

#/
2LE/M
GRID CIRCUIT
MODIFICATION PROCEDURE
STATION K R E M

The purpose of this modification is to prevent arcing in the grid tuning capacitor of the 2LE/M under dusty conditions. Such arcing has in some cases been erroneously interpreted as a grid-to-filament short in the final amplifier tube.

The modification includes replacement of the original grid tuning capacitor with one having wider spacing, and circuit modifications to provide improved balance between the voltages across the grid capacitor and to reduce the driving power required.

The transmitter remains fully operative during steps 1 through 10. However, it is disabled starting with step 11, so that a full off-the-air period should be allowed for steps 11 through 26.

This modification has been tested at the factory on your frequency (970 kc) and a copy of the tuning data is enclosed. While your final tuning data may vary somewhat, due to manufacturing tolerances on components, this data will be useful as a guide.

CAUTION: Remove all primary power at the main wall switch before proceeding.

1. Locate and drill 3 holes in the top surface of the PA grid box as shown in Figure 1. (If the holes are drilled from underneath, measure inside the box, subtracting 1/8" from the 11-15/16 and 5-7/8" dimensions for metal thickness). CAUTION: Cover the blower opening while drilling to catch the metal shavings).

2. Mount capacitor C-372 (Item AA) on the underneath surface, using 2

screws (item H), 2 lock washers (item L), and 2 nuts (item E).

3. Connect the near terminal of C-372 to ground at the third hole drilled in step 1, using No. 10 bus (item M), 2 lugs (item C), 1 screw (item F), 1 lock washer (item L) and 1 nut (item E).

4. Connect a short piece of No. 10 bus (item M) to the far end of C-372, using a solder lug (item C). Run the other end near (but not touching) the terminal of R-301 furthest from the chassis. Do not terminate at this time.

5. Refer to Figure 2, and locate and drill one hole in the left end of the grid box as shown.

6. Ground one end of R-348 at this hole, using 1 lug (item C), 1 screw (item F), 1 lock washer (item L), and 1 nut (item E).

7. Connect another lug (item C) to the other end of R-348. Do not terminate at this time.

8. Refer to Figure 3, and assemble one clip (item B) to upper support bracket (item T) as shown, using 1 screw (item F), 1 lock washer (item L, and 1 nut (item E).

9. Refer to Figure 4. Remove the screw from the left end of the bottom coil bar of L-301. Replace with 1 screw (item H), and mount the support angle (item U) as shown.

10. Refer to Figure 5. Assemble 1 clip (item B), and connecting strap (item V) as shown, using 1 screw (item G), 1 lock washer (item L) and 1 nut (item E). Assemble the metal washer (item N), 1 corprene washer (item AC) and ceramic standoff (item A) on the free end of the screw as shown.

NOTE: One full off-the-air period should be allowed for performing

the remaining steps. The transmitter will not be operative again until step 26 is completed.

11. Remove grid coil I-301, tagging all leads removed so that they can be returned to their proper location.

12. Remove and discard C-362 and its connecting strap. (On a 21M transmitter, also remove and discard C-363 and its strap).

NOTE: C-362 (and C-363) may be kept as spares for C-212 thru C-215, C-329, C-344 and C-345, if desired.

13. Check the air gap spacing on the label on the rear of C-301. If the air gap is .080", this capacitor is to be replaced with a unit having .125" spacing (item X). (a.) Tag and remove all leads. (b.) Loosen the set screws on the sprocket on the rear of the grid tuning dial, and slip the sprocket and chain off the shaft. (c) Remove four screws from the left end of the grid box which hold the tuning capacitor assembly in place and remove the assembly. (d) Remove two screws holding the grid capacitor to its aluminum mounting plate. Mount the new capacitor on this plate. (e) Transfer the sprocket-insulated coupling assembly from the old capacitor to the new unit. (f) Mount the new capacitor, and reconnect the leads. (g) Hook the drive chain over the capacitor sprocket, and place the upper loop of chain over the dial sprocket. Slip the dial sprocket on the dial shaft. Set the capacitor at full capacity, the dial at 100, and tighten the sprocket set screws.

14. Remove and discard the strap connecting the rear stator section of C-301 to the grid contact support.

15. Refer to Figure 6. Mount the upper support bracket assembly (step 8 and Figure 3) in the rear hole of the rear grid terminal of the

front RF tube socket, using the existing hardware.

16. Remount the grid coil. Mount the standoff assembly of step 10 on the support angle on L-301 as shown in Figure 6, using 1 screw (item F), 1 lock washer (item L) and 1 corprene washer (item AC). Connect the strap to the grid section (rear) of the stator of C-301.

17. Check that all connections to the grid coil are in place. Mount suppressor L-315 (item S) in its spring clips.

18. Check grid padders C-302, C-303, C-304, etc. If any of these padders are grounded, remove the ground connection.

19. Connect the remaining terminal of C-372 (which was left floating in step 4) to R-301. See Figure 8.

20. Connect the remaining terminal of R-348 (which was left floating in step 7) to the rotor of C-301 by fastening its lug under the screw holding C-301 to its mounting plate.

21. Check the bill of material. If C-302 (item AB) has been furnished, mount it on the holes provided behind L-301, using 2 screws (item H), 2 lock washers (item L) and 2 nuts (item E). Do not connect at this time.

22. If the equipment contains a parasitic suppressor above the chassis connected between the top plate of neutralizing capacitor C-310 and the RF tube mounting plate, remove and discard it. Connect the top plate of the neutralizing capacitor to the RF tube mounting plate, using neutralizing capacitor strap (item P), 1 screw (item J), 1 lock washer (item K) and 1 nut (item D).

23. Again check the bill of material. If capacitor C-150 (item Y) or C-151 (item Z) has been furnished, mount it in the output network of the driver, using 2 screws (item H), 2 lock washers (item L) and 2 nuts (item E).

Connect in parallel with the existing loading capacitors using connector strap (item R). (If C-150 or C-151 is furnished and there is already a C-150 or C-151 in the equipment, it is to be replaced with the new unit which has a higher capacity value. See test data enclosed).

24. Switch both the driver and final amplifier to low power. Set the driver loading control to minimum and energize the driver stage. Tune the driver plate circuit and final amplifier grid circuit to resonance. If the grid circuit will not reach resonance, add turns to L-301 or, if all of L-301 is in use, connect C-302 (added in step 21) across L-301, using No. 14 bus wire (item M) and 4 lugs (item C).

25. Switch the driver to high power and adjust tuning and loading to give 155 ma final amplifier grid current for a 2LE or 200 ma total grid current for a 2LM. The driver plate current should be considerably less for this amount of drive than before the modification was performed.

26. Energize the final amplifier in low power and resonate the plate circuit. Check neutralization and reneutralize as necessary, so that grid current maximum occurs at the same point as plate current dip. Tune and load to rated output.

27. If necessary, adjust driver tuning and loading to maintain the grid current values given in step 25. This completes the modification.

9-23-54

21 E Tuning Data
Radio Station KREM
Frequency 970 kc

C-148 2000 mmf
C-149 800 mmf
*C-150 2000 mmf
C-151 mmf
* L-108 54 turns
* L-109 20 turns
C-302 400 mmf
C-303 400 mmf
C-304 400 mmf
C-305 mmf
C-314 250 mmf
C-315 250 mmf
C-316 mmf
C-317 mmf
C-318 mmf
C-319 mmf
C-321 1000 mmf
C-322 1000 mmf
C-323 1000 mmf
C-324 500 mmf
* L-301 6 turns (pri)
32 turns (sec)
L-305 20 turns
L-306 14 turns

*Change from original factory test data.

Bill of Material

Radio Station K R E M

Quan.	Item No.	Part Number	Part Name
✓ 1	A	190 0018 00	Standoff - Ceramic
✓ 2	B	265 5010 00	Clip
✓ 5	C	304 1900 00	Lug - Solder
✓ 1	D	313 0053 00	Nut - 6-32
✓ 7	E	313 0054 00	Nut - 8-32
✓ 4	F	343 0309 00	Screw - 8-32 x 3/8
✓ 1	G	343 0312 00	Screw - 8-32 x 5/8
✓ 3	H	343 0314 00	Screw - 8-32 x 7/8 <i>NG 10-32</i>
✓ 1	J	343 0330 00	Screw - 6-32 x 3/8
✓ 1	K	373 7020 00	Washer - Lock, No. 6
✓ 8	L	373 7030 00	Washer - Lock, No. 8
✓ 2 ft.	M	421 1020 00	Wire - Bus, No. 10
✓ 1	N	310 0058 00	Washer - Flat, No. 8
✓ 1	P	504 9690 002	Strap - Neut, Cap.
✓ 1	R	504 9693 002	Strap - Connector
✓ 1	S	540 3955 002	Suppress - Par., L-315
✓ 1	T	540 3959 002	Bracket - Upper Support
✓ 1	U	540 3954 002	Angle - Support
✓ 1	V	540 3958 002	Strap - Connecting
✓ 1	W	745 5778 00	Resistor - R-348
✓ 1	X	920 0096 00	Capacitor - Var., C-301

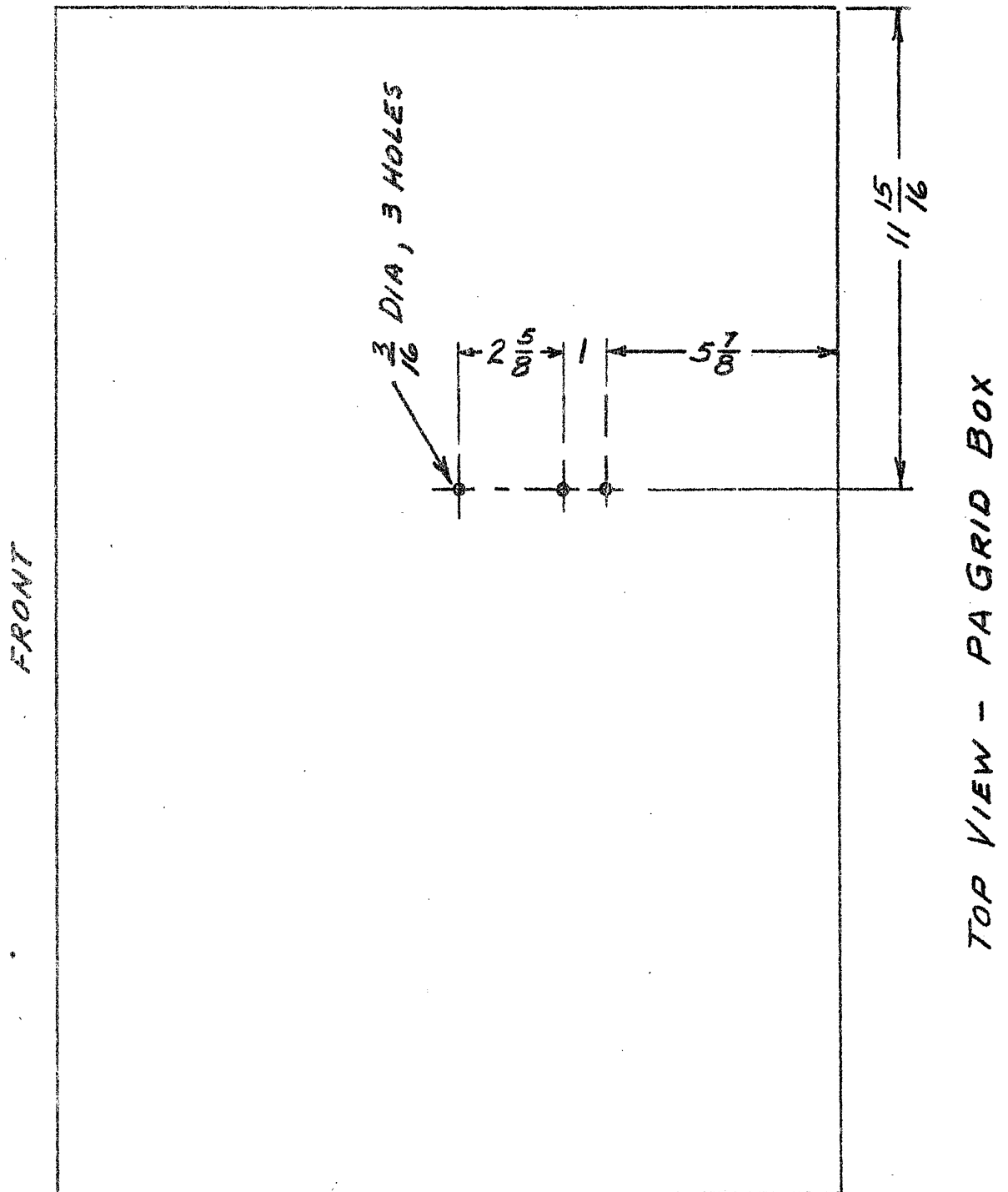
K R E M

2

Quan.	Item No.	Part Number	Part Name
✓ 1	Y	938 2080 00	Capacitor - C-150
		XX	Capacitor - C-151
✓ 1	AA	938 2088 00	Capacitor - C-372
		XX	Capacitor - C-302
✓ 2	AC	302 0029 00	Washer - Corprent

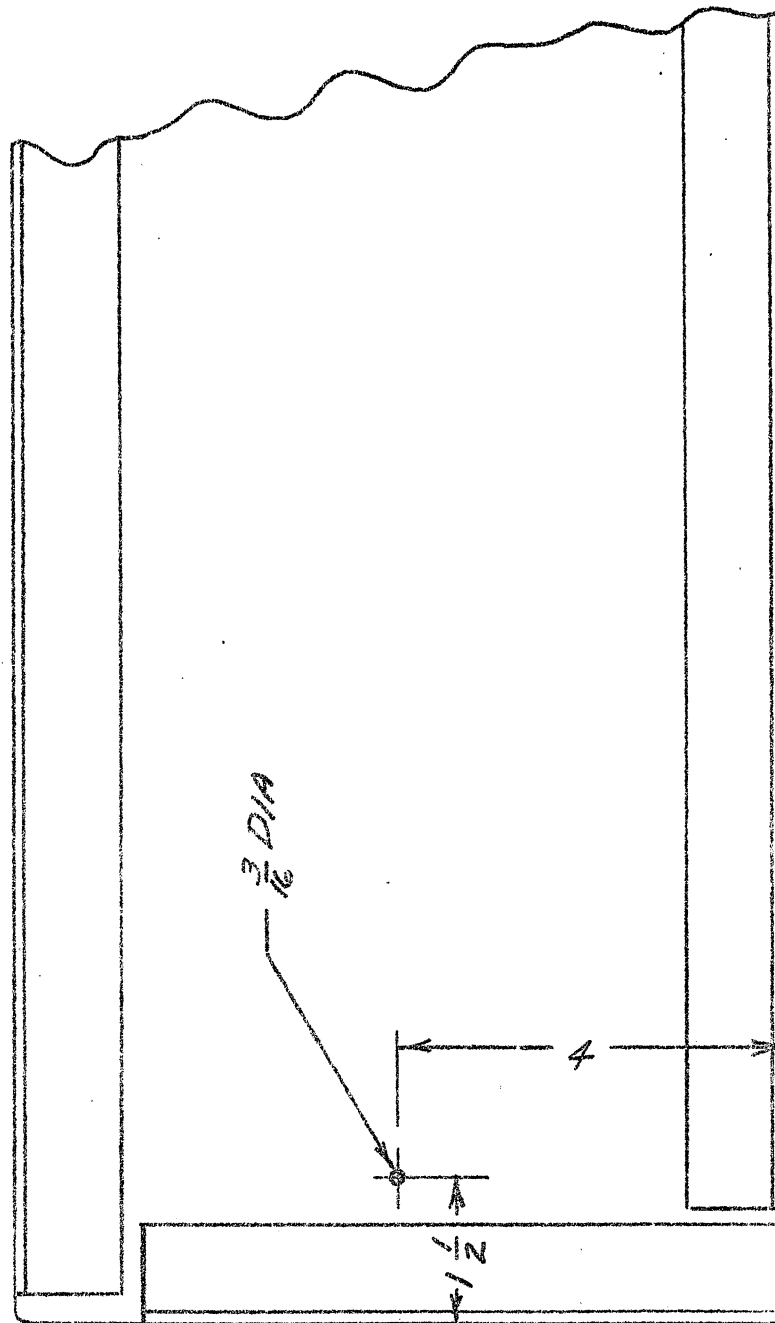
2070
3300
41
NG

FIGURE 1.



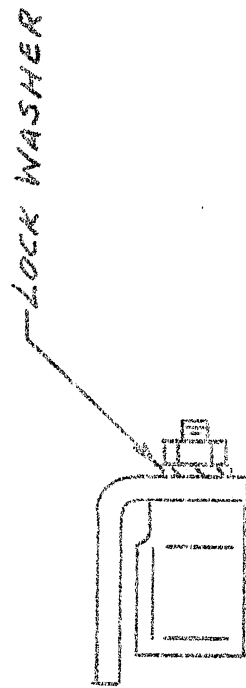
SCALE: 1/4" = 1"

FIGURE 2.



