JOHN'S JUKES
4234 MAIN STREET
VANCOUVER, B.C. V5V 3P9
872-5757

INTRODUCTION

The intention of the procedures outlined on the following pages is to enable people who may not be familiar with Seeburg Phonograph amplifiers to do the majority of repairs on these amplifiers. Experience shows that over 90% of the breakdowns that occur, involve the same components. This makes the establishment of a fixed diagnostic routine attractive and feasible.

People who make use of this routine need have only a reasonable familiarity with the "work-horse" of the diagnostic tools in the electronic field, the ohmmeter.

The first part of this outline deals with the use of an ohmmeter as a transistor tester. It is recommended that some practice in these test procedures be had by using the ohmmeter on known good transistors.

The next two sections involve themselves with the Seeburg amplifiers. The routines described there are crude when compared to the procedures laid out in the appropriate service manuals; these routines are not meant to invalidate those found in the manuals. As the saying goes, "if it doesn't work, consult the instructions". However, crude as they may be, the directions on the following pages will help solve the great majority of amplifier problems.

Tube-type amplifiers are not discussed, since semiconductor principles are only marginally involved in them, they are also a vanishing breed.

At the end of this manual you will find a list of transistors which can be used as substitutes for the original Seeburg parts. One or the other of the substitutes should be available at local electronics distributors. Bear in mind that these are to be used only if our parts department does not have or carry these particular items. Some of the transistors mentioned should be replaced as complementary and/or matched pairs, they carry an asterisk (*).

Finally, the basic symbols for the major components of amplifiers are shown on the last page.

USE OF REGULAR (VOM) OHMMETER

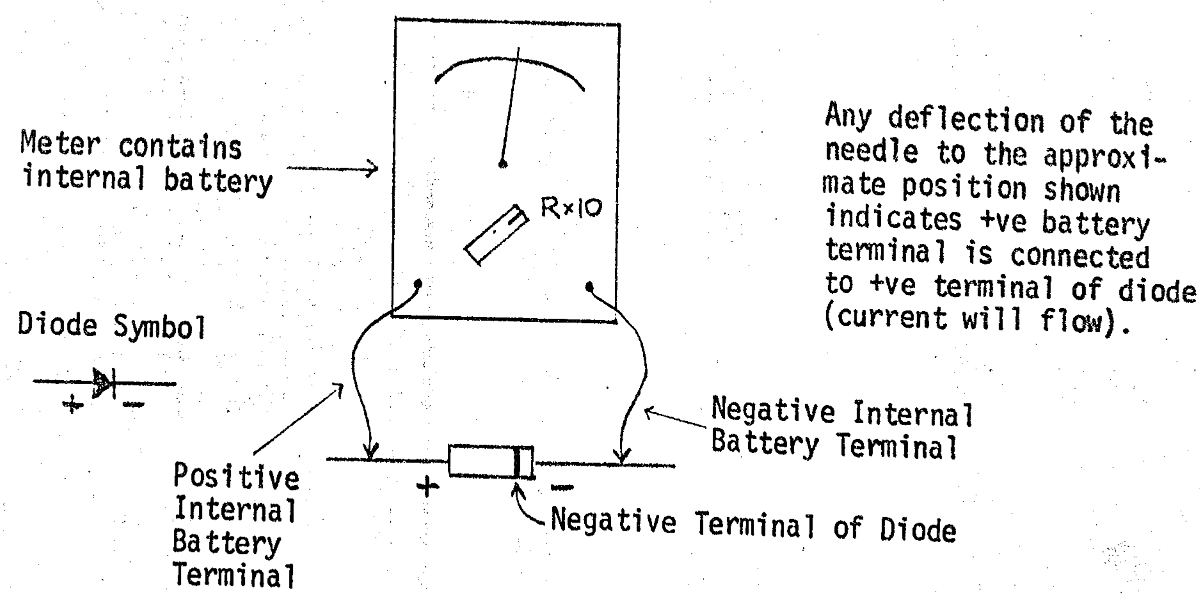
For Testing Semiconductor Devices

(NPN and PNP Bipolar Transistors
and Signal or Power Diodes)

In this test, use is made of the internal battery supply of the VOM. In order to limit the current through the devices being tested, the X10 setting on your VOM ohm range should be used. All tests described here are done with the device being tested out of circuit, i.e., no other components are connected to it.

It is important to realize that the markings (indicating polarity) for the testleads located next to the testlead terminals on your meter may not mean what they say in this test procedure. Depending on the internal construction of your meter, either the + (positive) or - (negative) terminal of the internal battery of your meter may be connected to the testlead marked + on the meter housing. Since it is important to know the polarity of the power applied to the device under test, determination of the internal arrangements of the meter can be made this way:

FIG. 1



If no deflection is observed, reverse the testlead connections to the diode. Once determination of internal polarity connections has been made, the knowledge gained will enable you to know the polarity of the power applied to the device being tested. This may show that the markings on the meter housing are opposite to this result.

For the purposes of testing semiconductor devices out of circuit only, disregard the polarity markings on your meter. When testing amplifiers and other electronic units with power applied (i.e. when testing for voltages and currents) the polarity markings are valid, since the internal battery of your meter is not used for these tests. Test that make use of resistance (ohm) ranges being made on amplifiers and other units must be made without power being applied to the units under test.

POWER TRANSISTORS

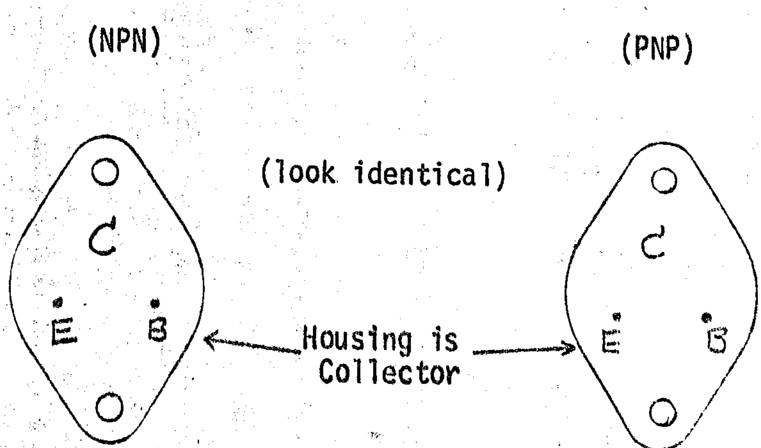


FIG. 2A

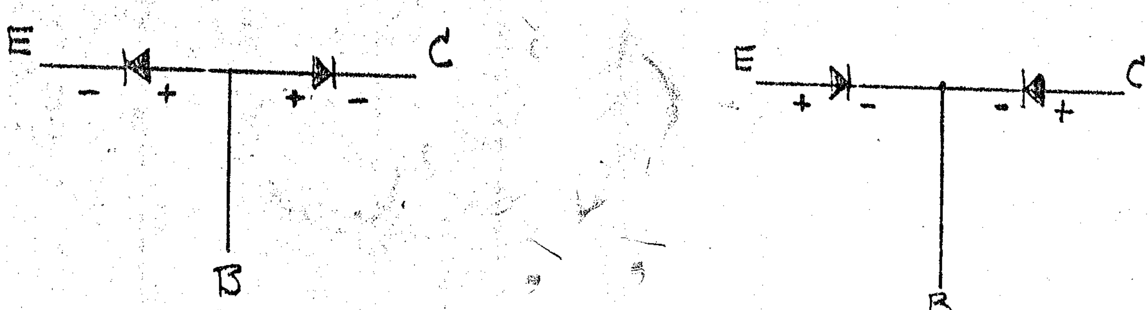
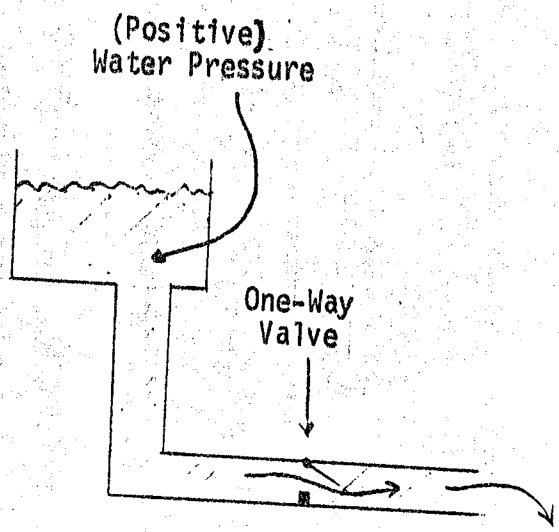
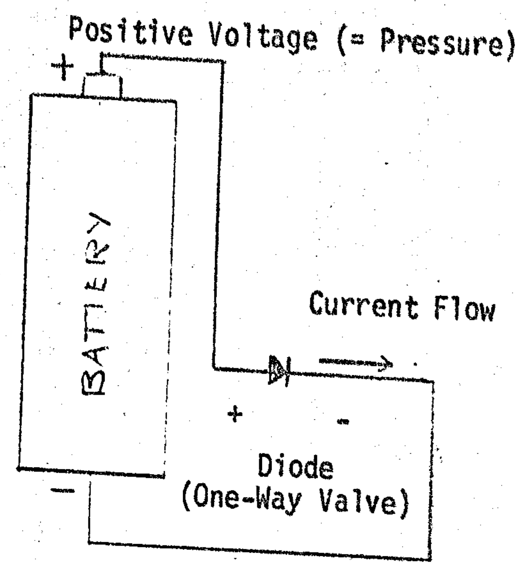


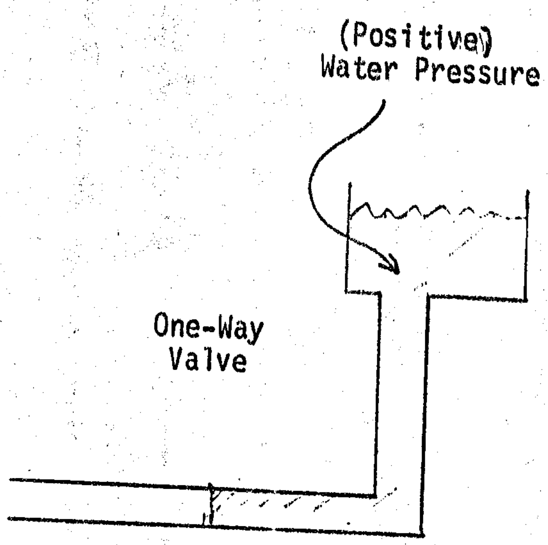
FIG. 2B

A word here for those who may not know the function of a diode. A diode is a device which allows current to flow only in one direction and block it in the opposite direction. The drawing below may help if compared to the "waterflow" concept.

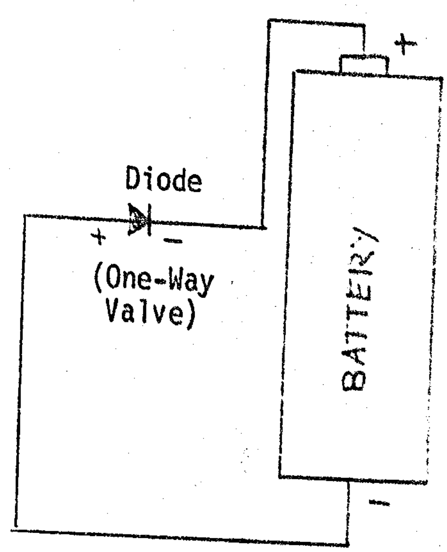


Current Flow





No Current Flow



No Current Flow

If "positive" battery terminal is connected to "positive" diode terminal, current will flow. If "negative" battery terminal is connected to "positive" diode terminal NO current will flow.

Figure 2A shows the connections of power transistors, which are called emitter (E), base (B) and collector (C). These are names that have their meaning derived from the operational aspects of the transistors. For the purpose of the tests that use the ohmmeter, the internal construction of a transistor can be visualized as shown in Figure 2B. This shows two diodes connected such that either their + (positive) or - (negative) terminals are connected together. It is obvious that each "diode section" of a transistor can be tested separately in the same manner as a single diode (see Figure 1). If the + battery terminal of your meter is connected to the +terminal of a diode and the - terminal of your meter battery to the - terminal of that diode, a current will flow, resulting in the meter needle registering some low resistance value. It is also obvious that, if your meter leads are reversed, none or very little current will flow, with a reading on the meter suggesting high resistance.

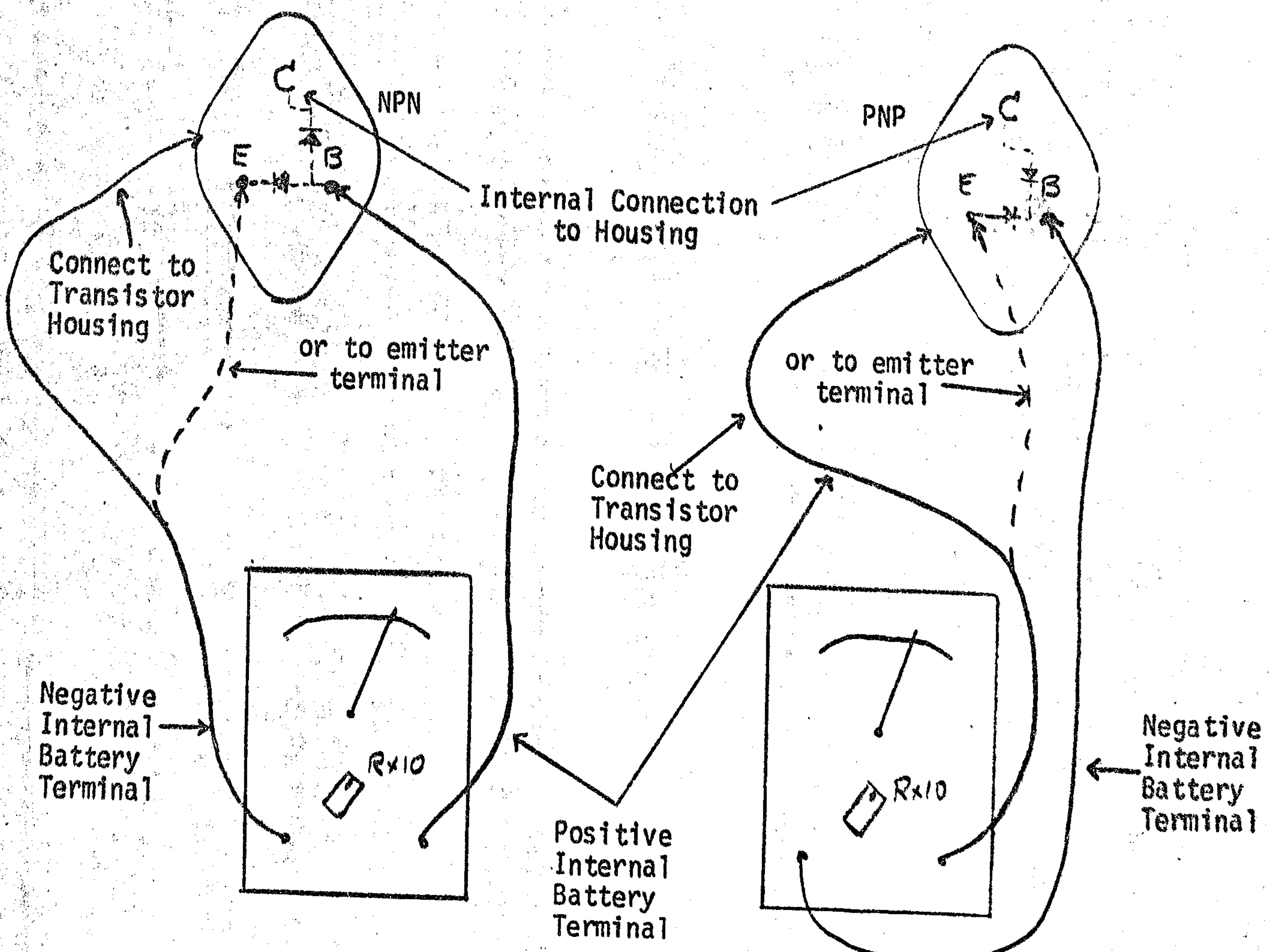


FIG. 3A

FIG. 3B

As shown in Figure 3 (A and B), the meter will register some low resistance reading (between 50 and 200 ohms, if using the X10 scale resistance position on your meter).

The real test of transistors is the "reverse polarity" test. This means that the test leads of your meter are connected in a fashion that should result in very high resistance readings (that is to say, for an NPN transistor the -ve battery terminal connected to the base and the +ve battery terminal connected to either emitter or collector). If you have low resistance readings with both the "proper" and "improper" hook-up, the transistor is faulty and must be discarded. Also note that there should never be anything but high resistance readings when connecting your meter between emitter and collector of any transistor type; this should be true irrespective of which polarity lead is connected to the emitter or collector. A low resistance reading of any kind between these two connections also indicates a faulty transistor, (this is by far the more common fault in power transistors).

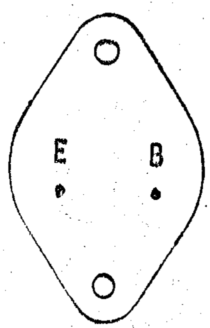
"Reverse polarity", also called leakage tests, are meaningful only with the transistors being tested disconnected from any other circuit components. "In circuit" leakage tests may be influenced by the presence of these components if they are connected to the transistor under test.

There are two precautions to be mentioned: The test procedure described here should never by used on CMOS or Mosfet devices. These are so sensitive that even the relatively low voltages inherent in ohmmeters could cause them to break down. In this connection, the use of ohmmeters which use a 9-volt battery is also discouraged, since silicon transistors have a "reverse" breakdown rating of approximately 5-volts between emitter and base.

Some Pin Configurations (Seeburg Amplifiers) For Common Transistors

Found In

(1)

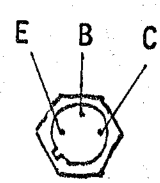


Housing is Collector

POWER (Output) TRANSISTORS

TSA1, up to and including all SHP amplifiers.

(2)

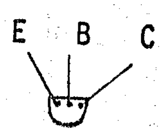


Housing is also Collector

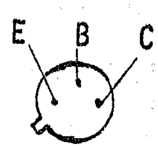
DRIVER TRANSISTORS

TSA1 to TSA10, inclusive

(3)



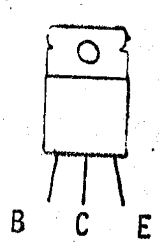
(4)



SIGNAL (Small) TRANSISTORS

TSA1 to SHP, inclusive

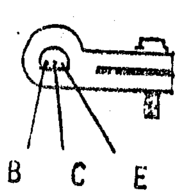
(5)



DRIVER TRANSISTORS

SHP1 to SHP4

(6)



BIAS TRANSISTOR (located under heatsink for power transistors)

SHP1, SHP2

AN APPROACH TO DIAGNOSING FAULTS IN SEEBURG AMPLIFIERS

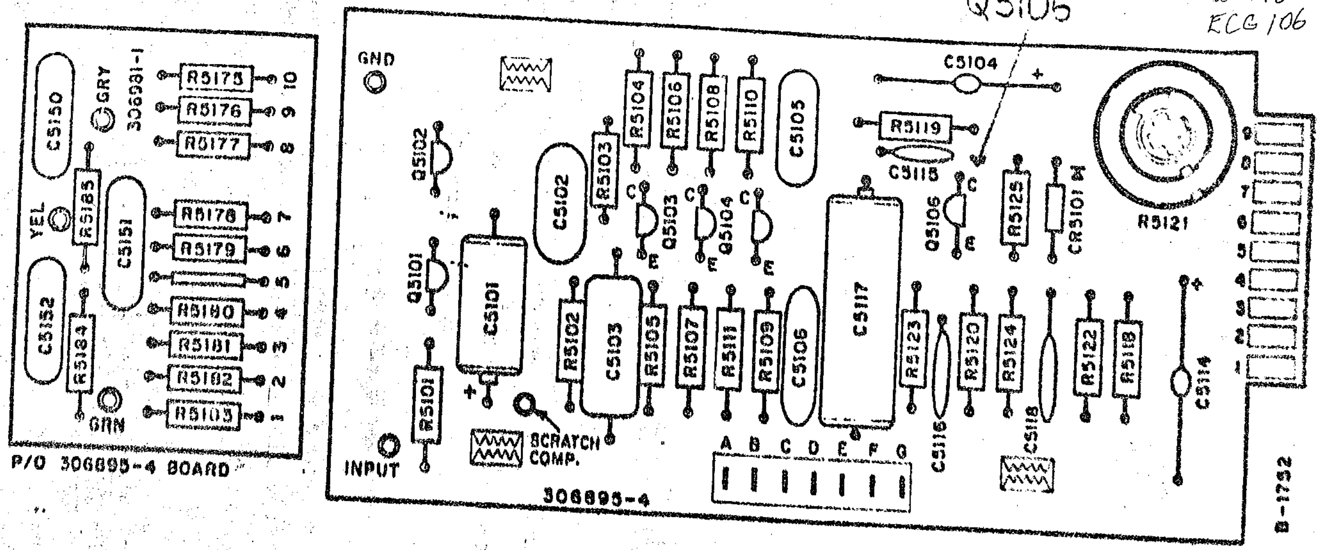
Section (1) TSA1 to TSA10

These amplifiers use a negative polarity, single rail (unbalanced, positive ground) power supply. As a consequence, most transistors found in these amplifiers are of the PNP type.

