PRIVATE LINE TELEPHONE SERVICE
CENTRALIZED MANUAL CONTROL SYSTEM
ANTI-AIRCRAFT OPERATIONS FOR DEFENDED AREAS
DESCRIPTION

CONTENTS PAGE

1. GENERAL

1.01 This section describes the centralized manual control communication system to be used in the Anti-Aircraft Operations Control System for Defended Areas. The arrangements will be used in any new anti-aircraft defenses and it is expected will also ultimately replace the present Sector Control Plan now in effect in existing defense systems. The arrangements are also designed to be readily integrated into future systems for automatic processing of information and control of weapons. In the future Automatic Fire Direction System (Missile Master) the Anti-Aircraft Operating Center (AAOC) described in this section will be known as the Army Air Defense Command Post (AADCP).

1.02 The arrangements described in this section cover the maximum defense installation contemplated in any defended area. Actual installations will conform to this basic plan but the number of circuits installed and the number of multiple appearances will vary with the size of the particular installation.

1.03 In the centralized manual control system the Subordinate AAOC (Anti-Aircraft Operating Center) is eliminated and all defense units report directly to the area AAOC. This eliminates the necessity for subsector switching arrangements and all communication facilities, both wire and radio from Missile Fire Units, Gun Batteries, Skysweeper Units and Radar Units are terminated in the Anti-Aircraft Operating Center.

1.04 Provision is made for one or more Alternate Operating Centers to take centralized control of the defense area in emergencies. Communication to the alternate locations will be entirely by radio circuits (except for circuits to the Air Defense Direction Center) so that no multiple appearances of the AAOC wire line facilities will be required.

1.05 A typical defended area arrangement includes groups of Missile Fire Units (MFU), Gun Batteries (GB), Skysweeper Battery Units (SU) and Radar Units (RU) connected to the Anti-Aircraft Operating Center (AAOC) by both wire and radio circuits and to the one or more Alternate Anti-Aircraft Operating Centers (Alt AAOC) by radio circuits. Circuits are also provided between the AAOC and the Air Defense Direction and Combat Centers and the Navy Anti-Aircraft Control Center. The specific circuits provided are discussed in Part 2 of this section, a brief outline of terminating arrangements in Part 3 and details of the more important circuits are covered in Part 4.

2. CIRCUIT FACILITIES

A. Wire Circuits

2.01 Four-wire, 2-way wire circuits arranged for 2-way signaling are provided between the AAOC and all fire units (MFU, GB and SU). Each of these circuits serves a number of unit locations and utilizes bridging amplifier equipment located in a central office.

2.02 As shown in Fig. 1, each 4-wire circuit to the Missile Fire Units serves four unit locations. A maximum of six such circuits may be specified.

2.03 A maximum of four 4-wire Gun Battery circuits may be specified, each circuit serving eight batteries.

2.04 A maximum of six 4-wire Skysweeper Unit circuits may be specified, each circuit serving six unit locations.

2.05 A maximum of six 2-wire circuits, arranged for 2-way signaling, may be specified to the Radar Units, each circuit serving one location. If more than six surveillance radars are to be used in a defended area, 4-wire circuits are used with two or more radar locations on each circuit.

2.06 Two 2-wire circuits, arranged for 2-way signaling, are provided from the AAOC and from the Alternate AAOC to the Air Defense Direction Center, one liaison circuit and one telling circuit. In those cases where one AAOC receives information from more than one ADDC duplicate circuits are provided. The circuits to the Alternate AAOC may be provided on an engineered military circuit basis.

2.07 One 2-wire circuit, arranged for 2-way signaling, is provided from the AAOC to the Air Defense Combat Center.

2.08 One 2-wire liaison circuit arranged for 2-way signaling is provided, when specified, from the AAOC to the Navy Anti-Aircraft Control Center.

2.09 An intercommunicating system of point-to-point circuits is provided between various positions in the AAOC. These circuits are not discussed in this section.

2.10 Various conferencing arrangements are provided at the AAOC for the above wire circuits. As shown in Fig. 1, three of these (Circuits 3, 6 and 9) serve to group two each of the MFU circuits. Conference Circuit 10 gives access to all MFU locations. Circuit 15 gives access to all GB locations and Circuit 22 to all SU locations.

B. Radio Circuits

2.11 All radio circuits from the AAOC to fire units and radar sites are arranged to operate from the Alternate AAOC should the primary AAOC become inoperative. Fig. 2 shows the Alternate AAOC circuit arrangement.

2.12 One push-to-talk single-frequency radio circuit is provided between the AAOC and the group of eight MFU. A single transmitter and receiver at the AAOC serves the eight unit

locations. A maximum of three such circuits may be provided to reach the twenty-four MFU (maximum) covered by the wire circuits mentioned in Paragraph 2.02.

2.13 One push-to-talk single-frequency radio circuit is provided between the AAOC and each group of eight Gun Batteries.

2.14 One push-to-talk single-frequency radio circuit is provided between the AAOC and each group of six Skysweeper Units.

2.15 One push-to-talk single-frequency radio circuit is provided between the AAOC and each surveillance radar location.

2.16 One 2-way (two-frequency) radio circuit is provided between the AAOC and the Air Defense Direction Center.

2.17 A radio conference circuit is provided at both the AAOC and the Alternate AAOC to give access to all Missile Fire Units, Gun Batteries and Skysweeper Units.

3. TERMINATING ARRANGEMENTS

A. AAOC

3.01 Operating facilities at the maximum AAOC installation will consist of three bridges or tiers of operating positions, an operations or plot board, a track information board and an early warning board. In smaller installations two of the bridges may be combined. All operating positions where a number of lines are terminated are equipped with 102A Key Equipment line key units. Hang-up handsets or position jacks are used at positions where a single line is terminated. At the key positions, foot switches are used for the push-to-talk circuits. At jack terminated positions, a nonlocking press-to-talk switch in the telephone set is used on both wire and radio lines. Position jacks will be used for all terminations at the Operating Board and Early Warning Board.

3.02 The three operating bridges are known as the Commanders Bridge, Controllers Bridge and Tellers Bridge. Fig. 1 shows the circuit terminations at the operating positions on the three bridges.

3.03 The Commanders Bridge consists of a maximum of four operating positions: the Defense Commander, Anti-Aircraft Operations Officer (AAOO), Recorder and Navy Liaison Position. The first two are equipped with key equipment.

3.04 The Controllers Bridge is used only for missile operation and consists of a Master Controller position and one or two additional Controller positions as required. One Controller is used for each eight Missile Fire Units. Controllers are not used in the operation of Gun Batteries or Skysweeper Units. Each Controller position is equipped with key equipment. Circuits terminating are shown in Fig. 1.

3.05 The Tellers Bridge consists of a maximum of sixteen positions. Up to six Missile Teller positions are provided, each assigned to four Missile Fire Units. Up to four Gun Teller positions are provided, each assigned to eight Gun Batteries and up to six Skysweeper Tellers each assigned to six Skysweeper Units. Circuits terminated in each position are shown in Fig. 1.

B. Alternate AAOC

3.06 The arrangement of operating positions in the Alternate AAOC is similar to that in the AAOC except that a minimum of equipment is to be specified. A typical installation might consist of a two-position Commanders Bridge (Defense Commander and AAOO Positions), a Tellers Bridge with the required number of Teller positions and an Operations Board. Circuit terminating arrangements are shown in Fig. 2.

3.07 When a single alternate AAOC is used all radio circuits terminating in the AAOC are terminated in the alternate. Wire circuits to the ADDC are also terminated and may be supplied on an engineered military circuit basis. The same radio frequencies used between the AAOC to unit locations are used from the alternate AAOC.

3.08 In larger defense systems when two alternate AAOCs are provided each circuit will terminate only at one alternate AAOC (except the ADDC circuits which will terminate at both). An additional stand-by radio circuit may be installed between the two alternate AAOCs.

C. Unit Locations

3.09 Installations at Missile Fire Units and at Gun Batteries will usually consist of four positions, three in the control van and one in the command post. Where two control vans are used in the same location, duplicate terminations are provided except that the radio circuits are extended to the second van by wire.

3.10 At Skysweeper Units all circuits are terminated on jacks at the Gun Chief's position.

3.11 At Radar Unit locations two positions are provided and circuits terminated at the Radar Operator and Radar Plotter Positions.

3.12 In some cases a fire unit may be located at or near the AAOC or Alternate AAOC location. This is considered an On-Premise Battery and because of the short distance radio communication would be impractical. In this case communications normally on radio facilities may be supplied by wire circuits. Drawings SD-69296-01, SD-69330-01 and SD-69295-01 cover the circuits required for this case.

4. CIRCUIT OPERATION

A. General

4.01 Two basic types of wire line circuits and two types of radio circuits are used in the communication network. These are:

(a) Multistation 4-wire lines

(b) Point-to-point 2-wire lines

(c) Single-frequency radio channels

(d) Two-frequency radio channels

4.02 The multistation 4-wire lines are used between the AAOC and a group of Missile Fire Units, Gun Batteries or Skysweeper Units as discussed in Part 3 of this section. Each circuit from the AAOC goes to a grouping amplifier in a convenient Telephone Company control office and from there to the unit locations.

4.03 In normal operation these 4-wire multistation circuits are used to pass information from a Teller position in the AAOC to the firing unit and to return information from the unit to plotters at the Operations Board in the AAOC. As indicated in Fig. 1, however, these circuits may also be picked up thru conference circuits by the Defense Commander and the Anti-Aircraft Operations Officer (AAOO) as an alternate means of communication to the units. The usual operational path from the Defense Commander and AAOO to the units is by means of radio circuits.

4.04 Two-wire point-to-point circuits are used between the AAOC and each Radar Unit. They are used primarily to pass information from the Radar Unit to plotters at the Operations Board and Early Warning Board where they terminate on jacks. These lines also appear at the Defense Commander and AAOO positions. They are arranged for two-way signaling but out-signaling from the AAOC is provided only from the Defense Commander and AAOO positions.

4.05 Two-wire point-to-point circuits are also used from the AAOC to the Air Defense Direction Center, the Combat Center and the Navy Anti-Aircraft Center. The telling circuits from the ADDC are used to pass information to the Early Warning Board and are given multiple jack appearances there for three plotters. They also appear at the Defense Commander and AAOO positions for out-signaling. The ADDC Liaison circuit appears at these two positions only. (Fig. 1) The ADCC circuit and the Navy Liaison circuit, if provided, are instrument terminated at the command and navy positions only.

4.06 The single-frequency radio channels are used primarily as command circuits from the Defense Commander and AAOO positions to

the fire units and radar locations. However, in case of failure of the wire circuits these circuits are used to pass information to the AAOC and are therefore also terminated at the Operations Board and at appropriate Teller and Controller positions (see Fig. 1). The circuits are arranged for push-to-talk operation (foot switch control of the transmitter) and are terminated at the AAOC in loudspeaker equipment for voice signaling. The loudspeaker is of the 100F type and is arranged so that the volume may be controlled but cannot be turned completely off. This modification is covered by Note 202 on Drawing SD-69296-016. A conference circuit is provided (Circuit No. 57) to permit grouping of radio circuits to all fire units from the Defense Commander and AAOO positions.

4.07 Single-frequency radio channels are also used between the AAOC and each Radar Unit. These circuits are used in case of failure of the wire circuits and are terminated in the same positions as the radar wire circuits.