INSIDE VIEW, LEFT END - PA GRID BOX
SCALE: $\frac{1}{2} = 1$

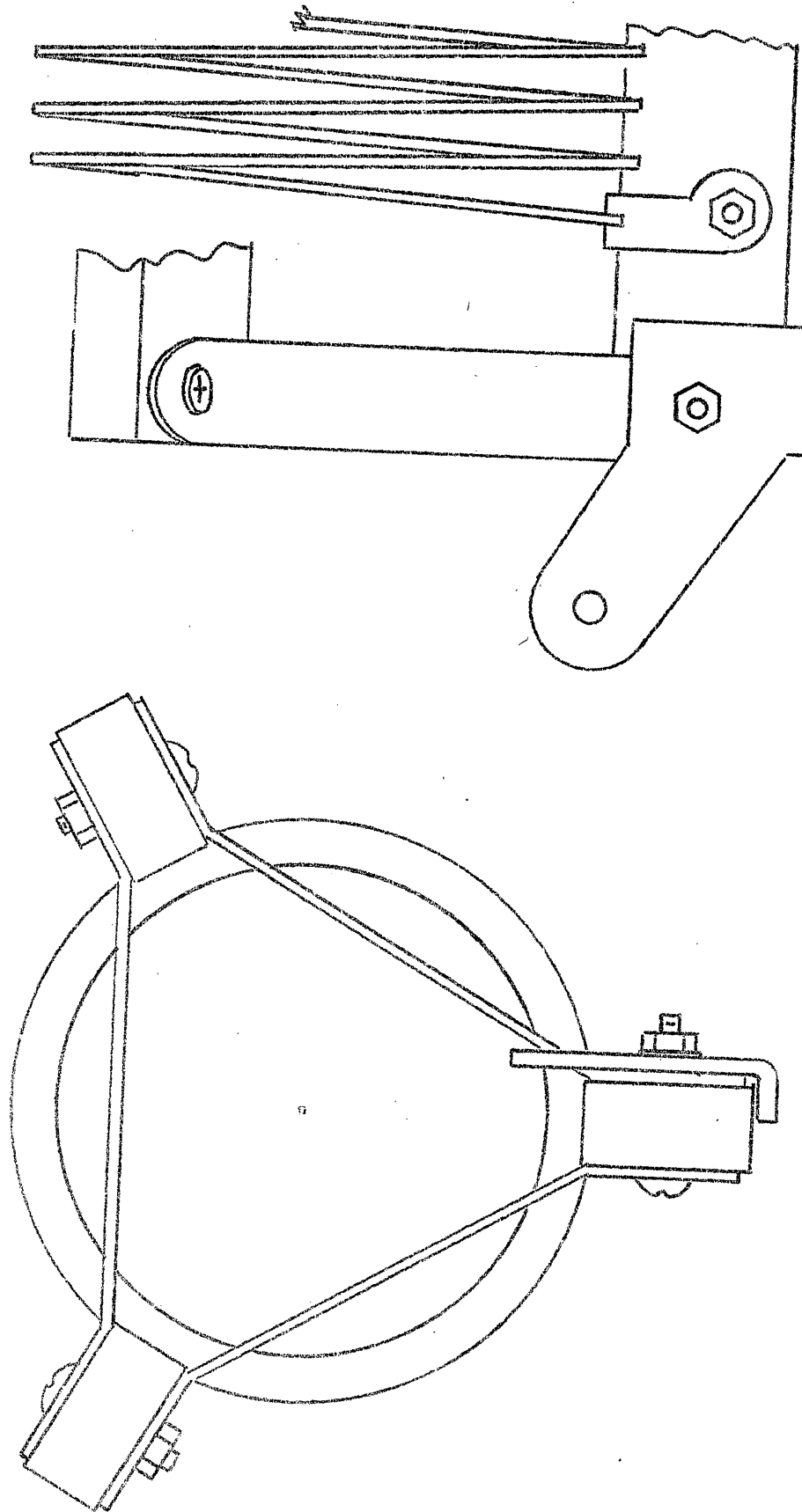
FIGURE 3.



UPPER SUPPORT
BRACKET ASSEMBLY DETAIL

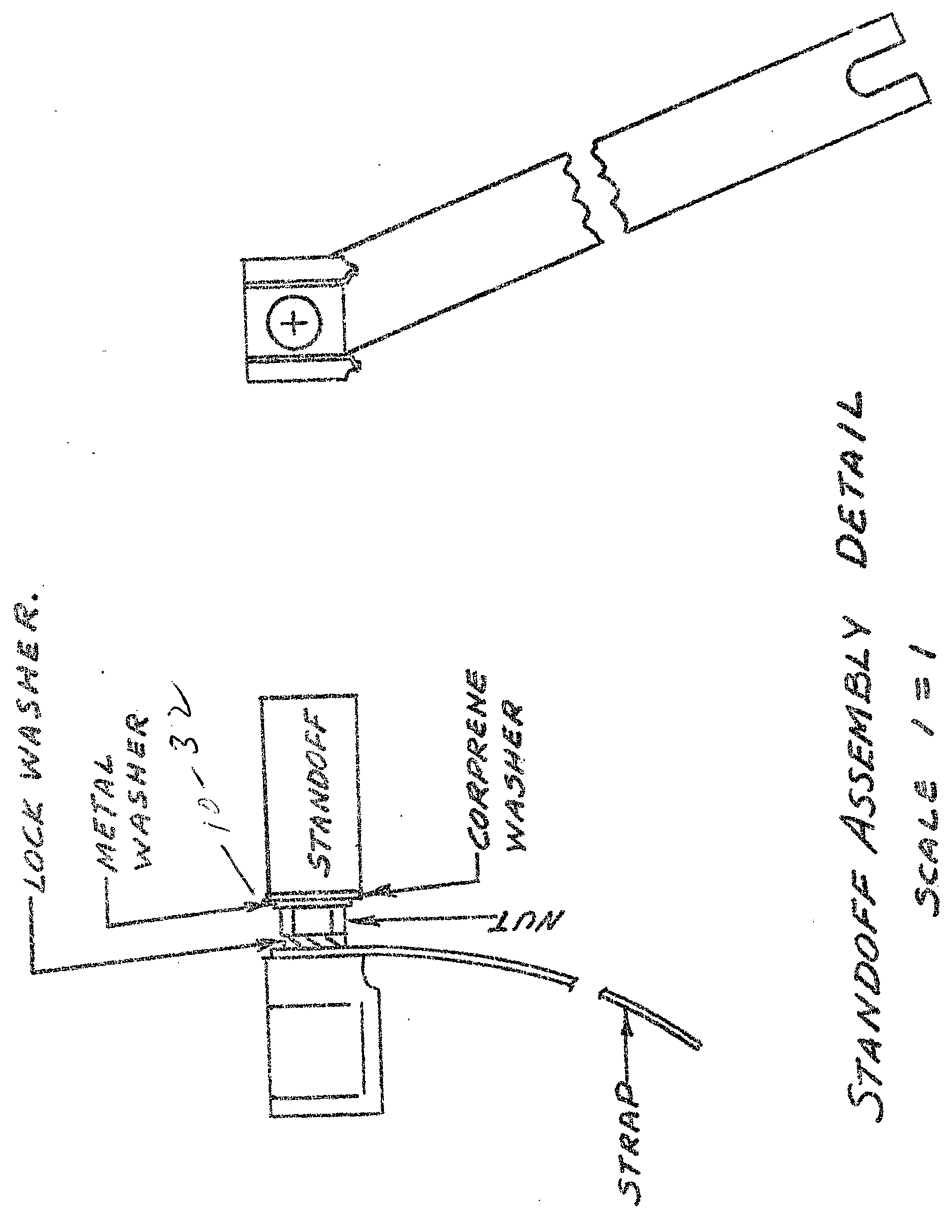
SCALE 1=1

FIGURE 4.



SUPPORT ANGLE MTG DETAIL

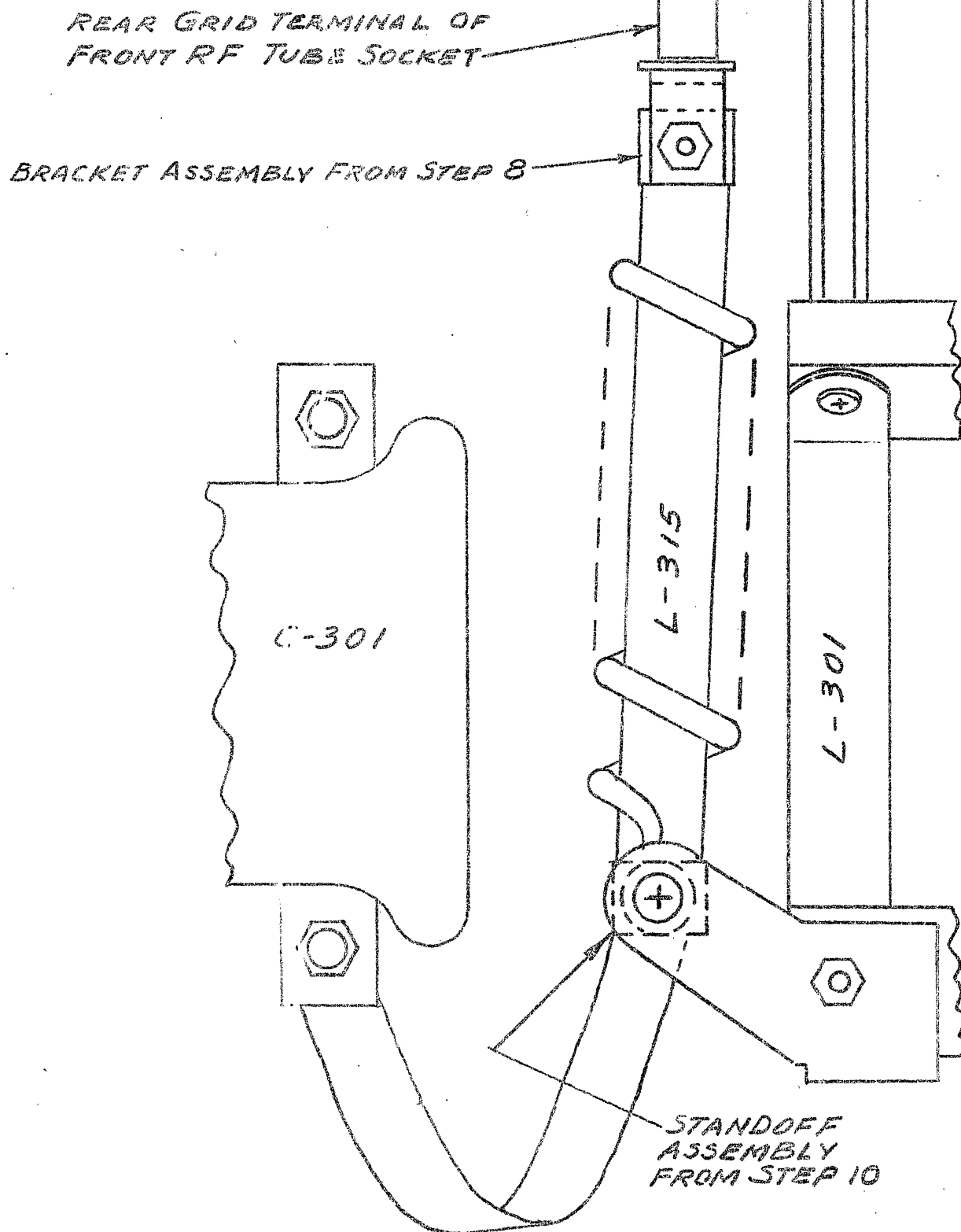
SCALE: 1=1



STANDOFF ASSEMBLY DETAIL

SCALE 1 = 1

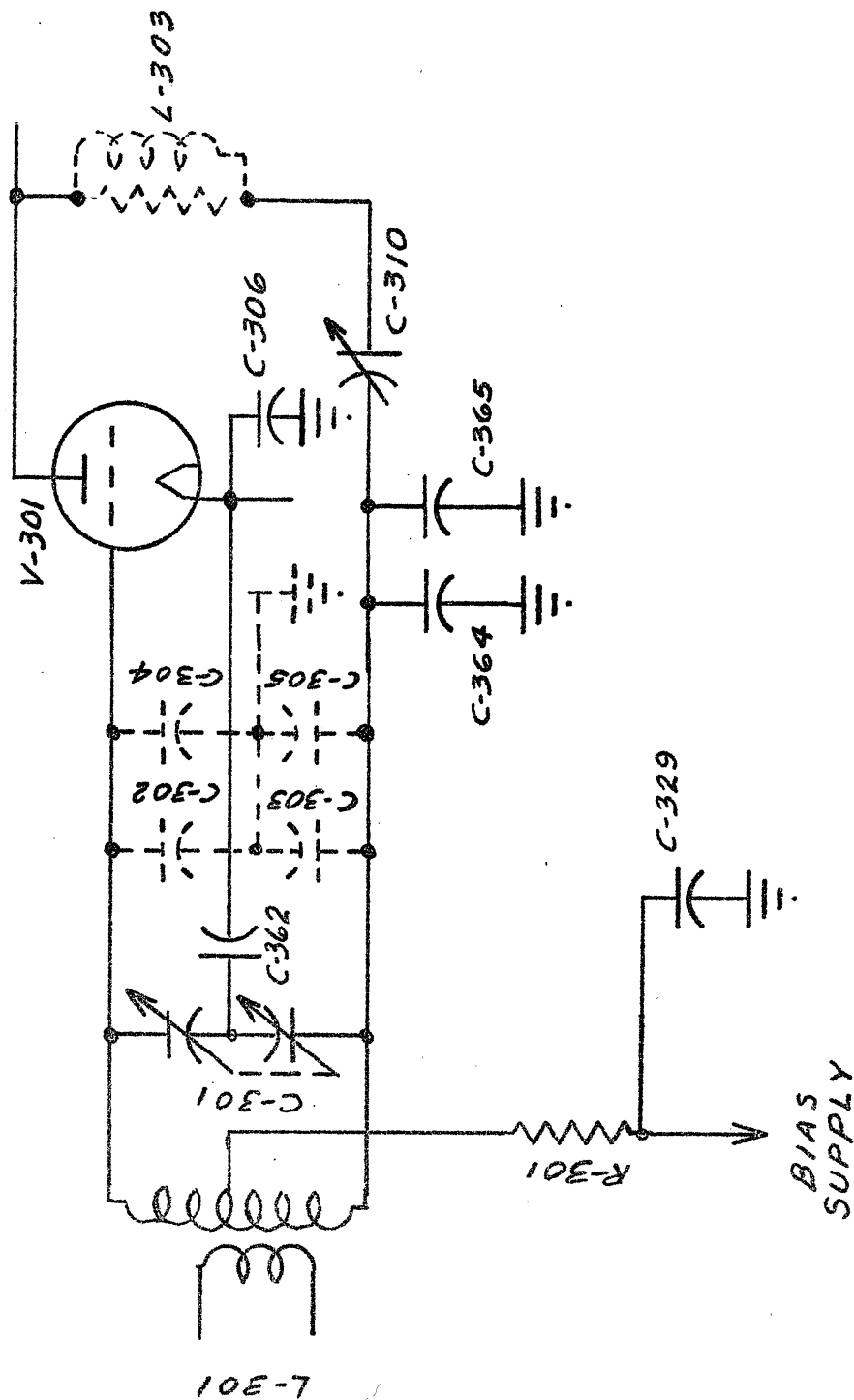
FIGURE 5



SUPPRESSOR ASSEMBLY DETAILS

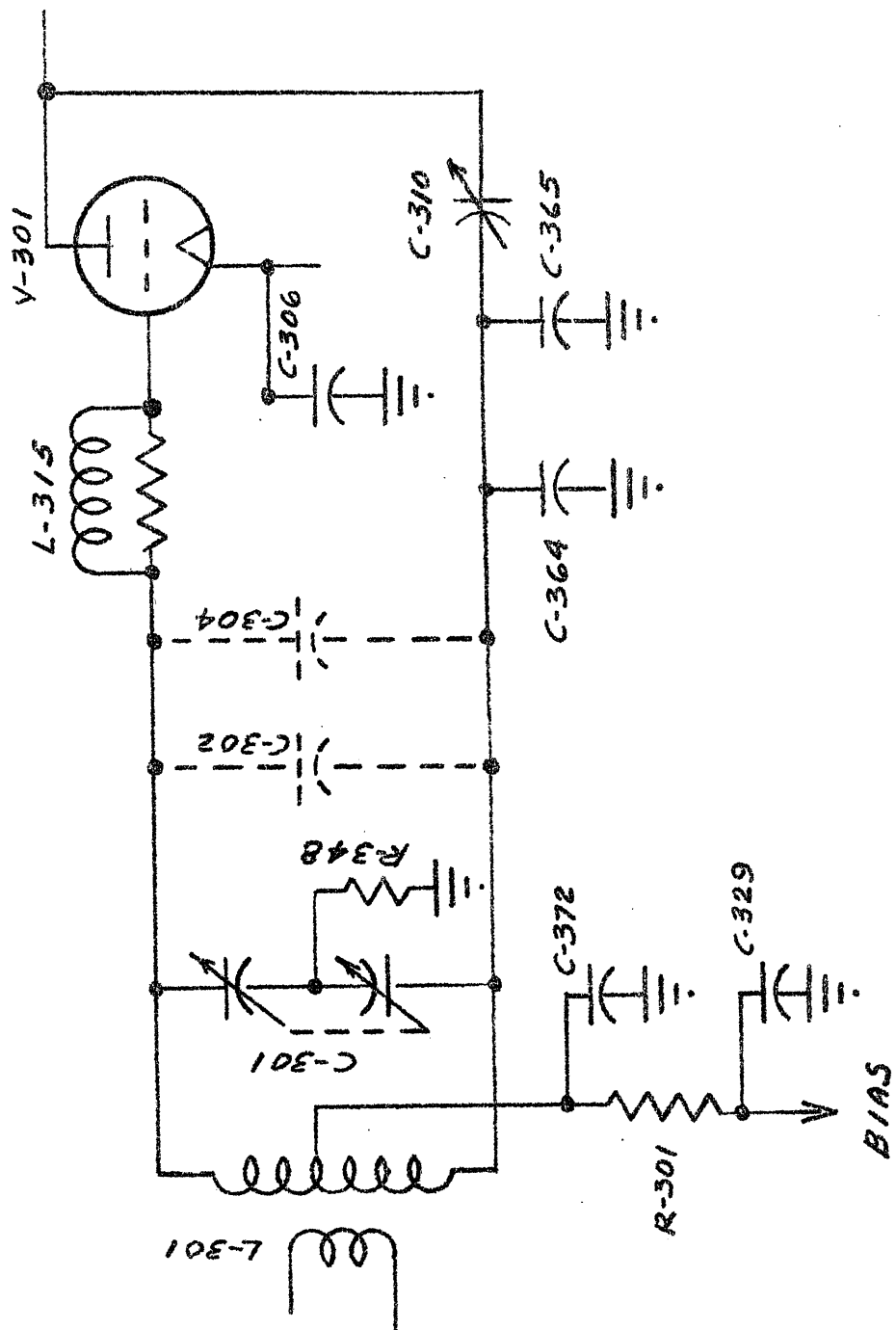
SCALE: 1=1

FIGURE 6.