The output stages of all transistorized Seeburg amplifiers are of the so-called "Quasi-complementary" configuration, which means that the output transistors (located on the large heatsink mounted on top of each amplifier) are either all PNP or all NPN, depending on the model. For all TSA series amplifiers the output transistors are PNP (see Figure 4B). As a matter of fact, the output transistors are identical for TSA1 to TSA10, inclusive; the differences among these amplifiers are confined to output power ratings and the use of circuit boards as opposed to handwired arrangements. From an operational point of view, they differ very little.

The most common fault in TSA series amplifiers is the shorting of the output transistors between emitter and collector. An unfortunate consequence is a chain reaction of breakdowns in associated components, because of the necessary non-isolated, direct coupling arrangements in the power stages. It is therefore useful to establish a routine to test all the components which may possibly be faulty as the result of such a condition. With this in mind, the procedure laid out on the following pages should be adhered to (this is a no-power procedure, the amplifier under test is not plugged in).

Q5105 (309437) 2N4061 2N4980 ECG 106



Voltage Amplifier Control Circuit Board.

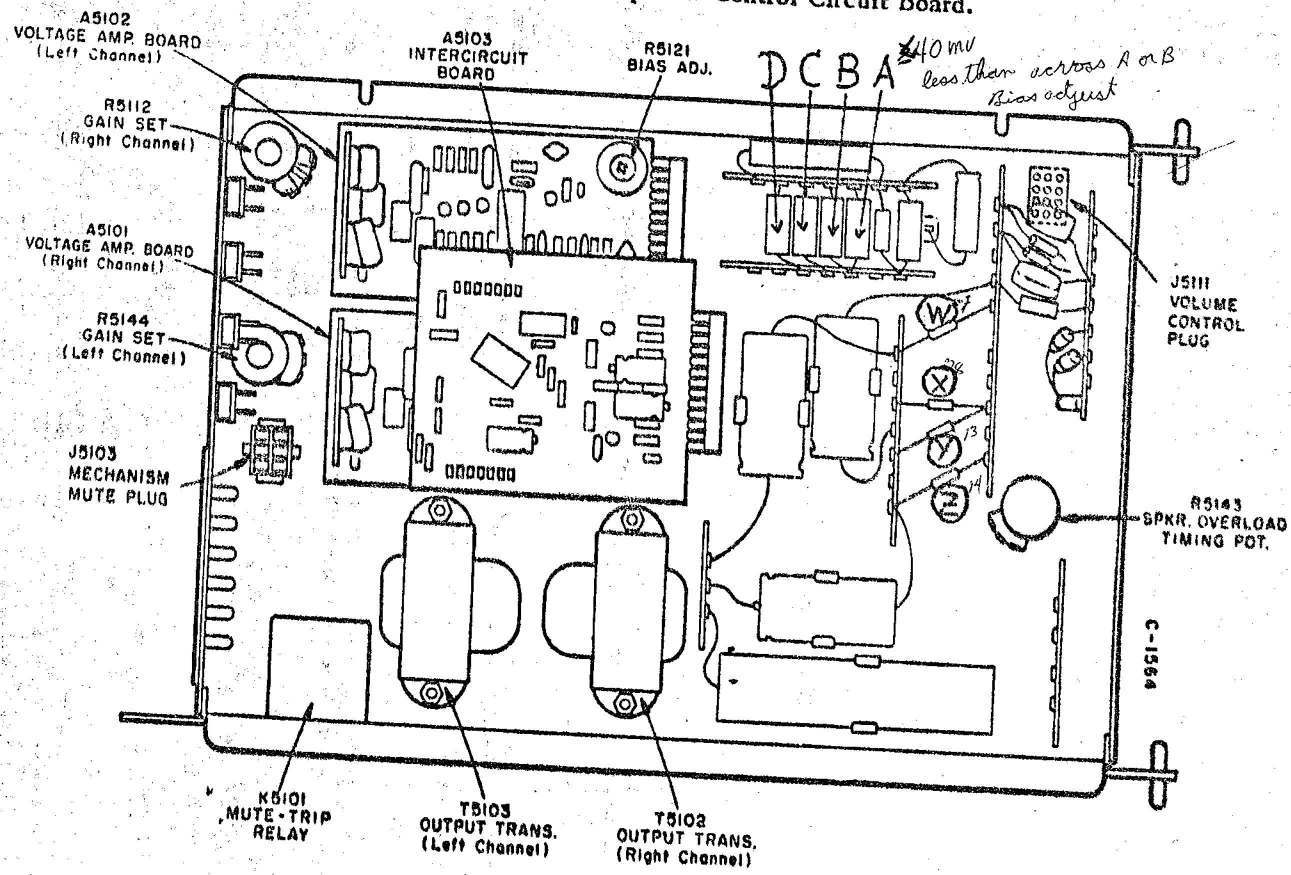
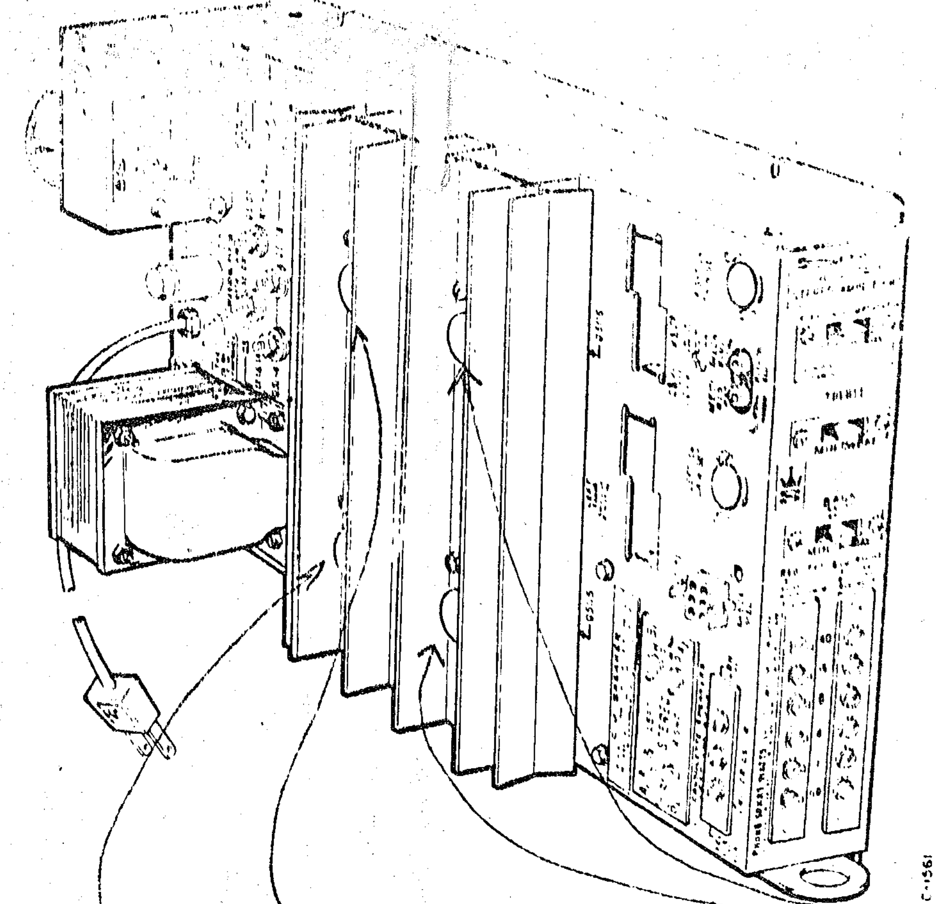


FIG. 4 A

Parts Location Detail - Bottom View.

W	Q 5107	(309429)	2N1131	EGG	129
X	Q 5108	(309430)	2N3295	ECG	128
Y	Q 5113	(309429)	2N1131	ECG	129
Z	Q 5114	(309430)	2N3295	ECG	128



Solid State Stereo Amplifier, Type TSA8.

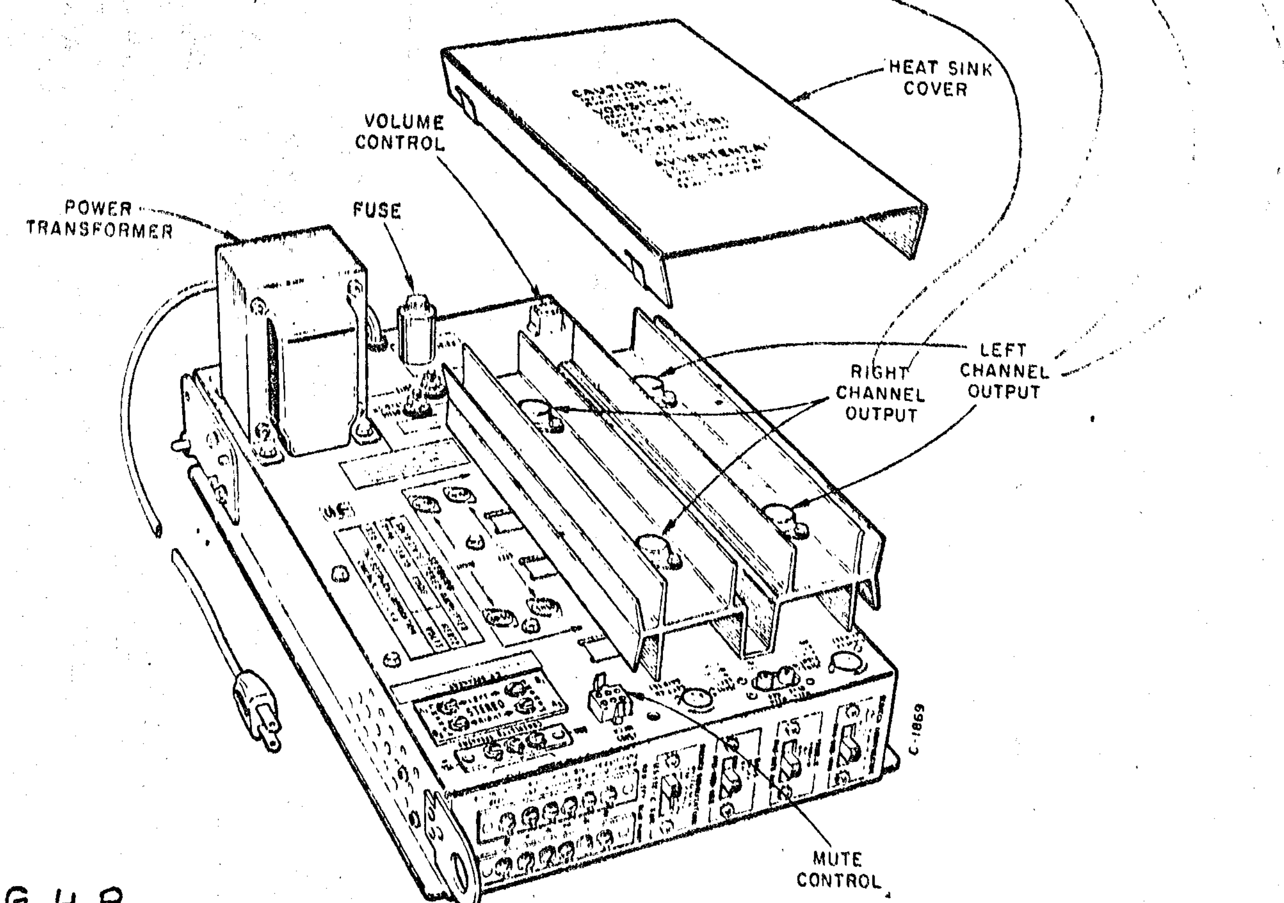


FIG. 4 B

Solid State Stereo Amplifier, Type TSA10.

NO-POWER Procedure for Finding Faulty Transistors

(TSA Series Amplifiers)

1. Remove output transistors and test according to Figure 3B (PNP type).

   Check for low resistance reading between collector and emitter. A reading of less than 3,000 ohms between these two transistor connections (on the X10 resistance scale on your meter) indicates excessive leakage. Discard transistor.

   Next, use the "reverse polarity" test between emitter-base and then collector-base. There should be no perceptible reading on the meter.

2. Inspect resistors W,X,Y,Z to see if they are burned out. This will indicate faulty driver transistors. (Note that these transistors can be faulty with the resistors not having been subject to excessive currents.) Disconnect any burned resistors. (Refer to Figure 4.)

3. With your ohmmeter on the X1 scale position, measure the resistances of resistors A,B,C,D, (Figure 4). They should read less than 1 ohm. Some meters will show zero ohms (short circuit). A reading of more than 1 ohm means the resistor is open and must be replaced.

4. Test the driver transistors with your meter on the X10 scale position (refer to Figures 3A and 3B). There are 2 NPN and 2 PNP driver transistors. They can be tested "in circuit". However, bear in mind that "reverse polarity" tests are not meaningful with transistors still connected to the circuit. The "correct polarity" tests are useful, however, as in transistor layout shown in Figure 5.

Resistor Values

W - 75 ohms
X - 33 ohms
Y - 33 ohms ¼W
Z - 75 ohms

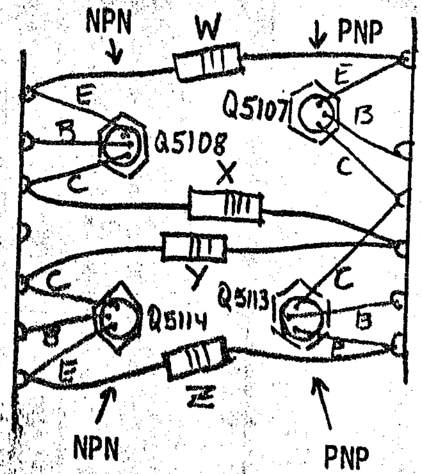


FIG. 5

DRIVER TRANSISTOR LAYOUT
(TSA6 - TSA10)

EXAMPLE:

Connect ohmmeter testlead leading to negative battery terminal of your ohmmeter (read page 2) to base (B) of Q5107. Connect the other lead (+ve battery terminal) first to E and then to C (of Q5107). There should be a reading of approximately 150 ohms (scale X10) for each reading. Readings much below this value indicate shorts; above this value they indicate open internal connections. Repeat this procedure for Q5113 and following instructions on page 4, for Q5108 and Q5114 (Figure 3A). Any suspected transistors should be disconnected from the circuit and tested on their own.

5. Test transistor Q5106 (PNP type). This transistor controls the bias currents to all the transistors in the output stages mentioned above. Replacing all transistors will do no good unless Q5106 is either found to be in good condition, or, in the other case, is replaced. A fault in this transistor will cause all other replaced transistors to blow again. Note that there are two voltage amplifier boards. Q5106 is located on each one, that is, there are two transistors marked Q5106. Test both. (Remember, this is a stereo amplifier, i.e. two amplifiers in one, (refer to Figure 4A).)

6. The above procedure will detect 99% of the usual faults in the TSA series amplifiers. Faults occurring in the circuits involving transistors Q5101 to Q5105 will not normally cause burnouts in the power (output) stages. Faults in these stages can be isolated by tracing signals injected at appropriate points or substitution of suspected voltage amplifier boards.

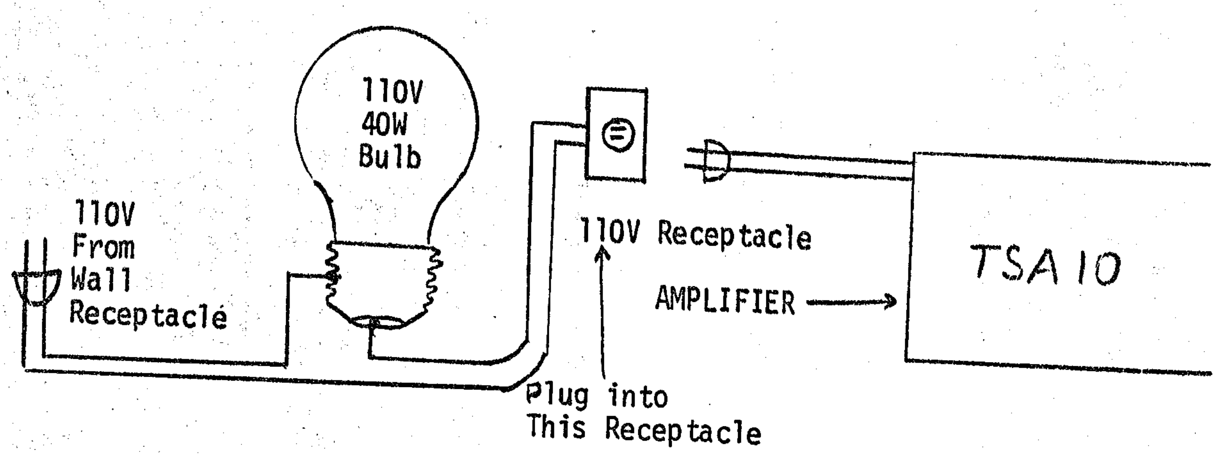
7. After all faulty components have been replaced, you will obviously want to test the amplifier with power. The following procedure is recommended:

"POWER ON" TEST PROCEDURE
(TSA1 - TSA10)

NOTE:

It is recommended that an initial "power on" test be made with the amplifier connected to the 110V supply through a current limiting resistance. This will prevent damaging transistors that may have been replaced but could burn out again if the real source of the problem which caused them to fail in the first place has not been found. An ideal "limiter" is a 110V 40W standard light bulb, which should be hooked into the amplifier as shown in Figure 6. The bulb is then connected "in series" with the amplifier.

FIG. 6



If this bulb glows brightly, the amplifier is drawing too much current and is therefore still faulty. In most cases, however, the "no power" procedure discussed above will have detected the fault. An amplifier which has been restored to working condition will cause the bulb to glow only dimly or not at all (it depends on the bias setting). In this connection it is important to emphasize that any amplifier should never be powered up without either speakers or a dummy load connected to the speaker terminals. Signals applied to an amplifier without a speaker load can destroy output components, since the power signals generated (after all, an amplifier amplifies) are dissipated internally and not transferred to the speaker load. With this in mind, proceed to:

STEP (1) On each voltage amplifier board (see Figure 4) you will find a control marked R5121. This control sets the current through the output transistors with no signal applied to the amplifier inputs. Turn this control all the way counterclockwise to zero. (This is the bias setting control.)

STEP (2) Plug amplifier into "limiter" as shown in Figure 6. If there is no bright glow in the "limiter" bulb, a signal can now be applied to the input of the amplifier. The tuner output of a conventional receiver will work well if hooked into the amplifier through a network as shown in Figure 7. Note that an initial "flash" of the "limiter" bulb is normal. This indicates the charging of the electrolytic filter capacitors of this amp.

It may be useful to build one of these "limiters" into a 2-gang rough-in box with the outlet wired "in series" as shown in Figure 6. This arrangement could be used on location to determine whether an amplifier is faulty.

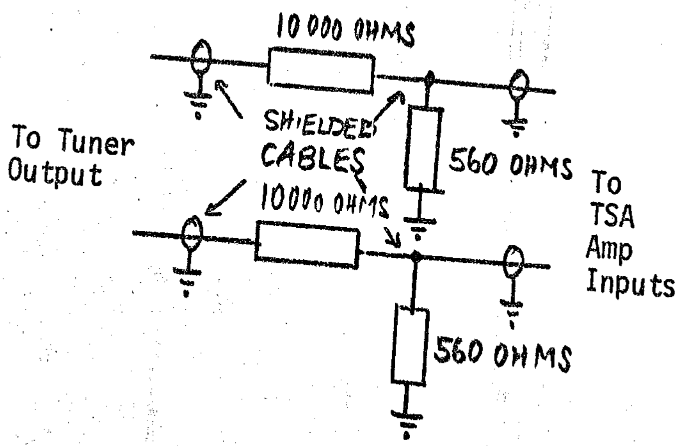


FIG. 7

ATTENUATOR FOR TSA AMPLIFIERS

STEP (3) A signal that results in sufficient output to the loudspeakers will make the "limiter" bulb glow dimly in accordance with the variations in that signal. The output of the amplifier as heard through the loudspeakers should be nearly without distortion. If this is the case, the amplifier can now be powered "directly" (plug directly into wall receptacle or install in a phonograph).

STEP (4) Before playing any music through the amplifier allow it to stabilize for about 10 minutes. With no signals applied, adjust R5121 mentioned in Step (1) so that a voltage of no more than 40mV ((=40/1000) of a volt) is read across resistors A and B of Figure 4A. The control R5121 on the left channel voltage board adjusts voltage across resistor A, and the control R5121 on the right channel voltage amplifier board adjusts the voltage across resistor B. R5121 on the right channel voltage amplifier board is accessible through a hole in the intercircuit board. Measurements across resistors A and B are made as shown in Figure 8 (also refer to Figure 4A for component location).