4.08 A two-frequency 2-way radio circuit is used between the AAOC and the Air Defense Direction Center. The circuit will be supplied by military owned radio equipment and will be terminated in multiple jacks at the Operation Board and at the Defense Commander and AAOO positions. (Fig. 1)

B. Transmission Requirements

4.09 Point-to-point 4-wire circuits should not exceed a maximum 1000-cycle line loss of 18 to 20 db between terminating instruments. This will give an effective transmission loss of approximately 0 db. (The "effective" transmission system as mentioned here and in paragraphs below is a method of evaluating the transmission efficiency of the subset instruments and line facilities and should not be confused with 1000-cycle losses used in circuit measurement. In the 4-wire circuits utilizing the central office amplifier the circuit from the AAOC to the amplifier and the circuit from the amplifier to the unit location should not exceed a 1000-cycle line loss of 16 db. It is not expected that the 20-cycle signaling used will be limiting.

4.10 When the 4-wire lines are connected to the central office amplifier (Fig. 11) the transmitting lines are bridged thru adjustable pads to the amplifier input. These pads should be adjusted in each line depending on the individual line loss so that the loss of all lines to the amplifier including the pad is between 13 and 16 db. The receiving lines are connected to one of three output bus terminals, A, B or C. Receiving lines should be terminated as follows:

Lines up to 3.9 db—To Terminal A

Lines 4.0 to 9.9 db—To Terminal B

Lines 10 to 16 db—To Terminal C

4.11 The gain of the central office amplifier (Fig. 11) is selected to give an over-all ***effective*** transmission loss (T+R) of 0 db. In determining the gain required it is assumed that N1 transmitter units and HC4 receivers will be used at all locations connected for 2-way, 4-wire operation and that in general one position telephone is transmitting and two receiving alternately in either direction.

4.12 In the above conditions the required gain may be approximately computed as follows:

	EFFECTIVE LOSS T+R
Reference effective T+R loss of F1A-HA1-AST sets	—17 db
Lower efficiency N1 transmitter	+ 7 db
Higher efficiency of HC4 receiver	— 2 db
Transmitting gain from 4-wire operation	— 3 db
Receiving loss from elimination of induction coil	— 3 db
Total Subset (T+R)	—18 db
Bridge losses of additional receivers (both ends)	+ 5 db
Miscellaneous coil and wiring losses	+ 2 db
Two maximum loss 16 db lines	+32 db
Desired amplifier insertion gain	—21 db
Total Over-all Effective Loss	0 db

4.13 The above amplifier insertion gain includes the input bridging loss caused by bridging two or more inputs to the amplifier and the output bridging loss caused by the output bridge arrangement. The input bridging loss depends on the number of inputs bridged together, being a minimum of two (AAOC plus one unit location) to a maximum of nine (AAOC plus eight Gun Batteries). This loss is tabulated below:

TOTAL INPUTS (Including AAOC)	APPROX. INPUT BRIDGING LOSS
2	8.0 db
3	9.5
4	11.0
5	12.0
6	13.0
7	14.0
8	15.0
9	15.5

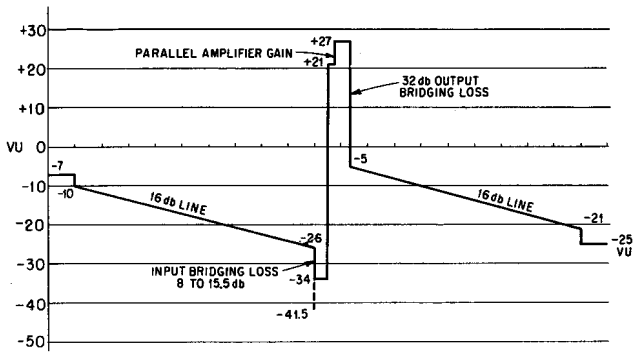
Due to the low-impedance nature of the output bridging arrangement and the isolating line resistors the output bridging loss is independent of the number of outputs and may be assumed constant at 32 db.

4.14 The use of the second amplifier in parallel (Fig. 11) when properly phased gives an additional gain of 6 db at the output load terminals. (An accidental reversal in either amplifier causes instead a loss of about 10 db.)

4.15 From the above, the required amplifier gain (each amplifier) for 16 db lines is as follows:

No. of Inputs (Inc. AAOC)	Input Bridging Loss	Output Bridging Loss	Gain from Parallel Amplifier	Required Amplifier Gain
2	8.0	32	6	55
3	9.5	32	6	56.5
4	11.0	32	6	58
5	12.0	32	6	59
6	13.0	32	6	60
7	14.0	32	6	61
8	15.0	32	6	62
9	15.5	32	6	62.5

4.16 When adjusted as above the 1000-cycle loss of the over-all circuit measured between the line terminals at the AAOC and at any unit location (with all instruments removed and assuming maximum loss 16 db lines) will be 11 db. This may be shown by the volume diagram below. An average input of —7 vu is assumed at the subset terminals. A suggested procedure of adjusting the amplifier gain to obtain these losses is covered in Part 6.



LEVEL DIAGRAM - CENTRAL OFFICE AMPLIFIER

5. TYPICAL CIRCUITS

A. Four-Wire Multistation Circuits

AAOC Termination—Fig. 3
AAOC Conference Circuit—Fig. 4
Central Office Amplifier—Fig. 11
Unit Location Termination—Fig. 12

5.01 A maximum of sixteen of these 4-wire multistation circuits may be provided in a defense installation. Each circuit connects the AAOC thru a central office amplifier circuit to a group of five units. The circuits may be grouped in various conference arrangements at the AAOC. Circuit numbers, terminating arrangements and conference groupings are shown in Fig. 1.

5.02 Fig. 3 shows the AAOC termination of the 4-wire circuit. An Operations Board and a key equipped position termination are shown. Other positions are bridged as indicated and are identical. Outgoing 20-cycle signaling is provided by a ringing key at the key positions which operates the SW relay and connects ringing current to both sides of the receiving loop. Signaling is not provided from the Operations Board.

5.03 Incoming 20-cycle signaling coming in over the transmitting loop is picked off at the midpoint of the 120L coil primary, is then rectified by the diode bridge and operates the R1 relay and the ST relay and line lamp. A flashing circuit (not shown) gives flash indication and buzzers may be provided. The signal is extinguished by operation of the L relay. Ground to operate the L relay is provided either by operation of the line pickup relay LL at one of the key positions or by insertion of a subset plug at the Operations Board. A recorder jack circuit is provided at the key positions for tape recorder operation.

5.04 At the central office amplifier (Fig. 11) the transmitting loops from the AAOC and from all unit locations on the circuit are connected thru the adjustable pads to the amplifier input. The receiving loop to the AAOC and all unit locations are connected to the amplifier output.

5.05 The amplifier consists of two basic amplifiers with inputs in parallel and outputs connected to a balanced bridge. The output arm of the bridge is brought out at three points to form a low-impedance output bus of three output levels. The receiving loops are connected to one of these three points, Group A lines, Group B lines or Group C lines depending on the line loss of the particular loop. (Paragraph 4.10)

5.06 Signaling thru the amplifier is arranged so that the AAOC will ring all unit locations and so that any unit may ring the AAOC but so that ringing from any unit will not ring any other unit. This operates as follows. (See Fig. 11) An incoming signal from the AAOC comes in over the AAOC receiving loop and is picked off in 94E input coil midpoint to operate the R relay. This applies a ground to operate an RS relay in the transmitting loop to all unit locations. The operation of this RS relay applies ringing current to both sides of all transmitting loops to the units. An incoming signal from one of the unit locations comes in over the unit receiving loop simplex and is applied to the amplifier output bus. The midpoint of this bus is connected through a capacitor to relay S. Operation of this S relay supplies a ground to operate the RS relay in the AAOC transmitting loop which applies ringing current to both sides of the loop. No operation of the RS relays in the transmitting loops to the other unit locations takes place and the signal is passed only to the AAOC.

5.07 The transmitting and receiving loops from the amplifier come into the unit location and terminate as shown in Fig. 12 in jack circuits in the Command Post and at one or more positions in the fire control trailer. Ringers or loudringers are provided for incoming signaling and ringing keys for outgoing. Incoming signaling is received over the transmitting loop from the bridging amplifier and is rectified by the diode bridge to operate relay R1. Operation of R1 applies ringing current to all position ringers. No pickup cutoff is provided. On outgoing signaling the ringing keys at each position are wired through the subset jacks so that a circuit must be picked up before the ring key will operate. Proper operation of the ring key operates the SW relay and applies ringing current to the receiving loop.

5.08 The conferencing arrangement at the AAOC for these 4-wire circuits is shown in Fig. 3 and Fig. 4. Terminations of the conference circuits in the AAOC and the 4-wire circuits grouped on each of the six conference circuits are shown in the blocks at the bottom of Fig. 4.

5.09 Operation of one of the conference line pickup keys operates the conference circuit relay TR (Fig. 3) on each of the 4-wire circuits to be grouped transferring these circuits from the normal terminations and bridging them together into the conference amplifier (Fig. 4). The terminating side of the two one-way amplifiers go to conference line terminating circuits in the positions indicated. Outgoing signaling on the group of circuits is by transfer of the S leads (Fig. 3) of all grouped circuits to the conference circuit ringing key.

B. Point-to-Point Two-Wire Circuits

AAOC Termination—Figs. 5 and 6
Radar Unit Termination—Fig. 14

5.10 The point-to-point 2-wire circuits are used between the AAOC and Radar Units, ADDC, ADCC and Navy Liaison locations. Circuits are arranged for 2-way ringdown signaling. Terminating positions at the AAOC are shown in Fig. 1.

5.11 The terminating circuit at the AAOC is shown in Fig. 5. Terminations are made to line pickup and signaling keys on the key equipment at the command positions and on jacks at the Operations Board. Circuit No. 30 appears only at the two command positions.

5.12 Circuits Nos. 37 and 38 shown in Fig. 6 are similar to the other 2-wire circuits but are terminated in hang-up handsets instead of on the key equipment. Each circuit has a single instrument termination. Ringers and ringing keys are provided for signaling as shown in Fig. 6.

5.13 At the Radar Locations (Fig. 14) these 2-wire circuits terminate on jacks at two positions. Separate ringers and ringing keys are provided. The incoming signal operates the ringers by closure of the R relay and outgoing ringing is applied from one side of the line to ground by operation of the SW relay under control of the ringing key. The ringing key circuit is taken thru a contact of the subset jack to prevent false operation from an open position.

C. Radio Circuits to Unit Locations

AAOC Termination—Fig. 7

Conference Circuit—Fig. 10

Fire Unit Termination—Fig. 13

5.14 As shown in Fig. 1, each of the single-frequency radio channels to the Missile Fire Units covers the group of eight units covered by two of the 4-wire circuits. To the Gun Batteries and Skysweeper Units the radio circuit covers the same group of eight and six units covered by a particular wire circuit. A separate frequency is assigned to each circuit.

5.15 The circuits operate on a push-to-talk basis from terminating position as shown in Fig. 1. Foot-switch operation is used at the key positions and push-to-talk buttons on the subsets at the Operations Board. As shown in Fig. 7 the receiver terminates on the line pickup relay (TR) and in the idle condition is connected thru to the conference pickup relay (Fig. 10) and grouped with other radio circuits on the 100F loudspeaker which is used for incoming signaling for the group of circuits.

5.16 When a circuit is picked up the TR relay (Fig. 7) transfers the receiver line from the loudspeaker to the position circuit. Operation of the push-to-talk button or foot switch operates the PT relay which opens the receiver line, transfers the transmitter to the position circuit and keys the transmitter by closing the transmitter control lead to one side of the transmitter line (leads 2 and 3).