ORIGINAL P.A. GRID CIRCUIT

FIGURE 7.



MODIFIED P.A. GRID CIRCUIT

FIGURE 8.

COLLINS

#2

21E/M Cooling System Modification Procedure

The purpose of this modification is to provide improved filtering and cooling for the PA bay of the 21E/M transmitter. The new filter panel provided offers double the filter thickness and nearly three times the original filter area, while the cooling system modifications increase the air flow from approximately 136 cfm per tube to approximately 155 cfm per tube.

CAUTION: Remove all primary power at the main wall switch before proceeding.

1. Remove the rear filter panel from the PA bay. This panel may be discarded, or stripped and kept as a spare for the back panel of the driver bay.
2. If equipment is operating on 50 cycle power, check the blower intake. If a "U" shaped strap is mounted across the intake, remove and discard it. Omit steps 3 through 6.
3. On 60 cycle equipment, remove and discard the strap connected across the blower intake. Dismount the blower intake ring.
4. Locate and drill two holes in the intake ring for the baffle (item H) as shown in Figure 1. Make sure the holes are accurately centered on a centerline between two of the intake ring mounting holes.
5. Mount the baffle using 2 screws (item D), 2 lock washers (item E) and 2 nuts (item C).
6. Remount the intake ring-baffle assembly on the blower in the relative position shown in Figure 2.

7. Mount the new filter panel (item F), on the rear of the PA bay, using the original hardware. Insert 2 filters (item A), and slip the air filter retainer (item G) in place.

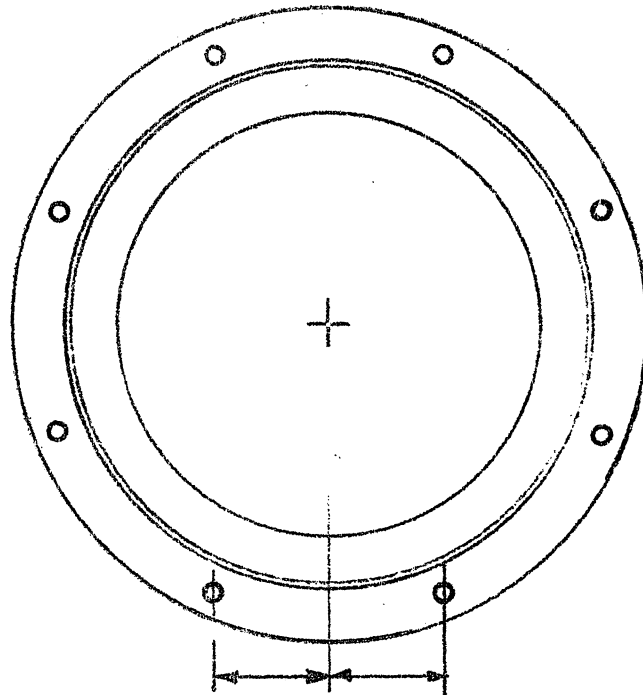
8. Refer to figure 3. Plug the holes in the PA grid tank box corresponding to those shown shaded in Figure 3, using snap button plugs (item B). This completes the modification.

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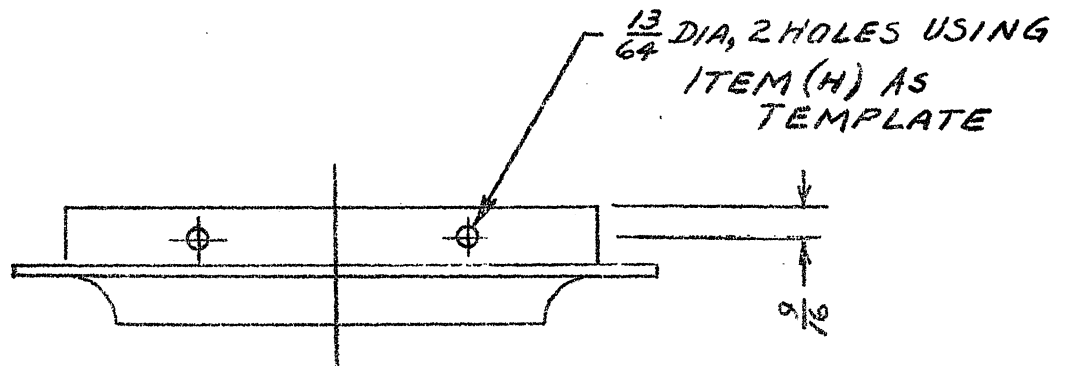
BILL OF MATERIAL

Quantity	Item No.	Part Number	Part Name
✓ 2	A	*009 1296 00	Filter - air
✓ 11	B	308 0054 00	Plug - snap button
✓ 2	C	313 0054 00	Nut - 8-32 vex ✓
✓ 2	D	343 0309 00	Screw - 8-32 x 3/8 ✓
✓ 2	E	373 7030 00	Washer - lock ✓
1	F	540 4402 004	Panel - air filter
1	G	540 4401 003	Retainer - air filter
✓ 1	H	540 4399 003	Baffle - intake

*Cleanable type permanent filters available on special order. Specify part No. 009 1129 00.



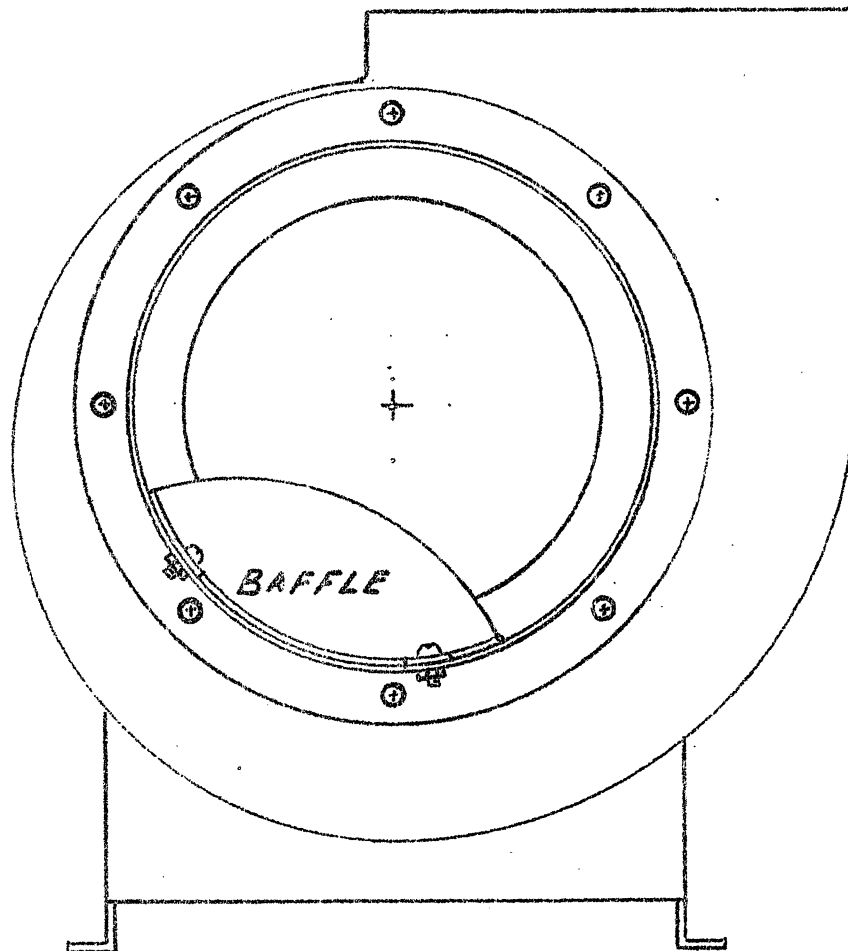
LOCATE THIS CENTER LINE BETWEEN
ANY PAIR OF HOLES AS SHOWN.



BLOWER INTAKE RING
DRILLING DETAIL

SCALE: $\frac{1}{4} = 1$

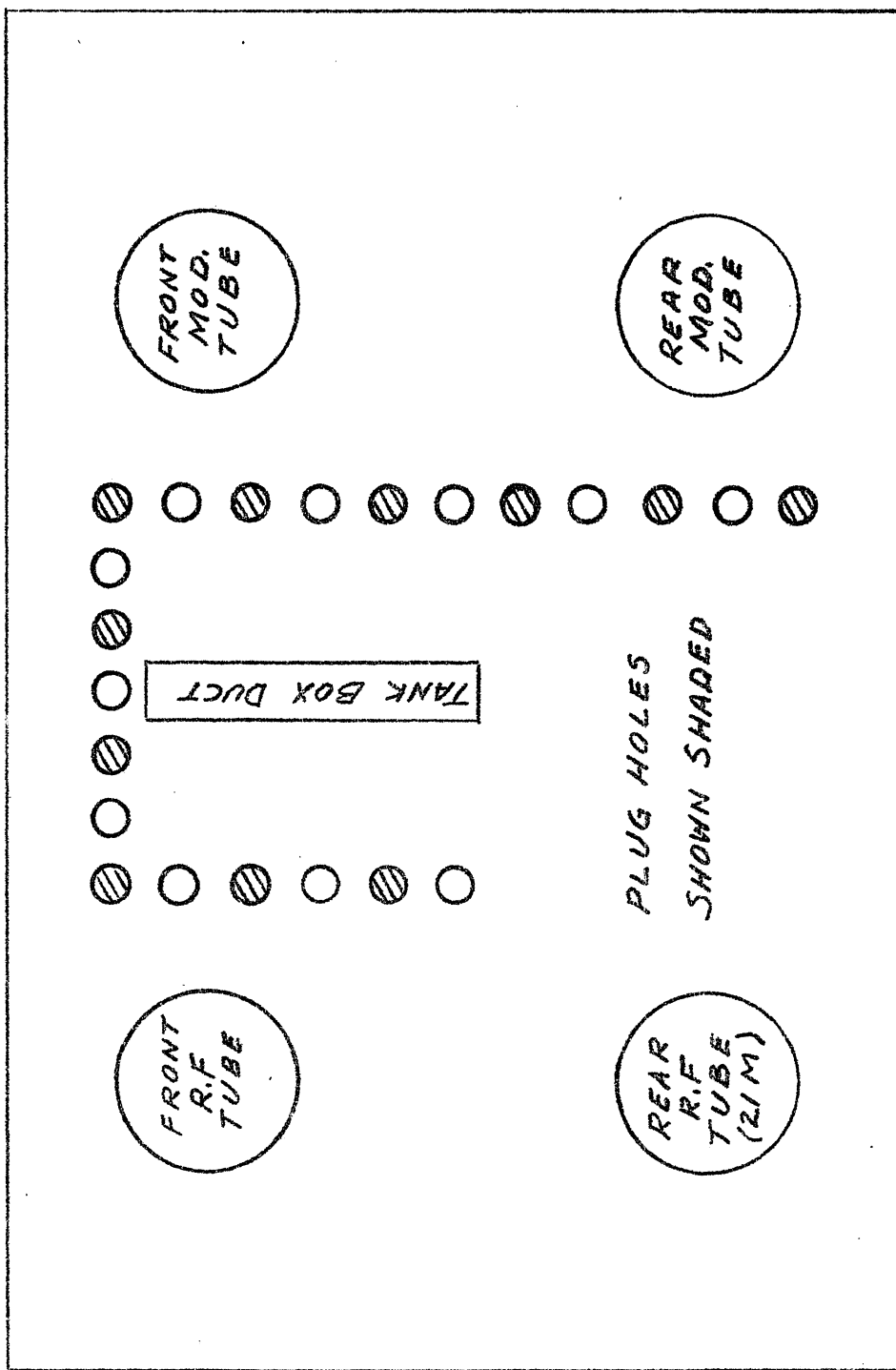
FIGURE 1.



BAFFLE INSTALLATION DETAIL

SCALE $\frac{1}{4} = 1$

FIGURE 2.



TOP VIEW GRID TANK BOX

SCALE $\frac{1}{4} = 1$

FIGURE 3.

#5
21E/M

MODIFICATION INSTRUCTIONS

This modification covers the following changes in the 21E/M:

Replacement of .47 megohm resistor R-139 with a .33 megohm unit, to provide slightly improved audio performance. *(Raises screen voltage on 657's)*

Replacement of 1000 ohm 10% multimeter multiplier R-333 with a 910 ohm 1% unit, for greater accuracy in metering.

Replacement of 5000 ohm resistor R-172 with a 15,000 ohm unit, for an improved time delay recycling characteristic. *(Slower)*

Addition of arc gaps to the secondary of the modulation transformer, for greater protection in the event of loss of RF load.

Addition of series dropping resistors R-184, R-212 and R-347 to the panel illumination lamp circuits to provide longer life for the Lumiline bulbs.

The modification has been planned so that the transmitter is completely operative at the end of each numbered step. Accordingly, the modification can be interrupted at the end of any step for return to the air.

CAUTION: Disconnect the transmitter at the main wall switch before proceeding.

1. Replace .47 megohm resistor R-139 in the audio amplifier chassis with the 0.33 megohm unit furnished (item P). See Figure 7-12 in the 21E/M instruction book for location of R-139.

2. Replace 1000 ohm resistor R-333 (mounted on multimetering switch S-306) with the 910 ohm unit furnished (item L).

3. Replace 5000 ohm 10 watt resistor R-172 (located in the time delay assembly on the relay panel of the driver bay) with the 15,000 ohm unit furnished (item M).

4. Mount the arc gap straps (item K) on the secondary terminals of modulation transformer T-211. Set the gap at not less than 1/16" nor more than 5/64" for sea

level operation or not less than $5/64$ " nor more than $3/32$ " at 6000 feet. Check by energizing the equipment in normal operation and applying 100% modulation. If the arc gap fires, de-energize the equipment and increase the gap in not more than $1/64$ " steps until the gap does not fire in normal operation.

5. Remove the air filter panel from the rear of the driver bay. Drill 2 holes (using drilling template, figure 1, enclosed) for R-184 in the flange of the cabinet corner post near control circuit breaker S-106.

6. Mount R-184 (item N), using 2 brackets (item A), 2 screws (item E), 2 lock washers (item F), and 2 nuts (item D).

7. Remove the single AC95 wire from control circuit breaker S-106 which connects to the Lumiline lights (check by momentarily energizing equipment with wire removed and note whether lamps remain dark). Connect this wire to one terminal of R-184. Connect this wire to one terminal of R-184. Connect the remaining terminal of R-184 to S-106 using AC95 wire (item J) and a soldering lug (item B). Replace the air filter panel.

8. Refer to figure 2 and assemble R-212 (item N), bus wire (item G), and soldering lugs (item C) as shown.

9. Open the power supply cabinet door, and locate and remove the jumper connecting the adjacent terminals of the Lumiline sockets. Install the R-212 assembly in place of this jumper.

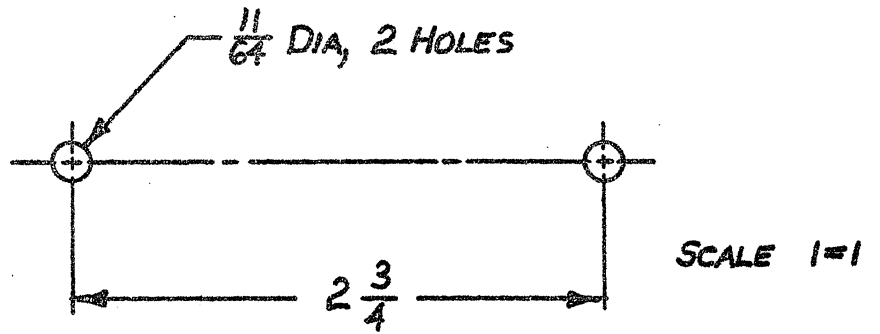
10. Remove the front lower insert panel from the PA bay. Drill 2 holes (using drilling template, figure 1) for R-347, above and to the left of terminal board E-302.

11. Mount R-347 (item N), using 2 brackets (item A), 2 screws (item E), 2 lock washers (item F), and 2 nuts (item D).

12. Disconnect the AC90 wire from terminal 1 of E-302 and solder it to one terminal of R-347. Connect the remaining terminal of R-347 to terminal 1 of E-302, using AC90 wire (item H) and a soldering lug (item B). Replace the insert panel. This completes the modification.