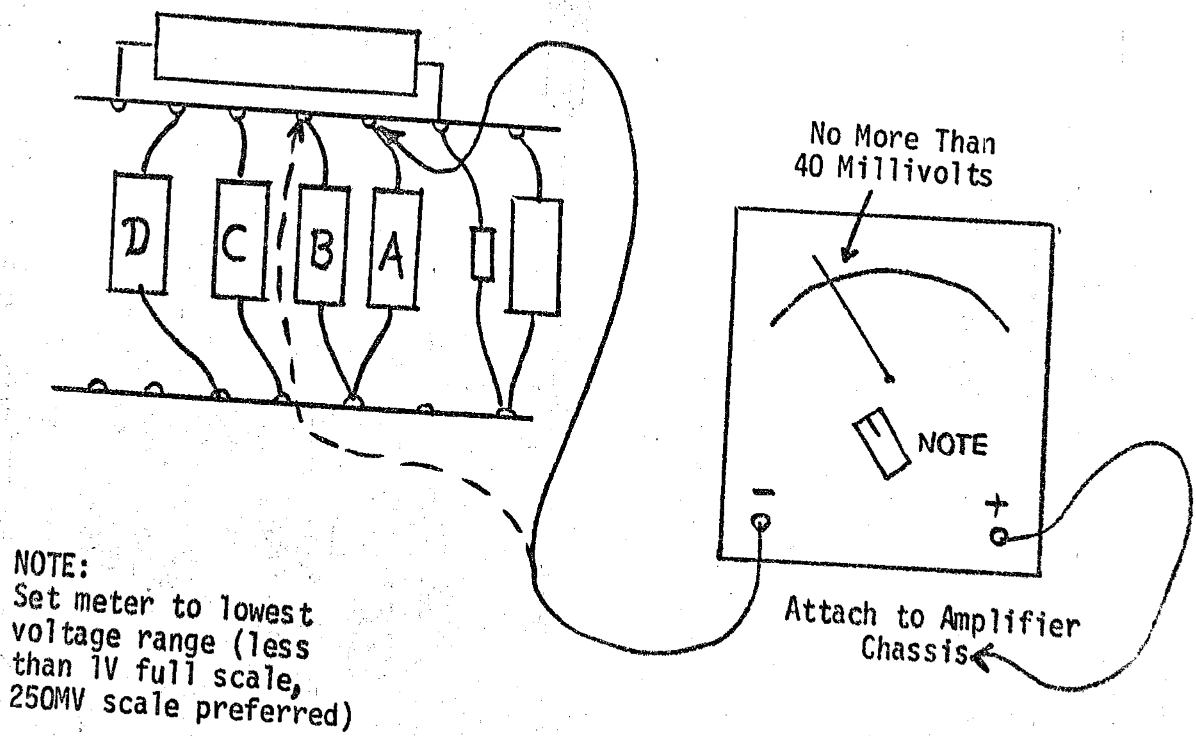


FIG. 8

This will complete the adjustments necessary.

For a complete adjustment procedure refer to the service manual.

Leaving controls R5121 in the fully counterclockwise position does not in itself harm the amplifier. However, there will be "crossover distortion" at low volume levels, which may be objectionable to some people.

One may wonder why the breakdowns described on the previous pages are actually occurring. One reason has already been mentioned: No load connected to the loudspeaker terminals. Another cause is the shorting, even for an instant, of the line that carries power to PRVC remote volume controls. This results in large, momentary "power spikes" which exceed the ratings of the power transistors. The same is true for amplifiers using the TPIK paging system, a short in the paging cable can have the same result.

Section (2): SHP Series Amplifiers

The major difference, from an electronic point of view, between TSA series and SHP series amplifiers is the way their internal power supplies are arranged. The SHP series amplifiers make use of a balanced, ±32V supply. Also, the output transistors of SHP amplifiers are of the NPN type, arranged in a "Quasi-complementary" fashion as in the TSA series. The output transistors of the SHP type amplifiers cannot be used in the TSA series amplifiers. At this point it may be said that, the above notwithstanding, TSA series amplifiers which make use of the "plug-in" type internal volume control and SHP series amplifiers are interchangeable in Seeburg phonographs, with the condition that loads do not exceed TSA amplifier ratings.

As is the case in TSA series amplifiers, the SHP output transistors are subject to collector-emitter shorts. Again, this condition results in a chain reaction of failures, for the reason mentioned in the previous section. The routine to test any possibly faulty transistors and components is almost identical to that described for TSA amplifiers. Differences in location of these components will be mentioned as they come up.

NO-POWER PROCEDURE
SHP Series Amps

1. Remove output transistors (refer to Figure 9, "Output") and test as shown in Figure 3A.

   There should be no resistance reading (i.e. meter indicates infinite resistance) with the X10 scale position between collector and emitter. Discard this transistor if a "leakage" of even 2,000 or 3,000 ohms is indicated. (This figure must be tolerated for TSA series amps because the transistors in TSA amplifiers are made from germanium, which exhibits much more leakage than the silicon transistors used in SHP amplifiers.)

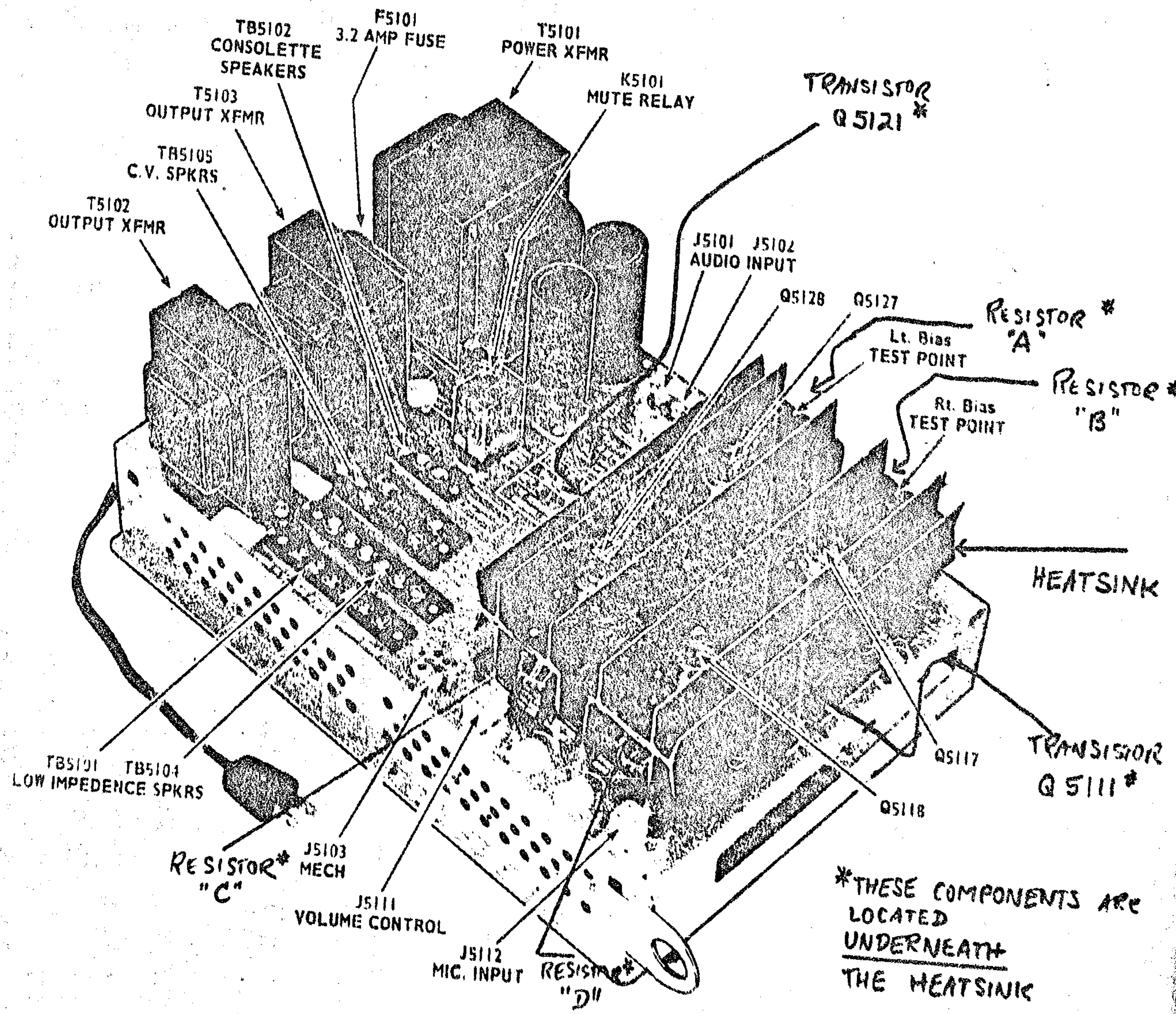


Figure 9. Top View of AMPLIFIER

Next, use the "reverse polarity" test between collector and base, then emitter and base. Again, there should be no perceptible reading on the meter.

2. Inspect resistors W,X,Y,Z (Figure 10). Any burnt out resistors will indicate one or more driver transistors to be faulty. Note that a faulty transistor need not invariably burn out a resistor; driver transistors can be faulty without the presence of burnt out resistors. Disconnect any burned resistors. NOTE: In some of the early SHP amplifiers resistors W,X,Y,Z (which on the driver board and the schematic are labelled R5175, R5176, R5198 and R5199) had a value of 560 ohms. These were later replaced by 100 ohm resistors. This change should be made in all SHP amplifiers which still have the 560 ohm resistors.

3. With your ohmmeter on the X1 scale position measure resistors A,B,C, and D. These are located underneath the heatsink on which the output transistors are mounted (refer to Figure 9). For access, remove the two screws holding the heatsink into place. These resistors will have a value of 0.2 ohms (most meters will read a short). Any reading larger than this indicates an open resistor, which must be replaced.

4. While the heatsink is loose, tests should be made on transistors Q5111 and Q5121. They are mounted underneath the heatsink approximately half-way between the sockets for the output transistors, (see page 6, #6 drawing). These transistors will not be found on SHP 3 and 4 amplifiers. Their function is identical to that of Q5106 in TSA series amplifiers, and a fault in these will blow all other transistors in the driver and output stages. Q5111 and Q5121 are of the NPN type; test as shown in figure 3A.

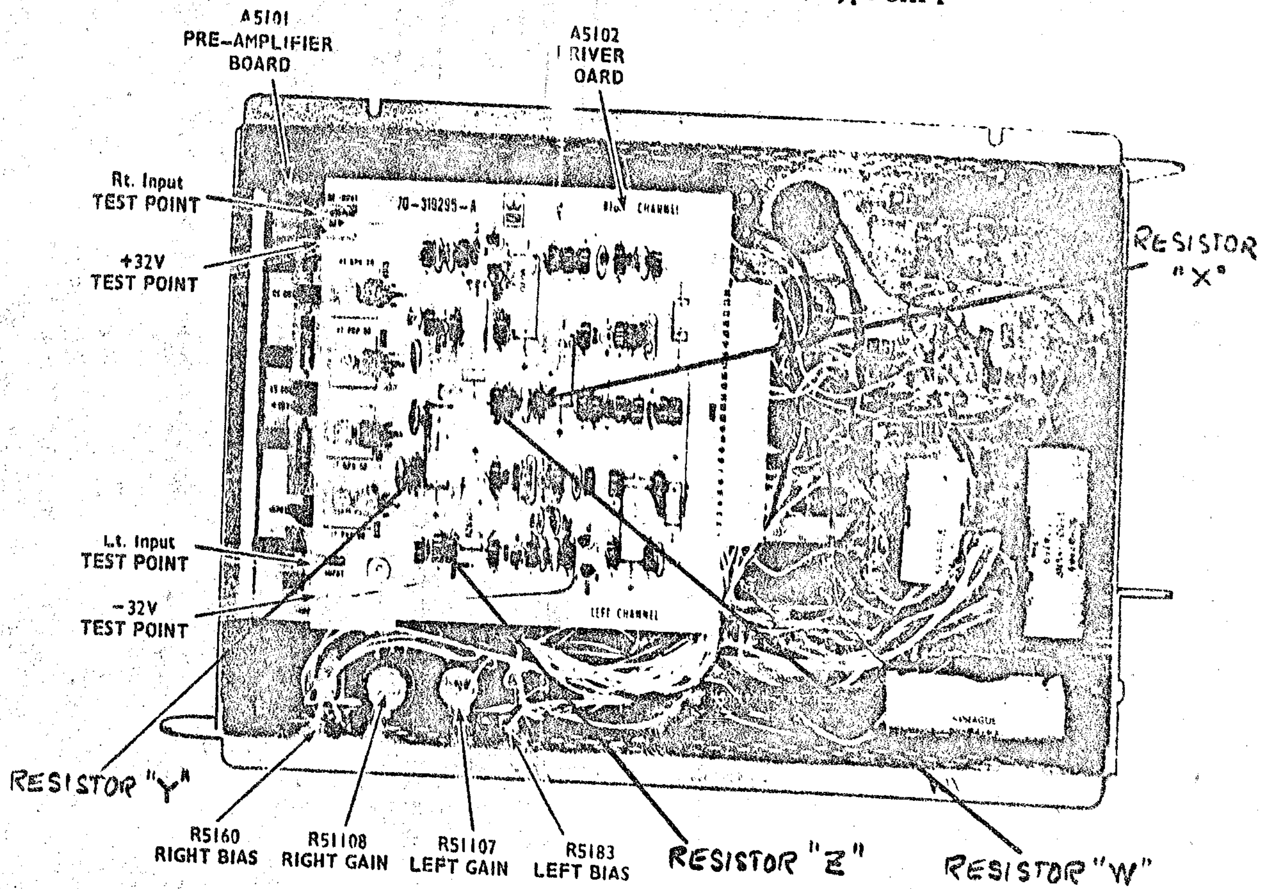


Figure 10. Underside of AMPLIFIER

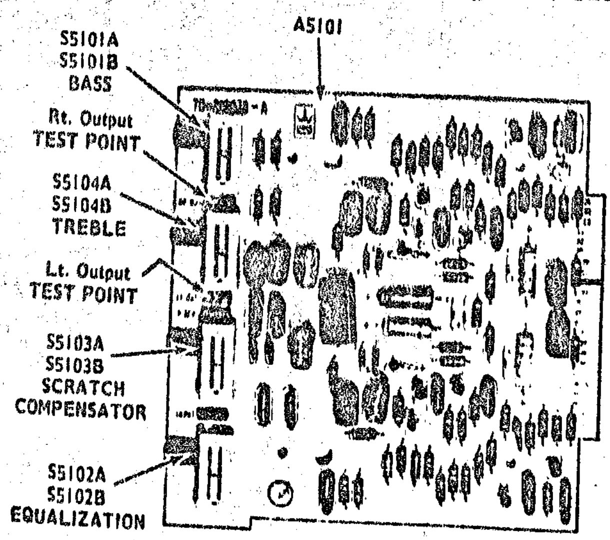


Figure 11. Pre-Amplifier Board

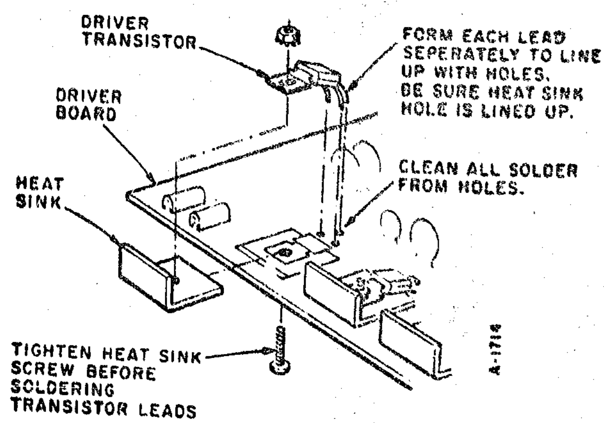


Figure 12. Driver Transistor Replacement

B. BIAS ADJUSTMENT

The Bias adjustment potentiometer located on the bottom edge of amplifier chassis is used to set the idle current through output transistors. This adjustment should be made whenever components are changed on the driver board, A5102 or on the heat sink.

5. Test the driver transistors with your meter on the X10 scale position. There are again 2 NPN and 2 PNP transistors which can be tested in circuit. "Reverse polarity" tests are again not too meaningful (see item 4 in TSA no-power procedure). The driver transistor layout is shown in Figure 13. Driver transistor replacement is shown in Figure 12.

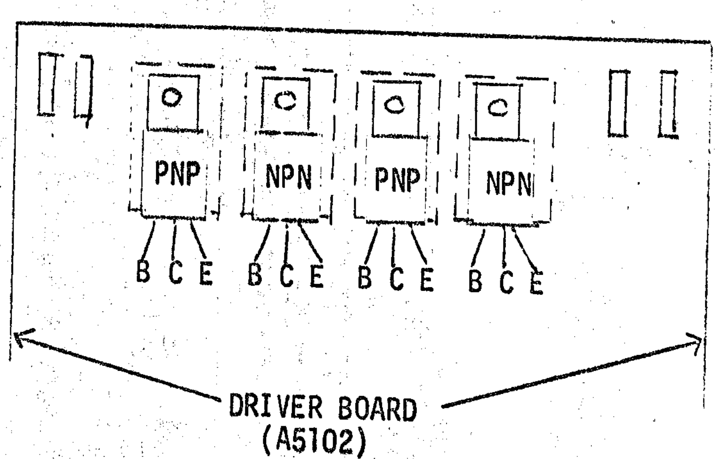


FIG. 13

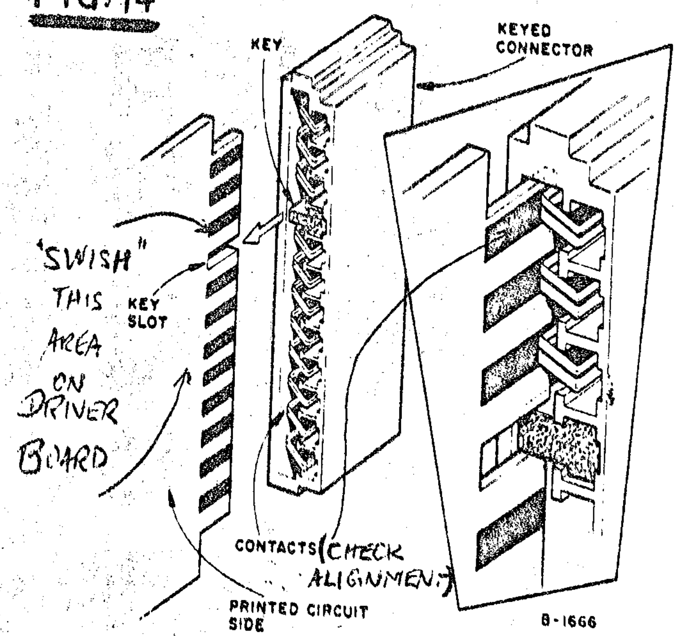
DRIVER TRANSISTOR LAYOUT

6. The driver board contains other transistors as well. They are listed here according to their type and should be tested also:

PNP		NPN
Q5114		Q5112
		Q5113
Q5120 ←	Overload Protection Circuit	→ Q5119
		Q5122
Q5124		Q5123

7. Driver transistor, output transistor and other transistor failures can sometimes be caused by a momentary loss of contact in the connectors of the plug which supplies the driver board. This is especially true for contact loss in contact #3, 6, 18, and 21. It is recommended that the contact areas on the driver and pre-amplifier board be cleaned by means of "swish" or some other contact cleaner and the contacts be inspected for alignment. (See Figure 14.)

FIG. 14



One very important modification must be made in amplifiers in the Olympian and Matador model phonographs. Jumpers are to be soldered from contact areas #3, 6, 18 and 21 on the driver boards to their corresponding wires on the plug. This effectively shortcircuits (bypasses) these four contacts, making even a momentary contact loss impossible. A copy of the conversion procedure is shown on the following pages.

PROCEDURE FOR EARLY MODEL SHP-1 AMPLIFIERS

The purpose of this procedure is to eliminate a remote possibility of momentary and intermittent contact failure in a critical bias control circuit. Please note - this type of failure often results in damaged power amplifier circuit.

PROCEDURE:

1. Remove 70-319295 driver board from amplifier and unplug P-5105 connector.

2. Carefully inspect and clean both mating connectors. (Refer to Field Bulletin CP73-20.) Make certain that no film, dirt or foreign particles exist on any contacts.

3. Locate contacts #3, #6, #18 and #21 and scrape off green solder-resist approximately 1/2-inch away from J-5105 connector. Tin these cleaned areas with light coat of solder, using 25-40 watt iron. (Caution: Do not allow any solder to flow into the edge contacts.)

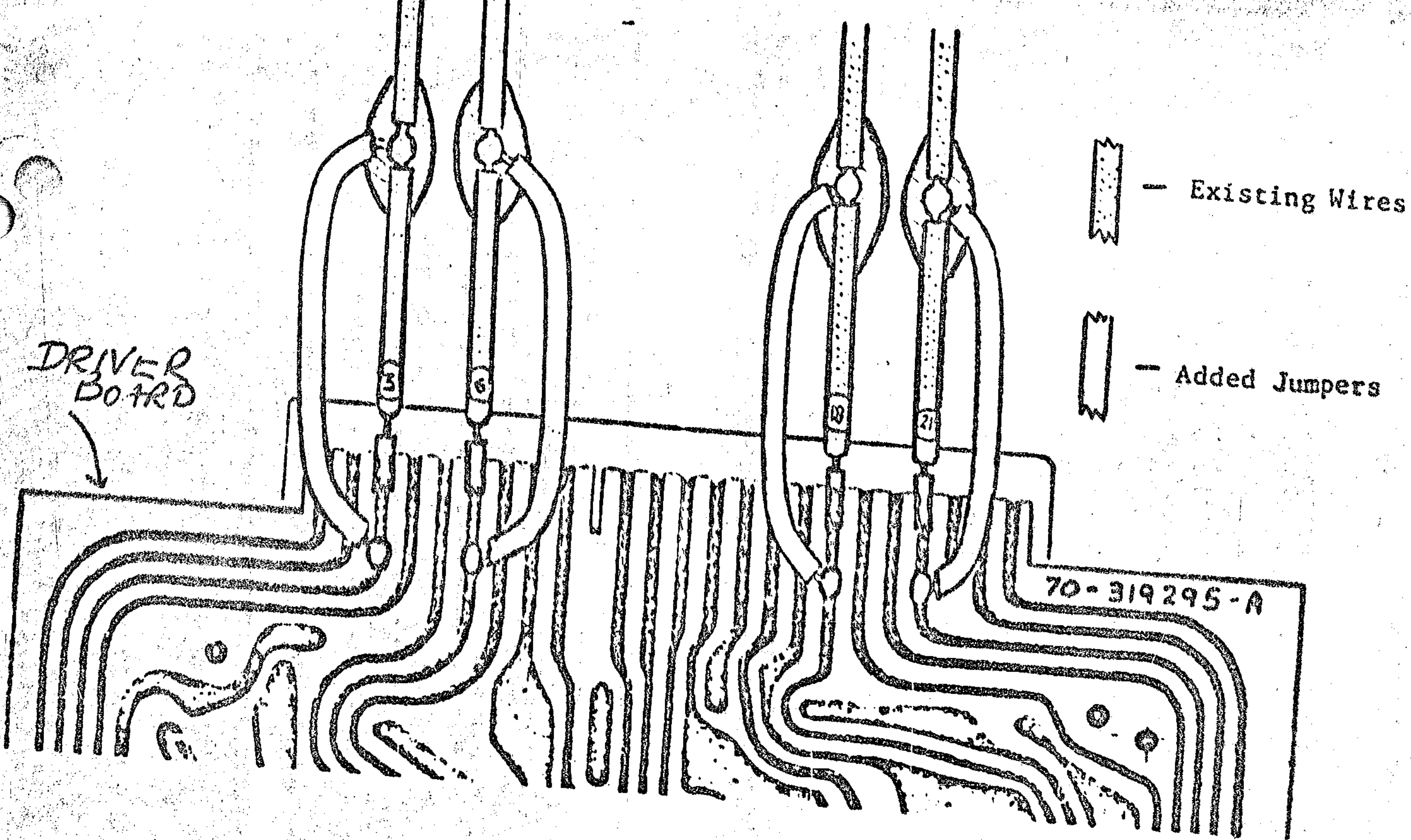
4. Locate the following wires and strip back about 1/8-inch of insulation 1 to 2 inches away from P-5105 connector.