5.17 At the unit location (Fig. 13) the receiver comes in thru the normal contacts of the SW-B relay to two 181B coils feeding the fire control trailer or trailers and the battery command post. (The SU circuits appear at the Gun Chief's position only.) From the tapped primary of the 181B coil the receiver leads go thru normal contacts of the pickup jacks to the loudspeaker for incoming signaling.

5.18 When the line is picked up the receiver goes to the subset and the loudspeaker is shut off. Operation of the push-to-talk button on the subset at a trailer position operates the BF relay which removes a shunting termination from the coil secondary, operates the SW-B relay to connect the subset thru to the transmitter and key the transmitter by closing the A-F leads. Operation from the Battery Command Post is similar. The push-to-talk button here operates the BS10 relay and the SW-F relay to close in and key the transmitter.

5.19 A conference arrangement is provided at the AAOC to permit the command positions (Defense Commander and AAOO) to group all radio lines to all fire units.

5.20 The circuit from each radio receiver is connected thru the normal contacts of its TR line pickup relay (Fig. 7) thru an isolating pad to a common 120P coil (Fig. 10). This circuit in the normal condition then goes to the common loudspeaker for incoming signaling.

5.21 Operation of the conference key operates the line pickup relay C (Fig. 10) which removes the loudspeaker and connects the group of receivers to the position telephone circuit. This conference key also operates the conference relay C1 (Fig. 7) to transfer the transmitter leads on all circuits thru isolating pads to the output of the conference amplifier (Fig. 10). Operation of the push-to-talk foot switch then operates the PT relay (Fig. 10) transferring the subset from the receivers to the amplifier input and keys all transmitters.

D. Radio Circuits to Radar Locations

AAOC Termination—Fig. 8

Radar Termination—Fig. 15

5.22 The single-frequency radio circuits from the AAOC to the Radar Units are similar to those to the fire units described in Part 5C except that a separate circuit (separate frequency) is used to each unit and no conference arrangements are provided.

5.23 The AAOC termination is shown in Fig. 8. In the idle circuit condition the line from the radio receiver is grouped with those from the other radar units and connected to the loudspeaker for voice signaling. When a circuit is picked up at either the Operations Board jack or at one of the key positions the TR relay transfers the incoming line from the loudspeaker to the telephone circuit. Operation of the push-to-talk foot switch at the key position operates the PT relay transferring the telephone to the transmitter and keying the transmitter by closing the transmitter control loop. Push-to-talk operation is not provided from the Operations Board.

5.24 The termination of these circuits at the radar location is shown in Fig. 15. The receiver is connected to the loudspeaker in the idle condition. Picking up the circuit at either the Operator or Plotter position cuts off the loudspeaker which is wired thru the normal jack contacts of both positions. Push-to-talk buttons on the subset operate the BF relay which in turn operates the SW relay to transfer the subset to the transmitter and key the transmitter by closing the transmitter control loop.

E. Radio Circuits to ADDC

AAOC Termination—Fig. 9

5.25 The two-frequency radio circuit between the AAOC and the Air Defense Direction Center is the only circuit of this type usually provided. Termination at the AAOC is shown in Fig. 9. The radio equipment will be supplied by the customer.

5.26 Since the transmitter and receiver are operating on different frequencies no transfer relay or push-to-talk operation is required. Line lamp indication is operated when the circuit is picked up at either the Early Warning Board or the key positions but no provision is made for signaling. Provision is made for a tape recorder termination at the Recorder position.

6. AMPLIFIER ADJUSTMENT

A. Four-Wire Central Office Amplifier

6.01 Adjustment of the bridging amplifier to obtain the gains required in Paragraph 4.15 may be most readily done by one of the two following methods.

6.02 ***Method 1*** assumes all input and output loops to station equipment to be in place and connected to the amplifier.

(a) Each ***transmitting*** line is connected to the parallel amplifier inputs thru a 94E coil, an adjustable pad and isolating resistors. (Fig. 11). This arrangement gives an input impedance for each line of from 400 to 600 ohms depending on the number of input lines. Measure the 1000-cycle loss of each transmitting line between line jacks at amplifier and station locations and adjust each pad as follows:

LINE LOSS	PAD LOSS
0— 4.9 db	12 db
5.0— 8.9 db	8 db
9.0—12.9 db	4 db

(b) Each ***receiving*** line is connected to one of the three output bus terminals thru a 300-ohm isolating resistor in each side of the line presenting approximately a 600-ohm termina-

tion for the line. Measure the 1000-cycle loss between line jacks of the receiving lines and connect them to the proper bus according to their loss as follows:

LINE LOSS	BUS TERMINAL
0 to 3.9 db	A
4.0 to 9.9 db	B
10.0 to 16 db	C

(c) Transmit a 1000-cycle test signal at a —10 dbm level into the transmitting line jacks at the AAOC.

(d) Adjust the gain of Amplifier No. 1 to read —3 ±1.0 vu on the volume indicator with the AMP1 key operated.

(e) Adjust the gain of Amplifier No. 2 to read —3 ±1.0 vu on the volume indicator with the AMP2 key operated.

(f) Measure the level at the load terminals by closing the LOAD key. This level should be within 1.0 db of that set in Steps (d) and (e). A large difference in this level usually indicates incorrect phasing of the two amplifiers.

6.03 ***Method 2*** is primarily for use when the station loops are not available or when it is desired to adjust the amplifier gains independently of the over-all circuit.

(a) Send 1000-cycle test signal at —37 dbm into the IN jacks. (NOT AMP IN)

(b) With the AMP1 key operated adjust the gain of Amplifier No. 1 to give a volume indicator indication as given below depending on the number of input circuits to be wired to the amplifier.

NO. OF INPUTS (Including AAOC)	VU METER READING
2	—6.0
3	—4.5
4	—3.0
5	—2.0
6	—1.0
7	—0.0
8	+1.0
9	+1.5

(c) With the AMP2 key operated adjust the gain of Amplifier No. 2 to the same value as Amplifier No. 1.

(d) Measure the level at the load terminals by closing the LOAD key. This level should be with 1.0 db of that set in (b) and (c). (If the test signal is fed into the AMP IN 1 and AMP IN 2 jacks thus energizing one amplifier at a time, the level at the load terminals will be 6.0 db below the amplifier output level).

B. Conference Amplifier—Wire Circuits

6.04 The function of the conference amplifier at the AAOC (Fig. 4) used on circuits No. 3, 6, 9, 10, 15 and 22 is to supply sufficient gain to compensate approximately for the bridging loss of the grouped lines. This may be accomplished with sufficient accuracy by adjusting both amplifiers on each circuit to a gain of 20.0 ±1.0 db as measured between 600-ohm terminations.

C. Conference Amplifier — Radio Circuits

6.05 The conference amplifier used on circuit No. 57 (Fig. 10) should be adjusted to give a gain of 13.0 ±1.0 db measured between 600-ohm terminations.

7. REFERENCES (Not Attached)

Station Circuit Drawings

SD-69295-01	— Station Systems—Anti-Aircraft Operations Control System Station Line and Telephone Circuits—For Operations Center
SD-69296-01 (New Installations)	— Station Systems—Line and Station Circuits for Anti-Aircraft Operations Control Systems —Battery Locations— New Installations
SD-69330-01 (Existing Installations)	— Station Systems—Modification of Line and Station Circuits for Anti-Aircraft Operations Control System— Battery Locations

Station Equipment Drawings

ED-69328-01 — Station Systems—Key Equipment No. 112A Line Conference Amplifier Circuit and Preempt Control, Splitting and Conference Grouping Circuit (Two Lines) —Relay Rack Equipment—J53022BY

ED-69332-01 — Station Systems—Key Equipment No. 112A Radio Mixer Circuit—Relay Unit Equipment —J53022CD

ED-69333-01 — Station Systems—Key Equipment No. 112A—Radio Mixer and Conference Circuit—Relay Unit Equipment—J53022CE

ED-69337-01 — Station Systems—Anti-Aircraft Operations Control System—Operations Center—Typical Equipment for Station Line and Tel. Ckts

ED-69338-01 — Station Systems—Anti-Aircraft Operations Control System—Battery Locations—Typical Equipment for Line and Station Ckts

ED-69345-01 — Station Systems—Anti-Aircraft Operations Control System—Typical Equipment—Modification of Line and Station Circuits

Central Office Circuit Drawing

SD-96465-01 — Common Systems——Two-Way Speech Multipoint System Central Amplifier Circuit—For use with AAOC Systems for Defended Cities and Strategic Areas and with a Private Line 4-Wire Bridging Arrangement

Central Office Equipment Drawing

ED-92710-01 — Common Systems—Two-Way Speech Multipoint System Central Amplifier and Misc. Unit Equipment —For use with Anti-Aircraft Operations Control Systems for Defended Cities and Strategic Areas

Central Office Wiring Diagrams

T-96465-30 — Common Systems—Two-Way Speech Multipoint Systems—Central Amplifier Circuit—Wiring Diagram—AAOC System for Strategic Areas, "Y" Line System

T-96465-31 — Common Systems—Two-Way Speech Multipoint Systems—Central Amplifier Circuit—Wiring Diagram—AAOC System for Strategic Areas, "Y" Line System

T-96465-32 — Common Systems—Two-Way Speech Multipoint Systems—Central Amplifier Circuit—Wiring Diagram —AAOC System for Strategic Areas, "Y" Line System

T-96465-34 — Common Systems—Two-Way Speech Multipoint Systems—Central Amplifier Circuit—Wiring Diagram—AAOC System for Strategic Areas, "Y" Line System

T-96465-35 — Common Systems—Two-Way Speech Multipoint Systems—Central Amplifier Circuit—Wiring Diagram—AAOC System for Strategic Areas, "Y" Line System

8. LIST OF ATTACHED FIGURES

Fig. No. Title

1. AAOC—Communication Circuits and Terminating Arrangements.
2. Alternate AAOC—Communication Circuits and Terminating Arrangements.
3. AAOC—Four-Wire Circuits to Unit Locations.
4. AAOC—Four-Wire Conference Circuits.
5. AAOC—Two-Wire Ringdown Circuit.
6. AAOC—Two-Wire Circuit—Telephone Terminated.
7. Radio Circuit—AAOC to Unit Locations.
8. AAOC—Radio Circuit to Radar Locations.
9. AAOC—Two-Frequency Radio Circuit to ADDC.
10. AAOC—Radio Conference Circuit.
11. Central Office Amplifier for Four-Wire Circuits.
12. Fire Unit Locations—Four-Wire Circuit from AAOC.
13. Fire Unit Locations—Radio Circuit from AAOC.
14. Radar Location—Two-Wire Circuit from AAOC.
15. Radar Location—Radio Circuit from AAOC.