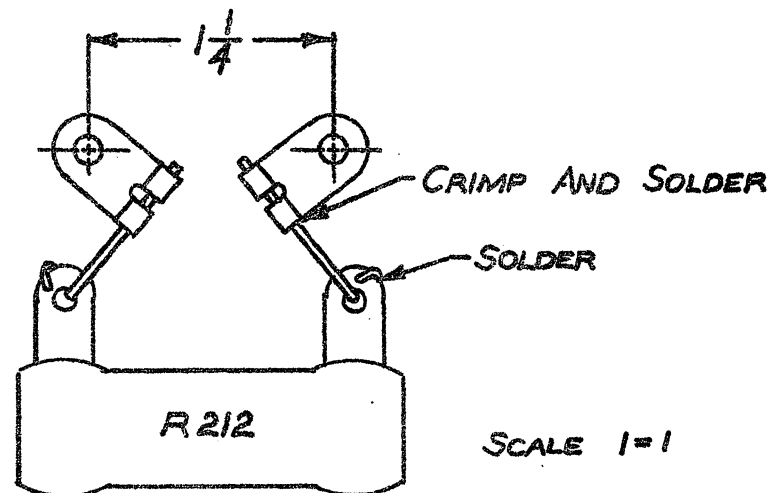
BILL OF MATERIAL

Quantity	Item No.	Part No.	Part Name
4	A	139 1900 00	Bracket-resistor mtg.
2	B	304 1900 00	Lug=soldering
2	C	304 6000 00	Lug=soldering
4	D	313 0053 00	Nut-6-32 hex.
4	E	343 0330 00	Screw-6-32 x 3/8
4	F	373 7020 00	Washer=lock, No. 6
0.5 Ft.	G	421 1420 00	Wire=bus, No. 14
1 Ft.	H	440 2702 00	Wire=No. 18, AC90
1 Ft.	J	440 2707 00	Wire=No. 18, AC95
2	K	540 5138 002	Gap=arc, mod.
1	L	705 2130 00	Resistor-1W, R=333
1	M	710 1154 20	Resistor-10W, R=172
3	N	710 3100 20	Resistor=25W, R=184, R=212, R=347
1	P	745 9202 00	Resistor=2W, R=139



DRILLING TEMPLATE FOR
R184, R347

FIGURE 1



ASSEMBLY DETAIL FOR
R212

FIGURE 2

4 21E/M ARC SUPPRESSION CIRCUIT

MODIFICATION INSTRUCTIONS

The purpose of this modification is to add arc protection circuits to the driver stage and P.A. stage of the 21E/M. These circuits protect the equipment by momentarily removing plate power whenever an arc to ground occurs in the driver output or P.A. output circuit, and re-apply plate power as soon as the arc is cleared.

The modification has been planned so that the equipment is operative at the end of each numbered step. This allows the modification to be spread out over several off-the-air periods, if desired.

CAUTION: Disconnect the transmitter at the main wall switch before proceeding.

1. Remove the tank box cover in the driver bay, and locate and drill mounting holes for C188 and C194, and rubber grommet (item C) as shown on Fig. 1. Insert rubber grommet (item C) in the 5/16 D hole.

2. Mount capacitors C194 (item AU), C188 and C190 if used (item AV) as shown in Figure 2, using two screws (item S), one soldering lug (item F), two spacing posts (item AG), two flat washers (item H) and two nuts (item K). If C190 is not used, the mounting screws may be clipped off short or left long, as desired.

3. Disconnect and remove the original monitor coil L110, and install the new coil (item AN) furnished. Reconnect the lead from L109 to the right hand terminal of L110. Connect the slider terminal of L110 to the near terminal of C194, and connect the far terminal of C194 to J106, using No. 16 bus wire (item Y). See Figure 3. Connect the left hand coil terminal of L110 to the near terminal of C188 and C190 (if used), and to one end of the 6 ft length of AC902 wire (item AC). Pull the free length of this wire through the rubber grommet and temporarily ground the other end at any convenient point.

4. Connect the remaining terminal of C188 and C190, if used, to the ground lug, again using No. 16 bus. Replace the tank box cover.

5. Mount the two arc gap arms (item AS) on capacitor C193, using two screws (item Q) and two lock washers (item U). Refer to Figure 4, and mount C192 and C193 (item AW) on the capacitor mounting angle (item AQ) and the capacitor mounting strap (item AR) using four screws (item Q), and four lock washers (item U). Mount two meter capacitor straps (item AP), using one screw (item Q), one lock washer (item U), and one nut (item K). The assembly should now look like Fig. 4.

6. Remove the strap connecting M101 to J105, and replace with the C192-C193 assembly of Step 5.

7. Remove the PA tank box cover, and locate and drill mounting holes for C367, C368, C369 and rubber grommet (item D) as shown on Fig. 5. (It will probably be necessary to remove the plate tank coil, L305, in order to drill the two 1/4 D holes.) Insert the rubber grommet in the 5/16 d.a. hole.

8. Mount C367 (and C368, if used) (item AV) shown in Figure 5, using two screws (item R), one soldering lug (item F), two spacers (item AG), two washers (item H), and two nuts (item K).

9. Disconnect and remove the original monitor coil L307, and install the new coil furnished (item AJ). Reconnect the lead from L16 to the left hand terminal of L307, and the lead from C325 to the tap on L307. Connect the right hand coil terminal of L307 to the near terminal of C367 (and C368, if used), using No. 14 bus (item X) and soldering lug (item G) and to one end of an 8 ft piece of AC92 wire (item AA). See Fig. 7. Pull the free length of this wire through the rubber grommet and temporarily ground the other end at any convenient point.

10. Connect the remaining terminal of C367 (and C368, if used) to the ground lug, using No. 14 bus.

11. Refer to Fig. 8, and assemble the spanner nuts (item AH) on the ceramic standoffs (item B), using two studs (item J). Place a corprene washer (item E) between each spanner nut and standoff. Allow each stud to project approximately $3/4$ inch.

12. Fasten the standoff assemblies to one end plate of C369 (item AX), using two lock washers (item V) and two nuts (item L). Assemble the coil connector strap (item AM) and the arc gap strap (item AK) under the lock washer of one standoff assembly as shown in Fig. 8. Fasten two capacitor connector straps (item AL) to the remaining end plate of C369, using one screw (item T), one lock washer (item V), and one nut (item L).

13. Remove the strap connecting loading coil L306 to the feedthru bowl. Mount the C369 assembly, using two screws (item P) and two corprene washers (item E). Connect the straps and replace the tank box cover.

14. Locate and drill four mounting holes for R345 and R346 (item AT) on the feedback resistor board in the P.A. bay, as shown on Figure 9. 2

15. Mount R345 and R346, using four resistor brackets (item A), four self-tapping screws (item M), and four lock washers (item U).

16. Connect the right hand terminal of R346 to the ground bus just above it, using No. 16 bus (item Y). Connect the right hand terminal of R345 to the left hand terminal of R338, using AC92 wire (item AA). Connect the left terminal of R346 to the left terminal of R345, using AC2 wire (item AE) and to one end of an 8 ft length of AC2 wire. Route the other end down into the relay compartment, but do not terminate at this time. 7

17. Remove the lower front access panel of the driver bay, and locate and drill mounting holes for K107 as shown on Fig. 10.

18. Mount K107 (item AY), using two screws (item N) and two lock washers (item W).

19. Remove the lower front access panel of the PA bay, and locate and drill mounting holes for K302 as shown on Fig. 11.

20. Mount K302 (item AY), using two screws (item N) and two lock washers (item W).

21. Refer to Fig. 12. Connect the AC2 wire of step 16 to terminal 2 of K302. Unground the AC92 wire of step 9, route it into the relay compartment and connect to terminal 1 of K302.

22. Using AC0 wire (item AD) and a soldering lug (item G), connect terminal 9 on terminal strip E101 on the low voltage power supply to terminal 1 of K107. Unground the AC902 wire of step 3, route it into the relay compartment and connect to terminal 2 of K107.

23. Disconnect the AC90 wire from terminal 1 of E101 and from terminal 2 of K102 (check with an ohmmeter to make sure the correct wire is removed from K102). Clip and tape the ends. Connect terminal 4 of K107 to terminal 2 of K102, using AC90 wire (item Z) and a soldering lug (item G). Connect terminal 3 of K107 to terminal 1 of E101, using AC90 wire and a soldering lug (item G).

24. Connect terminal 5 of K107 to terminal 5 of K302, using AC5 wire (item AF).

25. Remove the AC93 wire connecting terminal 1 of K204 to terminal 7 of E207. Connect terminal 6 of K107 to terminal 7 of E207, using AC93 wire (item AB) and a soldering lug (item G). Connect terminal 6 of K302 to terminal 1 of K204, again using AC93 wire and a soldering lug (item G). This completes the modification.

26. With the equipment in normal operation, check by momentarily connecting terminal 2 of K107 to ground (corresponding to an arc to ground in the driver tank circuit). CAUTION: Approximately 150 volts dc appears across these points.

Plate voltage should be removed from both the driver and the power amplifier stages while this short circuit (arc) exists.

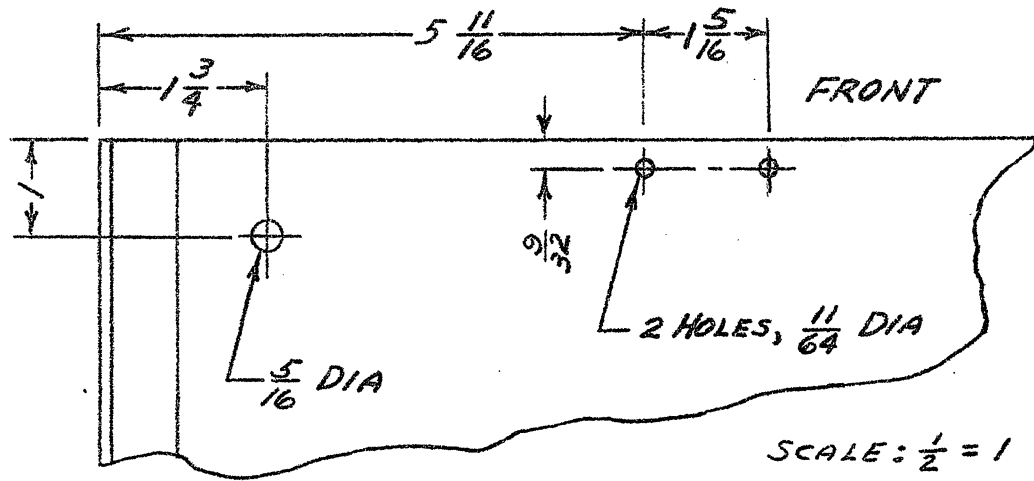
Momentarily connect terminal 1 of K302 to ground. Plate voltage should be removed from the power amplifier stage while this short circuit exists.

Bill of Material

<u>Qty</u>	<u>Item No.</u>	<u>Part No.</u>	<u>Part Name</u>
4	A	139 1900 00	Bracket-resistor mounting
2	B	190 1158 00	Post - ceramic
1	C	201 0001 00	Grommet
1	D	201 0037 00	Grommet
4	E	302 0034 00	Washer - Corprene
2	F	304 0016 00	Lug - solder
6	G	304 1900 00	Lug - solder
4	H	310 0056 00	Washer - flat
2	J	312 3220 00	Stud - 10-32 x 1-1/2
5	K	313 0053 00	Nut - 6-32 Hex
3	L	313 0056 00	Nut - 10-32 Hex
4	M	330 0737 00	Screw - No. 6 self-tap
4	N	343 0133 00	Screw - 4-40 x 1/4
2	P	343 0227 00	screw - 10-32 x 7/16
7	Q	343 0330 00	Screw - 6-32 x 3/8
2	R	343 0340 00	Screw - 6-32 x 1-3/4
2	S	343 0341 00	Screw - 6-32 x 2
1	T	343 0348 00	Screw - 10-32 x 5/8
11	U	373 7020 00	Washer - Lock No. 6

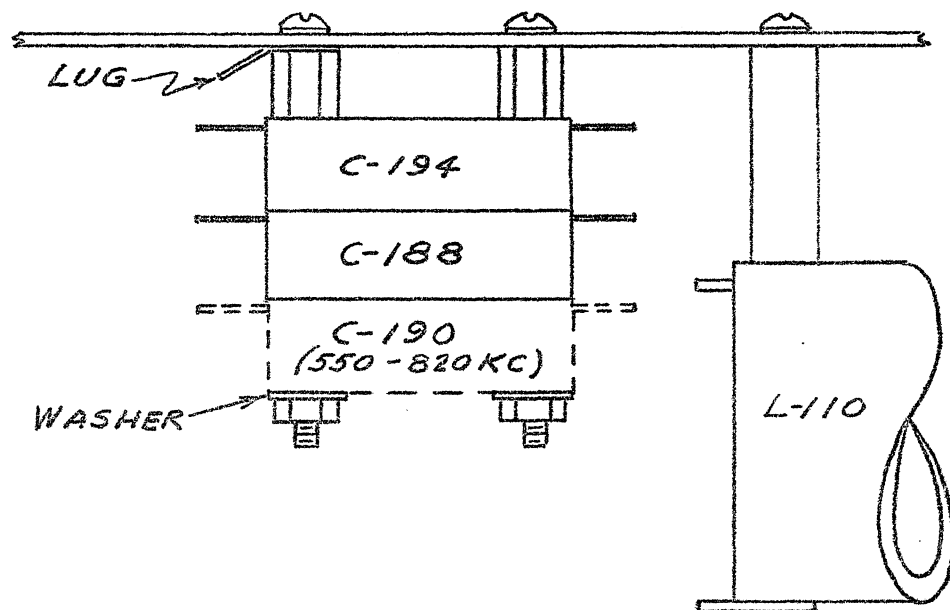
<u>Qty</u>	<u>Item No.</u>	<u>Part No.</u>	<u>Part Name</u>
3	V	373 7040 00	Washer - lock, No. 10
4	W	373 8010 00	Washer - lock, No. 4
3.5 ft	X	421 1420 00	Wire - No. 14 bus
2 ft	Y	421 1620 00	Wire - No. 16 bus
8 ft	Z	440 2702 00	Wire - No. 18, AC90
9.5 ft	AA	440 2704 00	Wire - No. 18, AC92
10 ft	AB	440 2705 00	Wire - No. 18, AC93
6 ft	AC	440 2709 00	Wire - No. 18, AC902
5 ft	AD	440 2729 00	Wire - No. 18, AC0
9.5 ft	AE	440 2730 00	Wire - No. 18, AC2
10 ft	AF	440 2732 00	Wire - No. 18, AC5
4	AG	500 0445 001	Post - spacing
2	AH	503 4093 001	Nut - spanner
1	AJ	506 0537 003	Coil Assy - L307
1	AK	506 4290 002	Strap - arc gap
2	AL	506 9987 002	Strap - connector, cap.
1	AM	506 9988 003	Strap - connector, coil
1	AN	506 9995 003	Coil Assy - L110
2	AP	506 9996 002	Strap - cap, meter
1	AQ	506 9997 002	Angle - cap. mtg.
1	AR	506 9998 002	Strap - cap. mtg, short
2	AS	506 9999 002	Arm - arc gap
2	AT	710 3204 20	Resistor - 25W, R345,6
1	AU	910 1103 10	Capacitor - C194
4	AV	936 1149 00	Cap - C188, C190, C367, 8
2	AW	937 2025 00	Capacitor, C192,3
1	AX	939 1064 00	Capacitor, C369
2	AY	970 1727 00	Relay K107, K302

