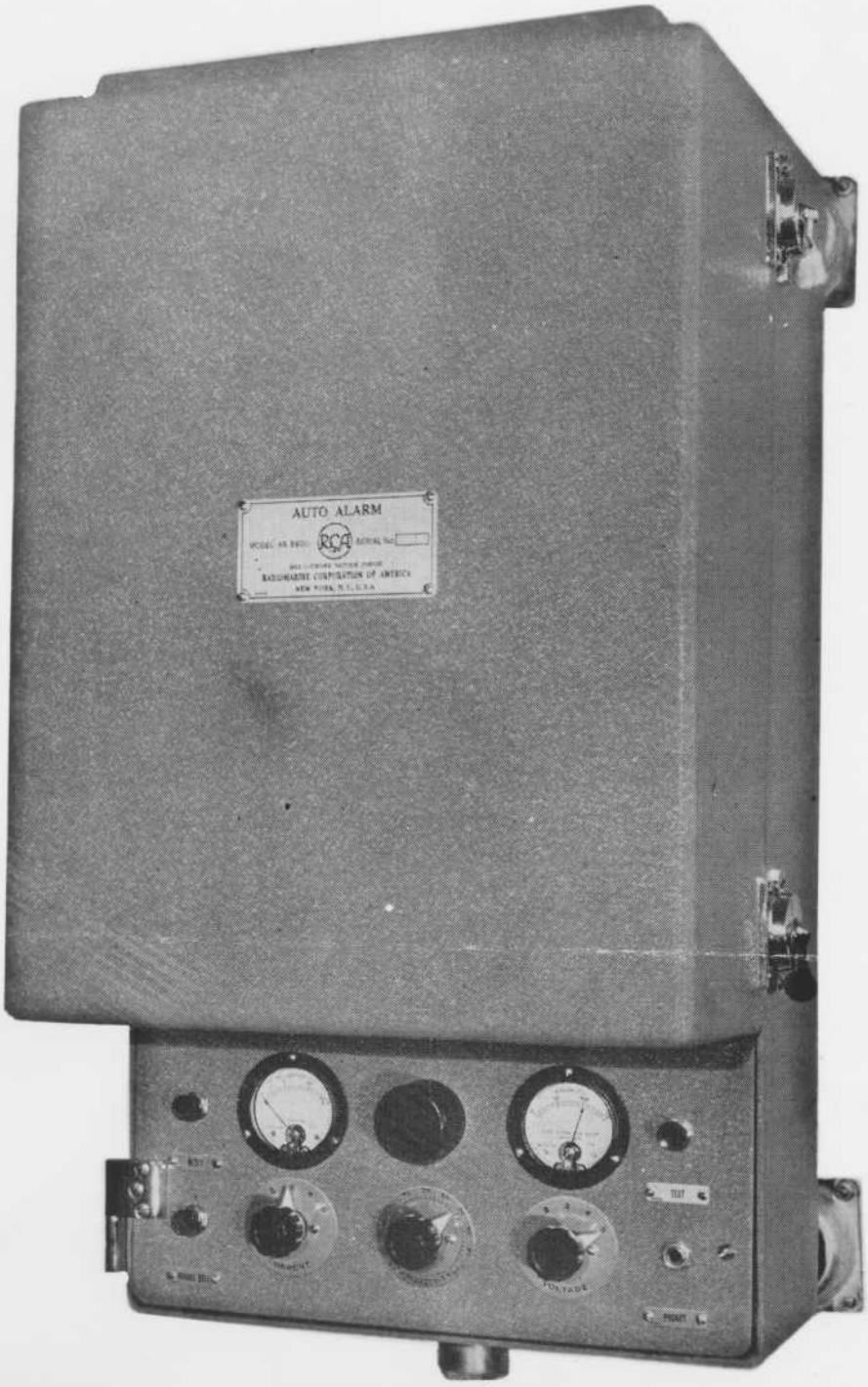
AUTO ALARM AR-8600
VOLTAGE ANALYSIS DIAGRAM

RADIOMARINE CORP. OF AMERICA

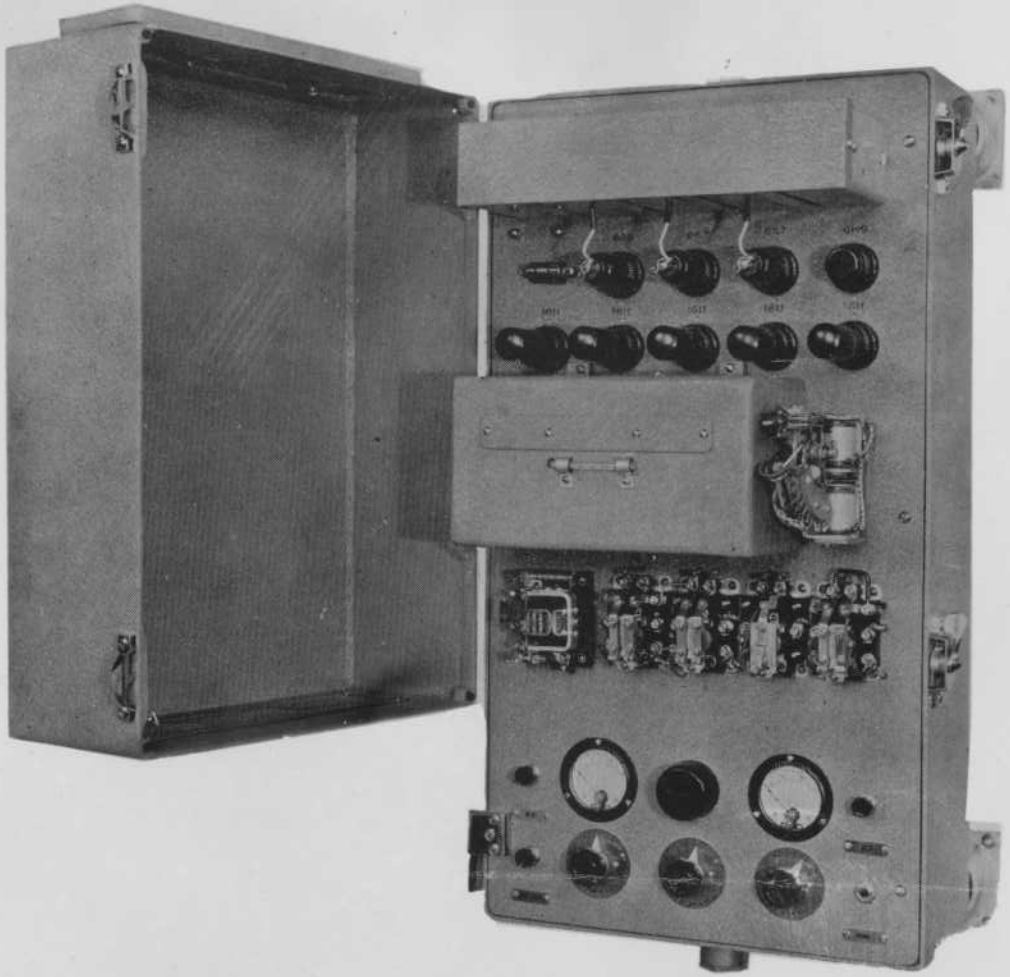
DEPARTMENT OF TRANSPORT
RADIO DIVISION


C-3

No. 1. Auto-Alarm with cover closed.



No. 1. AQB-11 with cover opened.



No. 3. Auto-Alarm Switch