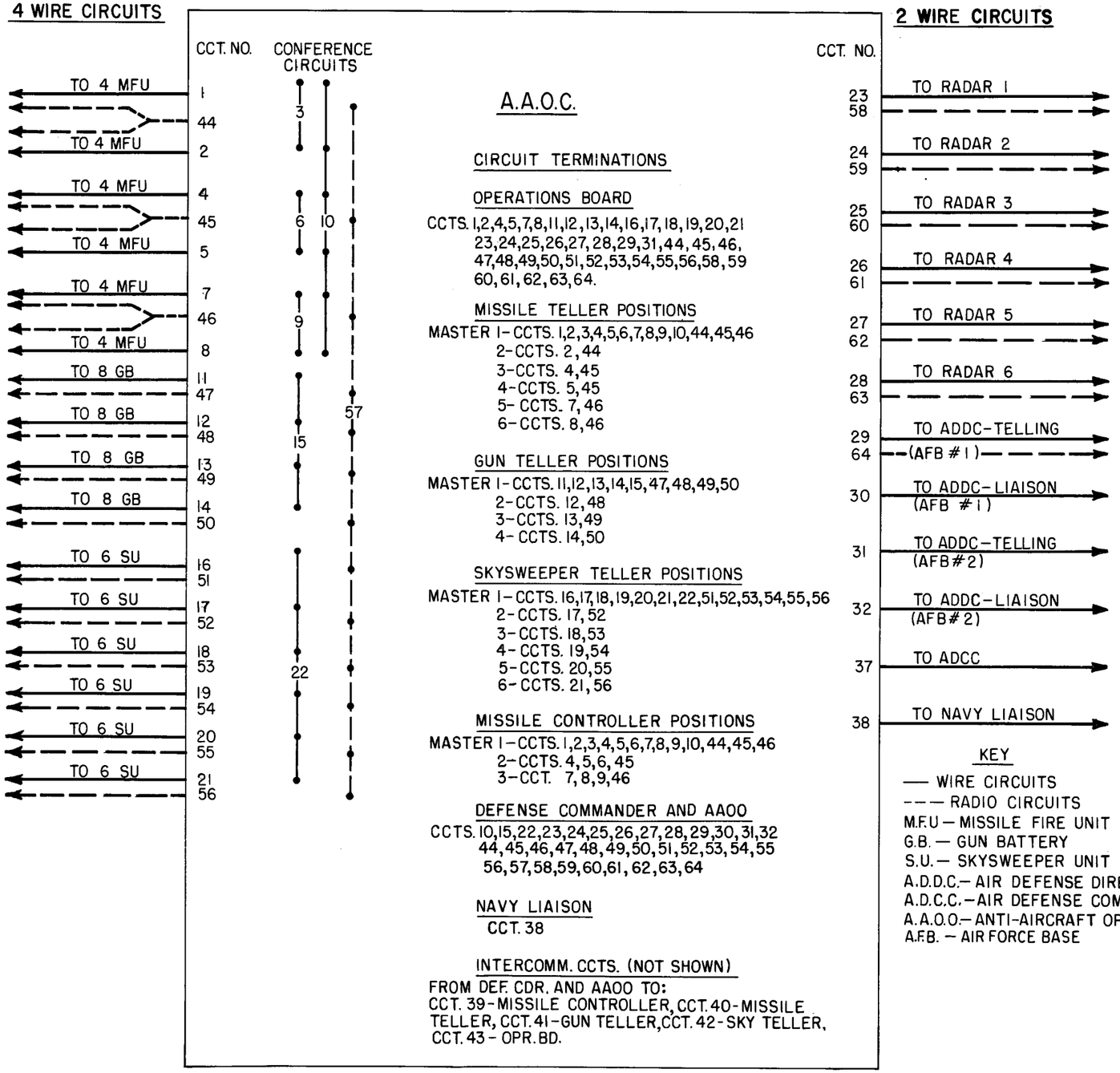


Fig. 1 — AAOC — Communication Circuits and Terminating Arrangements

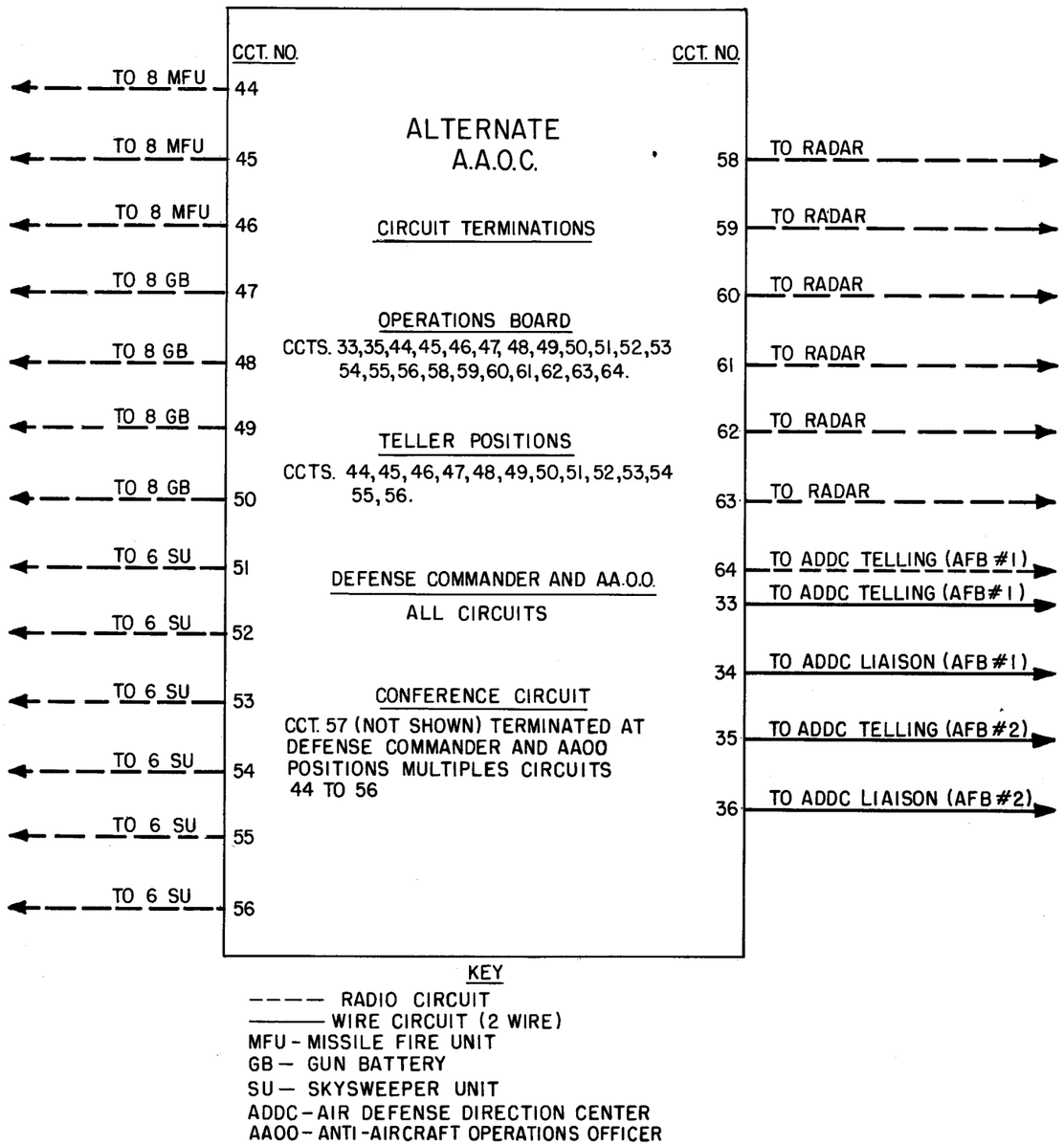
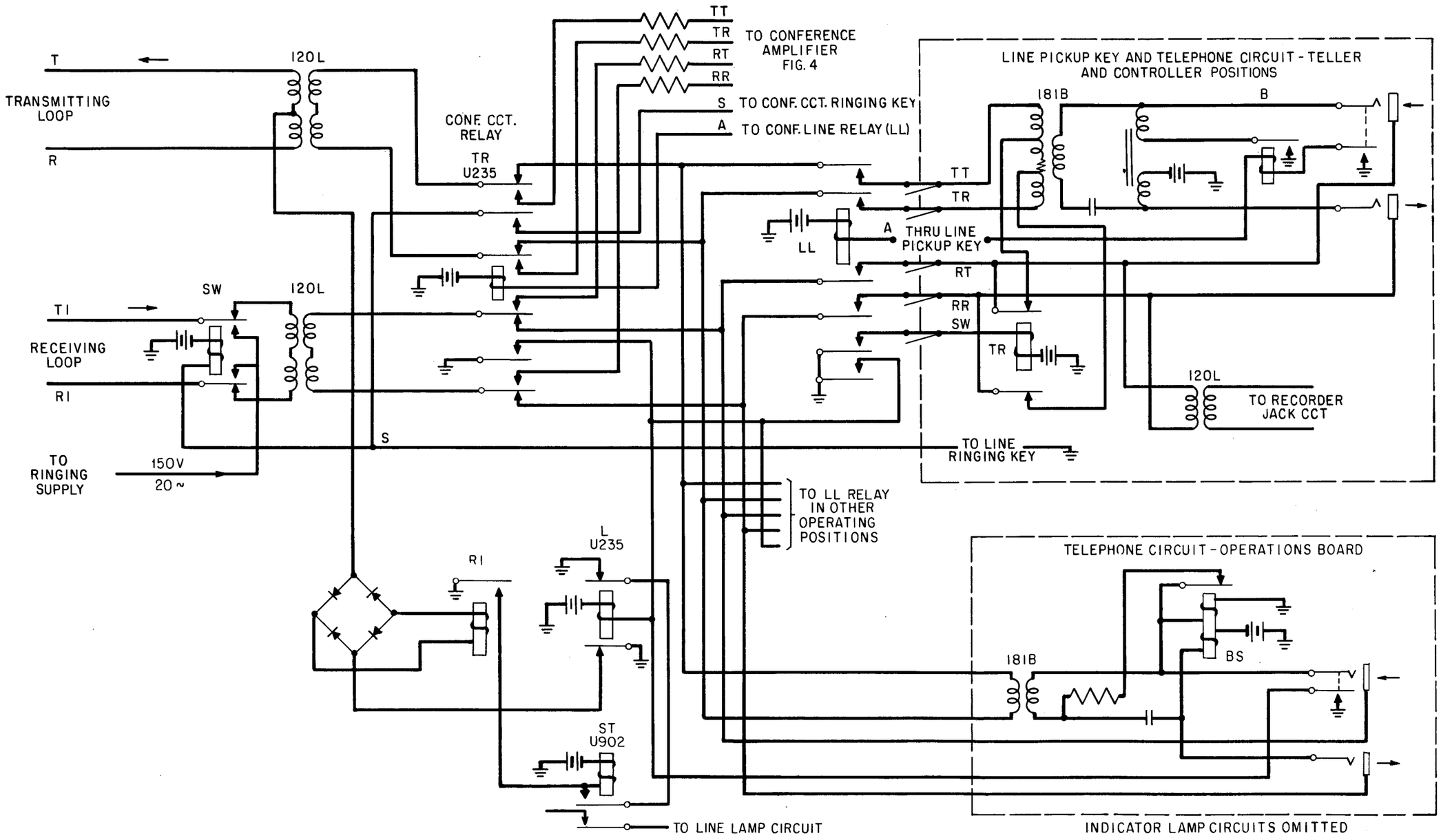
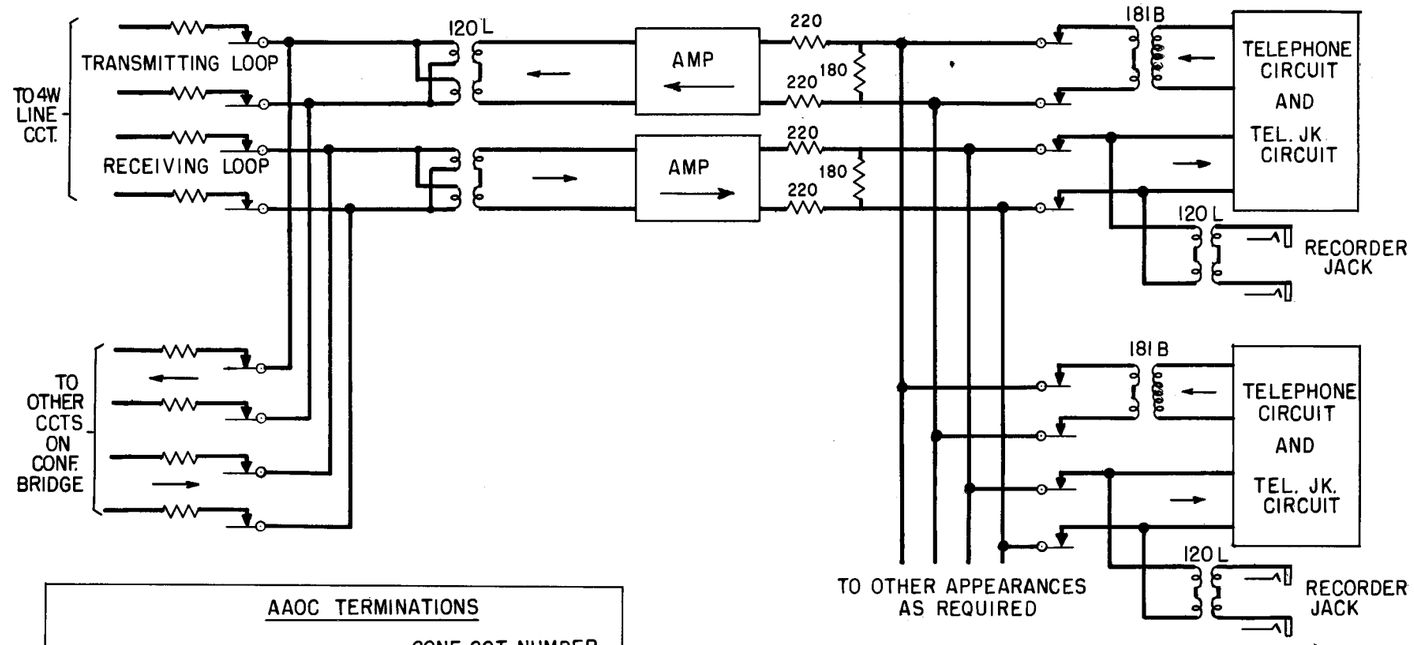