FIGURE 1



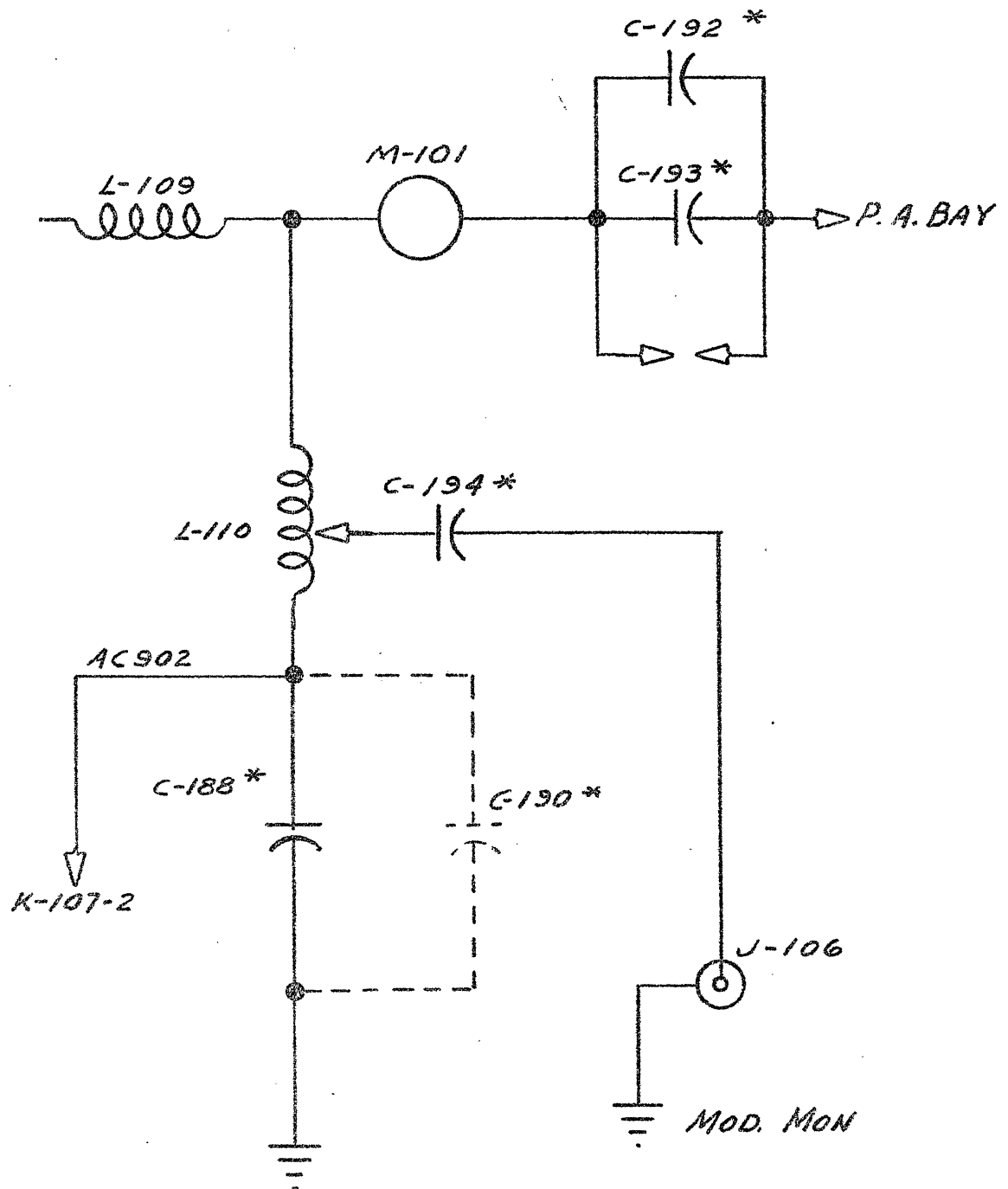
INSIDE VIEW OF TOP OF DRIVER TANK BOX

FIGURE 2

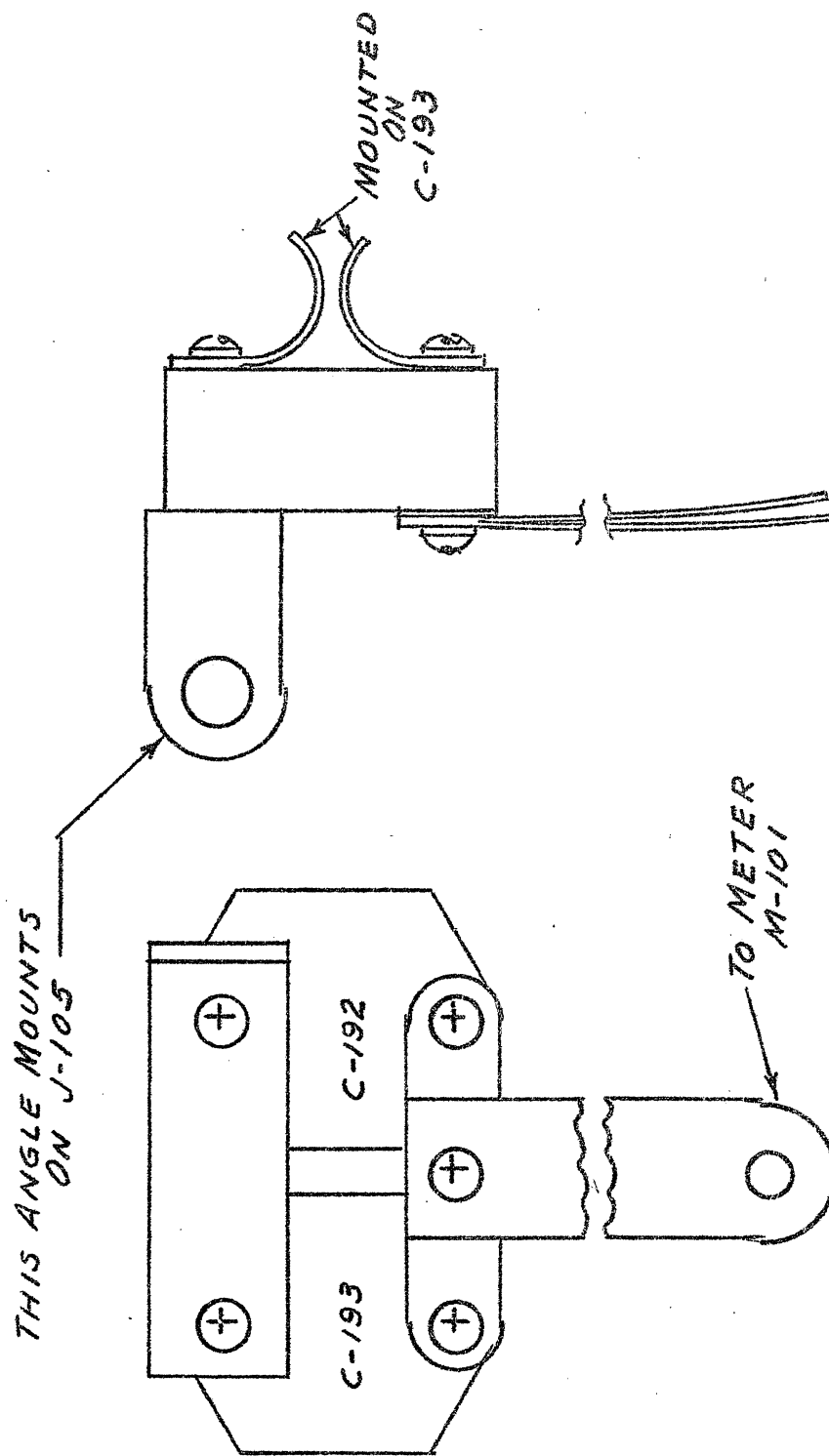


MOUNTING DETAIL FOR
CAPACITORS C-188, C-190, C-194

FIGURE 3.



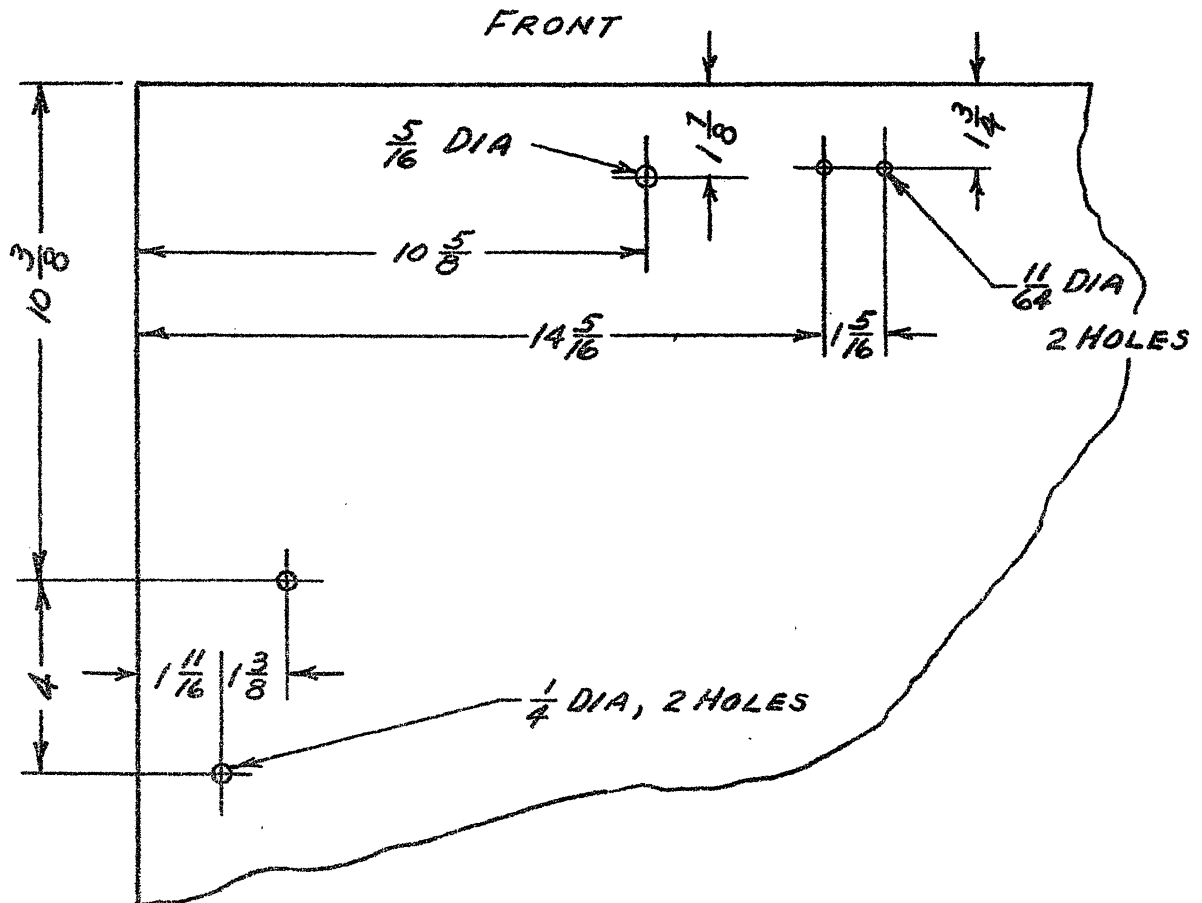
(* = ADDED PARTS)



MOUNTING DETAIL FOR CAPACITORS C-192, C-193

FIGURE 4

FIGURE 5



INSIDE VIEW OF TOP OF P.A. TANK BOX
SCALE $\frac{1}{4} = 1$

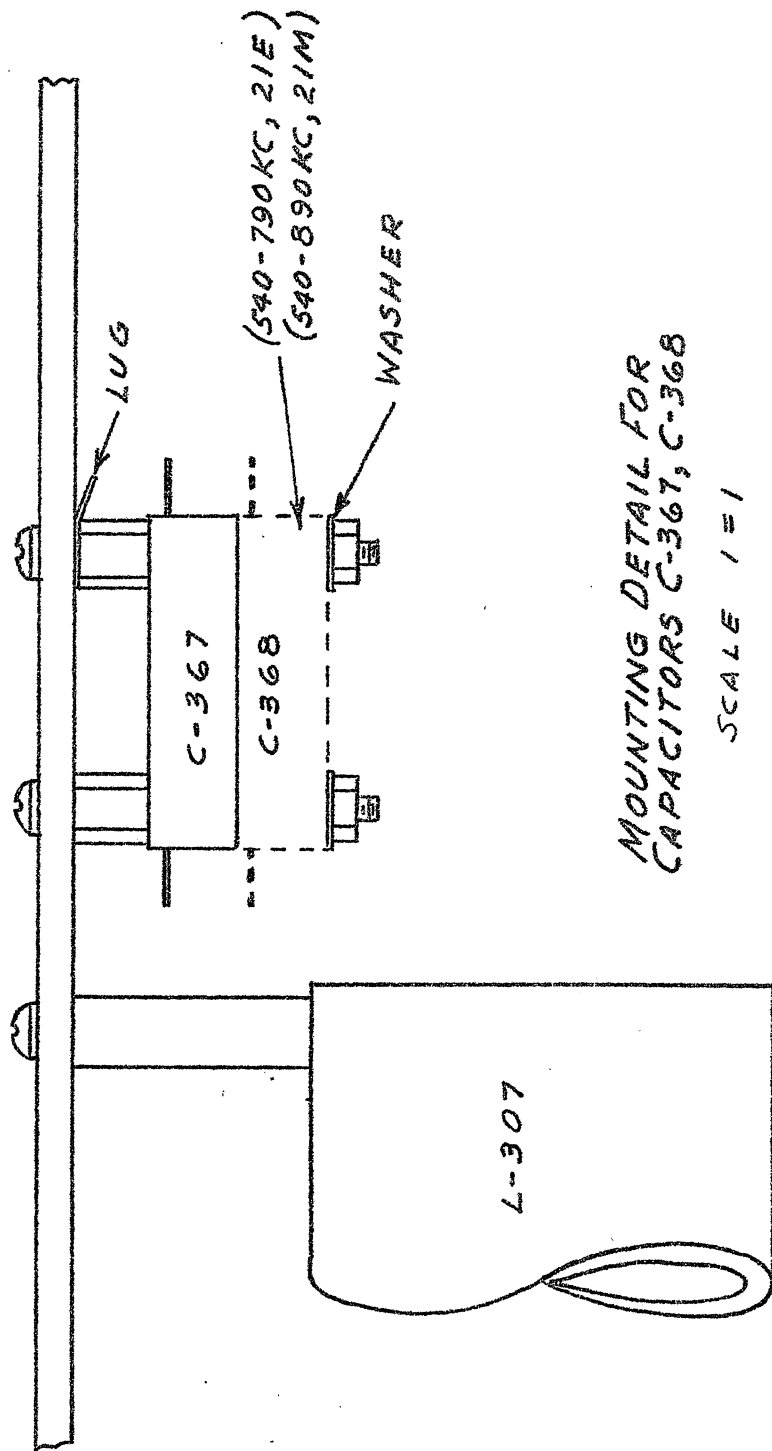
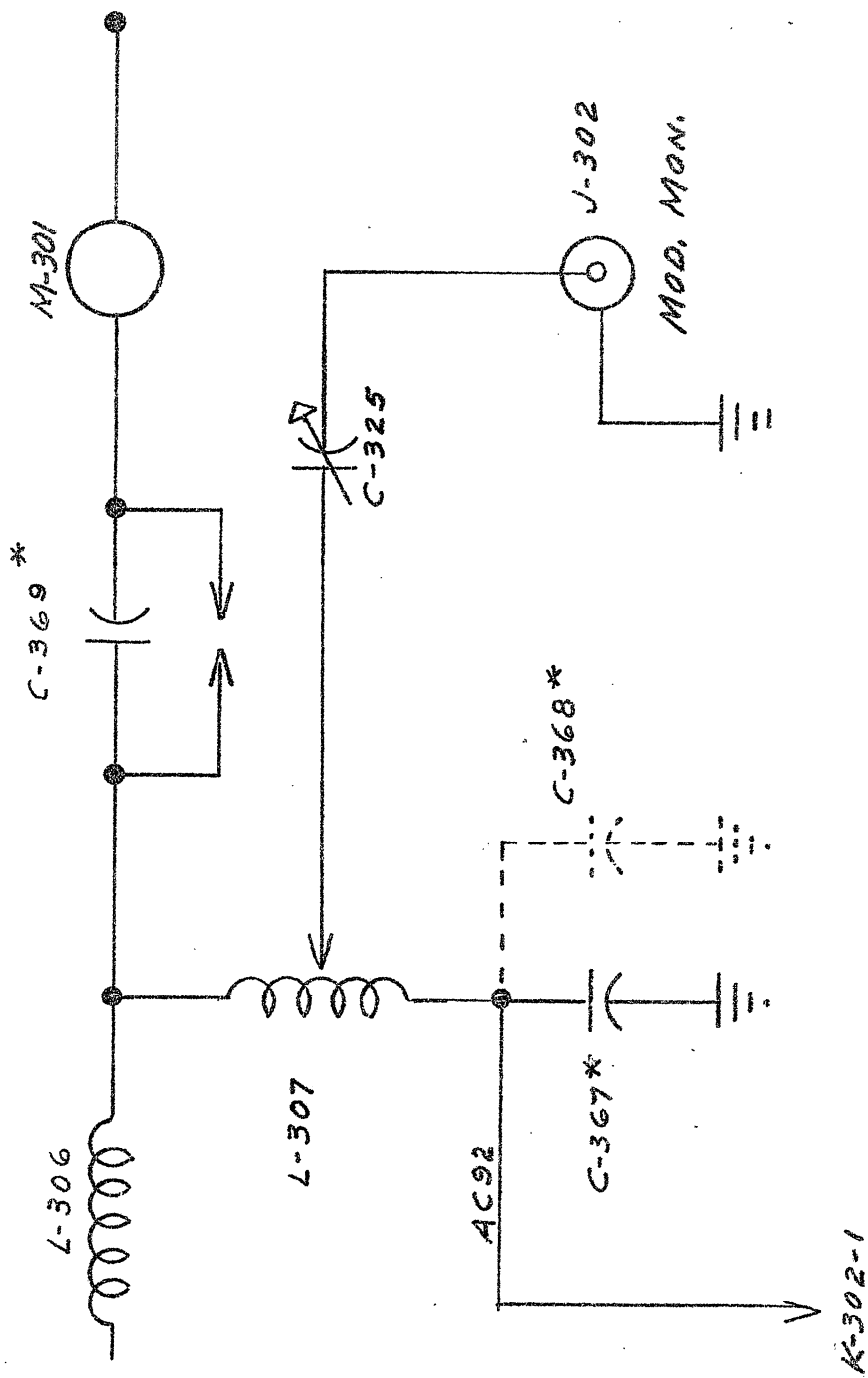


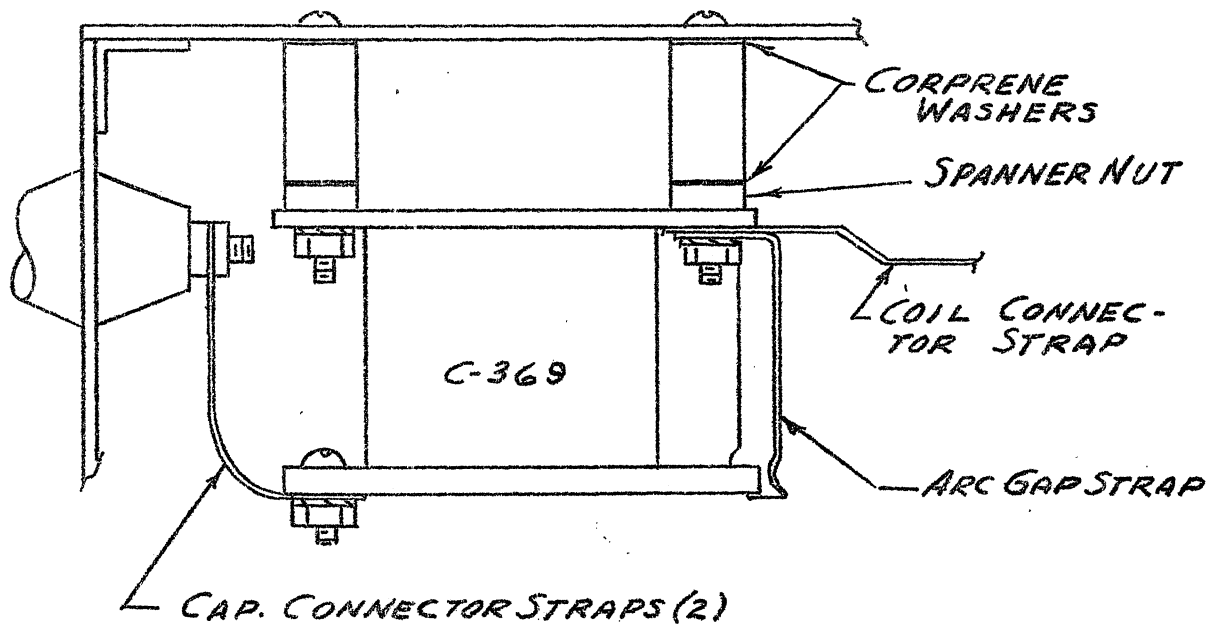
FIGURE 6.