   (A) Solid gray wire (Pin #3)
   (B) Solid yellow wire (Pin #6)
   (C) White/gray wire (Pin #18)
   (D) White/yellow wire (Pin #21)

5. Locate 4 to 5 inches of same respective color coded #22 gauge stranded wire and strip both ends.

6. Jumper the following by soldering the color coded wires between the scraped area and stripped lead of SAME contact wiring. (See sketch attached.)

   (A) Pin #3 scraped area to Pin #3 gray stripped lead.
   (B) Pin #6 scraped area to Pin #6 yellow stripped lead.
   (C) Pin #18 scraped area to Pin #18 white/gray stripped lead.
   (D) Pin #21 scraped area to Pin #21 white/yellow stripped lead.



7. Carefully tape all four soldered leads to prevent any possibility of adjacent shorts.

8. Insert the driver board in chassis and apply power through a 40-60 watt lamp at first, as precaution against any possible wiring shorts or broken connections. If no short exists (lamp momentarily flashes then returns to a very dim glow), further test the unit by lightly tapping driver board and heat sink with an insulated screwdriver handle.

   If unit is good no flashes due to tapping will be evident.

9. Allow the unit to run-in for 5 to 15 minutes while under lamp protection. At the end of this period feel the heat sink. It should be 80° to 100°F and lamp should always glow dimly. If lamp glows brightly either a short exists in amplifier or bias is set extremely high - readjust as required.

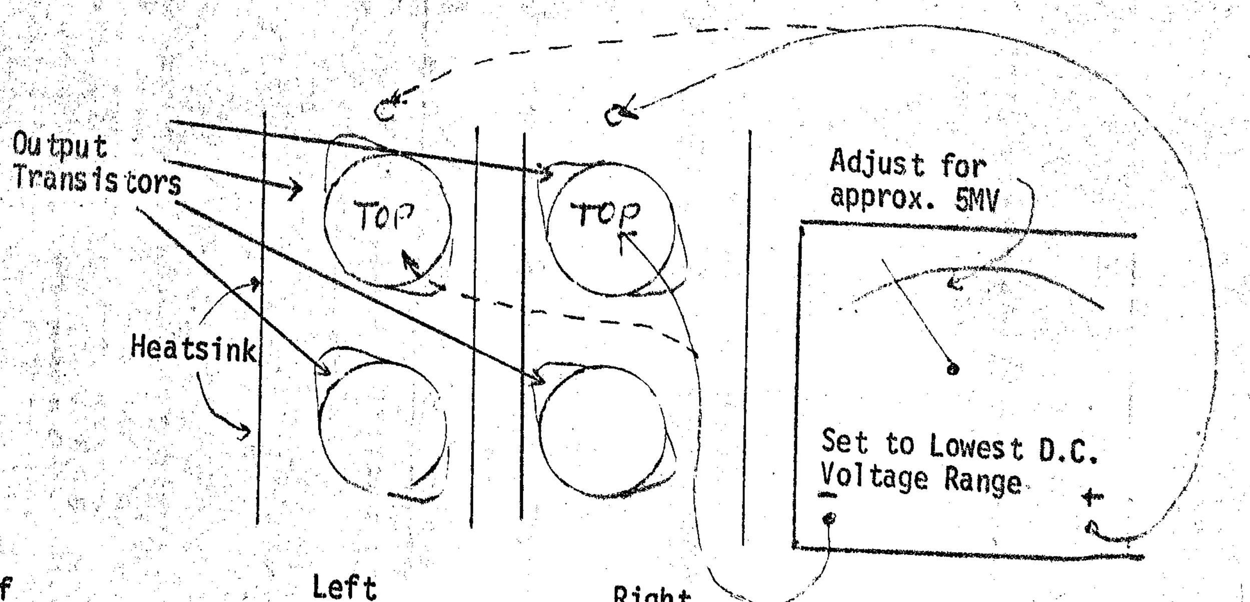
10. If no failure is noted remove the lamp protection circuit and apply power direct to operate amplifier normally.

8. The bias adjustments (no-signal-current through output transistors) are located on the main amplifier chassis. They should be turned counterclockwise to zero if any component changes have been made.

"POWER-ON" PROCEDURE

This procedure is the same as for the TSA series amplifiers and all the statements made as to amplifier loading apply here as well. The attenuator in Figure 7 can also be used on SHP amplifiers and the time required for amplifier stabilization is also the same.

The adjustments for"Quiescent" (i.e. bias, meaning: no signal) currents in the output transistors of SHP amplifiers are similar, <u>however</u>, the voltage readings we are looking for are much <u>smaller</u>; for this reason a very sensitive meter capable of reading a voltage of 10 millivolts or less is needed. Figure 15 illustrates the procedure (refer also to Figure 9).



TION:
not short top of
put transistors
heatsink.

Bias
Bias controls on side of Chassis

FIG. 15

A word of caution regarding the gain controls in both TSA and SHP series amplifiers.

The basic functions of the gain controls are:

1. Compensation for gain differences between channel 1 and 2.
2. Balancing of the system.
3. AVC compression of signals to ensure equal output for both channels.

These controls must never be set to maximum. There is an elaborate procedure in the service manual regarding the proper set-up of these controls. As a rule, following this procedure in the field is not feasible, therefore, the following simplified procedure is suggested.

1. Select any record (monophonic).
2. Set volume control to a reasonable level.
3. If phonograph speakers are not used, connect them for the duration of this procedure.
4. Turn each gain control to maximum, then decrease the setting until an audible drop in volume occurs.
5. Adjust each gain control "down" until balance is established, use voltmeter (A/C setting at 10V) across 70V output terminals or your ears.

Note in Item 5: Balancing is done by successively decreasing the gain of each channel until balance is obtained; turn the controls slowly each time.

Too high a gain setting can result in activating the overload protection circuitry even when load ratings are within specifications. This may cause fruitless searches for non-existent speaker cable problems and may also be implicated in some of the "unexplainable" breakdowns of amplifiers in the field.

C O N C L U S I O N

As stated in the introduction, the procedures in this manual are designed for people who have only the ohmmeter as a service tool. People with more advanced electronic training and equipment have undoubtedly evolved their own troubleshooting procedures. Nevertheless, these must include the points mentioned in this manual. For this reason the service routines laid out here will be useful to everybody who has occassion to work on these amplifiers.

After a certain amount of familiarity with these procedures has been reached, it should be possible to substantially cut the down time of any of these amplifiers; furthermore, the need to send these amplifiers to other branches for repair may also be lessened.

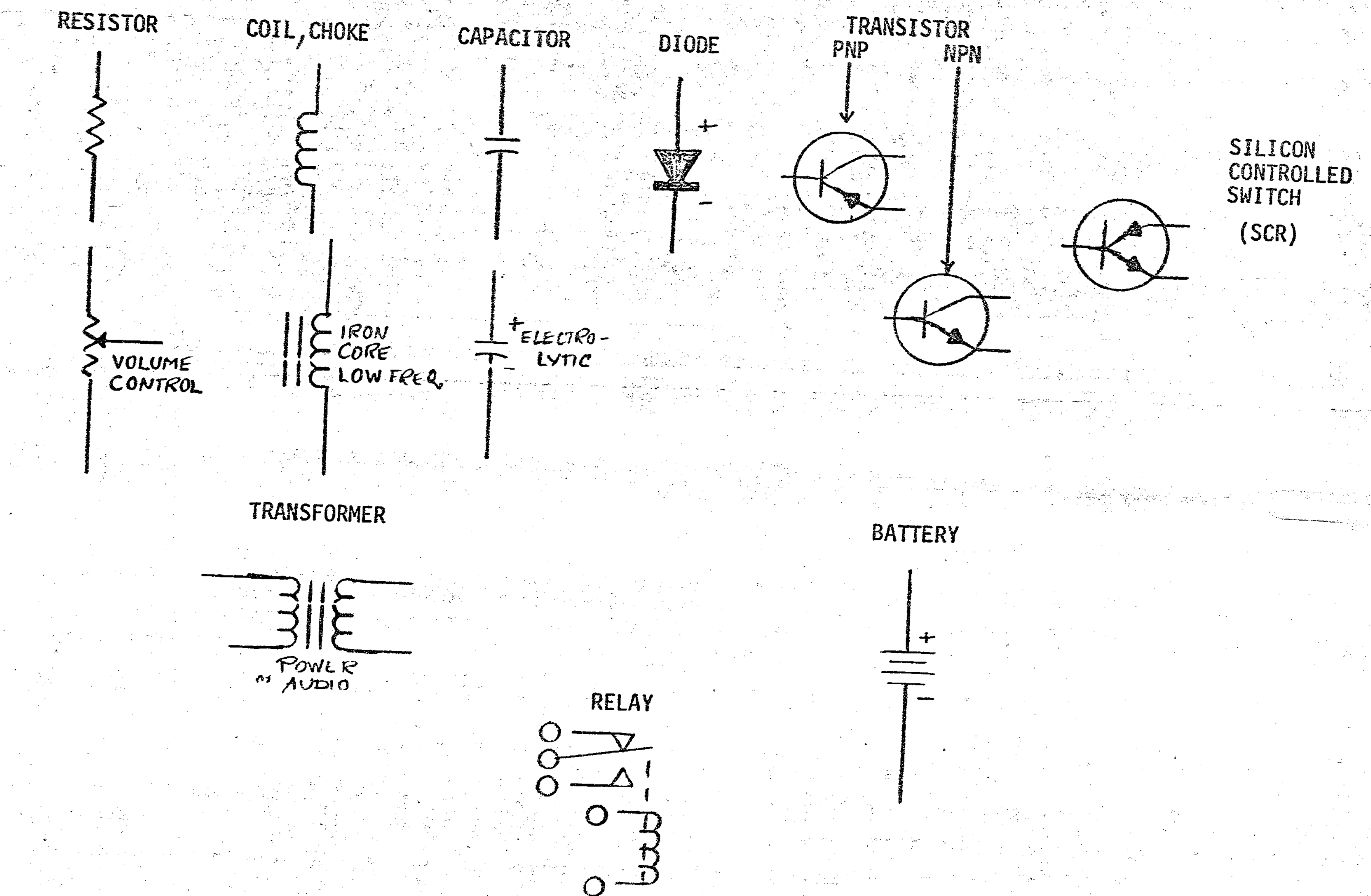
Please send any questions regarding this manual or any other query to:

J. Karl Miller, C.E.T
Hudson's Bay Wholesale
Vending Division
1415 Venables
Vancouver, B.C. V5L 2G2

And now, Good Luck.

Karl

J. Karl Miller



RESISTOR
VOLUME CONTROL
COIL, CHOKE
IRON CORE LOW FREQ.
CAPACITOR
+ ELECTRO-LYTIC -
DIODE
+
-
TRANSISTOR
PNP
NPN
SILICON CONTROLLED SWITCH
(SCR)
TRANSFORMER
POWER
" AUDIO
RELAY
BATTERY
+
-

SEEBURG - QUICK PROBLEM GUIDE

(1) NO CREDITS:

- Check control centre and black box plugs
- Check control centre fuses (Fig. 6)
- One coin, or all ? One: Check switches, All: Buffer Board (Fig. 6)
- Operate free play switch. Works ? - Buffer board; No ? - Black box
- Do coin switch plug test. (Fig 10) Works ? - Switches or plugs
  No ? - Black box faulty

(2) MISSING, WRONG, OR NO SELECTIONS:

- Make test selections (Fig. 10). Works ? Yes No ?

Yes:

- Check read source/read load (Fig. 5)
- Clean detent switch (Fig. 7)
- Check tormat contacts
- Select 179 and 279 (must scan twice); if not, then
  Check play control subtract switch (on Mech.)
- Do data line test (Fig. 10)

No ?

- Check 1/8 A Fuse (Fig. 6)
- Battery Test (Fig. 2,3,4)
- Clean Contact 2 Mi (Fig. 8)

(3) PLAYS ONE RECORD CONSTANTLY:

- Check and clean 3 Mi contacts (Fig. 9 . Must open and close during cycle).
- Interchange trip and mute relay (where possible).

(4) REJECTS RECORD IMMEDIATELY:

- Check remote reject
- Check service reject switch
- Check tone arm switch
- Check timing on 3 Mii and 3M12 contacts: 3 Mii must open before 3M12
  closes (Fig. 9).

(5) NO SCAN START: Operate service mech. start switch

Works?

- Check Yes-No switch
- Do pin #15 test
  (Blue plug - Fig. 10)

No?

- Check 25 VAC fuse (Fig. 6)
- Check play control (Fig. 6)
- Check play contr. switch (Fig. 6)

(6) STRANGE / INTERMITTANT PROBS (IE - MISSES SELECTIONS SOMETIMES OR OVERSELEC
- UNPLUG TORMAT PLUG + CHECK CONTROL CENTRE TO MECH FOR GOOD
GND CONNECTION

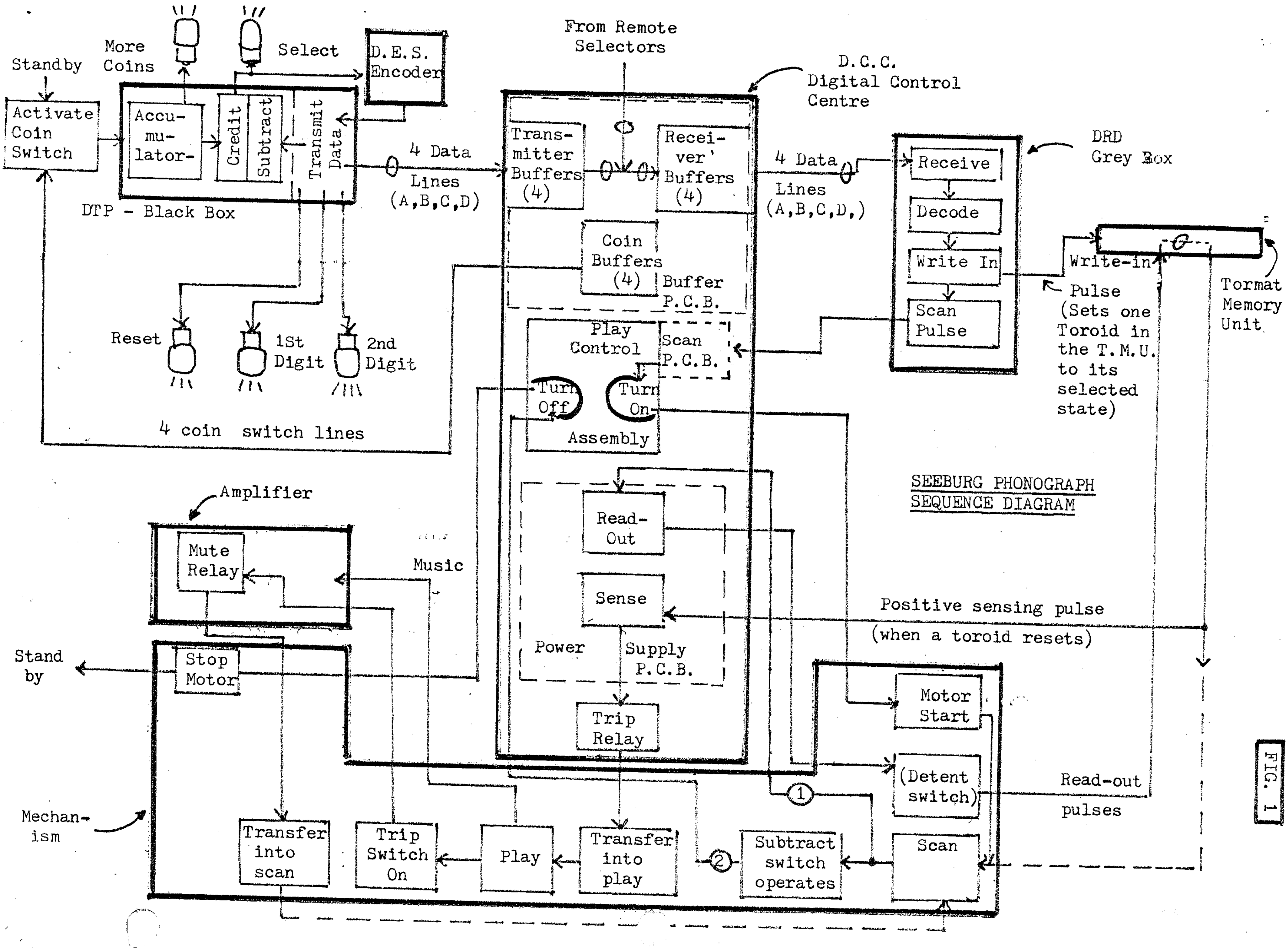
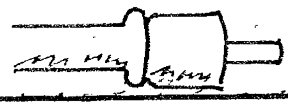

Standby
More Coins
Select
D.E.S. Encoder
Activate Coin Switch
Accu-mu-lator-
Credit
Subtract
Transmit Data
DTP - Black Box
4 Data Lines (A,B,C,D)
From Remote Selectors
D.C.C. Digital Control Centre
Trans-mitter Buffers (4)
Recei-ver' Buffers (4)
Coin Buffers (4)
Buffer P.C.B.
4 Data Lines (A,B,C,D,)
Receive
Decode
Write In
Scan Pulse
DRD Grey Box
Write-in Pulse (Sets one Toroid in the T.M.U. to its selected state)
Tormat Memory Unit
Reset
1St Digit
2nd Digit
4 coin switch lines
Play Control
Scan P.C.B.
Turn Off
Turn On
Assembly
SEEBURG PHONOGRAPH SEQUENCE DIAGRAM
Amplifier
Mute Relay
Music
Read-Out
Sense
Power Supply P.C.B.
Positive sensing pulse (when a toroid resets)
Stand by
Stop Motor
Trip Relay
Motor Start
(Detent switch)
Read-out pulses
Mechan-ism
Transfer into scan
Trip Switch On
Play
Transfer into play
2
Subtract switch operates
1
Scan

FIG. 1

SEEBURG BATTERY TEST

(1) Remove tormat plug from control centre



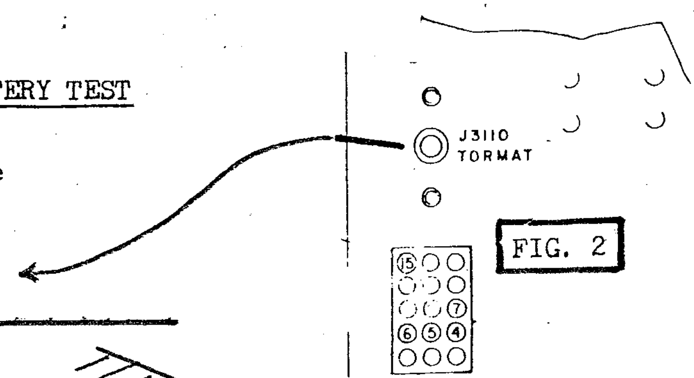
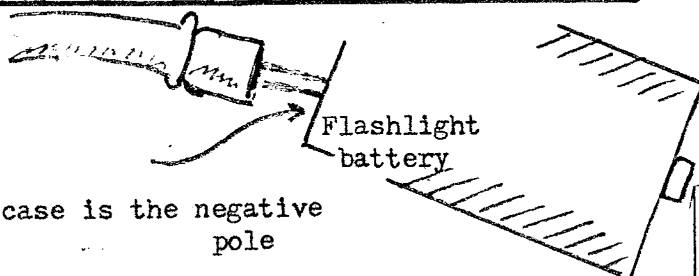


FIG. 2



(2) Place positive pole of battery against the metal of control centre. Momentarily touch the centre post of the tormat plug to the negative pole.