Fig. 2 — Alternate AAOC — Communication Circuits and Terminating Arrangements



CIRCUITS 1,2,4,5,7,8 TO MISSILE FIRE UNITS
CIRCUITS 11,12,13,14 TO GUN BATTERIES
CIRCUITS 16,17,18,19,20,21 TO SKYSWEEPER UNITS
SEE FIG. 1 AND 2 FOR POSITION TERMINATIONS

Fig. 3 — AAOC — Four-Wire Circuits to Unit Locations



AAOC TERMINATIONS

	CONF. CCT. NUMBER 3	6	9	10	15	22
MASTER MISSILE TELLER	X	X	X	X		
MASTER MISSILE CONTROLLER	X	X	X	X		
MISSILE CONTROLLER # 2		X				
MISSILE CONTROLLER # 3			X			
MASTER GUN TELLER					X	
MASTER SKYSWEEPER TELLER						X
OPERATIONS OFFICER				X	X	X
DEFENSE COMMANDER				X	X	X

FAR END TERMINATIONS

	CONF. CCT. NUMBER NO. 3	6	9	10	15	22
CIRCUITS BRIDGED	NOS. 1,2	4,5	7,8	1,2,4 5,7,8	11 to 14	16 to 21
MAX. UNITS PER BRIDGED CIRCUIT	4	4	4	4	8	6
MAX. UNITS ON CONFERENCE CIRCUIT	8	8	8	24	32	36

Fig. 4 — AAOC — Four-Wire Conference Circuits

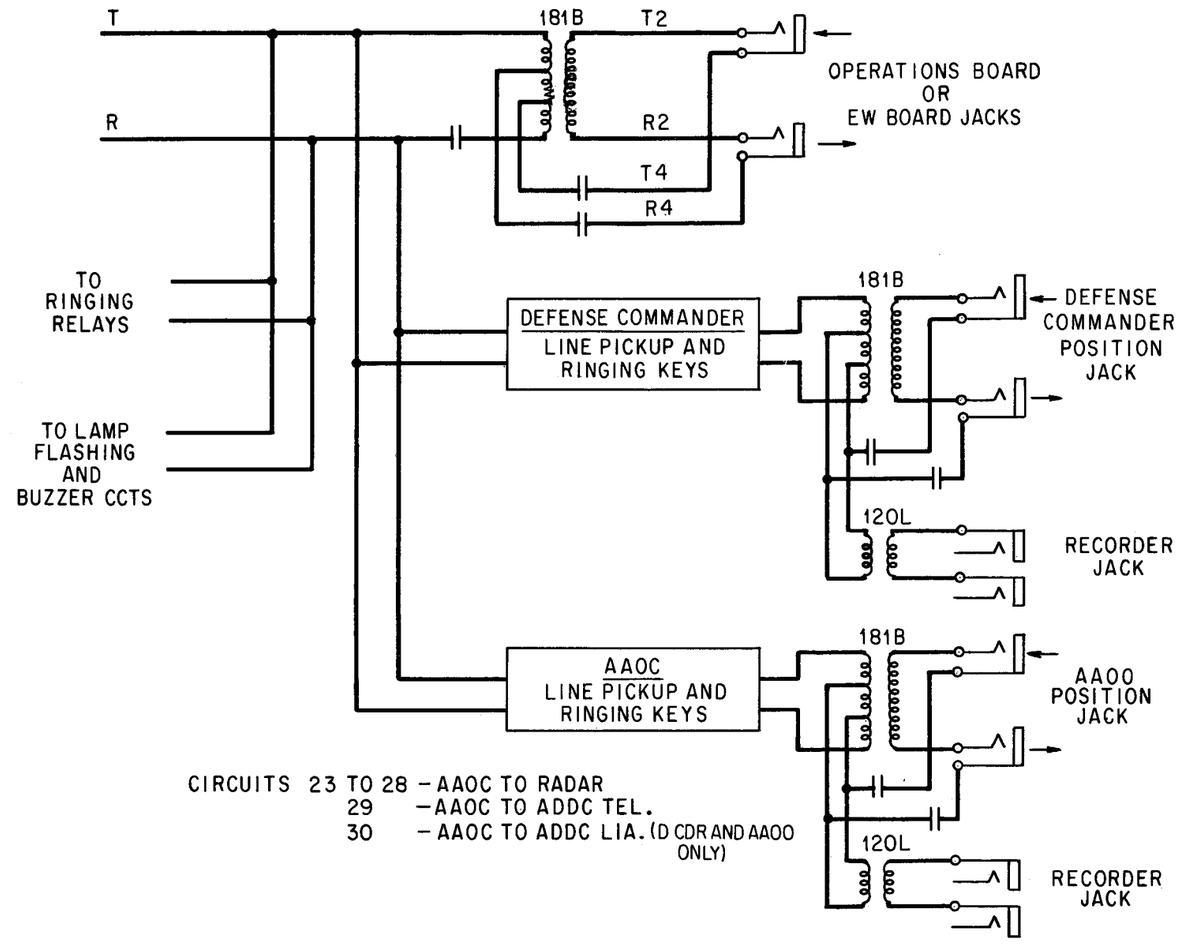
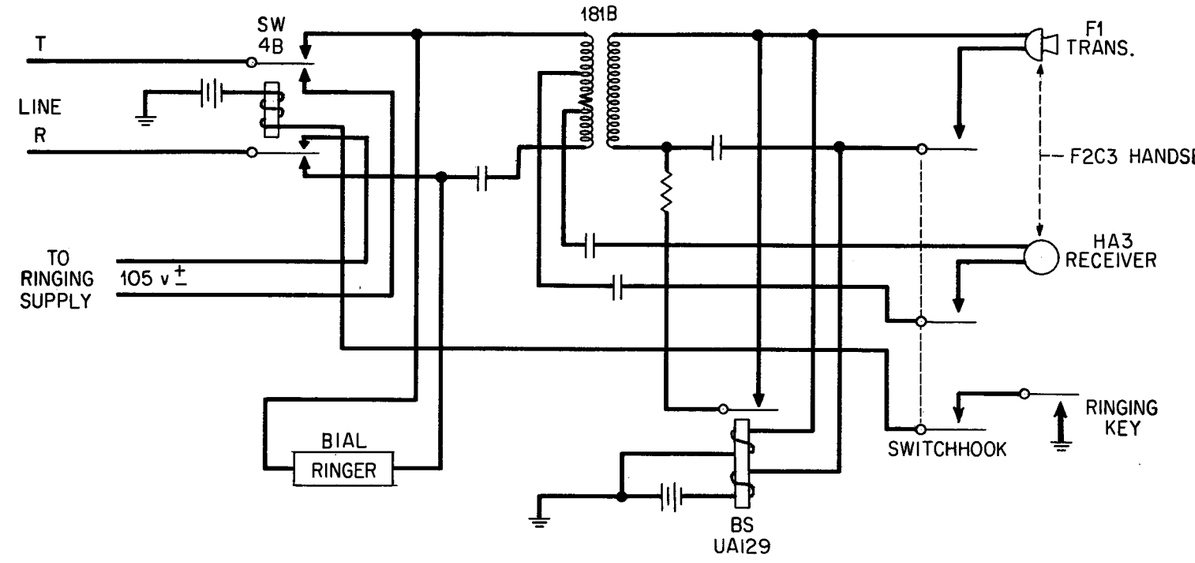
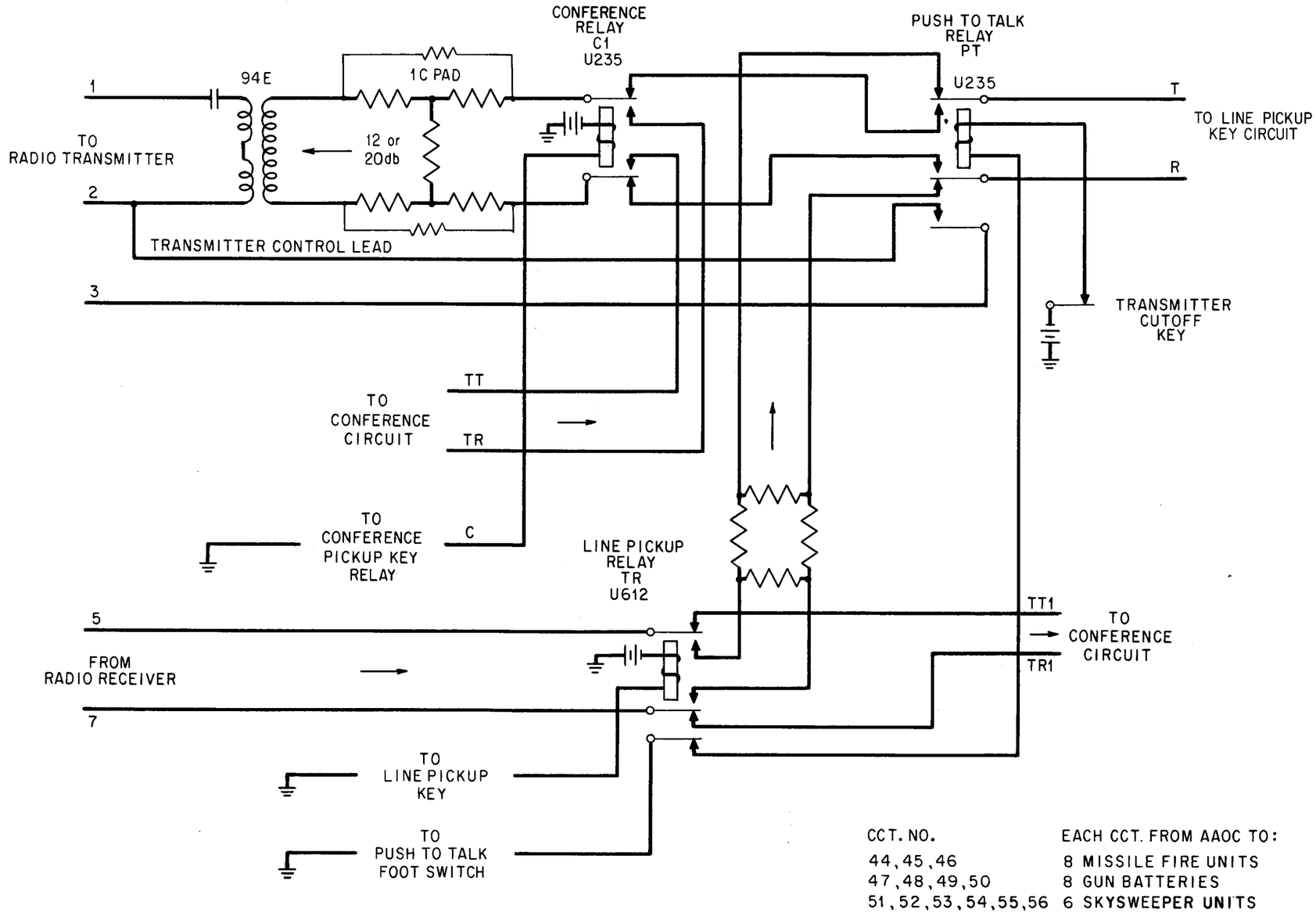