* ADDED PARTS

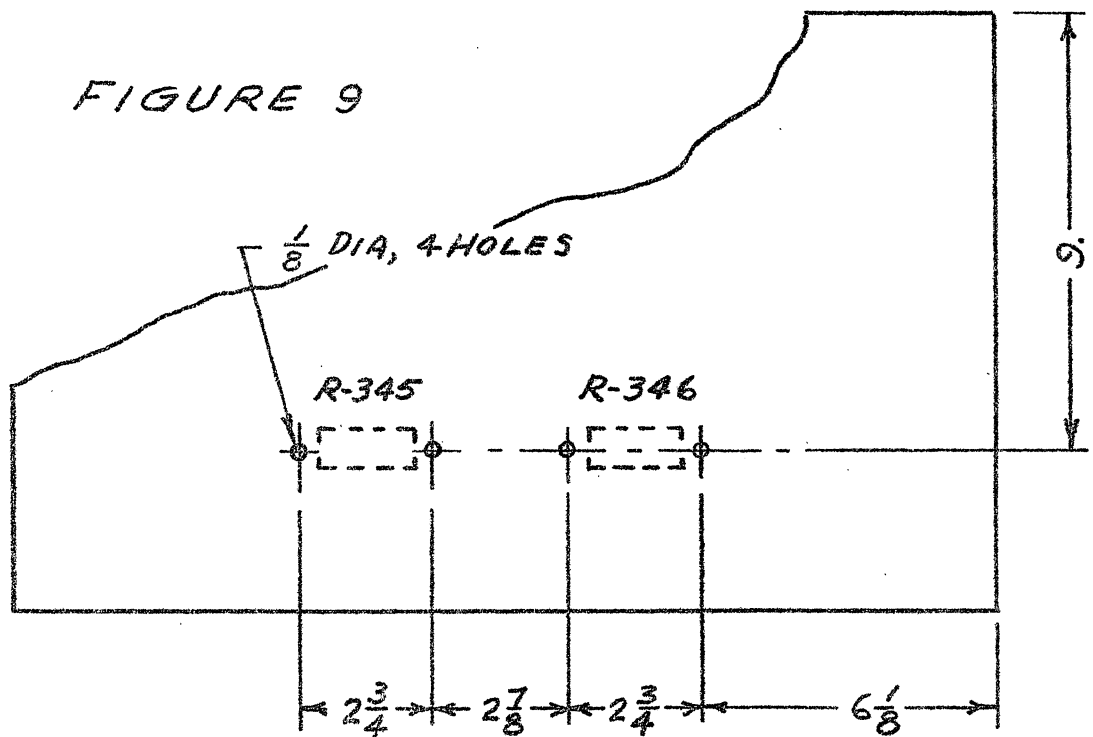
FIGURE 7.

FIGURE 8



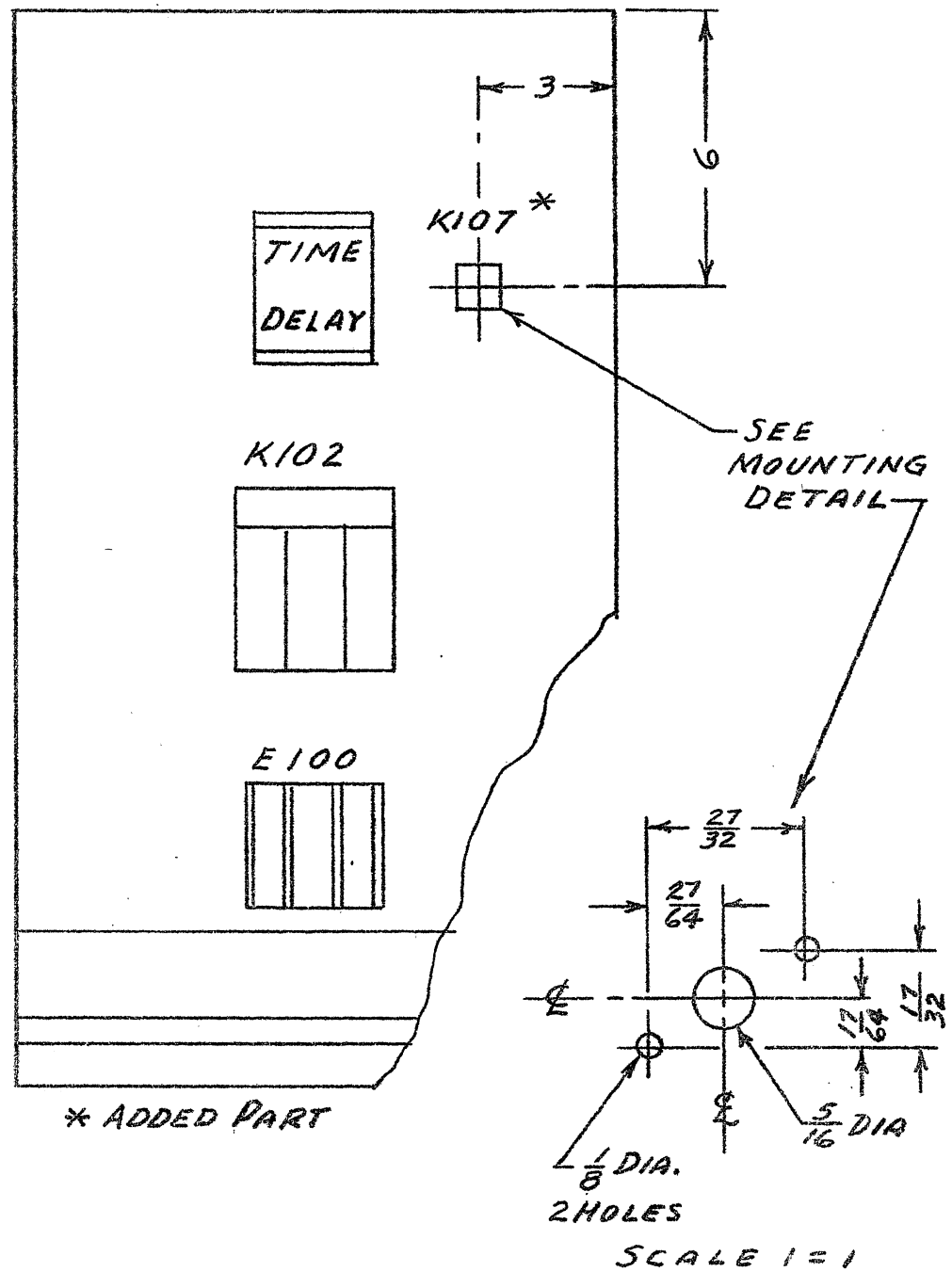
MOUNTING DETAIL-CAPACITOR C-369
SCALE: $\frac{1}{2} = 1$

FIGURE 9



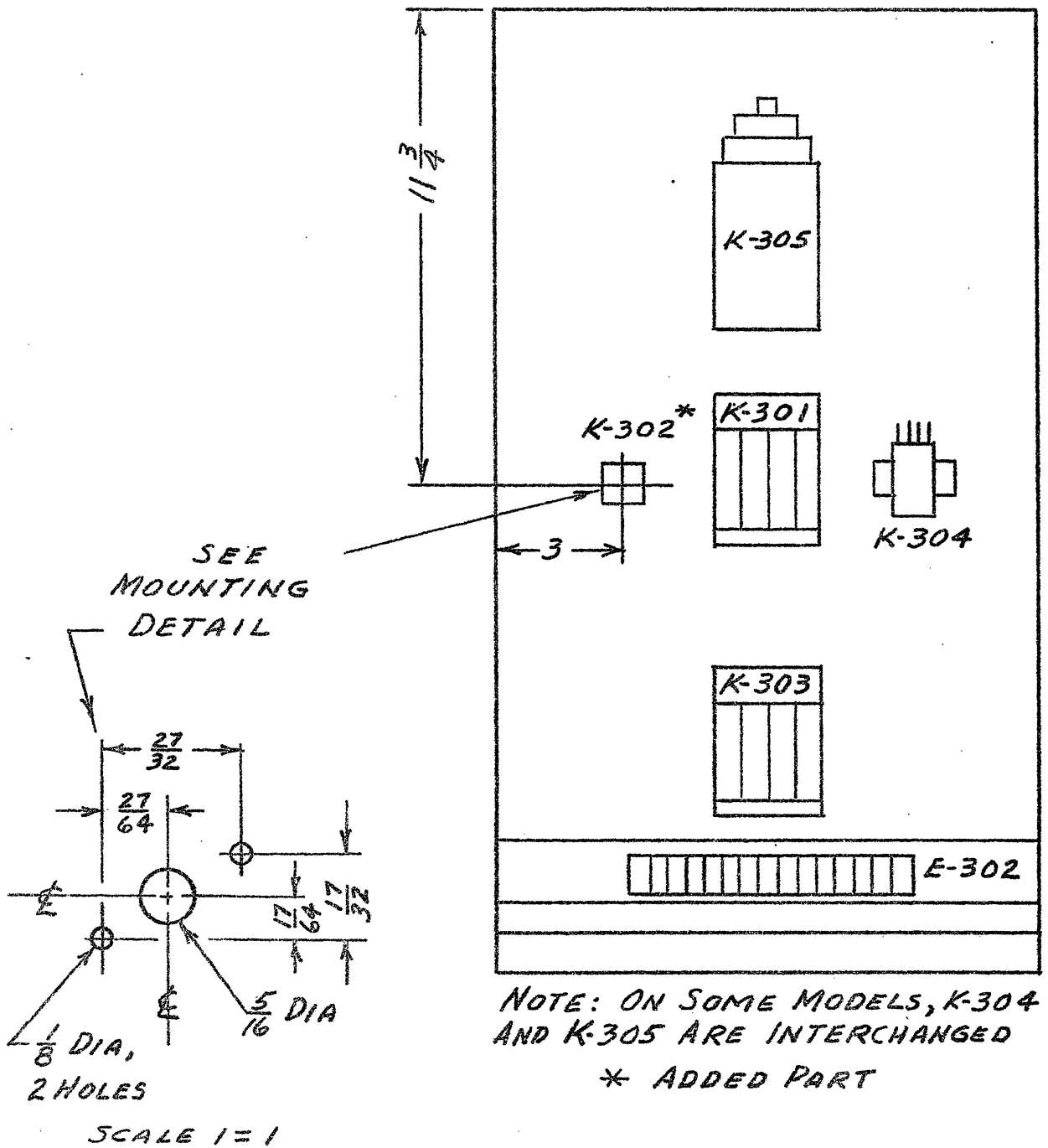
FRONT VIEW, FEEDBACK RESISTOR BOARD
SCALE: $\frac{1}{4} = 1$

FIGURE 10.



FRONT VIEW RELAY PANEL
DRIVER BAY
SCALE $\frac{1}{4} = 1$

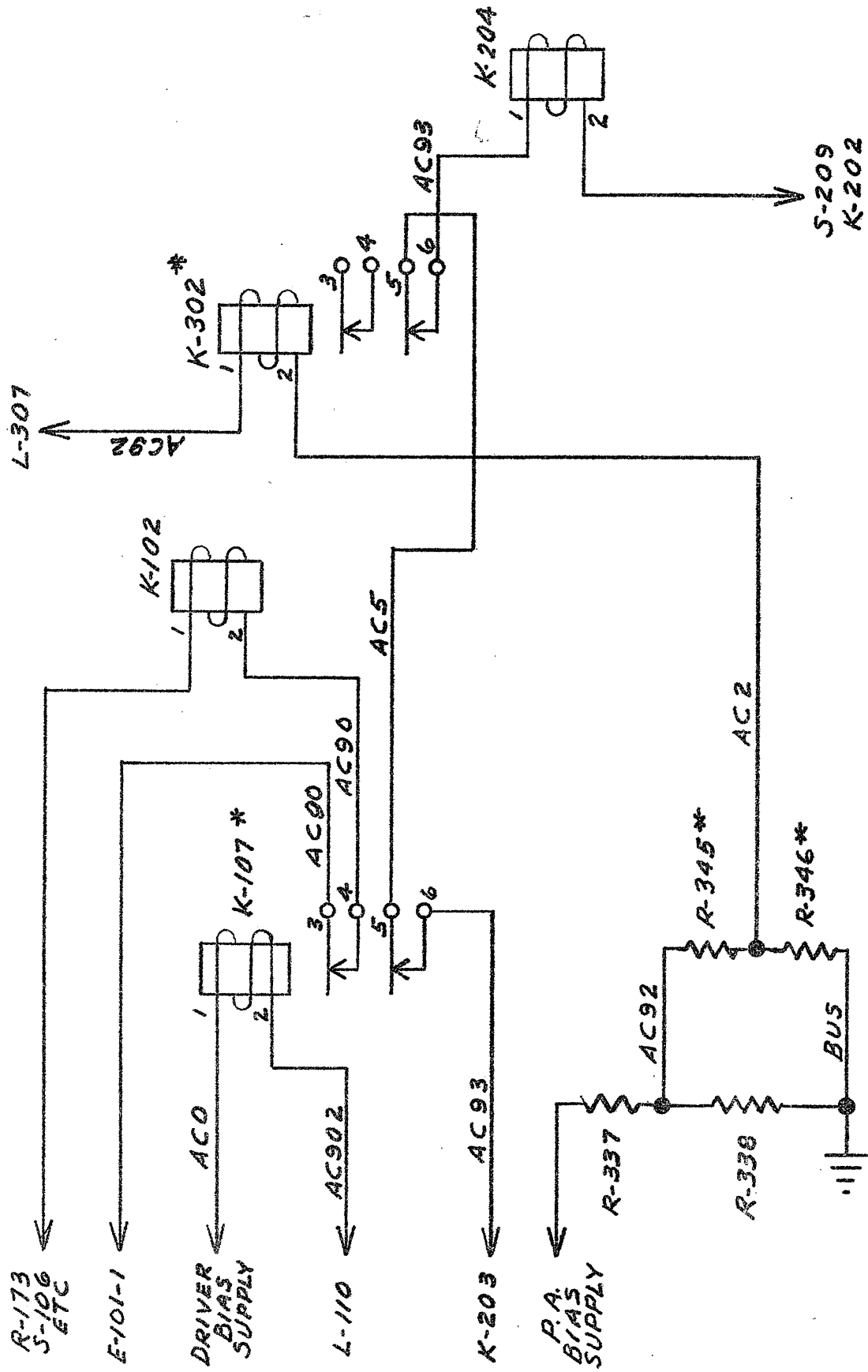
FIGURE 11.



FRONT VIEW - RELAY PANEL - P.A. BAY

SCALE $\frac{1}{4} = 1$

FIGURE 12



* = ADDED PARTS

#3
21E/M
Overload Relay
Modification Procedure

The purpose of this modification is to add individual overload relay protection for the PA and modulator stages of the 21E/M transmitter. The modification has been planned so that the transmitter is operative at the close of each step for steps 1 through 23. Thus, the modification can be interrupted at the end of any of the first 23 steps for return to the air. However, the transmitter is disabled starting with step 24, so that a full off-the-air period should be allowed for steps 24 through 37.

CAUTION: Remove all primary power at the main wall switch before proceeding.

1. Remove the chassis skirt from the audio amplifier chassis in the driver bay (this is the lower chassis on the right, viewed from the rear). Locate and drill mounting holes for R-193 in the front apron of the chassis, as shown in Figure 1.
2. Mount R-193 (item Z), using 2 brackets (item A), 2 screws (item F), 2 lock washers (item J), and 2 nuts (item E).
3. Remove the chassis skirt from the audio driver chassis in the driver bay (the upper chassis on the right, viewed from the rear). Locate and drill mounting hole for R-144 in the front apron of the chassis, as shown in Figure 2.
4. Mount R-144 (item M), using one lock washer (item H).
5. Refer to Figure 3. Disconnect the AC-905 wire from the arm of R-189, and reconnect this wire to one terminal of R-193. Connect the remaining terminal of R-193 to the arm of R-189, using AC-90 wire (item U).

If the transmitter is to be operated following this stage, temporarily short-circuit R-193.

6. Refer to Figure 4. Disconnect the AC-5 and AC-0 wires from the counterclockwise terminals of R-162 and R-163, leaving the AC-5 wire which connects the two terminals together in place. Connect the AC-5 and AC-0 wires to the counterclockwise terminal of R-114.

Connect one end of R-113 (item AB) to the clockwise terminal of R-114. Connect the other end to the ground bus which terminates on the mounting screws for X-121. Connect the arm of R-114 to the counterclockwise terminals of R-162 and R-163, using AC-5 wire (item Y).

Remove the temporary jumper added across R-193 in step 5. Remove and discard R-188 (connected between terminals 9 and 11 on E-101). Replace the audio amplifier and audio driver chassis skirts.

Set R-114 all the way clockwise and energize the equipment without modulation. Adjust R-114 to give normal audio driver static current (approximately 100 ma). De-energize the equipment.

7. Remove the front lower insert panels and the rear filter panels from the power supply and PA bays. Locate and drill mounting holes for C-370, C-371, R-341, R-342, R-343, R-344, K-306, K-307 and rubber grommets (item C) as shown on Figure 5.

8. Insert rubber grommets (item C).

9. Mount relays K-306 and K-307 (item N), with the coil terminals down, using 8 screws (item G) and 8 lock washers (item K).

10. Mount resistors R-343 and R-344 (item AA) on the rear of the panel, using 4 brackets (item A), 4 screws (item F), 4 lock washers (item J), and 4 nuts (item E).