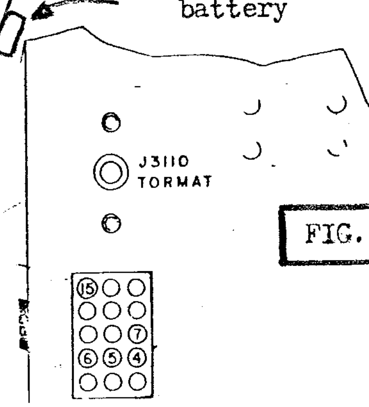
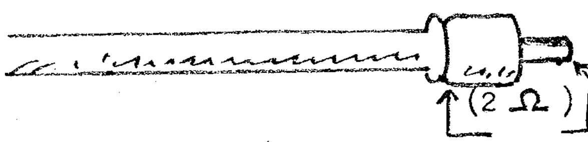


FIG. 3

(3) Re-insert the tormat plug into control centre



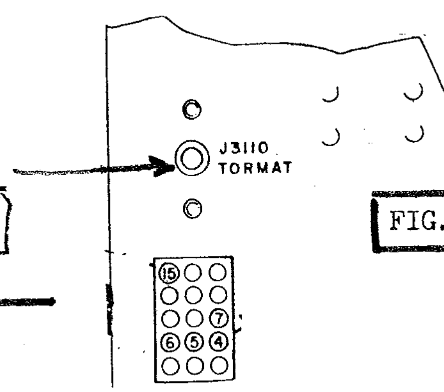


FIG. 4

(4) Operate manual scan start switch - all selections must now be picked up.

If not - check detent switch voltage (read source - read load), fig. 5
1/8 A fuse in control centre, clean mechanism contacts, fig. 6, fig. 8, fig. 9
measure 2 OHMS (Tormat cable). (Set meter to R x 1). fig. 4

DIGITAL CONTROL

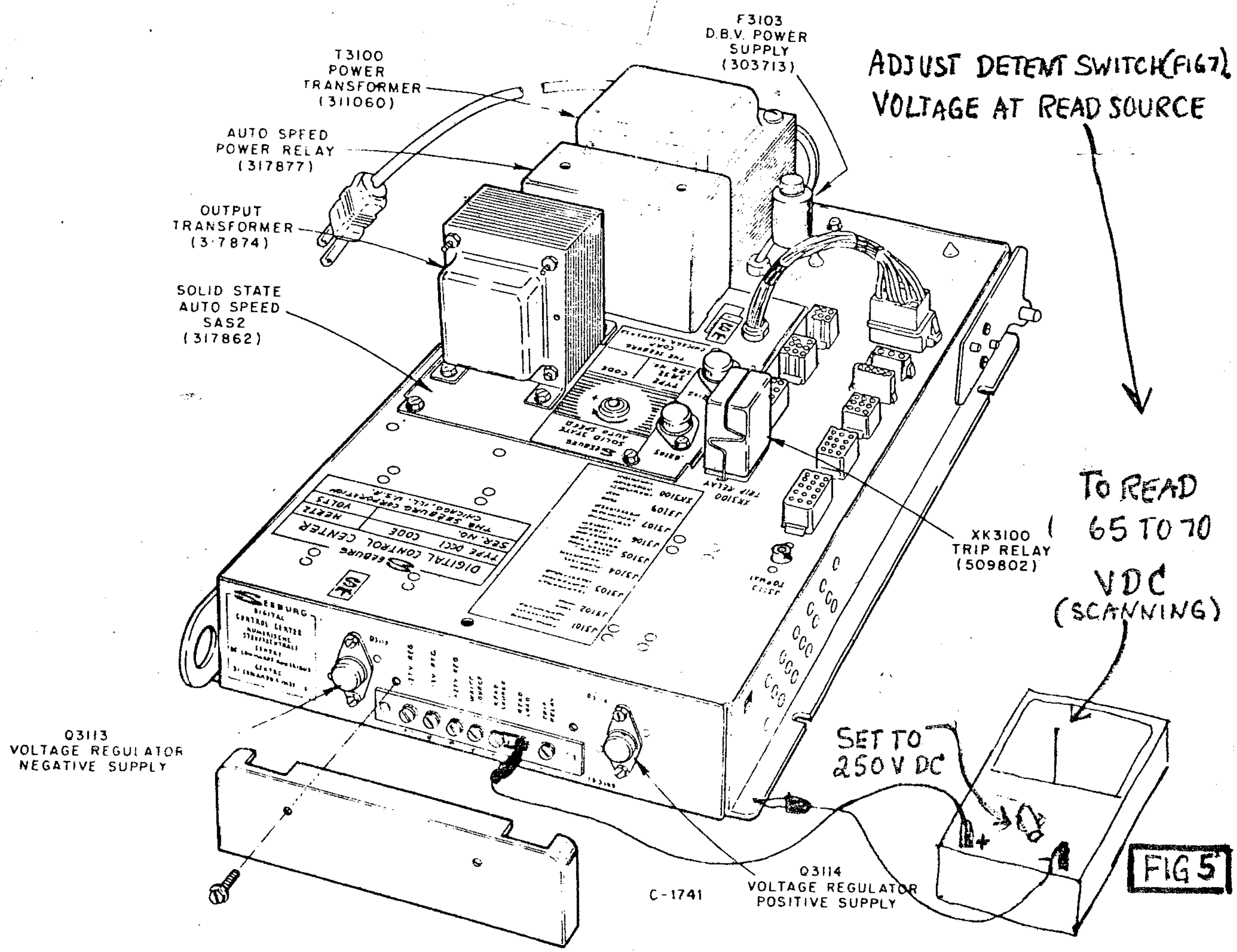
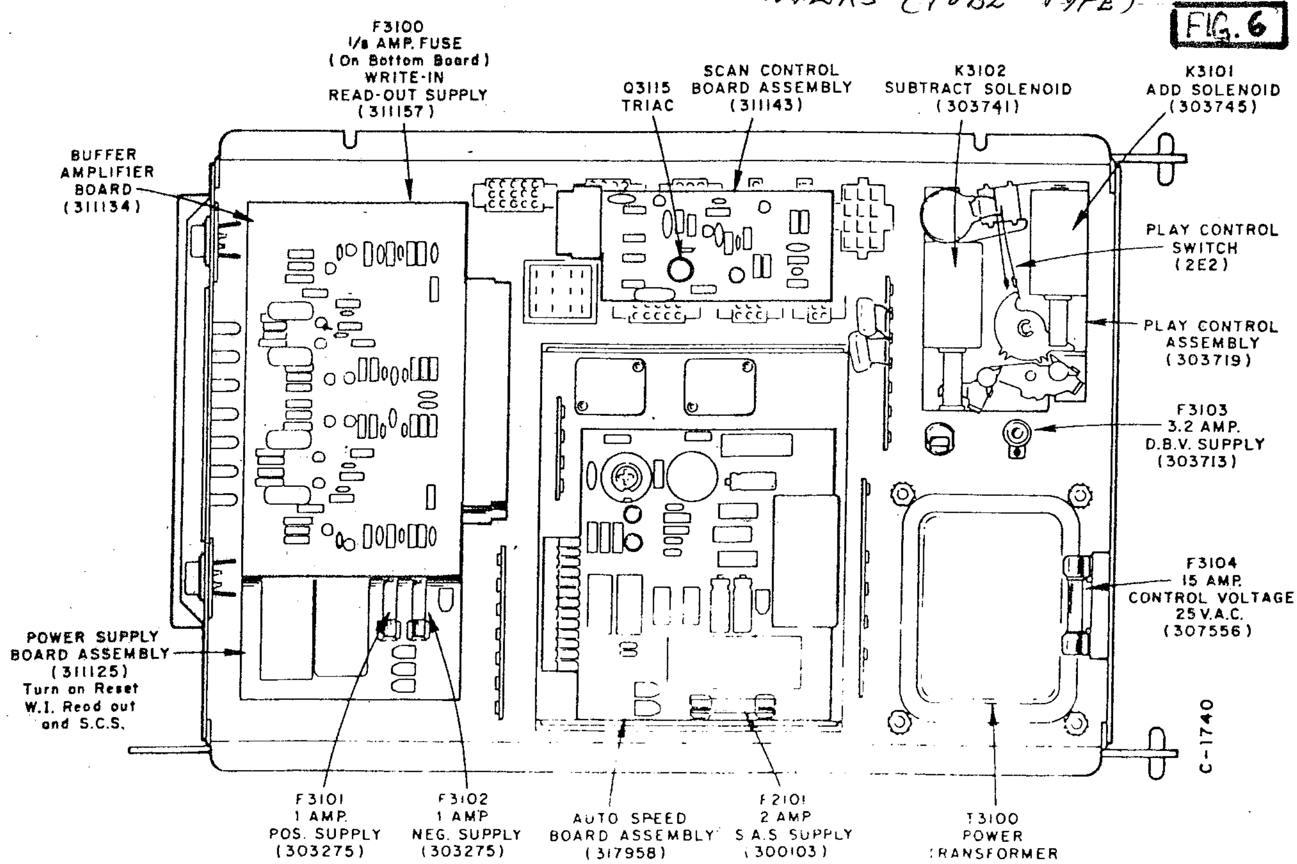


FIG 5

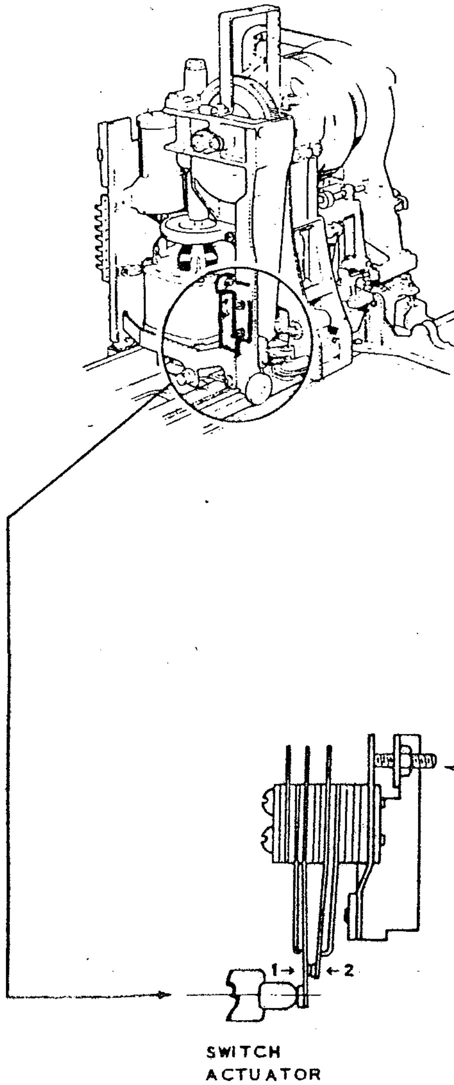
~~ON~~ G-H TERMINALS ON TS ~~FORMA~~ CONTROL CENTERS (TUBE TYPE)

FIG. 6



"DETENT SWITCH" - CONTACT GAP AND PRESSURE ADJUSTMENT

FIG. 7



Adjust this screw so that
meter reading is as shown
in Fig. 5 counter clockwise reduces reading

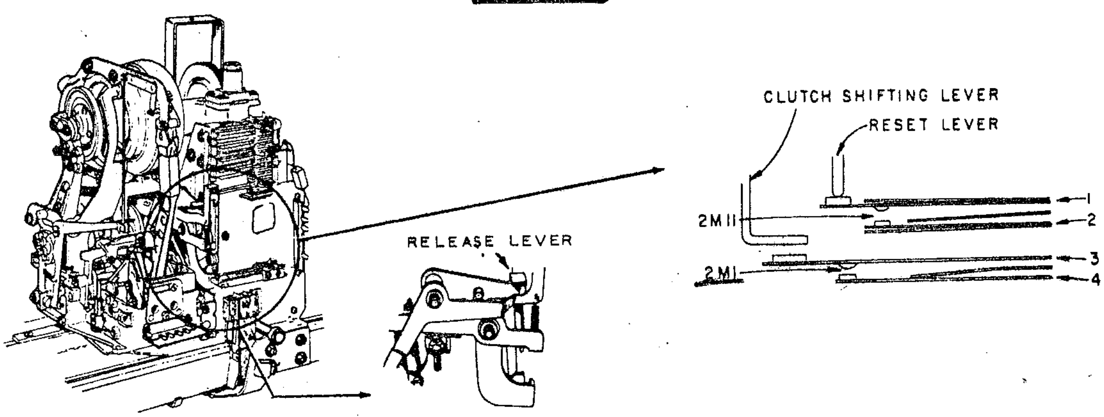
To clean these contacts, remove control centre power plug.

The detent switch contact tends to become badly pitted in time.
A contact file may be used for correcting this condition. Eventually, however, the detent switch has to be replaced.

<u>This switch is the weak link in Seeburg phonos</u>.

"CLUTCH and RESET LEVER SWITCHES" CONTACT GAP and PRESSURE ADJUSTMENT for SELECT-O-MATIC "160" MECHANISM only

FIG. 8



NOTE: "Clutch 1" to "4" Mechanical Adjustments must be correct before adjusting these switches.

CONTACTS	CONTACT GAPS	CONTACT FUNCTIONS
2M11	3/64 inch gap when mechanism trips. Closed in SCAN and PLAY positions.	Part of Popularity Meter Solenoid Circuit. Allows operation of Solenoid when mechanism is transferring into PLAY position but prevents "Extra" operation when mechanism is transferring out of PLAY position. Also opens ground return of Auto-Speed Unit Power Control Relay Circuit.
2M1	1/64 inch gap in PLAY position. Closed during Transfer and SCAN.	Part of Trip Solenoid Circuit, opens circuit when mechanism trips from SCAN position.

– ADJUSTMENT PROCEDURE –

REFERENCE SCALE
THESE LINES SPACED 1/64" ACTUAL SIZE

1. Place mechanism in SCAN position and TURN OFF POWER.
2. Trip by manually lifting Release Lever. While mechanism is in this position:
   A. Bias blade 1 to within 1/16 inch of Reset Lever.
   B. Bias blade 2 against bracer blade and adjust blade 2 for 1/16 inch gap between 2M11 contacts.
3. Turn motor shaft manually until mechanism is in PLAY Position.
   A. Bias blade 3 so its fibre lift bears against Clutch Shifting Lever with 35 grams pressure.
   B. Bias blade 4 against its bracer blade and adjust bracer blade for 1/64 inch gap between 2M1 contacts.

"CAM SWITCH" -- CONTACT GAP AND PRESSURE ADJUSTMENTS
for SELECT-O-MATIC "160" MECHANISM only

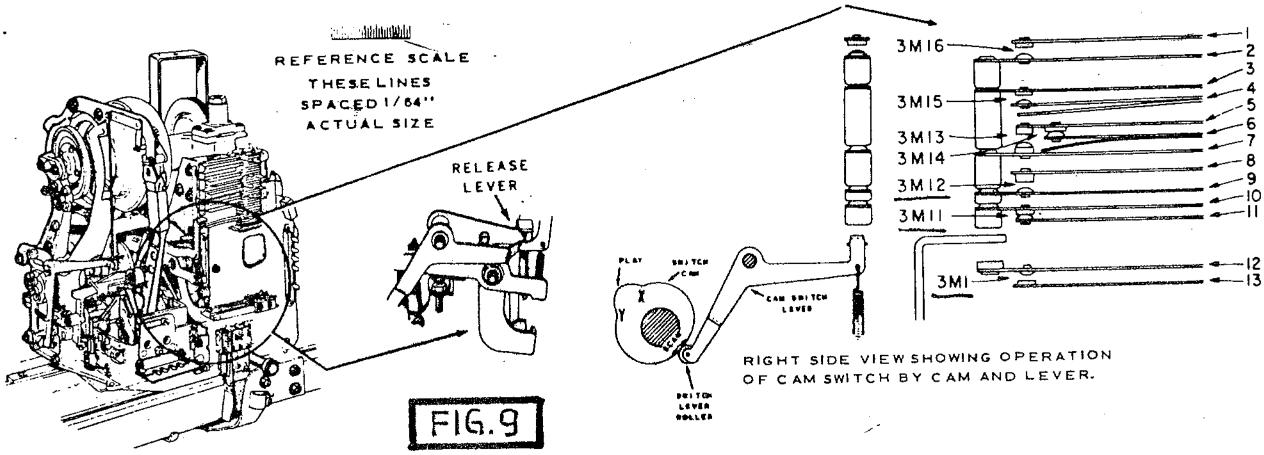


FIG. 9

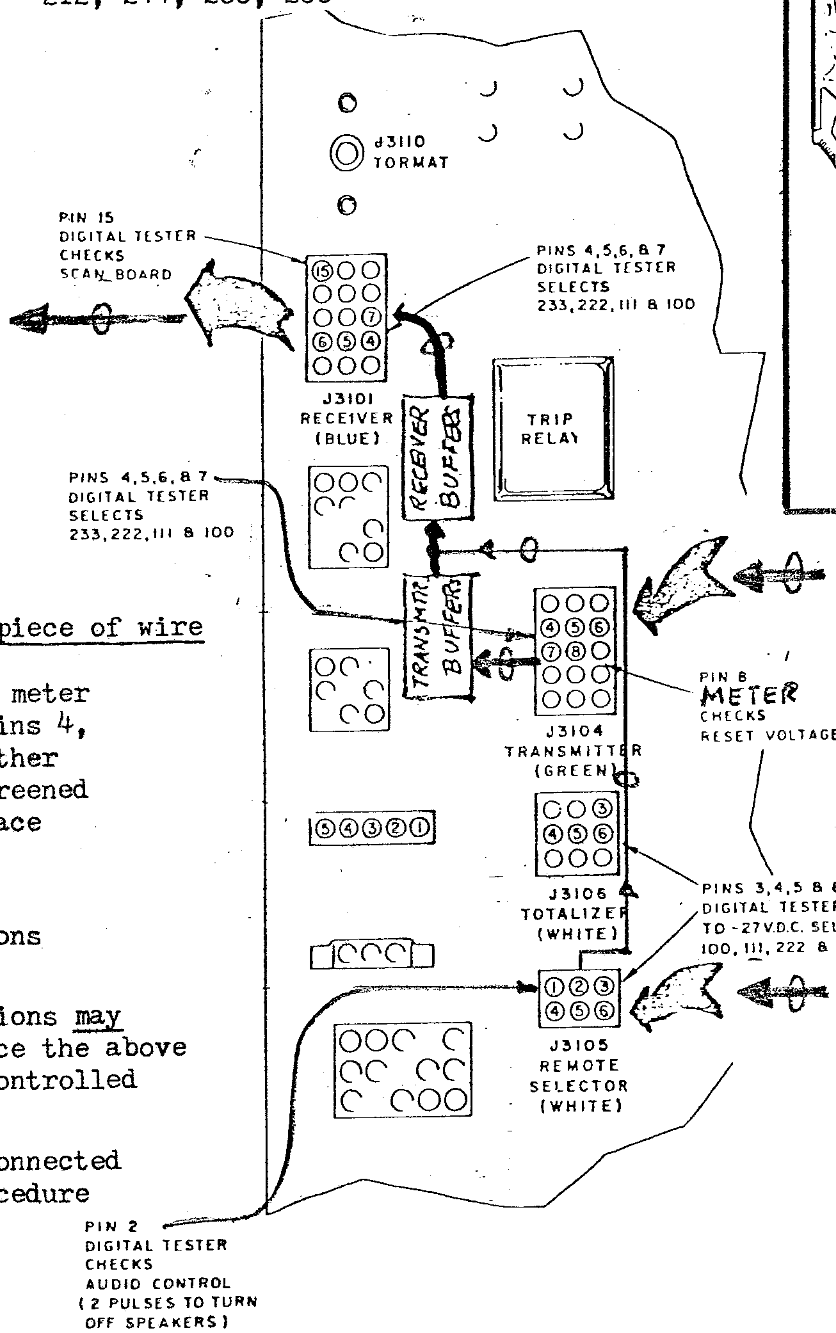
CONTACTS	CONTACT GAP	CONTACT FUNCTIONS
3M16	1/32 inch gap in SCAN. Closed only in PLAY.	In series with clamp arm switch, it completes power relay circuit in Auto-Speed Unit (if used).
3M15	3/64 inch gap in PLAY position. Closed in TRANSFER and SCAN.	Adds 1.65 mfd. condenser to motor circuit during TRANSFER and SCAN.
3M14	1/64 inch gap in PLAY position. Closed in SCAN position.	Part of popularity meter solenoid circuit. Just before the mechanism enters PLAY position the 3M13 and 3M14 contacts "Make and Break" controlling the pulse to the popularity meter solenoid.
3M13	1/32 inch gap in SCAN and during most of TRANSFER. Starts to close when record Clamp Disc first engages the turntable.	
3M12	1/32 inch gap in SCAN and during most of TRANSFER. Starts to close when record Clamp Disc first engages the turntable.	Trip Solenoid Circuit. Completes all circuits which can operate Trip Solenoid in PLAY position.
3M11	1/64 inch gap in play position. Closed during SCAN and part of transfer cycle.	Part of mute circuit. Maintains muting action of both channels of amplifier, during SCAN and part of transfer operation.
3M1	1/32 inch gap in PLAY position. Closed in SCAN position.	In holding circuit of trip relay.