Fig. 5 — AAOC — Two-Wire Ringdown Circuit



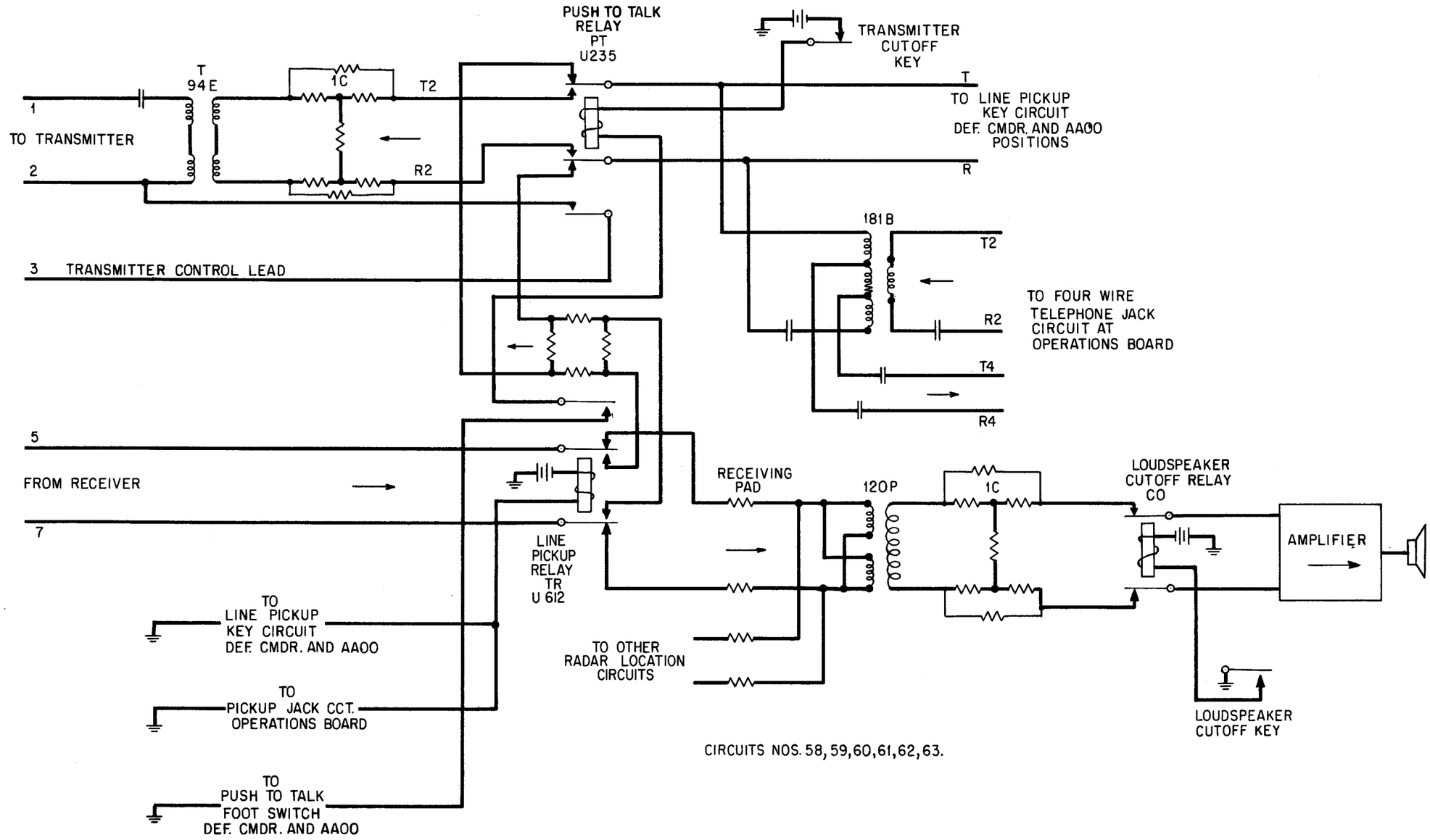
CIRCUIT NO. 37–AAOC DIFENSE COMMANDER TO ADCC
CIRCUIT NO. 38–AAOC NAVY LIAISON OFFICER TO NAVY LIAISON.

Fig. 6 — AAOC — Two-Wire Circuit — Telephone Terminated



CCT. NO.	EACH CCT. FROM AAOC TO:
44,45,46	8 MISSILE FIRE UNITS
47,48,49,50	8 GUN BATTERIES
51,52,53,54,55,56	6 SKYSWEEPER UNITS

Fig. 7 — AAOC — Radio Circuit to Unit Locations



CIRCUITS NOS. 58, 59, 60, 61, 62, 63.