11. Mount variable resistors R-341 and R-342 (item L), using 2 lock washers (item H).

12. Mount capacitor C-370 and C-371 (item B).

13. Connect the positive terminal of C-370 to the counterclockwise terminal (viewed from the rear) of R-341, to one terminal of R-343, and to terminal 2 of K-306, using AE-5 wire (item S). Do not solder K-306 terminal 2 at this time. See Figure 6.

14. Connect the arm of potentiometer R-341 to terminal 1 of K-306, using AC-5 wire (item Y).

15. Connect the negative terminal of C-370 to the clockwise terminal of R-341, and to the remaining terminal of R-343, using AE-90 wire (item R). Connect one end of a 96" length of AE-90 wire to this same point, and route the other end up along the front corner of the cabinet to the vicinity of the feedback resistor board. The other end is not terminated at this time.

16. Connect the positive terminal of C-371 to the counterclockwise terminal of R-342, to one terminal of R-344, and to terminal 2 of K-307, using AE-6 wire (item T). Do not solder K-307 terminal 2 at this time.

17. Connect the arm of potentiometer R-342 to terminal 1 of K-307, using AC-5 wire (item Y).

18. Connect the negative terminal of C-371 to the clockwise terminal of R-342, to the remaining terminal of R-344, and to ground stud E-306, using AE-9 wire (item P) and a soldering lug (item D).

19. Connect terminal 3 of K-306 to terminal 3 of K-307, using AC-3 wire (item X).

20. Connect one end of an 8' piece of AC-5 wire (item Y) to terminal

4 of K-306. Route the other end into the power supply bay to the vicinity of K-203, but do not terminate at this time.

21. Connect one end of a 9' piece of AC-95 wire (item V) to terminal 4 of K-307. Route the other end into the power supply bay to the vicinity of K-203, but do not terminate at this time.

22. Connect terminal 5 of K-306 to terminal 5 of K-307, using AC-90 wire (item U), and to one end of an 8' piece of AC-90 wire. Route the other end into the power supply bay to the vicinity of terminal strip E-207, but do not terminate at this time.

23. Connect terminal 6 of K-306 to terminal 6 of K-307, using AC-96 wire (item W), and to one end of an 8' piece of AC-96 wire. Route the other end into the power supply bay to the vicinity of K-203, but do not terminate at this time.

NOTE: One full off-the-air period should be allowed for performing the remaining steps. The transmitter will not be operative again until step 36 is completed.

24. Using AE-9 wire (item P), short-circuit resistor R-206 (and R-207, on a 21M).

25. Disconnect the AE-90 wire from R-329, and splice it to the AE-90 wire of step 15, above. Tape the splice. Connect the same terminal of R-329 to terminal 2 of K-306 (see step 13), using AE-5 wire (item S).

26. Disconnect the AE-9 wire and the bare bus from the lower terminal of R-332. Splice the AE-9 wire to the bare bus and tape. Connect the vacated terminal of R-332 to terminal 2 of K-307, using AE-6 wire (item T). See step 16, above.

27. Disconnect the AC-6 wire from terminal 1 of K-201 and terminal 1 of R-205. Remove this wire from the cable and discard, or clip and tape the ends.

28. Disconnect the AC-9 wire from terminal 2 of K-201 and terminal 5 of E-207. Discard or clip and tape.

29. Disconnect the AC-95 wire from terminal 3 of K-201 and terminal 6 of K-203. Discard or clip and tape.

30. Disconnect the two AC-5 wires from terminal 4 of K-201. Splice these two wires together and tape.

31. Disconnect the AC-96 wire from terminal 5 of K-201 and terminal 3 of K-203. Discard or clip and tape.

32. Disconnect the AC-90 wire from terminal 6 of K-201 and terminal 4 of E-207. Discard or clip and tape. (Caution: be sure the wire removed from E-207-4 is the same wire as the one removed from K-201-6). K-201 should now be completely disconnected. It can be kept as a spare for the new overload relays, K-306 and K-307.

33. Connect the AC-5 wire of step 20, above, to terminal 1 of K-203.

34. Connect the AC-96 wire of step 23, above, to terminal 3 of K-203.

35. Connect the AC-95 wire of step 21, above, to terminal 6 of K-203.

36. Connect the AC-90 wire of step 22, above to terminal 4 of E-207, using a soldering lug (item D). This completes the modification.

37. Set potentiometers R-341 and R-342 at their clockwise stops. Energize the equipment without modulation but with normal PA plate current. Slowly adjust R-342 until K-307 trips, then back off slightly. Remove and reapply plate power. If K-307 trips on the starting surge, back off a slight

additional amount on R-342.

Apply 1000 cps 95% modulation briefly, and quickly adjust R-341 in the same manner.

Replace the front lower insert panels and the rear filter panels.

9-15-54

Bill of Material

Quan.	Item No.	Part Number	Part Name
6	A	139 1900 00	Bracket - resistor
2	B	184 2000 00	Capacitor - C-370, 71
2	C	201 0019 00	Grommet - 3/16 ID
2	D	304 1300 00	Terminal - lug, No. 10
6	E	313 0002 00	Nut - 6-32 Hex
6	F	343 0169 00	Screw - 6-32 x 3/8
8	G	343 0185 00	Screw - 8-32 x 1/4
3	H	373 0085 00	Washer - lock, 3/8
6	J	373 8020 00	Washer - lock, No. 6
8	K	373 8030 00	Washer - lock, No. 8
2	L	377 0003 00	Resistor - variable, R-341, 2
1	M	377 0040 00	Resistor - variable, R-144
2	N	410 0084 00	Relay - K-306, 7
7 ft.	P	440 2501 00	Wire - No. 14, AE-9
9 ft.	R	440 2502 00	Wire - No. 14, AE-90
10 ft.	S	440 2532 00	Wire - No. 14, AE-5
11 ft.	T	440 2533 00	Wire, No. 14, AE-6
13 ft.	U	440 2702 00	Wire, No. 18, AC-90
9 ft.	V	440 2707 00	Wire, No. 18, AC-95
14 ft.	W	440 2708 00	Wire, No. 18, AC-96
5 ft.	X	440 2731 00	Wire - No. 18, AC-3
12 ft.	Y	440 2732 00	Wire - No. 18, AC-5

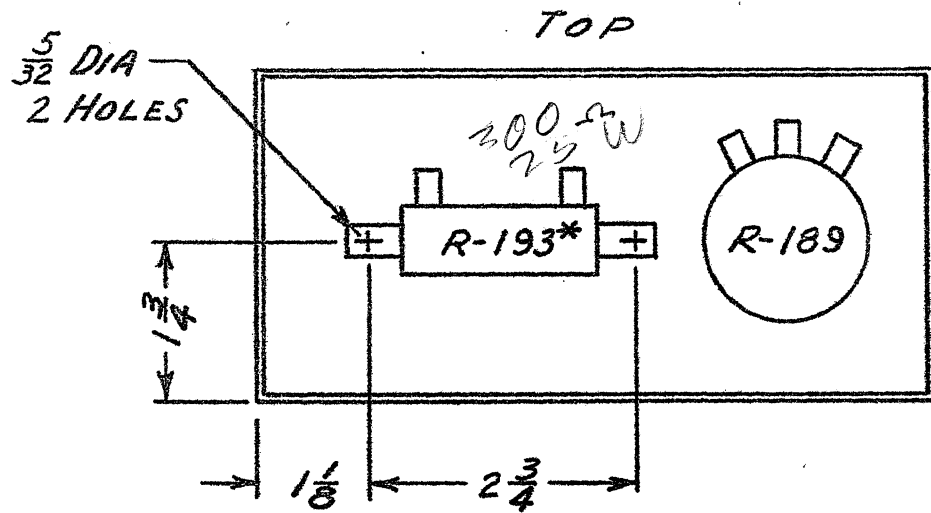
Bill of Material (Continued)

Quan.	Item No.	Part Number	Part Name
1	Z	710 3300 20	Resistor - 25 W, R-193 300 Ω
2	AA*	710 3520 00	Resistor - 25 W, R-343, 4
	or		
2	AA**	710 3220 00	Resistor - 25 W, R-343, 4
1	AB	745 5652 00	Resistor - 2 W, R-143

* 21E

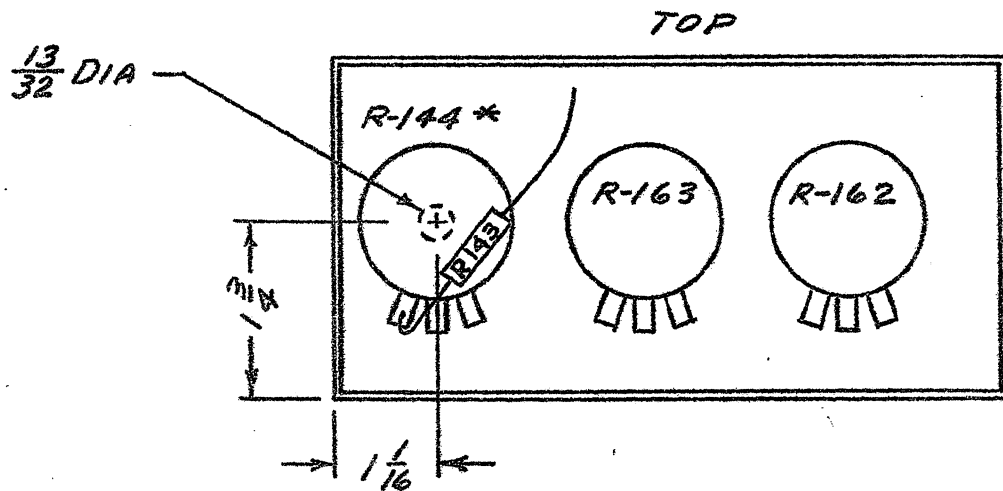
** 21M

FIGURE 1.



INSIDE VIEW - FRONT APRON
OF AUDIO AMPLIFIER CHASSIS.

FIGURE 2.



INSIDE VIEW - FRONT APRON
OF AUDIO DRIVER CHASSIS.

SCALE $\frac{1}{2} = 1$

* ADDED PARTS.

FIGURE 3.

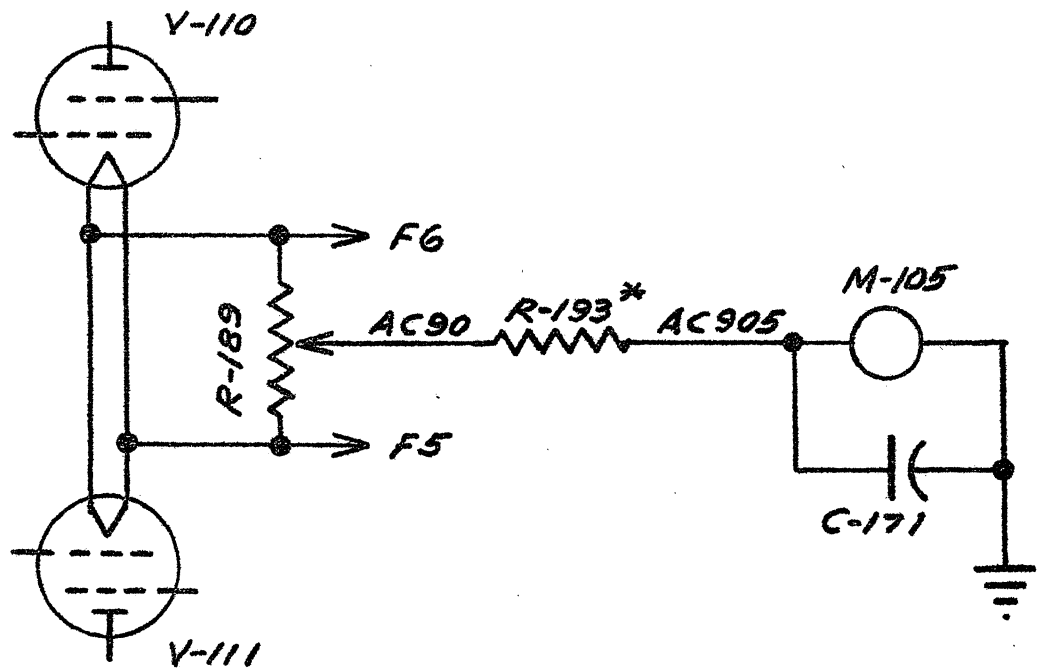
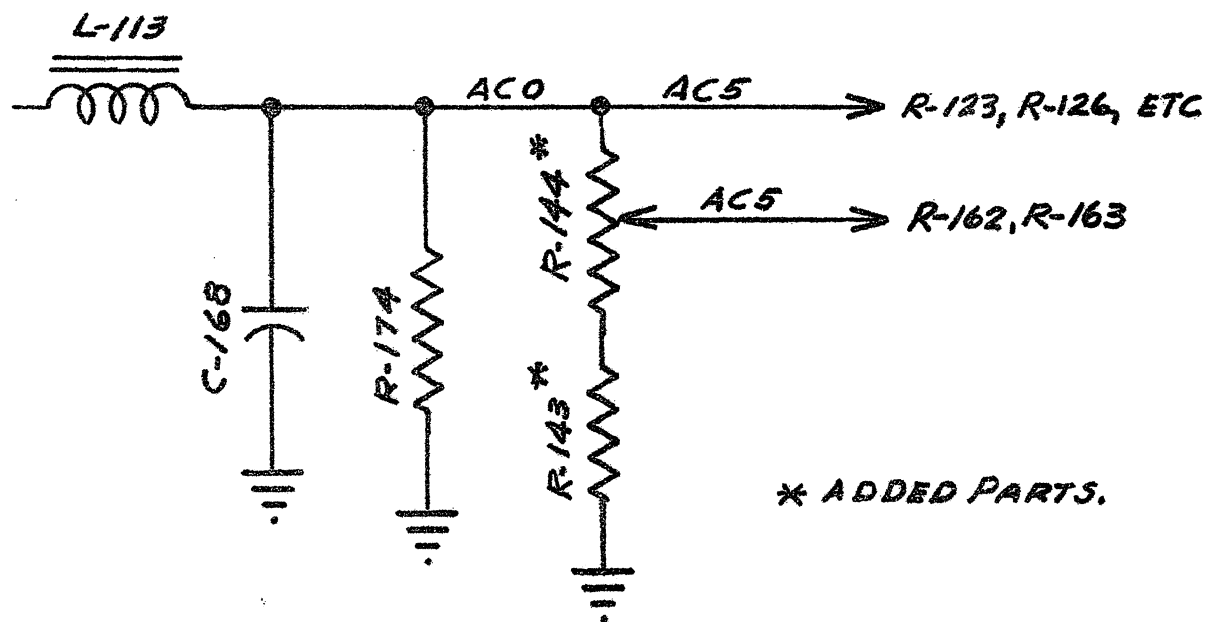
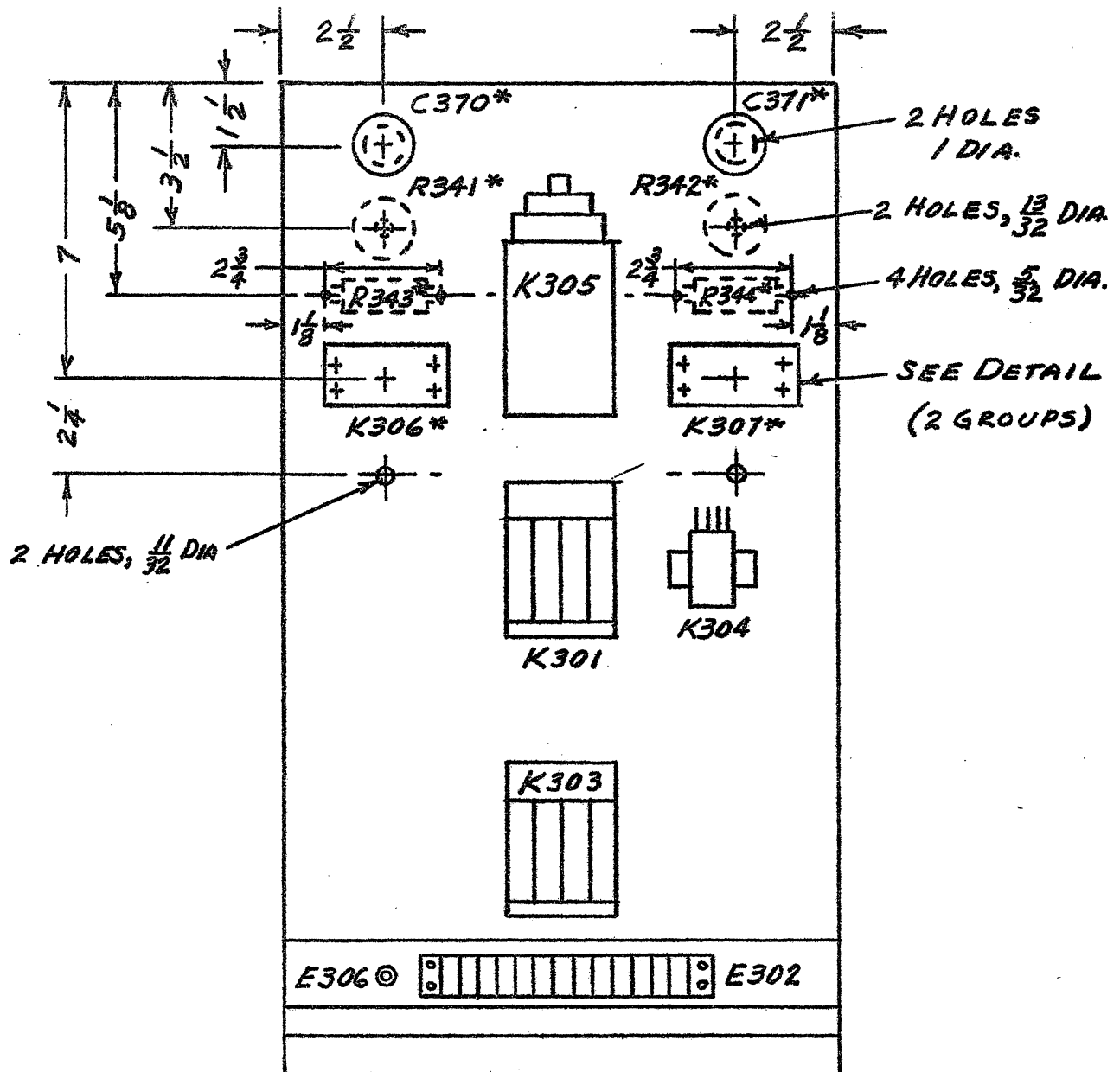


FIGURE 4.