– ADJUSTMENT PROCEDURE –

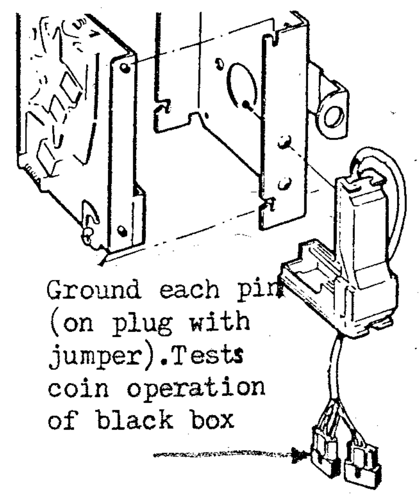
1. Place mechanism in Scan Position and TURN OFF POWER.
2. Trip mechanism by lifting release Lever and manually turn motor shaft until record Clamp Disc first engages the Turntable. (This places cam so Switch Lever Roller is at position X).
   A. Bias Fiber lift of blade 10 against switch lever. (35 grams pressure)
   B. Bias blade 9 against blade 10.
   C. Bias blade 7 against blade 9 and adjust blade 8 for 1/32 inch gap at 3M12 contacts.
   D. Bias blade 3 down so fiber lift touches blade 7 with 3M15 contacts closed (35 grams pressure). 3M12 contacts should still have 1/32 inch gap.
   E. With 3M14 contacts closed (35 grams pressure) adjust for 1/32 inch gap in 3M13 contacts.
   F. Adjust blade 12 so fiber lift just touches Switch Lever.
   G. Adjust blade 13 for 1/32 inch gap in 3M1 contacts.
3. Turn motor shaft until mechanism is full in PLAY position (this places cam so switch Lever Roller is on PLAY position peak).
   A. Adjust blade 11 for 1/64 inch gap in 3M11 contacts.
   B. Adjust blade 4 for 3/64 inch gap in 3M15 contacts.
   C. Adjust blade 6 for 1/64 inch in 3M14 contacts.
4. Trip mechanism by lifting Release Lever and manually turn motor shaft until clamp disc begins movement away from turntable. (This places cam so Switch Lever Roller is at position Y).
   A. Check for 1/32 inch gap in 3M13 contacts with 3M14 closed (35 grams pressure).
   B. Check to see that blade 10 bears against Switch Lever.
   C. Check for 1/32 inch gap in 3M12 contacts.
5. Trip and operate mechanism until it is in SCAN position.
   A. Adjust blade 2 so fiber lift bears lightly against blade 3.
   B. Adjust blade 1 for 1/32 inch gap between 3M16 contacts.
   C. Adjust blade 13 for 40 grams pressure.

MAKE TEST SELECTIONS
121, 133, 155, 177, 179, 200,
212, 244, 266, 268

SELECTION
INFORMATION TO
GRAY BOX



Coin switch plug test



Ground each pin (on plug with jumper). Tests coin operation of black box

SELECTION INFORMATION
FROM BLACK BOX

(-27V 2 sec. after power is switched on)

SELECTION INFORMATION
FROM D.E. CONSOLETTES

FIG. 10

Digital tester - piece of wire

Selection test:
Insert wire (i.e. meter test lead) into pins 4, 5, 6, 7 and run other end across silkscreened instructions on face of control centre chassis.

Indicated selections must be made.

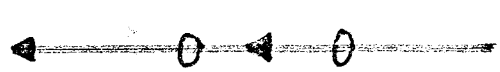
Some other selections may also be made, since the above test produces uncontrolled pulses.

Leave blue plug connected for this test procedure

Green plug may be disconnected.

DIGITAL SELECTION PHONOGRAPH
"CONTROL CENTRE PLUG & PIN DIAGRAM"

Represents 4 data lines



NOTE:

When checking a particular selector switch, consult the DES1 Schematic Diagram, Figure 4. Disconnect edge connectors from DES1 and connect a continuity tester to proper printed board contacts associated with selector switch being checked.

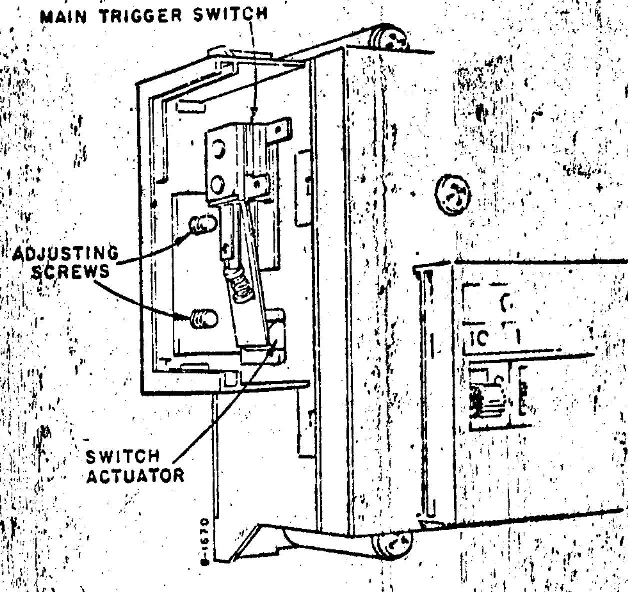


Figure 3. Trigger Switch Adjustment.

Main Trigger Switch –

The Main Trigger Switch should operate with 1/8 inch to 5/32 inch of any selector switch stem travel. (not necessarily selector button travel).

		DIGITAL SELECTOR BUTTONS										STAND-BY
		0	1	2	3	4	5	6	7	8	9	
DATA LINES	A	1	1	1	0	0	0	0	1	1	1	1
	B	1	1	0	1	1	0	1	1	0	0	1
	C	1	0	1	1	1	1	0	0	0	1	1
	D	0	1	1	1	0	1	1	0	1	0	1
		FOUR PART DIGITAL CODES-QUADRIBITS DEVELOPED BY DES1										

Figure 4. Four-Part Digital Codes – Quadribits.

FOUR PART DIGITAL CODE – QUADRIBIT

Three quadribits make up a three digit selection address. From Figure 4, a particular selection address can be shown. The three quadribits for the three digit selection 156 would be 0010 for the hundreds digit "1", 0011 for the ten's digit "5", and 0101 for the units digit "6".

The 0's of the quadribit are gound pulses. The 1's are - 6VDC levels - normal condition of data lines. Pressing button "5" approximately 1/16 inch, closes two switch segments 5S1 and 5S2, see Figure 5. Switches 5S1 and 5S2 connects credit set line "BB" (single credit - 2nd and 3rd digit) to data lines A and B, approximately 1/16 inch further travel of button "5" will close main trigger switch S3417. A ground pulse then appears on set line "BB", which passes through closed switch segments 5S1 and 5S2 to the A and B data lines. The data lines provide a path to the quadribit storage area in DTP1.

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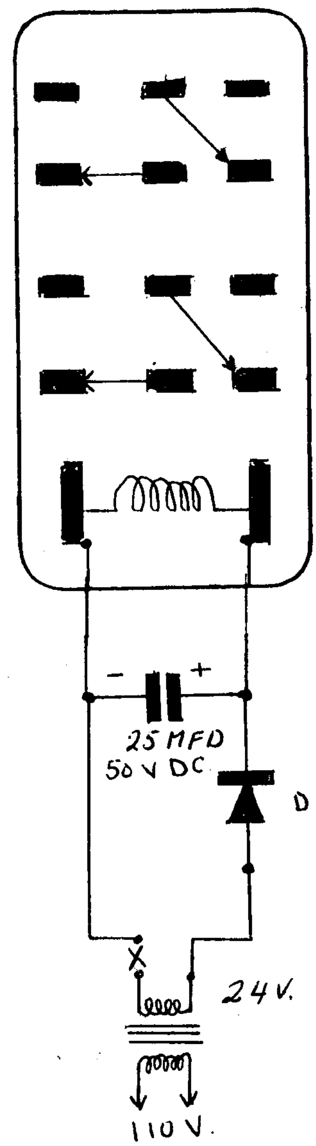
VANCOUVER 6, B.C.
255-5794



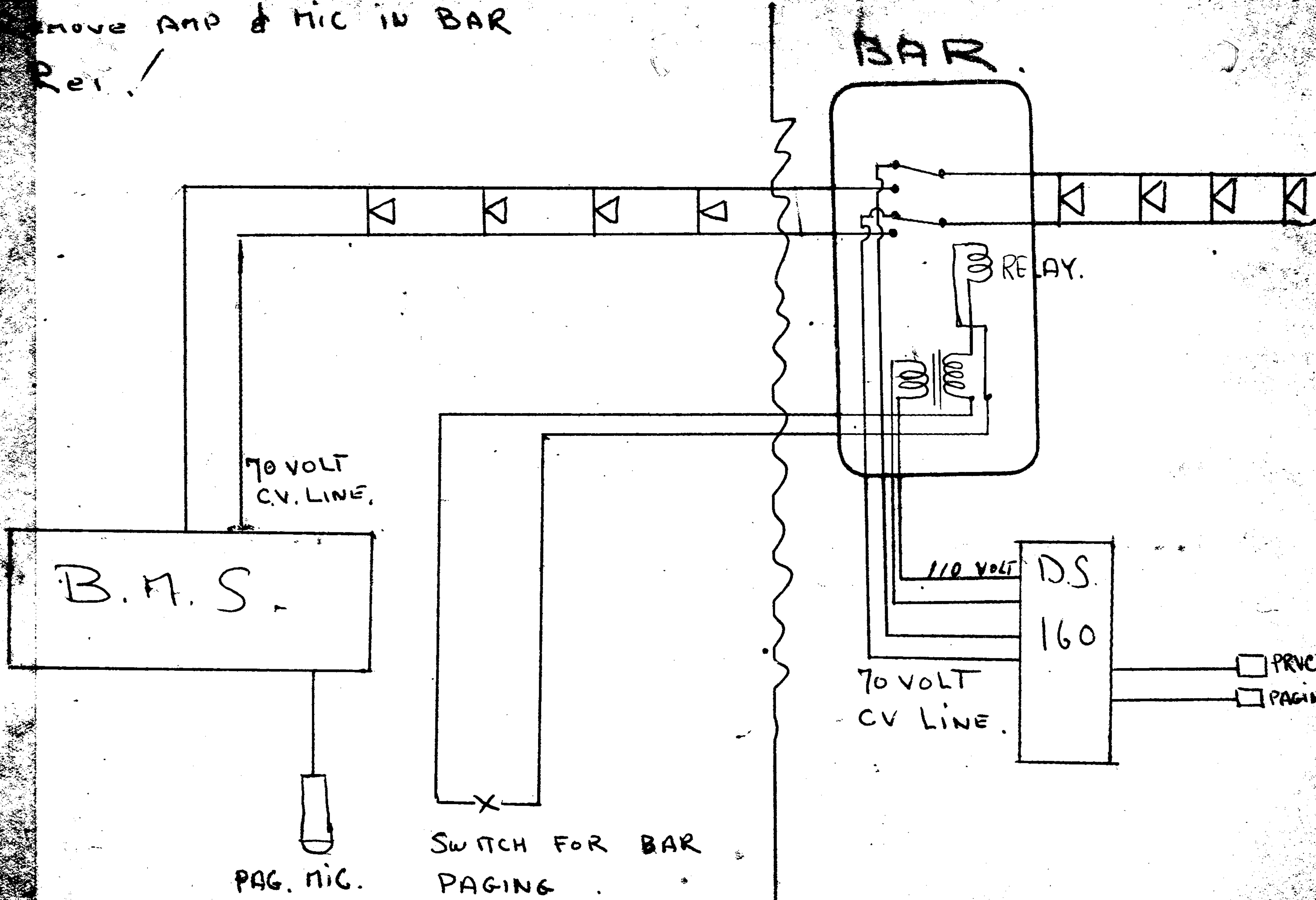
(BACKGROUND MUSIC SYS)
B.M.S. TO PHONO.

70 VOLT C.V. LINES.

JAN 13 1967

emove AMP & MIC IN BAR

Rei !



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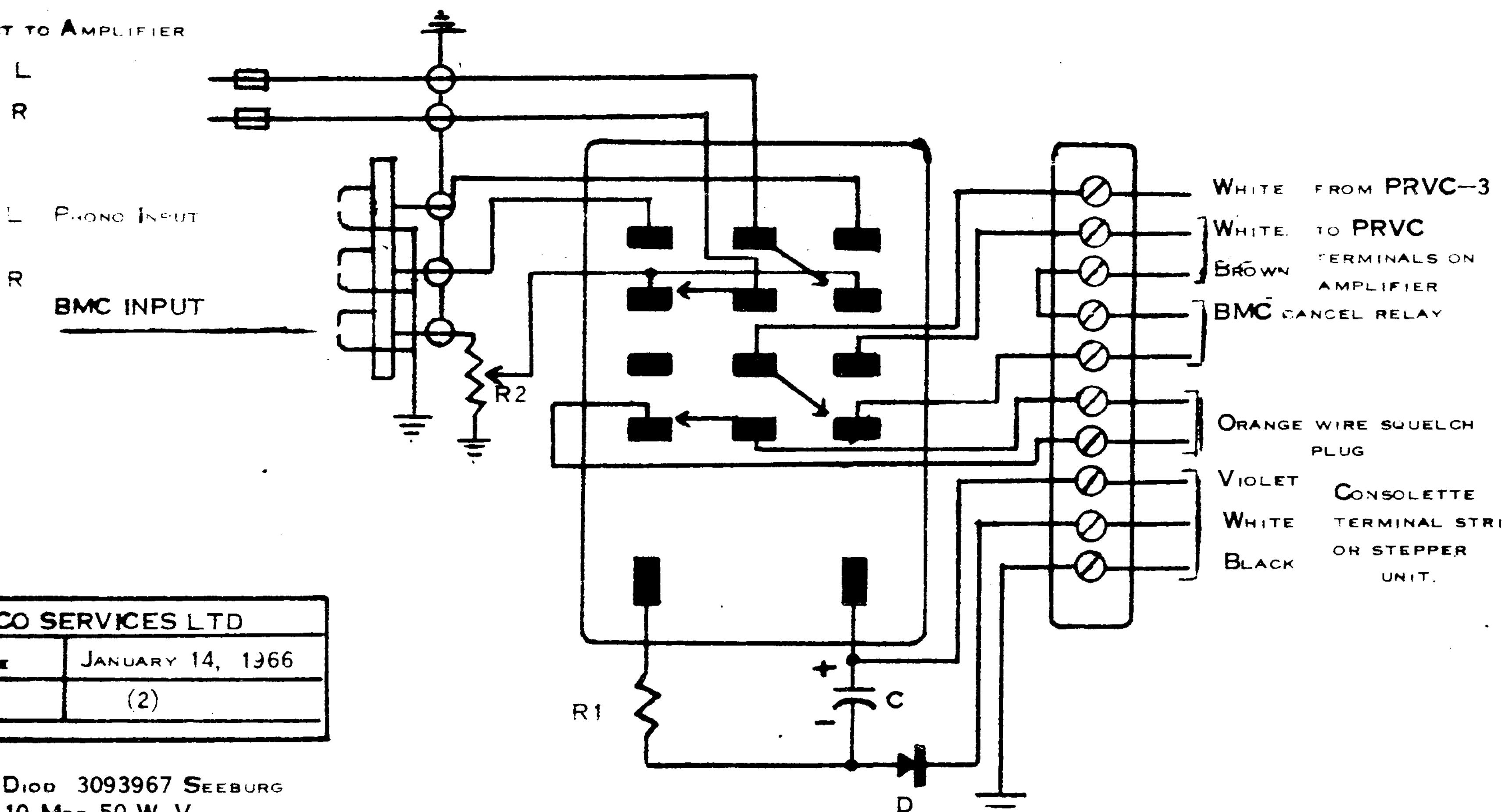
FEB 17 1967



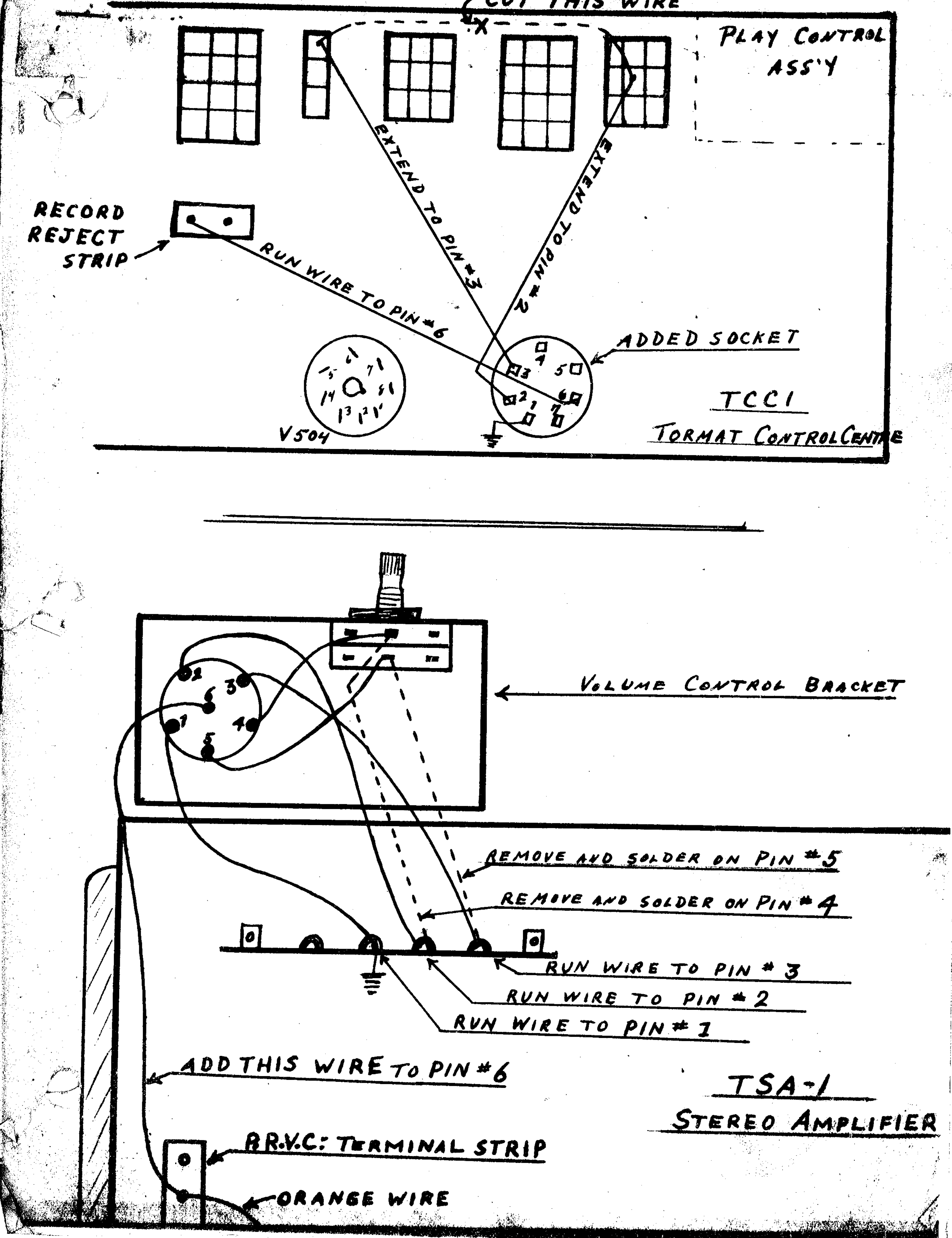
AMCO SERVICES LTD	
DATE	JANUARY 14, 1966
No.	(2)

D - DIOD 3093967 SEEBURG
C - 10 MED 50 W. V.
R1 - 330 OHM 2 WATT
R2 - 2000 OHM W WOUND

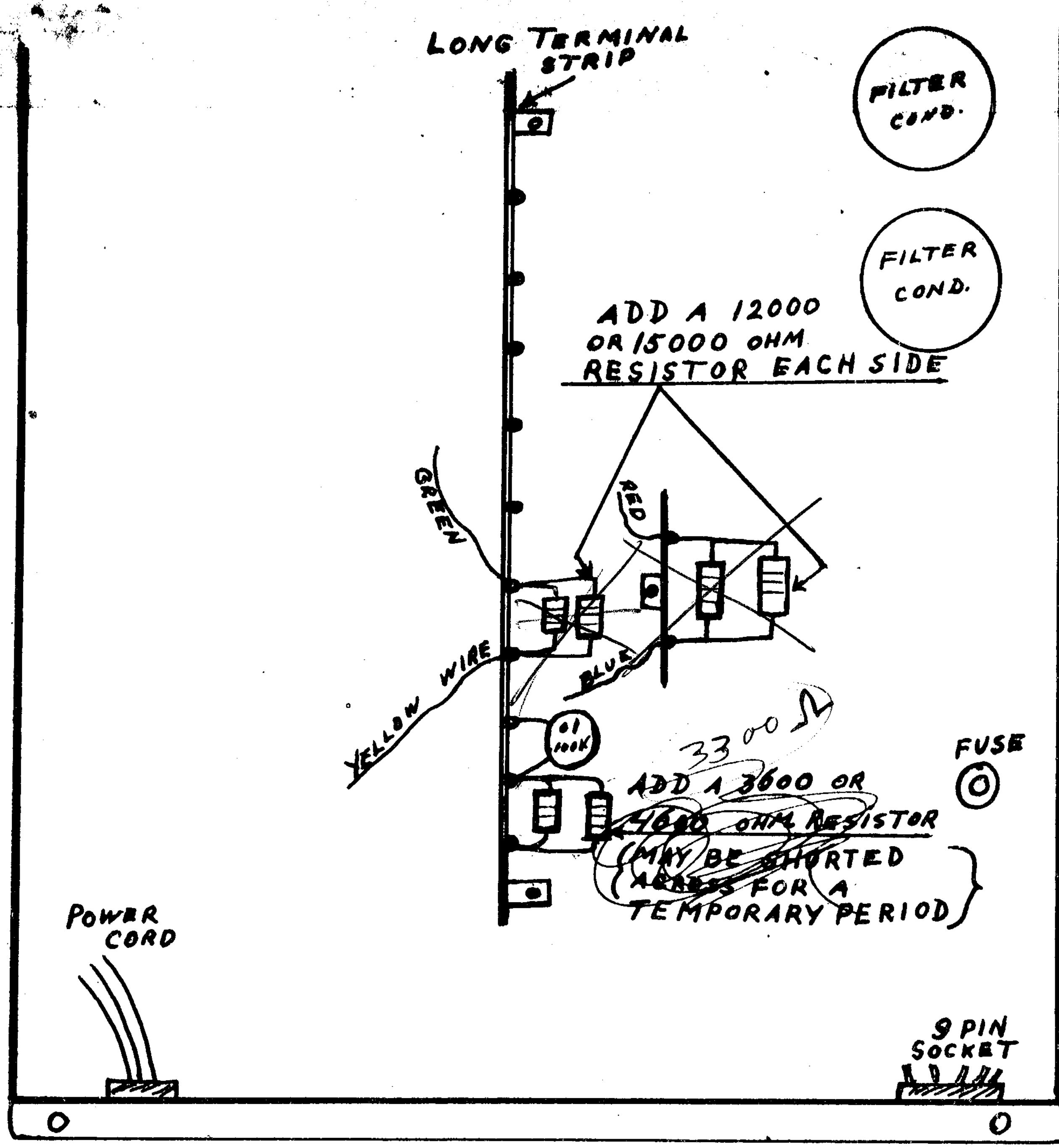
RELAY CONTROL UNIT TO OPERATE A BMC – 2 THROUGH AN LPCR1 OR LPC 480 SOUND SYSTEM.