Fig. 8 — AAOC — Radio Circuit to Radar Locations

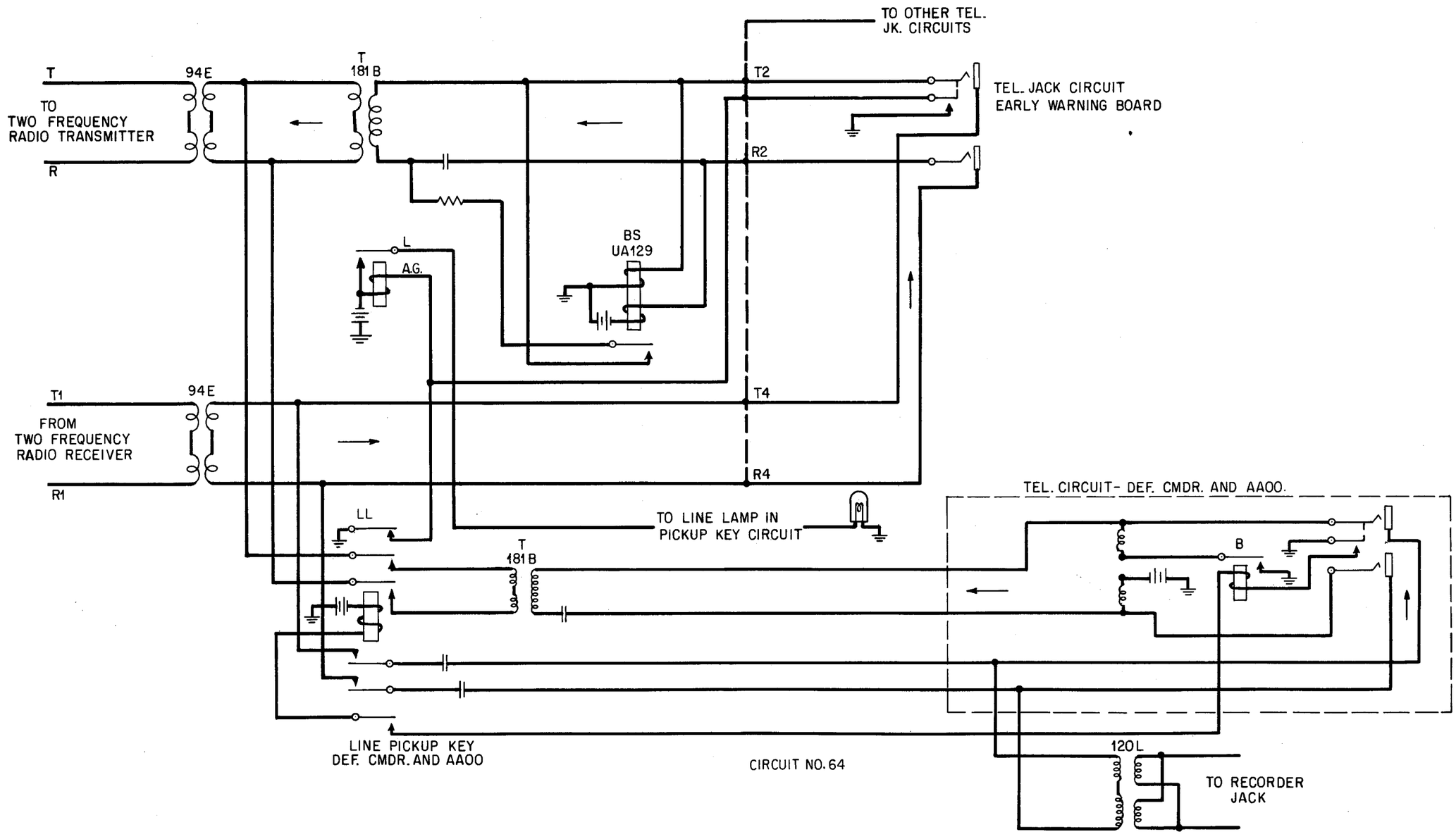


Fig. 9 — AAOC — Two-Frequency Radio Circuit to ADDC

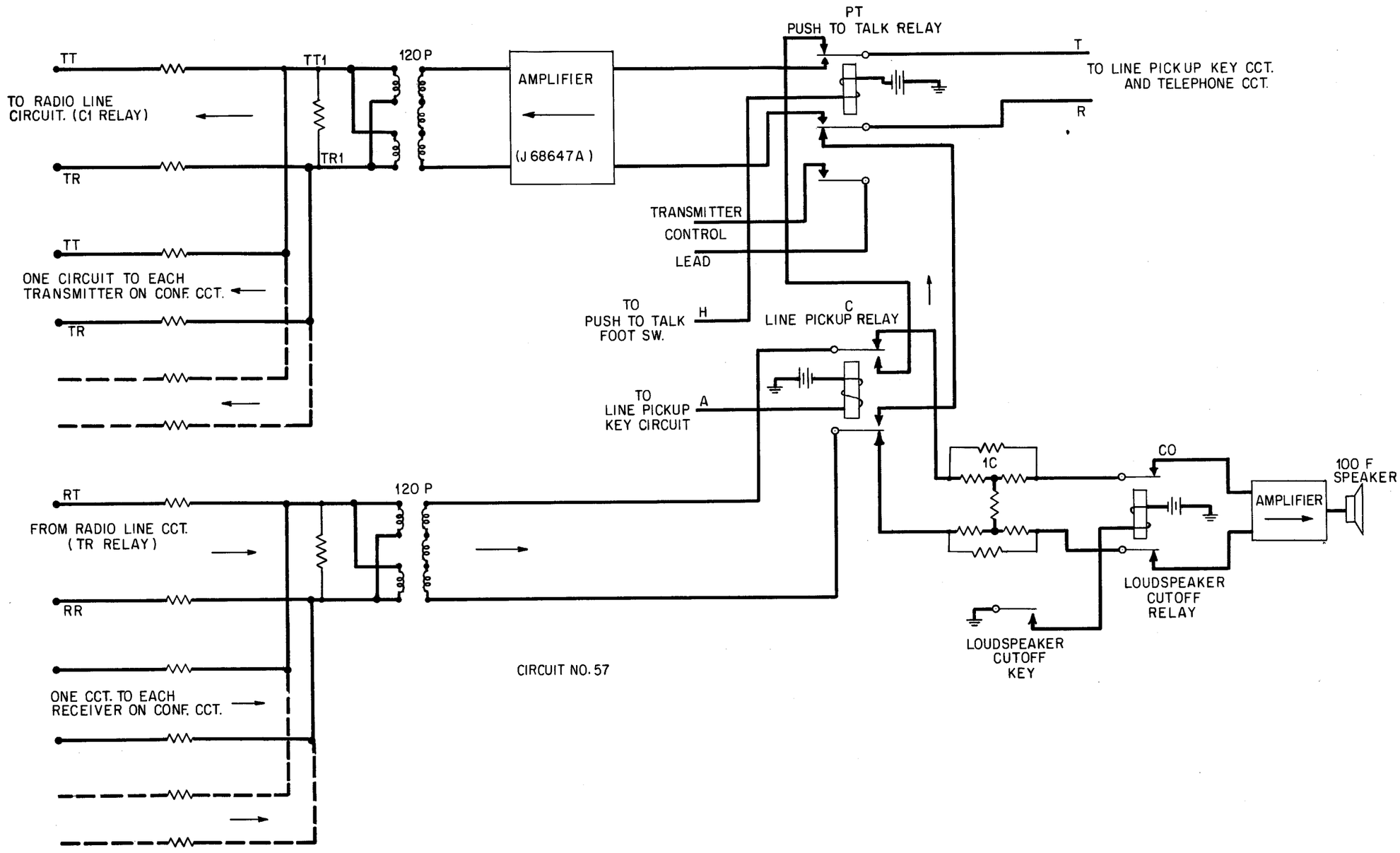


Fig. 10 — AAOC — Radio Conference Circuit

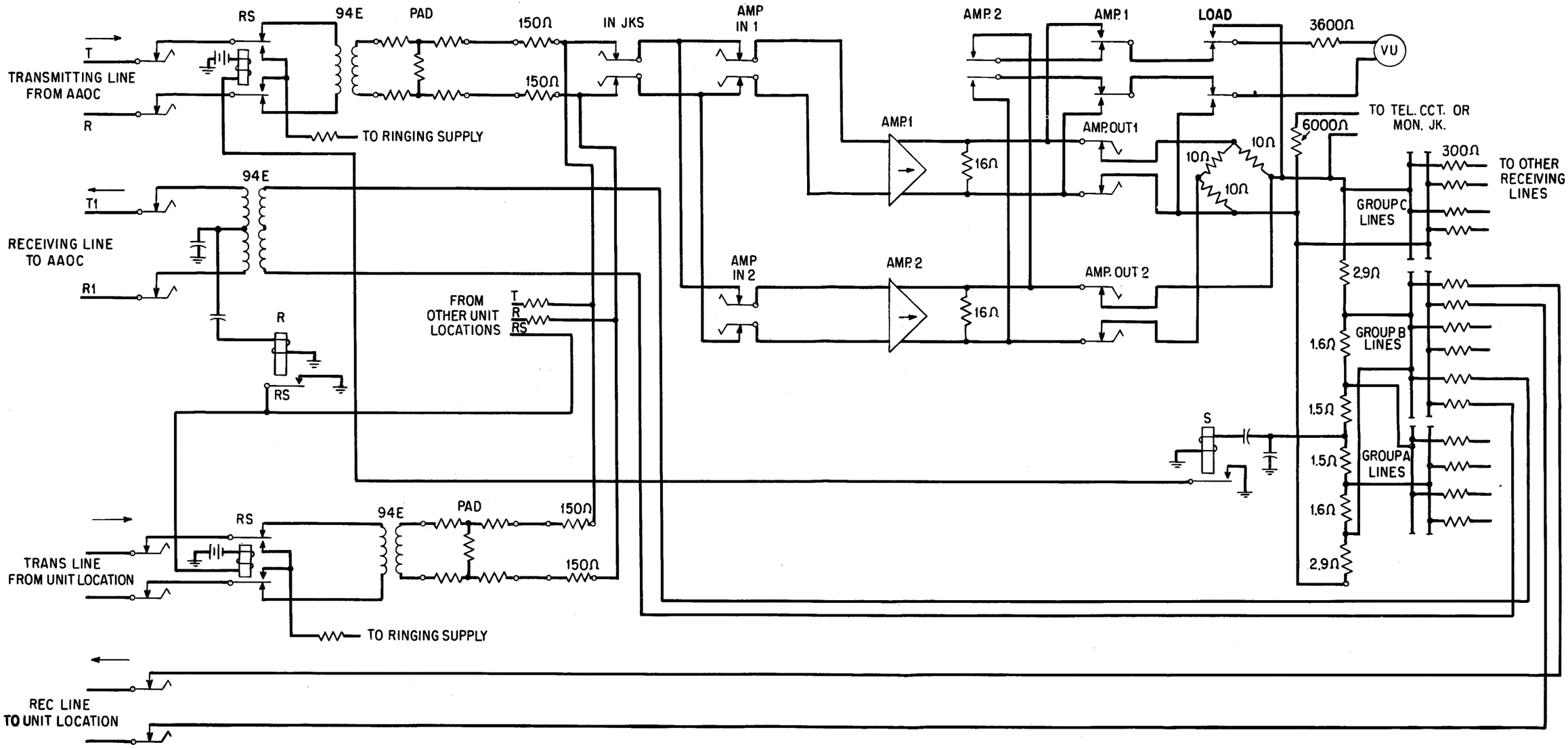


Fig. 11 — Central Office Amplifier for Four-Wire Circuits

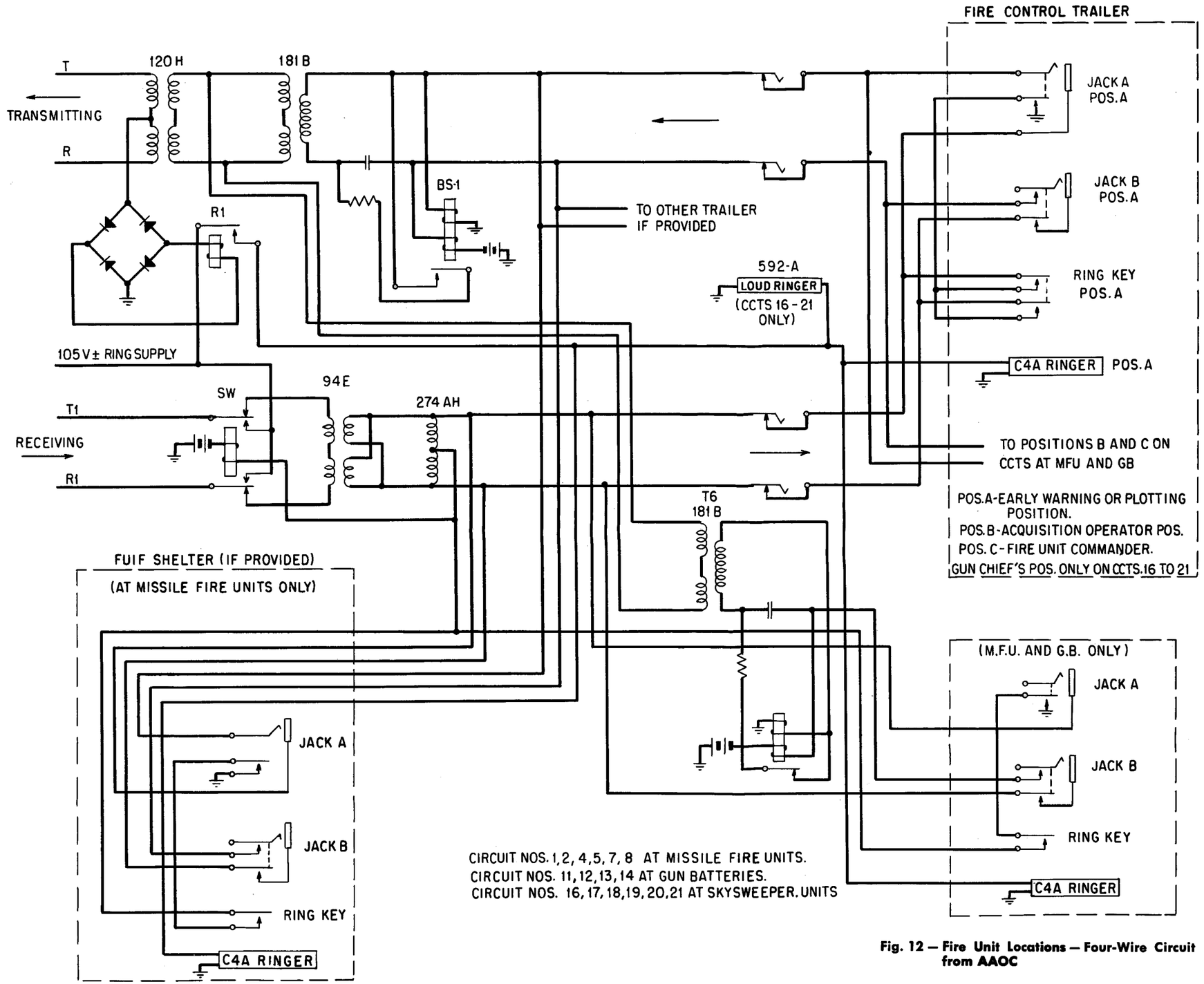
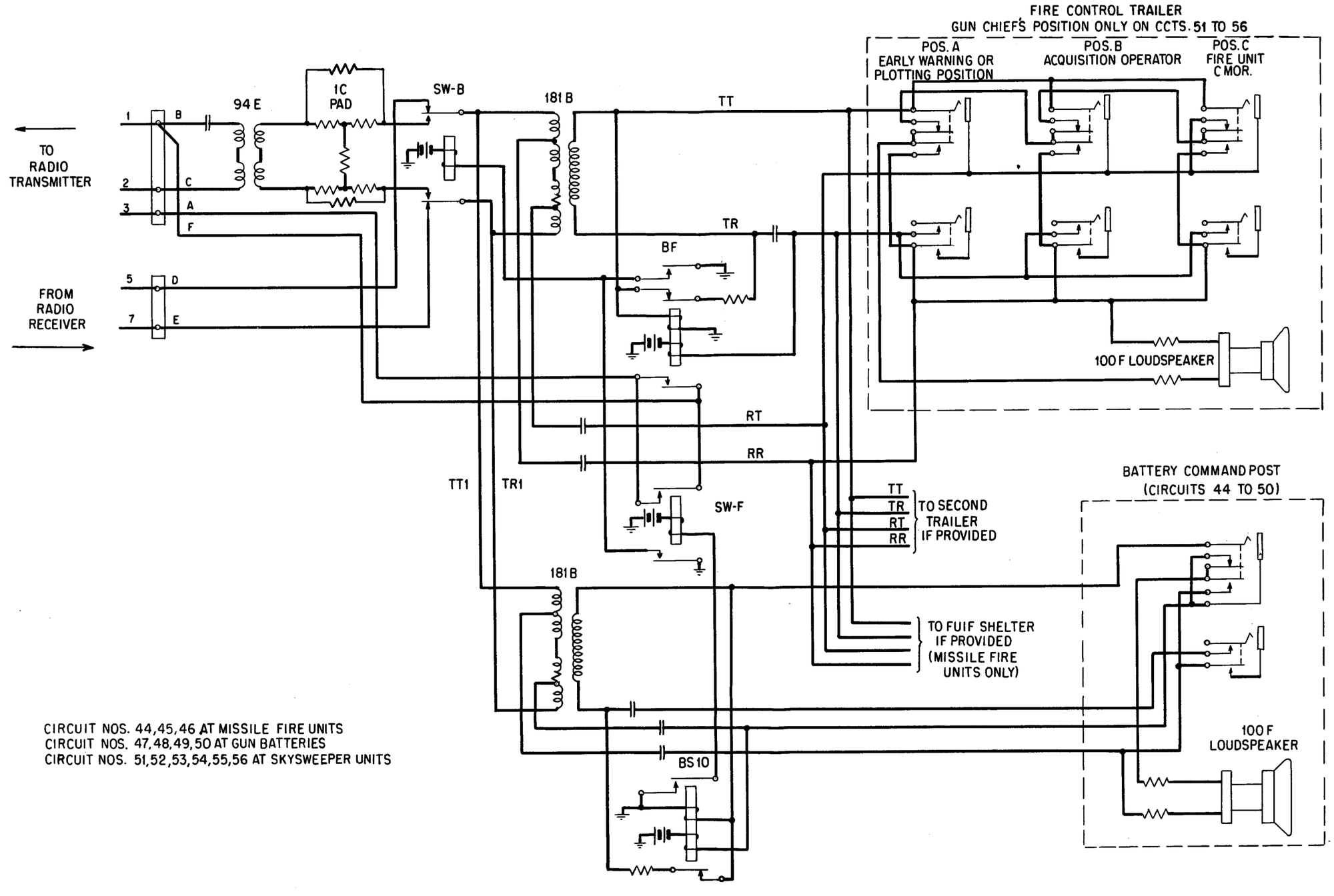