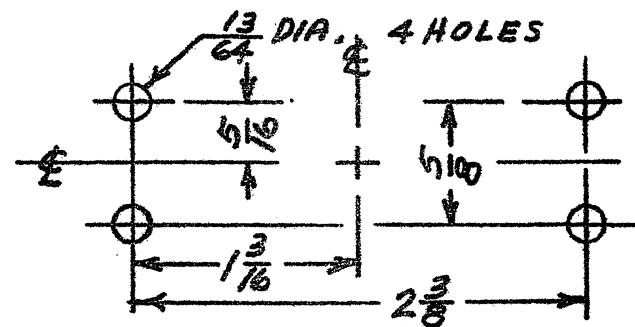
* ADDED PARTS.

FIGURE 5.



FRONT VIEW - RELAY PANEL - P.A. BAY
SCALE $\frac{1}{4} = 1$ * ADDED PARTS

NOTE
ON SOME MODELS,
K304 AND K305 ARE
INTERCHANGED.



MOUNTING HOLE DETAIL - K306, 7
SCALE 1 = 1

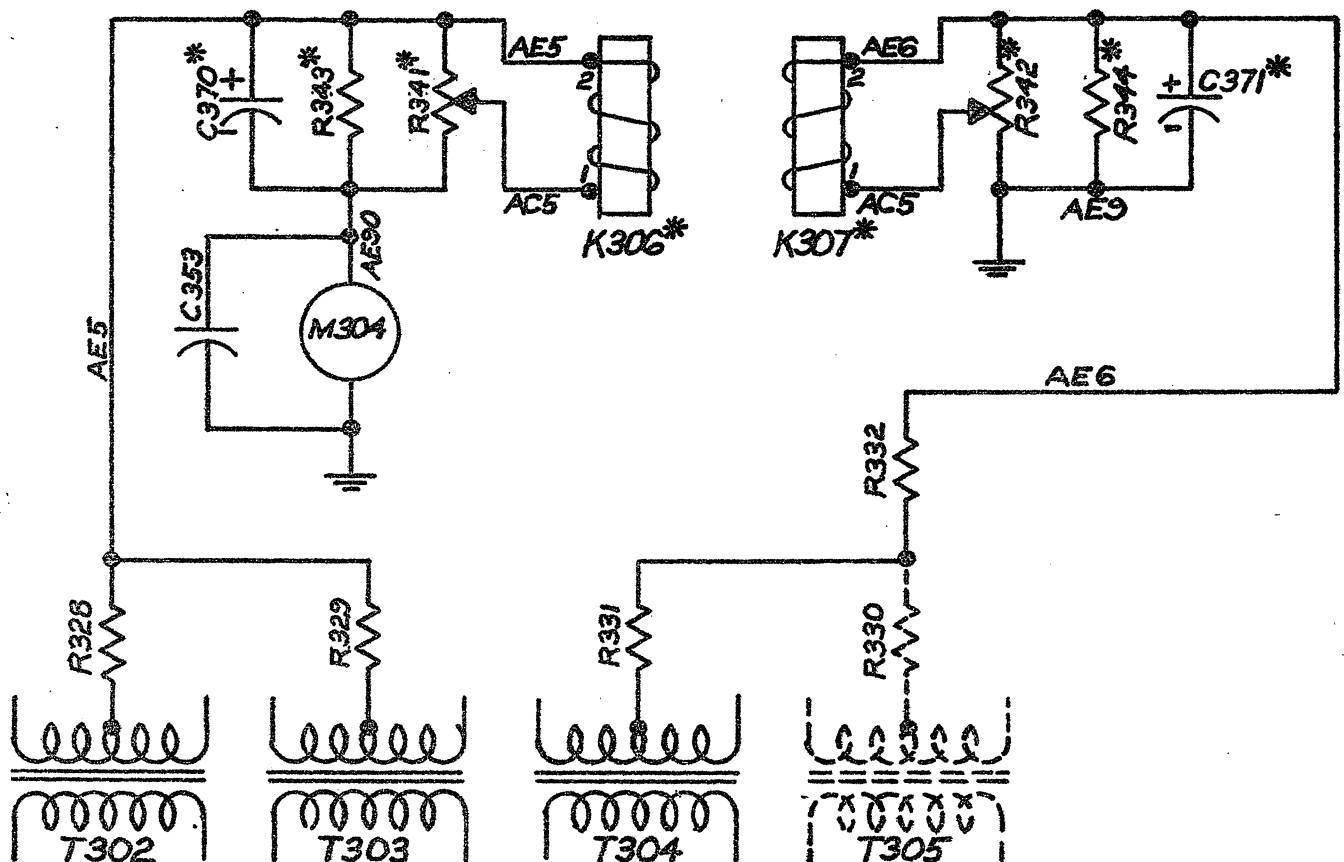
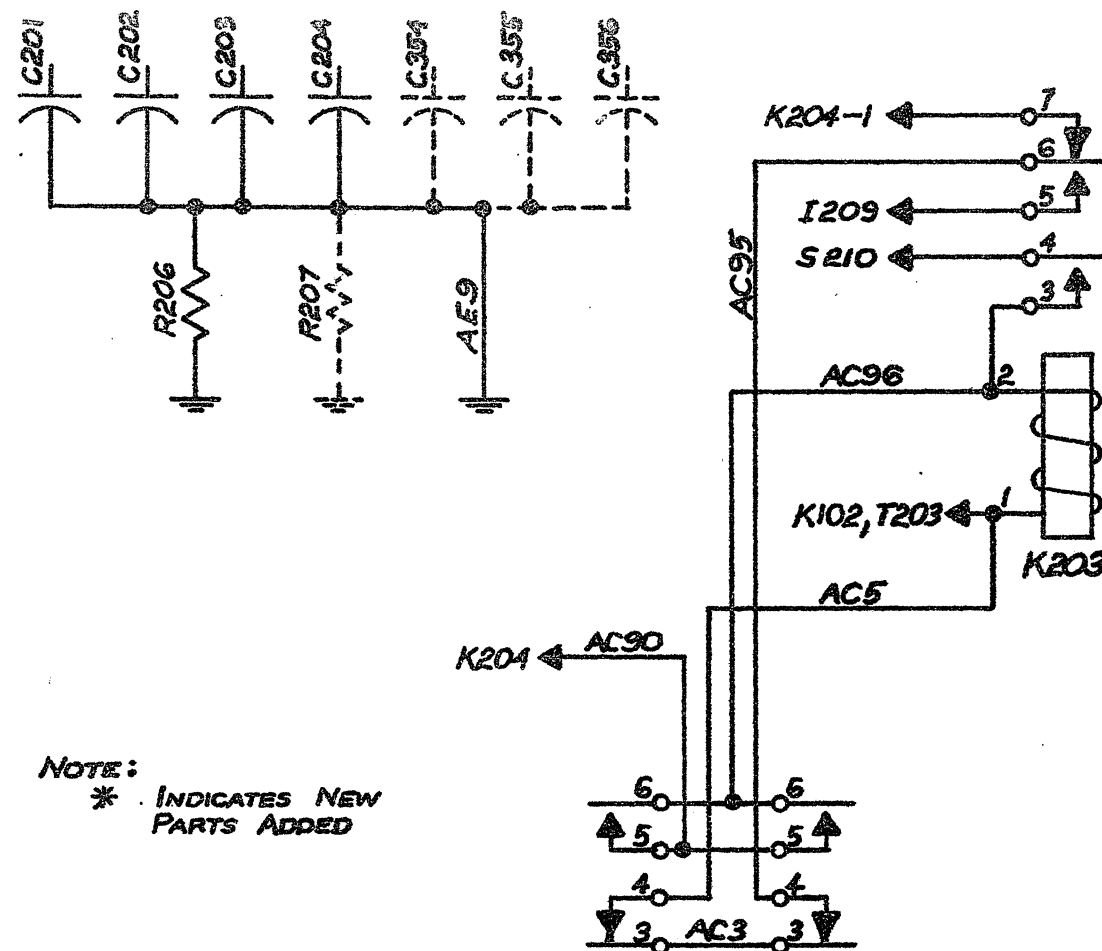


FIG. 6

KREM

21E/M
MODIFICATION INSTRUCTIONS
Modulator Circuit and Bias Plate Fuse

The purpose of this modification is to reduce the potential difference between the windings of modulation transformer T-211 by applying the same DC potential to both primary and secondary.

Also included in the modification kit are five 3 ampere slow-blow fuses (Item A) to be used in lieu of the original bias plate fuse, F-202. Please install one of these fuses, retaining the remainder as spares, and correct the instruction book parts list to correspond.

CAUTION: Disconnect the transmitter at the main wall switch before performing the modulator circuit modification.

1. Remove the back panels from the PA and rectifier bays.
2. Refer to Fig. 1. Remove and discard the AE9 wire connecting terminal 5 of T-211 to the ground stud in the rectifier bay.
3. Remove and discard the KEO wire connecting terminal 4 of T-211 to C-350 (and C-351, in a 21M).
4. Remove and discard the KEO wire connecting L-309 to C-350 (and C-351).
- ✓ 5. Refer to Fig. 2. ✓ Connect L-309 to terminal 4 of T-211, using KEO wire (item D) and 2 solder lugs (item B).
- ✓ 6. Connect terminal 5 of T-211 to C-350 (and C-351) using KEO wire (item D) and 2 solder lugs (item B).
- ✓ 7. Connect the remaining terminal of C-350 (and C-351) to ground, using AE9 wire (item E) and 2 solder lugs (item C). On the 21E, this ground point can be the ground stud on the PA bay relay panel (E-306). On the 21M, either this same stud, or the grounded terminals of C-354 thru

C-356 can be used. Route the AE9 wire well away from any high voltage points.

8. If the setting of the modulation transformer secondary arc gap was disturbed during the modification, reset as follows: Set the gap at not less than $1/16$ " nor more than $5/64$ " for sea level operation or not less than $5/64$ " nor more than $3/32$ " at 6000 feet. Check by energizing the equipment in normal operation and applying 100% modulation. If the arc gap fires, de-energize the equipment and increase the gap in not more than $1/64$ " steps until the gap does not fire in normal operation.

9. Replace the back panels. This completes the modification.

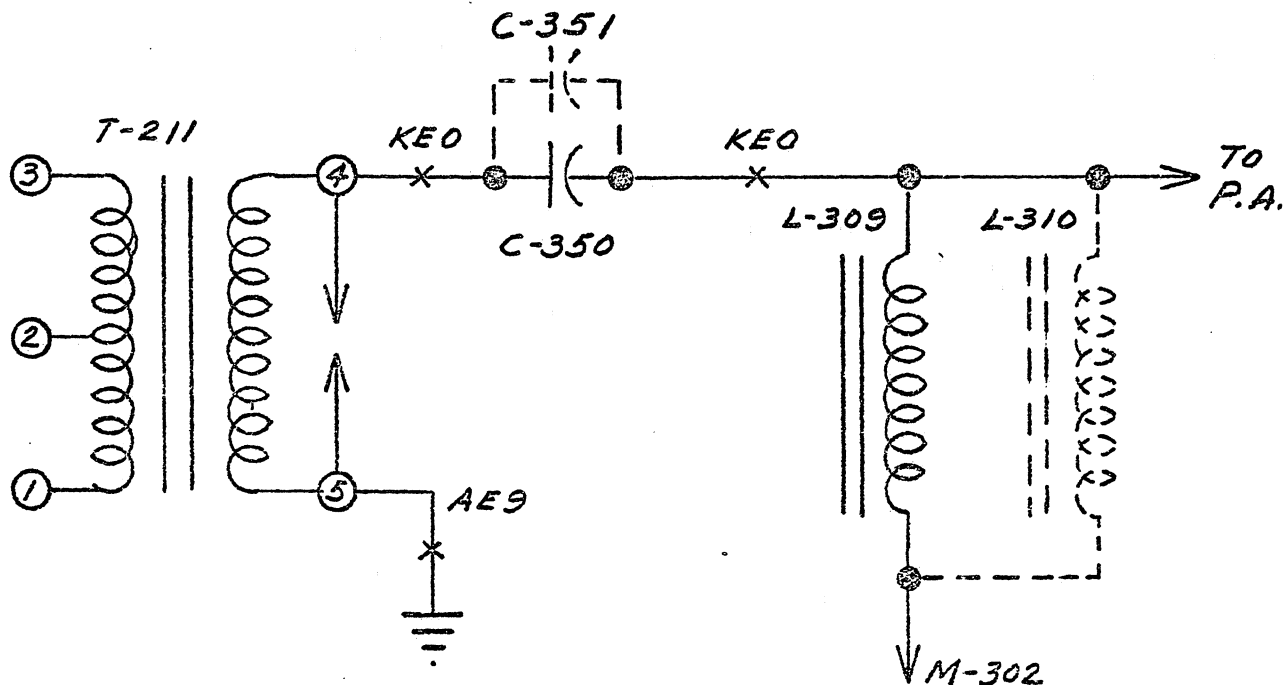
Re-set at $5/64$ " - Does not fire with percussion modulation at 125% —

$$\frac{5}{64} = \frac{2}{32} \quad \frac{1}{16} \quad \frac{2}{32} \quad \frac{4}{64}$$

$$\frac{3}{32} = \frac{1.5}{16}$$

Bill of Material

<u>Quan.</u>	<u>Item</u>	<u>Part Number</u>	<u>Description</u>
5	A	264 0009 00	Fuse - 3 A, slow-blow
4	B	304 0117 00	Lug - solder
2	C	304 1500 00	Lug - solder
10	D	423 0219 00	Wire - HV, KEO (ft)
4	E	440 2501 00	Wire - No. 14, AE9 (ft)



X = WIRES REMOVED

ORIGINAL MODULATION TRANSFORMER CIRCUIT

FIGURE 1.

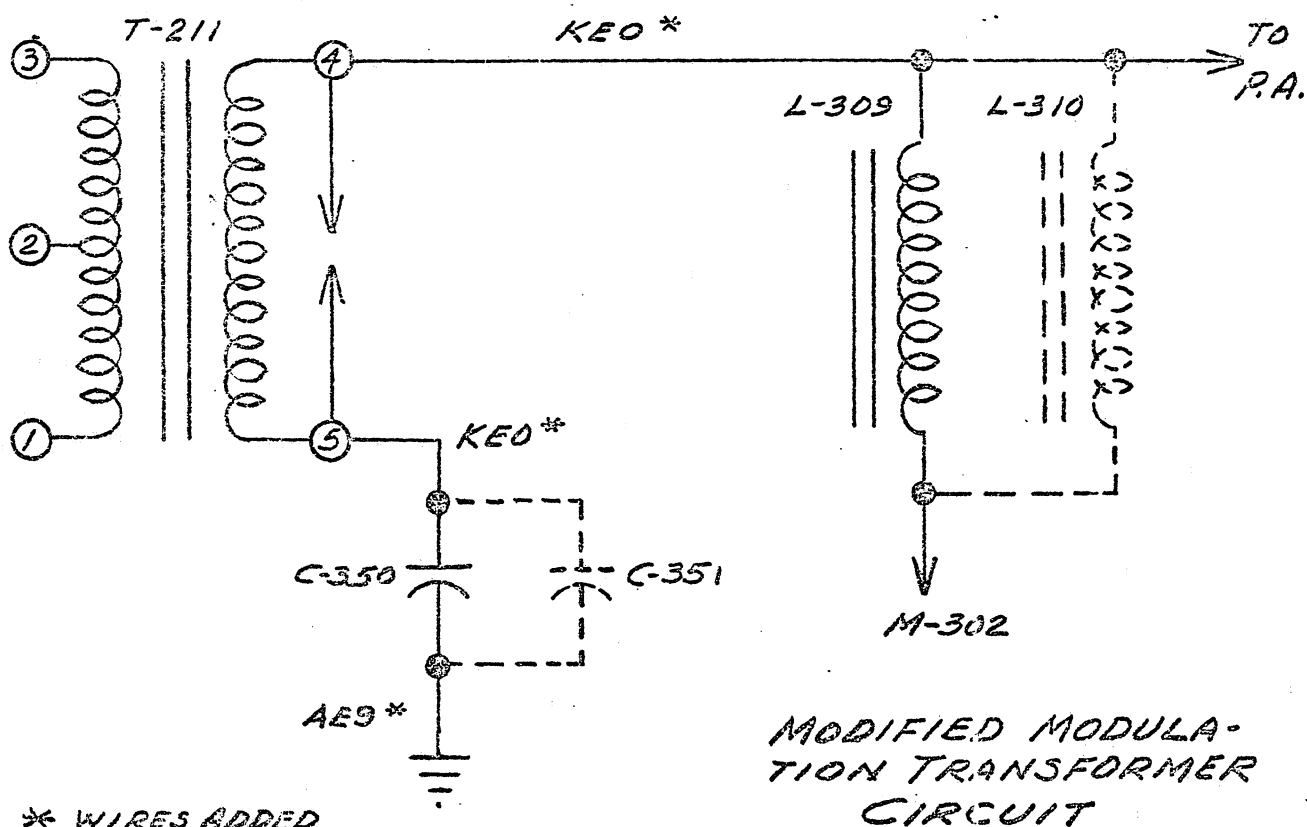


FIGURE 2.