NOTE – THE RECORD CANCEL BUTTON ON PRVC-3 WILL CANCEL RECORD ON EITHER BMC–1 OR LPC PHONOGRAPH, – WHICHEVER IS PLAYING AT THAT TIME.

JANUARY 14, 1966 (2)



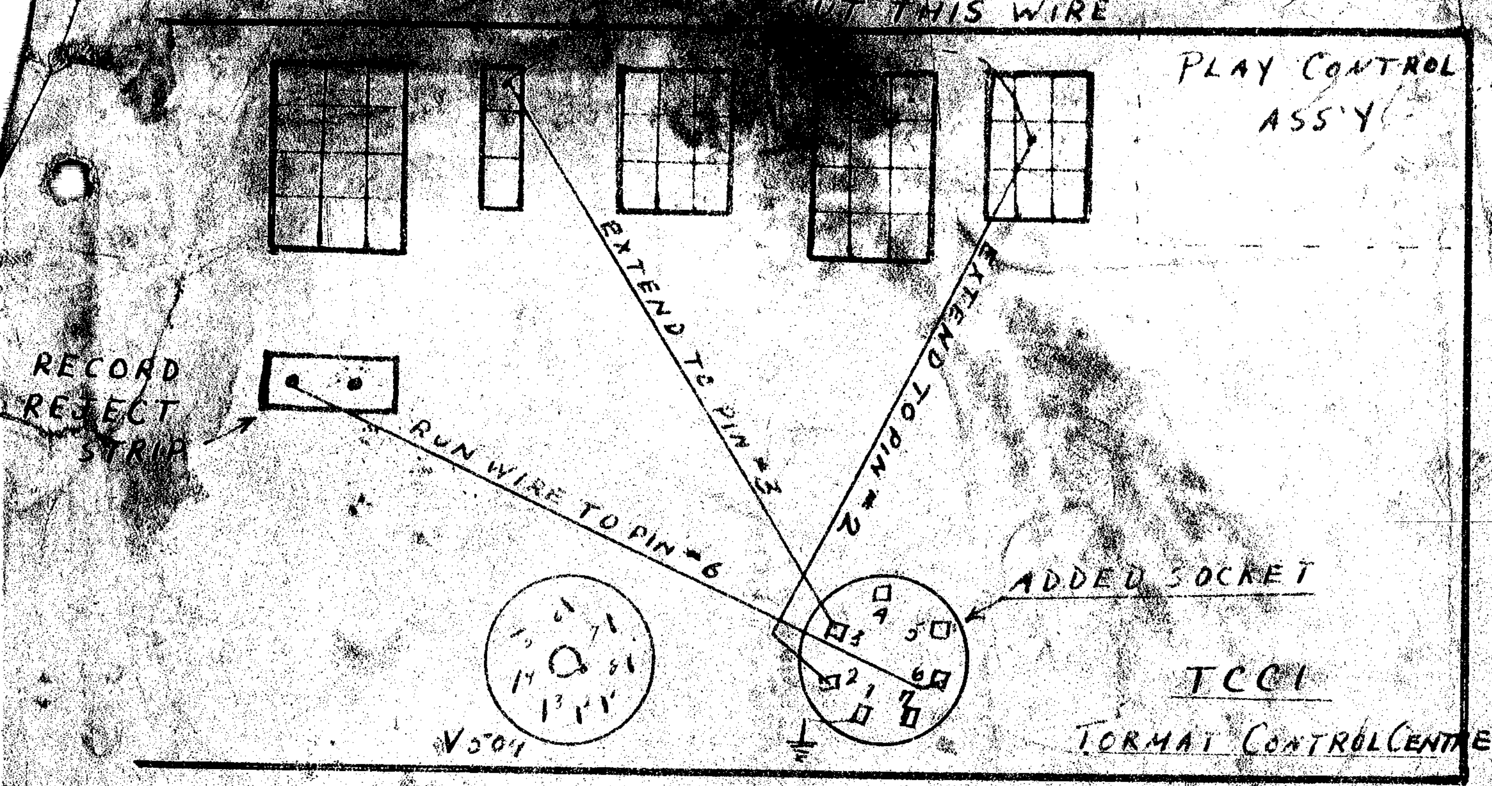
CUT THIS WIRE
PLAY CONTROL ASS'Y
EXTEND TO PIN #3
EXTEND TO PIN #2
RECORD REJECT STRIP
RUN WIRE TO PIN #6
ADDED SOCKET
V504
TCCI
TORMAT CONTROL CENTRE
VOLUME CONTROL BRACKET
REMOVE AND SOLDER ON PIN #5
REMOVE AND SOLDER ON PIN #4
RUN WIRE TO PIN #3
RUN WIRE TO PIN #2
RUN WIRE TO PIN #1
ADD THIS WIRE TO PIN #6
TSA-1
STEREO AMPLIFIER
B.R.V.C. TERMINAL STRIP
ORANGE WIRE



PS16-56 - PAGING POWER SUPPLY
MODIFICATIONS

REQUIRED -

1 - 3,600 TO 4,600 OHM RESISTOR 1/2 WATT
2 - 12,000 TO 15,000 OHM " " "



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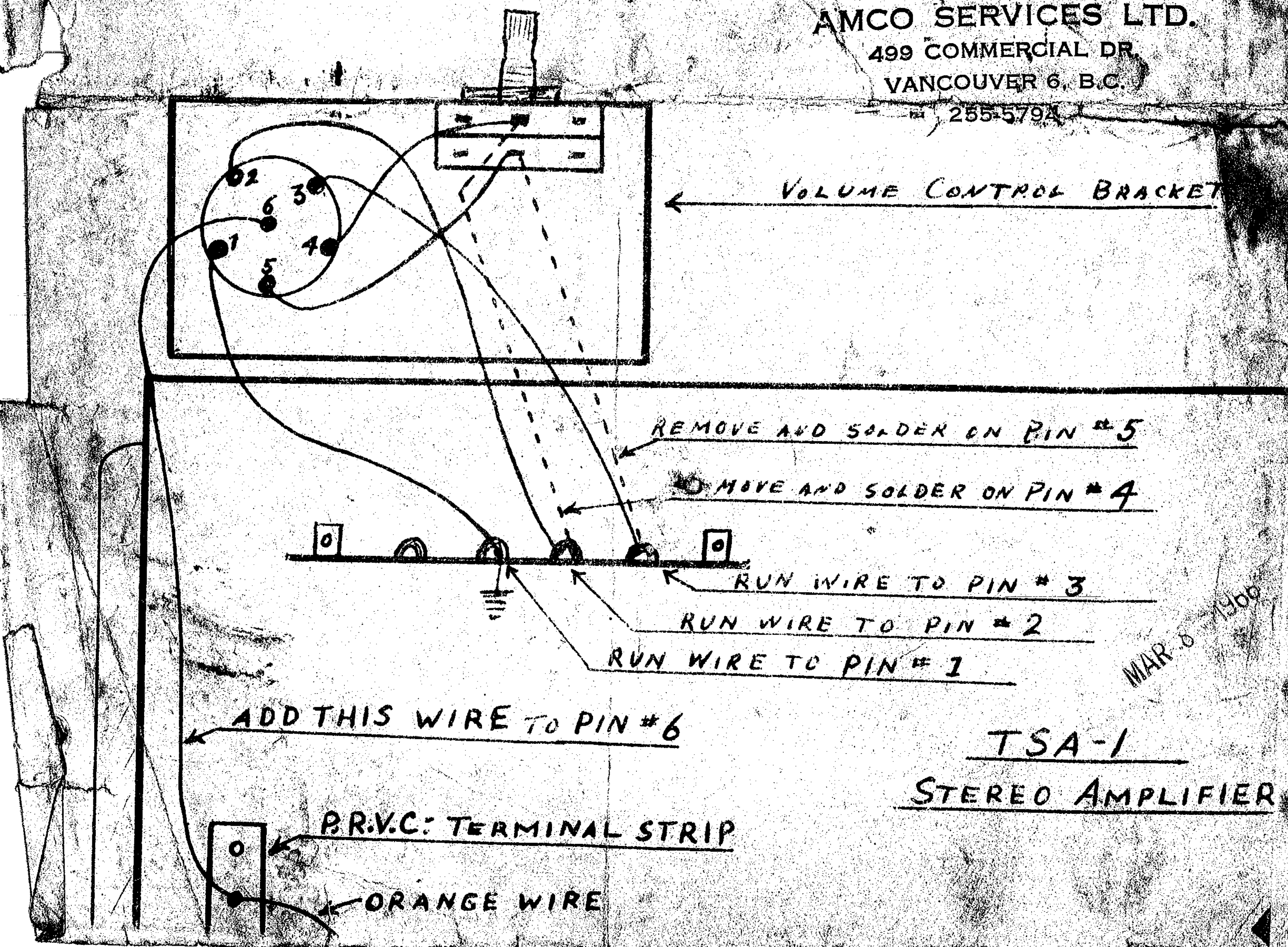
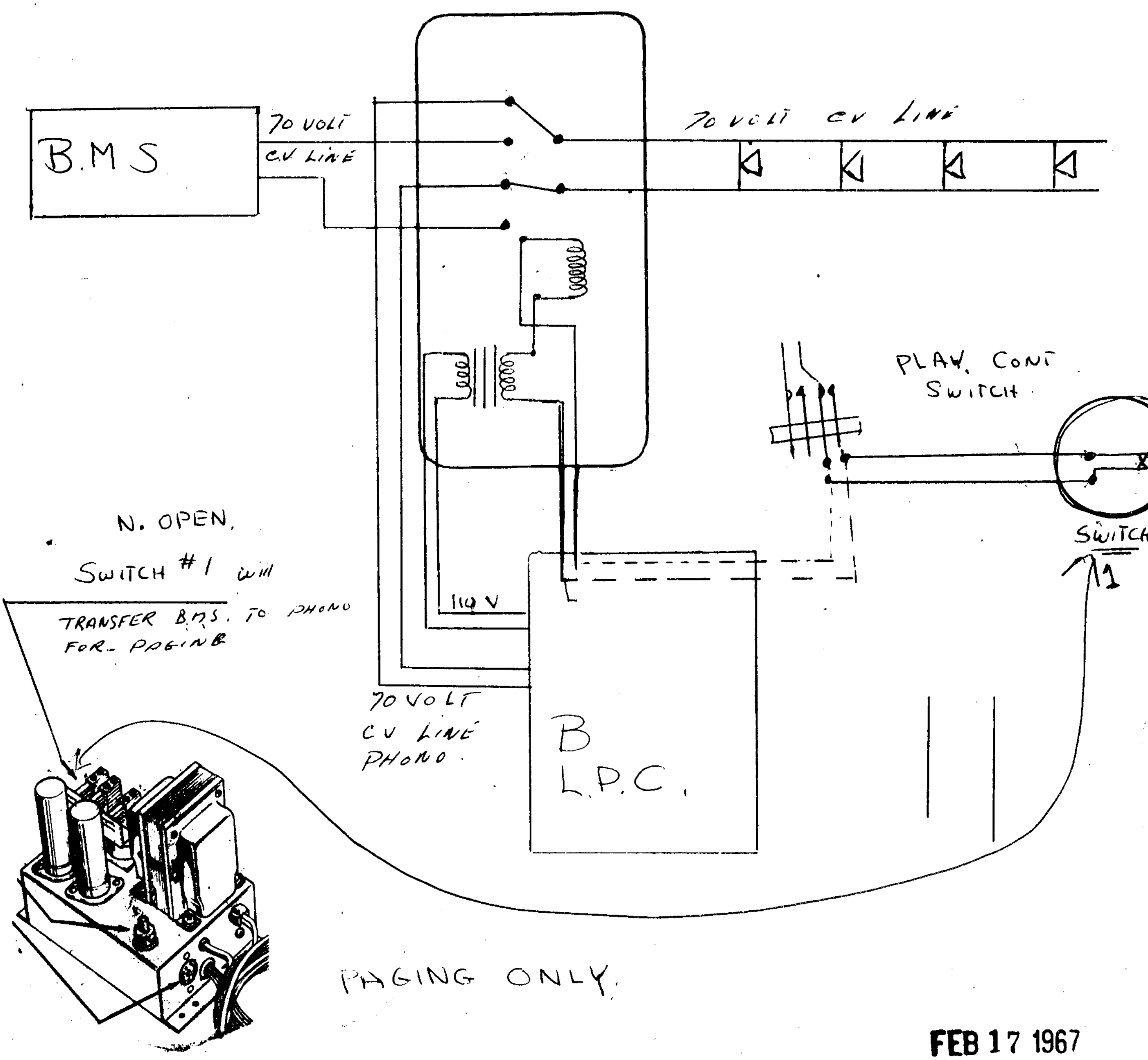
255-5794



AMCO SERVICES LTD.
499 COMMERCIAL DR.
VANCOUVER 6, B.C.
255-5794



FEB 17 1967

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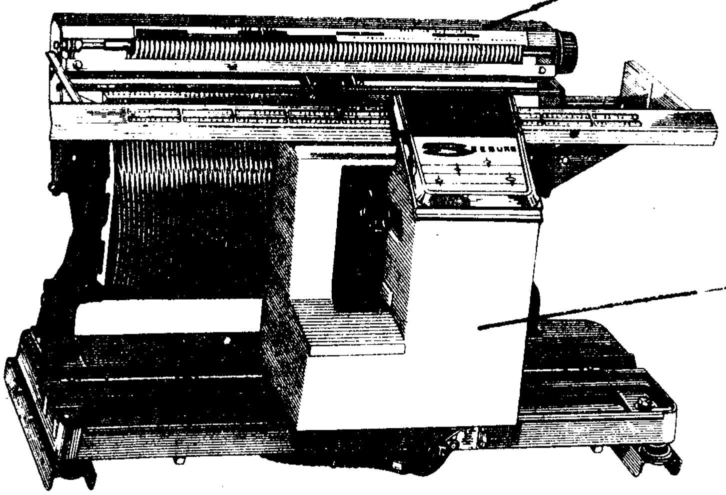
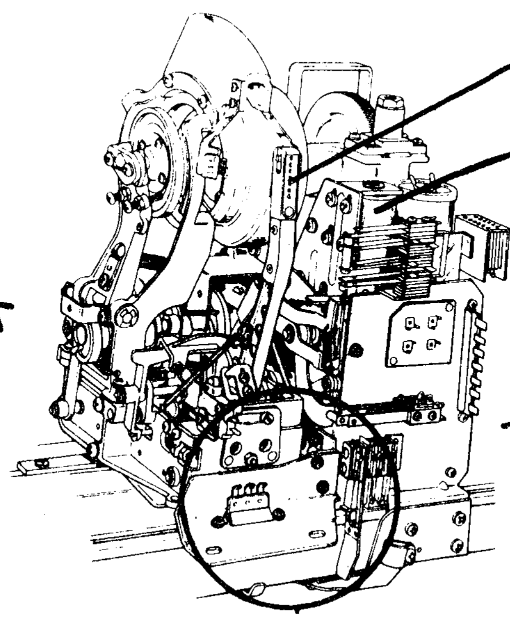




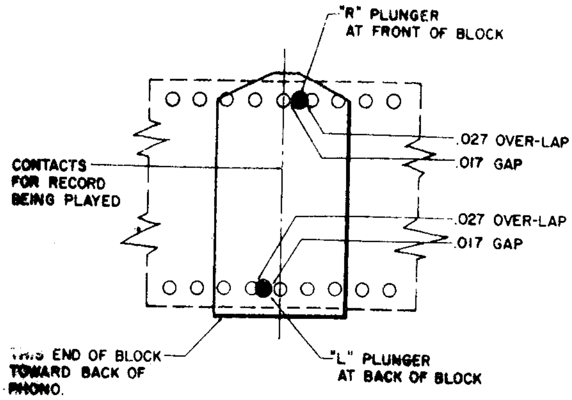
REMOVE FORMAT MEMORY UNIT

(1) SPRAY MECHANISM WITH CLEANER & DEGREASER CRYLON NO 1323. LET STAND FOR 20 MIN,

(2) SPRAY MECHANISM WITH E-Z OFF LET STAND 5 MIN.

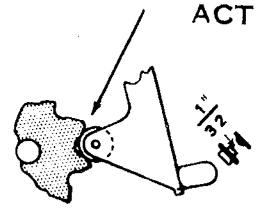
(3) SPRAY WITH WATER HOSE.

(4) DRY 1 DAY.