Fig. 12 — Fire Unit Locations — Four-Wire Circuit from AAOC



CIRCUIT NOS. 44,45,46 AT MISSILE FIRE UNITS
CIRCUIT NOS. 47,48,49,50 AT GUN BATTERIES
CIRCUIT NOS. 51,52,53,54,55,56 AT SKYSWEEPER UNITS

Fig. 13 — Fire Unit Locations — Radio Circuit from AAOC

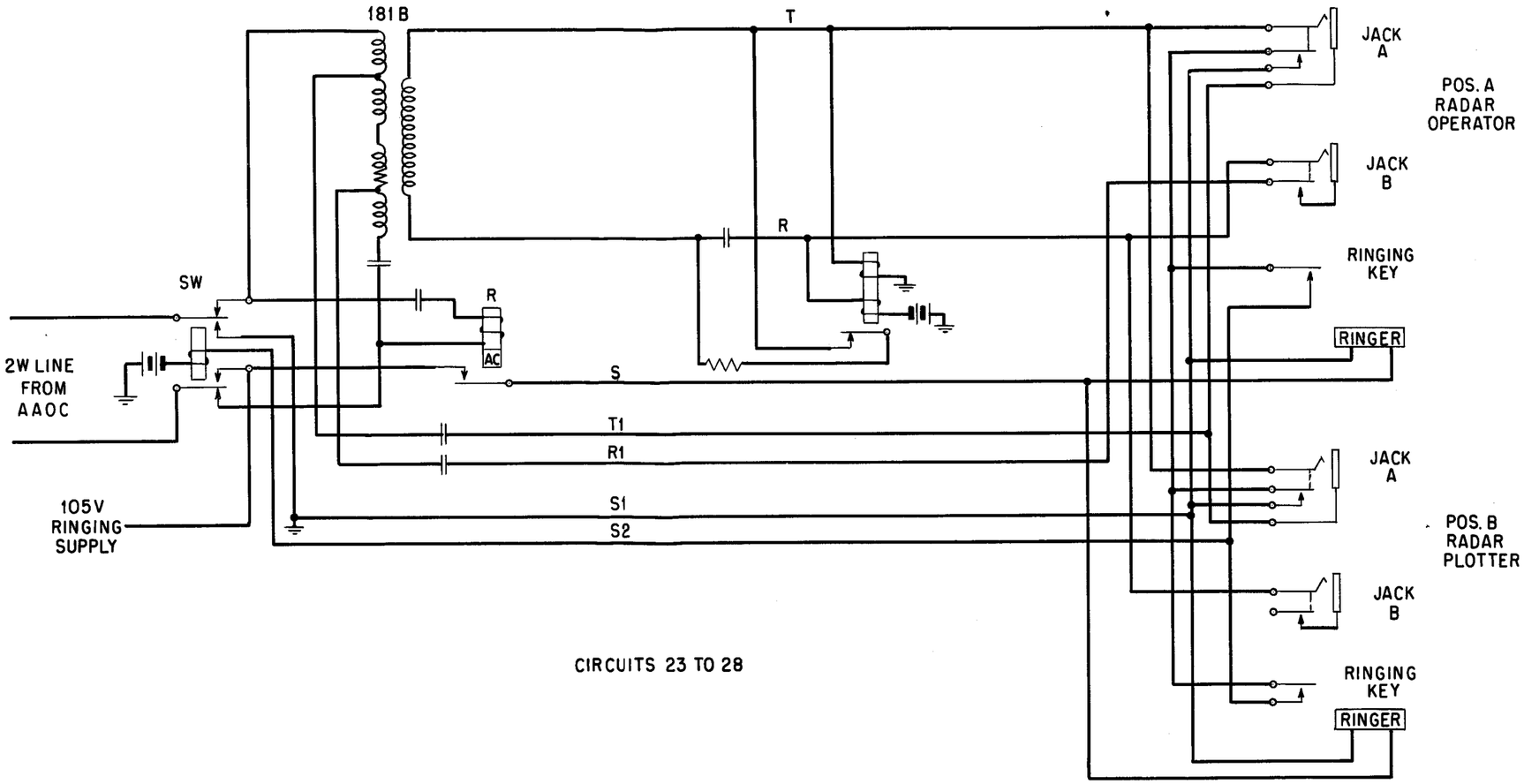


Fig. 14 — Radar Location — Two-Wire Circuit from AAOC

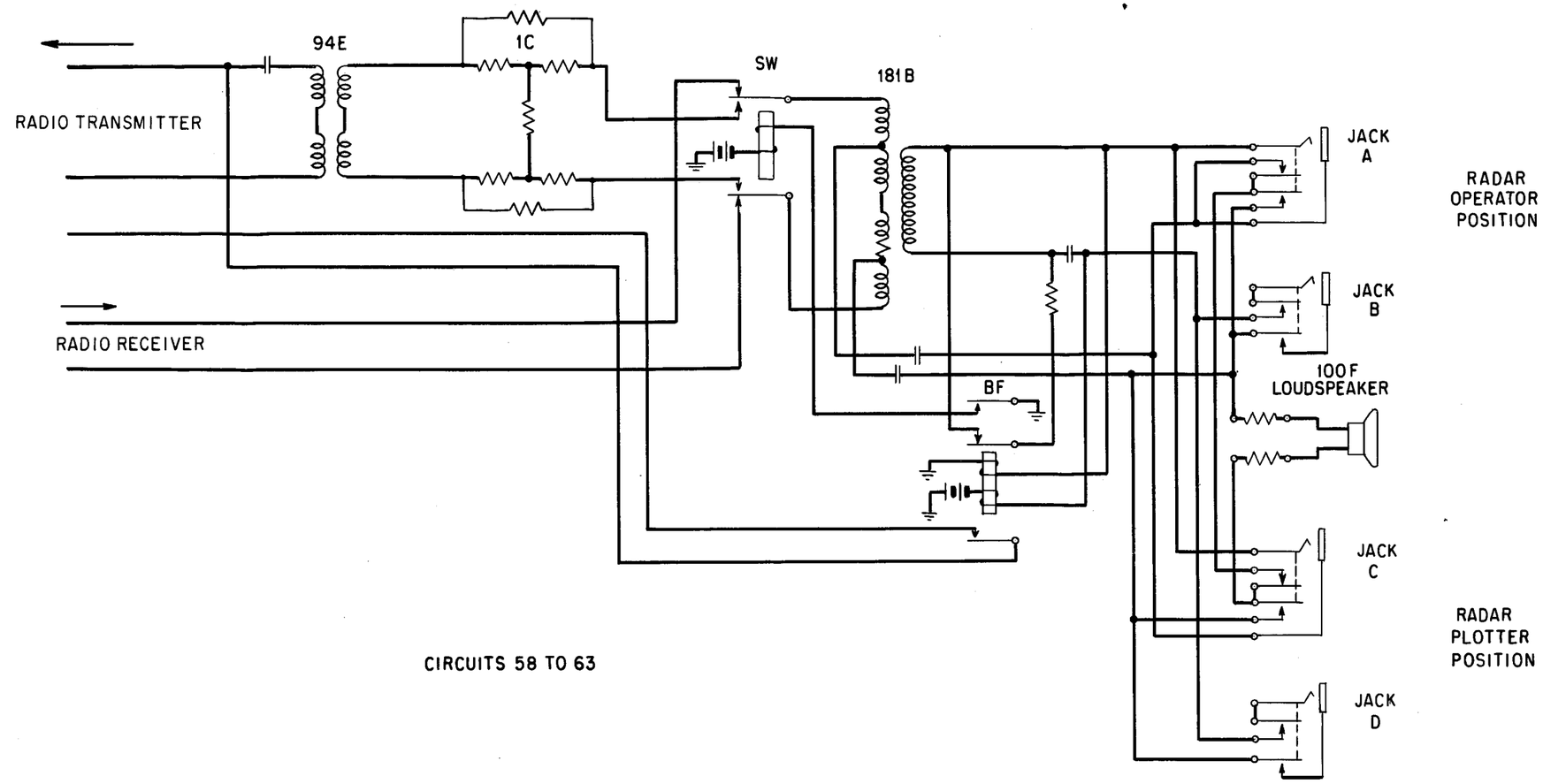


Fig. 15 — Radar Location — Radio Circuit from AAOC