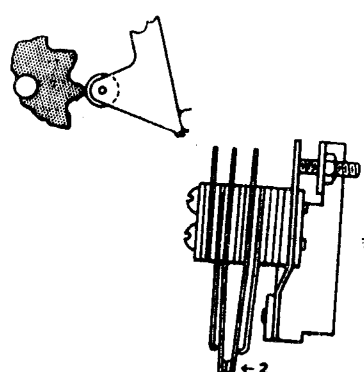


CONTACT BLOCK POSITION

ACTUATOR ROLLER

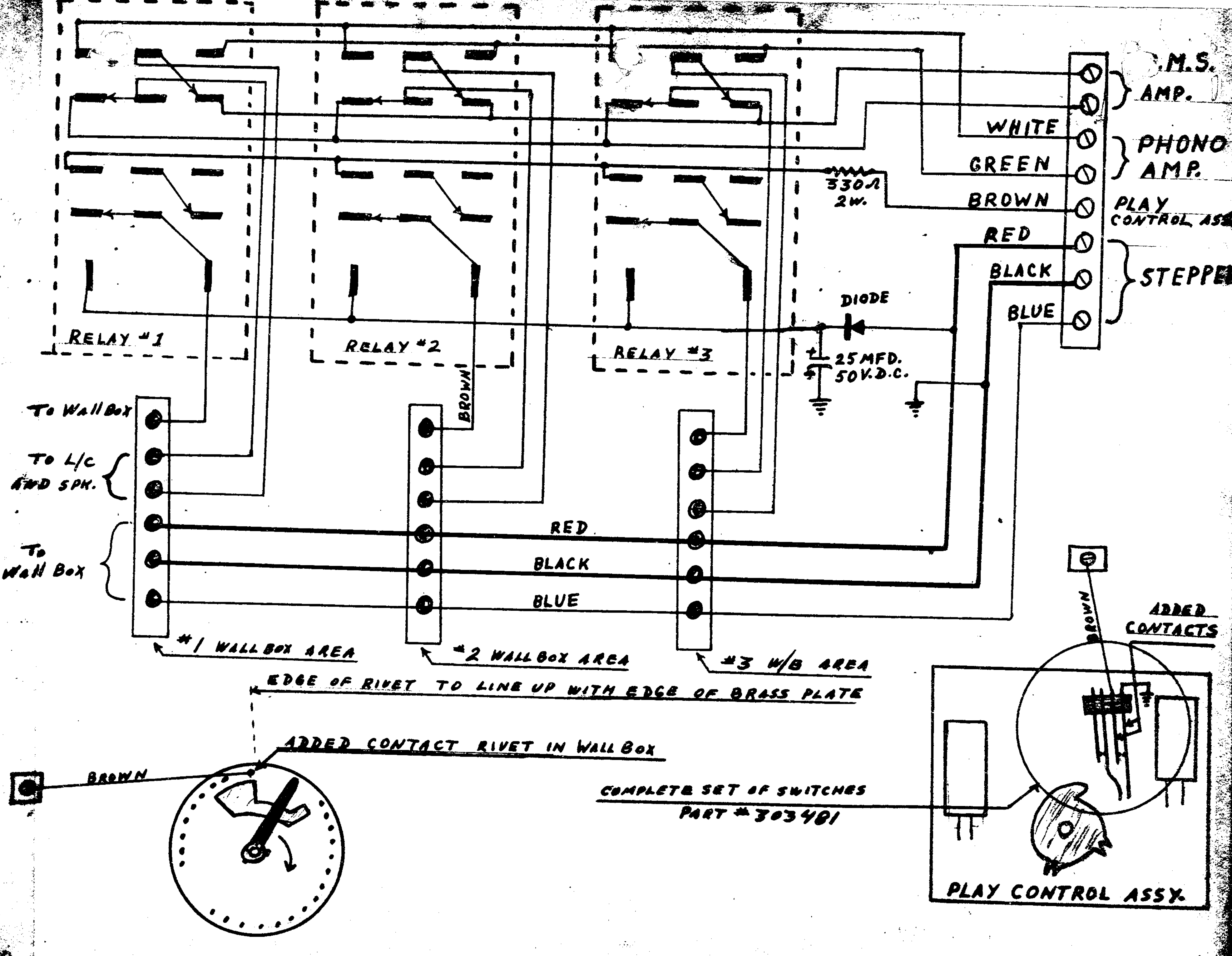


BEND ONLY THE BRACER
BLADES
TO MAKE ADJUSTMENTS



ADJUST DETENT SWITCH

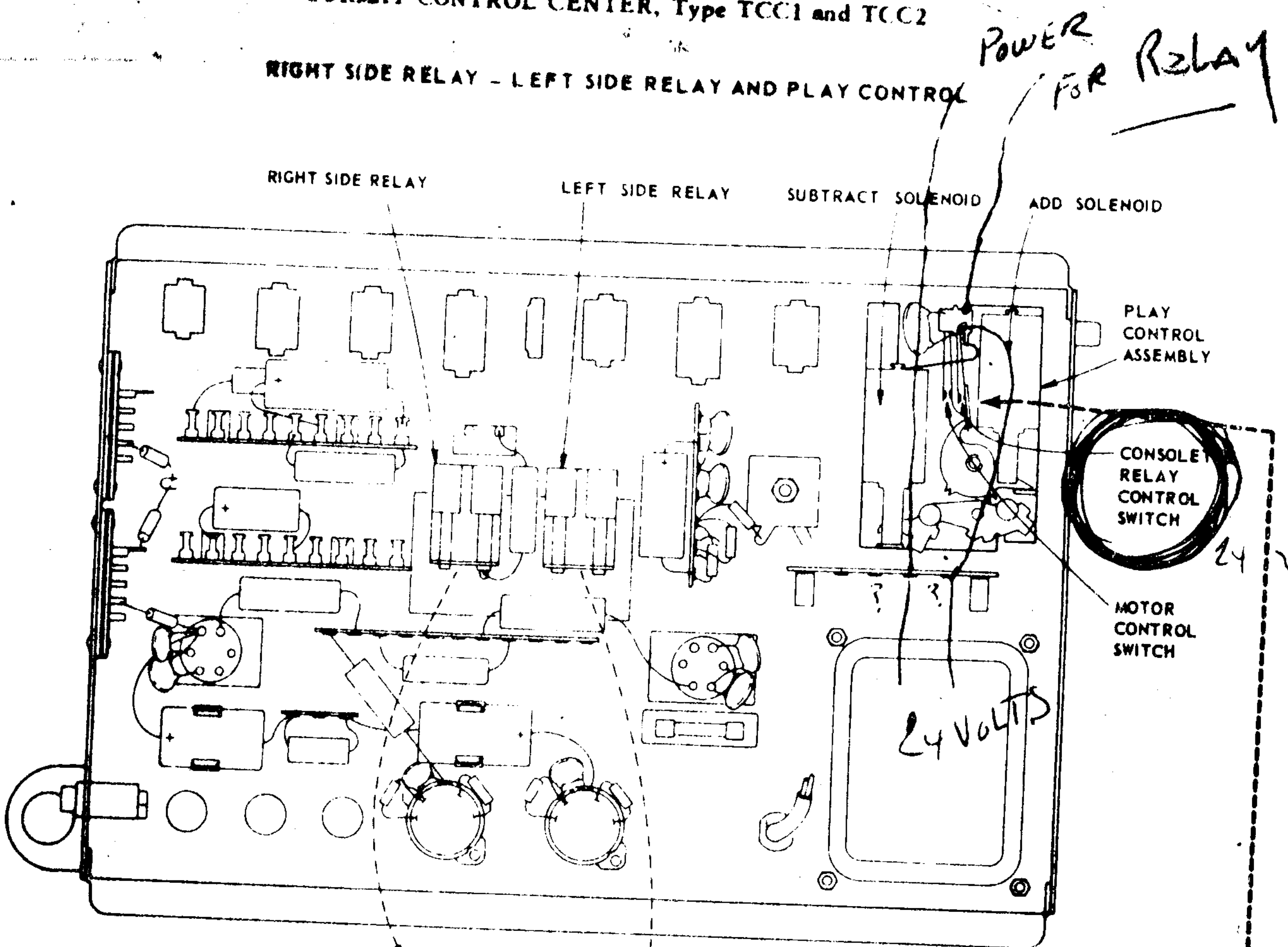
X NUT ON ADJUSTING SCREW AND
CREW CLOCKWISE UNTIL SWITCH
RE OPEN. BACK OFF SCREW UNTIL
RE JUST CLOSED. COMPLETE
BY CONTINUING TO TURN THE
ER-CLOCKWISE 1 TURN EXACTLY.
TIGHTEN HEX NUT WITHOUT TURNING SCREW.
CONTACT PRESSURE SHOULD NOW BE 2
OUNCES MINIMUM.



PAUL CURTIS FEB/65

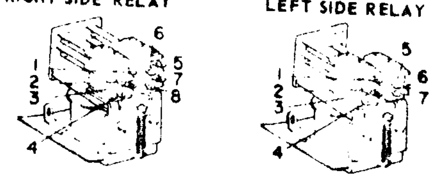
TORMAT CONTROL CENTER, Type TCC1 and TCC2

RIGHT SIDE RELAY – LEFT SIDE RELAY AND PLAY CONTROL



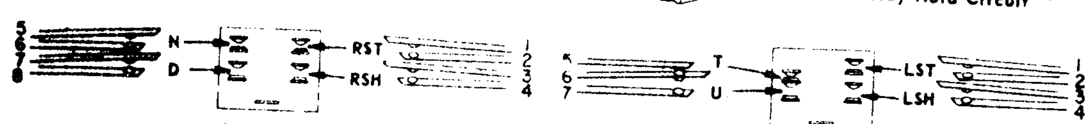
CONTACT FUNCTION

N - Read-Out Circuit
D - Reversing Relay Circuit
RST - Trip Circuit
RSH - Relay Hold Circuit



CONTACT FUNCTION

T - Reversing Relay Circuit
U - Read-Out Circuit
LST - Trip Circuit
LSH - Relay Hold Circuit

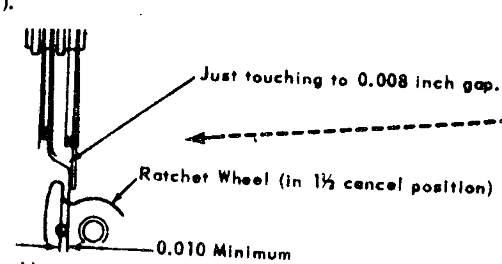


RELAY CONTACT ADJUSTMENT

1. Armature travel should be 1/16 inch measured between armature and armature back stop when relay is energized.
2. Short blades should move 1/64 inch when contacts make and break.
3. All contact gaps 0.020 inch.
4. All contact forces 1 ounce.

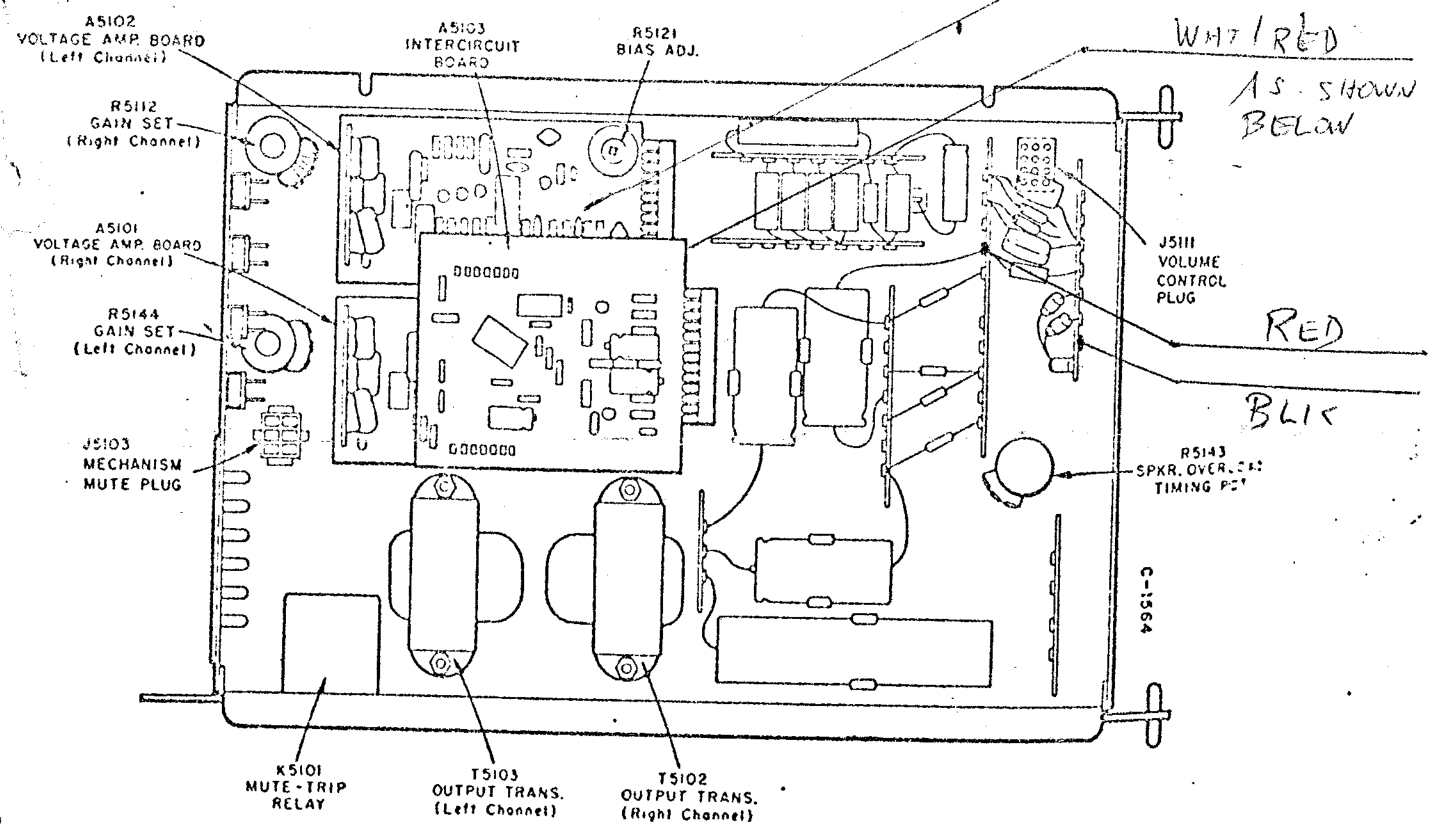
PLAY CONTROL CONTACT ADJUSTMENT

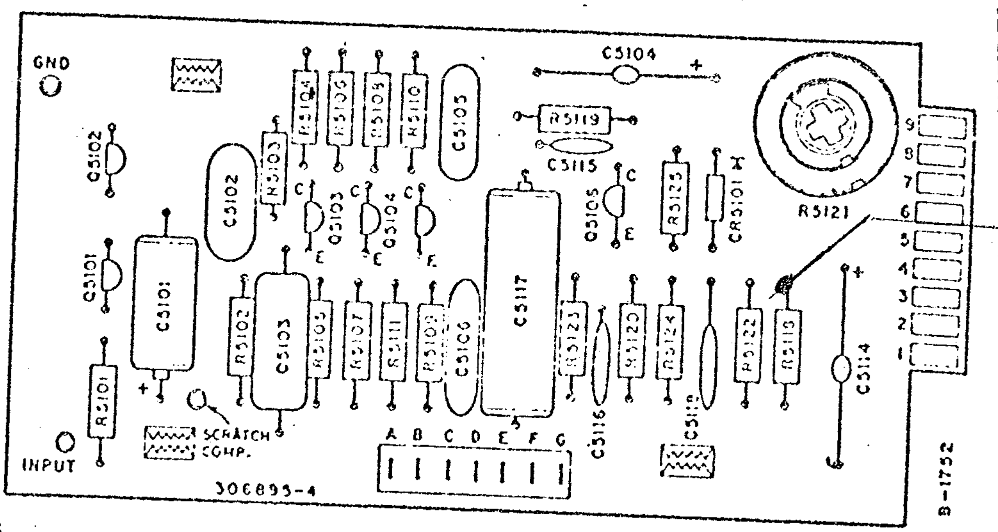
1. With ratchet wheel in fully stored position each switch contact pressure should be 30 grams min. (measured at contacts).
2.



3. With assembly in full cancel position each switch contact should be open with a 0.020 min. gap.

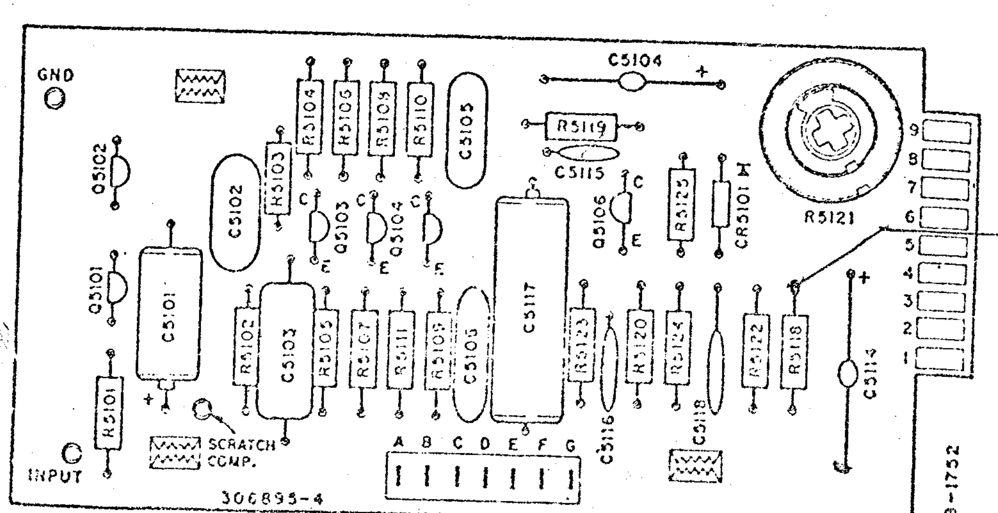
PR. G80





WHT/BLU

LSI TO FIRESTAR

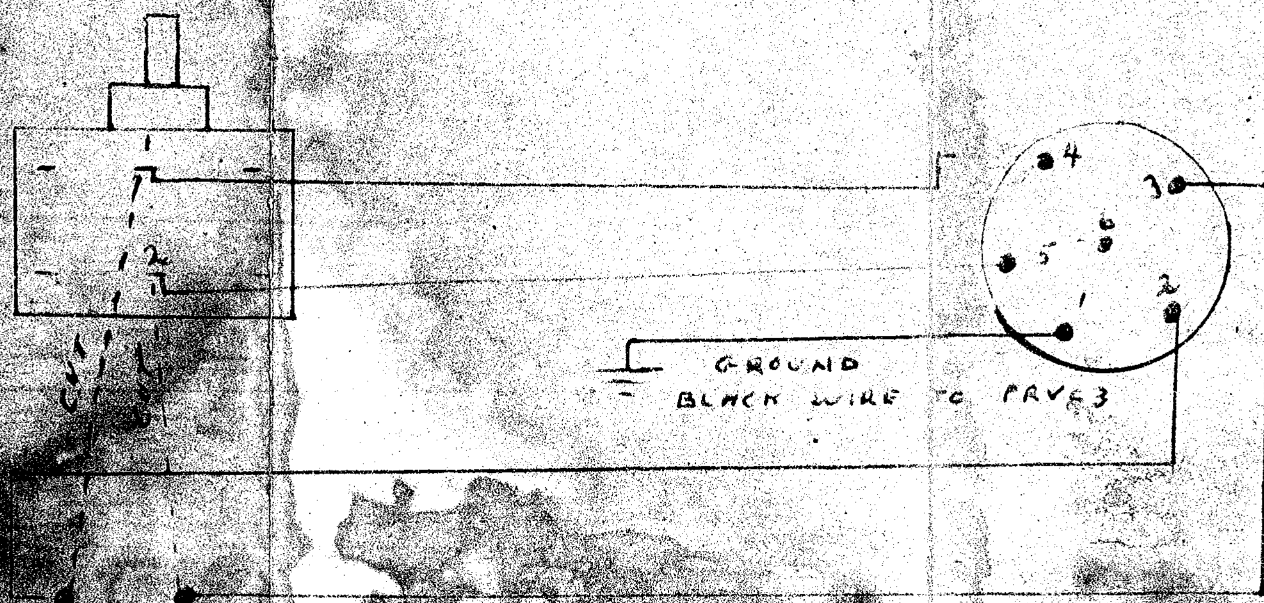


WHT/RD

TO WIRE IN
TPIK PAGING PLUG.

AMCO SERVICES LTD., 199 COMMERCIAL DR., VAN. 6, B.C.

PAGING PLUG FOR BANDSHELL PHONE



- (S) SPEAKER
- (SW) SWITCH
- (P) PRE AMP
- (BS) BACKGROUND SYSTEM
- (BC) BACKGROUND COMPACT
- (A) 10 AMP 10 WATT
- (L) LINE CONTROL

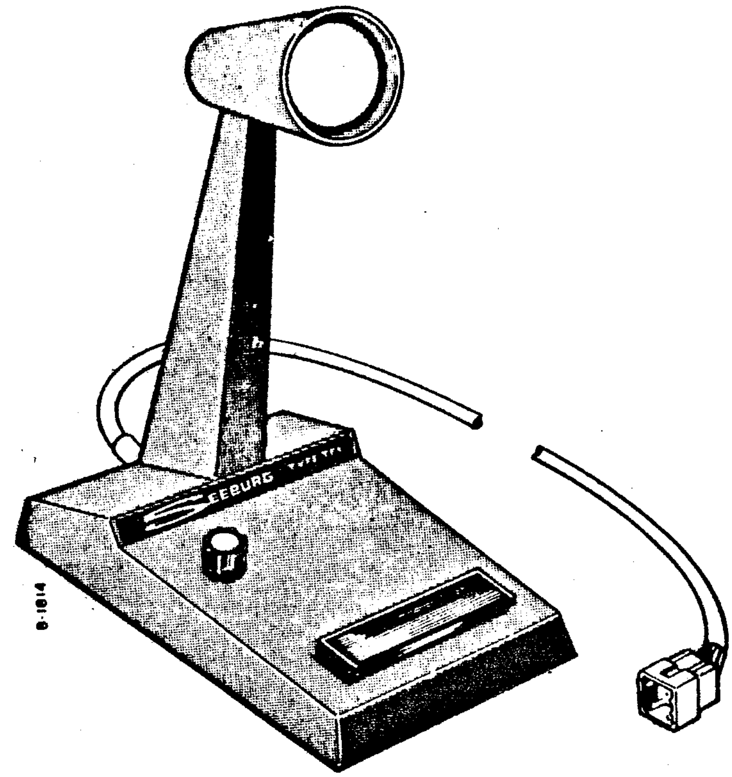
LOCATION - ADDRESS - CITY -

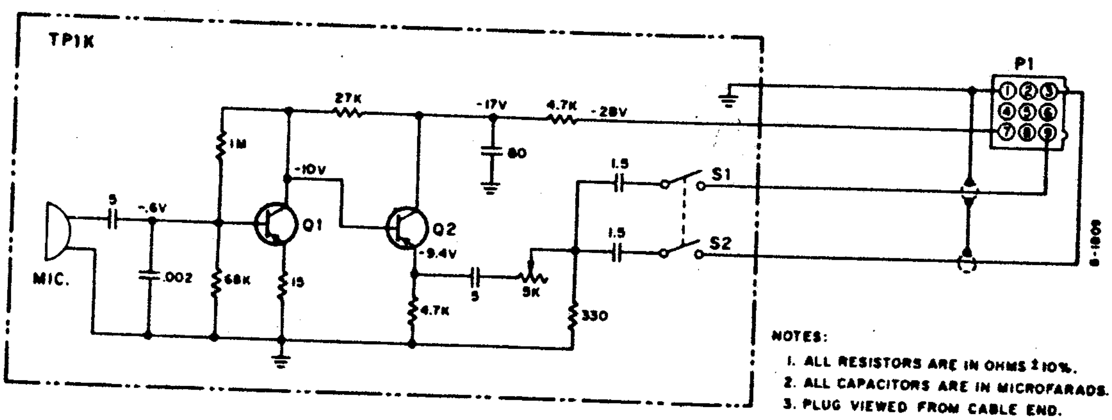
COMPLETED BY - DRAWING BY -

NOTE - ALL REMARKS ON BACK.

47-302571 Type TP1 TRANSISTORIZED PAGING UNIT

(See 81-302630 INSTRUCTION SHEET for installation.)





PARTS LIST (Special Items Only)

Item	Part No.	Description
A1	70-302626	Pre-Amp. Board Assembly
M1	47-302625	Microphone Cartridge
P1	73-309568	9 Cont. Pin Hsg. (WHT)
	72-941845	Pin
Q1	61-309436	PNP Transistor 2N4126
	61-309436	PNP Transistor
R1	51-302627	Volume Control
	33-302628	Knob

Item	Part No.	Description
S1	41-302629	Paging Switch
S2	41-302629	Paging Switch

NOTE:
Where installations require a longer microphone cable, 25 ft. 70-302632 extension cables can be purchased from the Seeburg Parts Division.

To modify to a [illegible] mike - RM1 etc - reverse electrolytic and change Q_1 + Q_2 to 2N2925