REFERENCE

1A1 KEY TELEPHONE SYSTEM

1. GENERAL

1.01 This section provides installation and maintenance information for the 1A1 Key Telephone System (KTS).

1.02 This section is reissued to add information on 1A2 KTS features and station features adaptable for use with the 1A1 KTS.

2. INSTALLATION

PLANNING

2.01 Figure 1 shows a typical 1A1 KTS installation.

2.02 For information required to select and install 1A1 KTS components and ▶adaptable 1A2 KTS and station features,◀ refer to the following sections:

SECTION	TITLE
463-140-100	Equipment Cabinets and Apparatus Mountings, Identification
518-010-105	Grounding and Special Protection Requirements, Key Telephone Systems
518-010-106	Power Unit Selection, Key Telephone Systems and Key Service Units
518-114-105	Reference, 1A1, Identification and Arrangements
518-114-110	Reference, 1A1 Key Telephone System, Key Telephone Units
518-114-120	Reference, 1A1 Key Service Units
518-114-432	Service, 1A1 Key Service Units
▶518-215-100	Reference, 1A2 Key Telephone System—Identification and Arrangements
518-215-401	Service, 1A2 Key Telephone System—Key Telephone Units, Auxiliary Line Services
518-215-403	Service, 1A2 Key Telephone System—Key Telephone Units, Control Services
518-215-419	Service, 1A2 Key Telephone System—620A, 641A, and 642A Modular Panels
518-215-420	Service, 1A2 Key Telephone System—69B, D, and G Apparatus Mountings
518-215-422	Service, 1A2 Key Telephone System, 110A Apparatus Mounting
518-300-413	Key Telephone Units Common to Several Systems—259-Type, Identification
518-300-417	Key Telephone Units Common to Several Systems—272A Key Telephone Unit, Identification.◀

A. Limitations

2.03 Key telephone system line circuit units are designed for use on central office, Centrex, or PBX lines.

2.04 Because of the hold feature, line circuits should not be installed on party lines.

2.05 See Section 500-114-100, entitled Station Ringing Apparatus, Selection and Limitations,

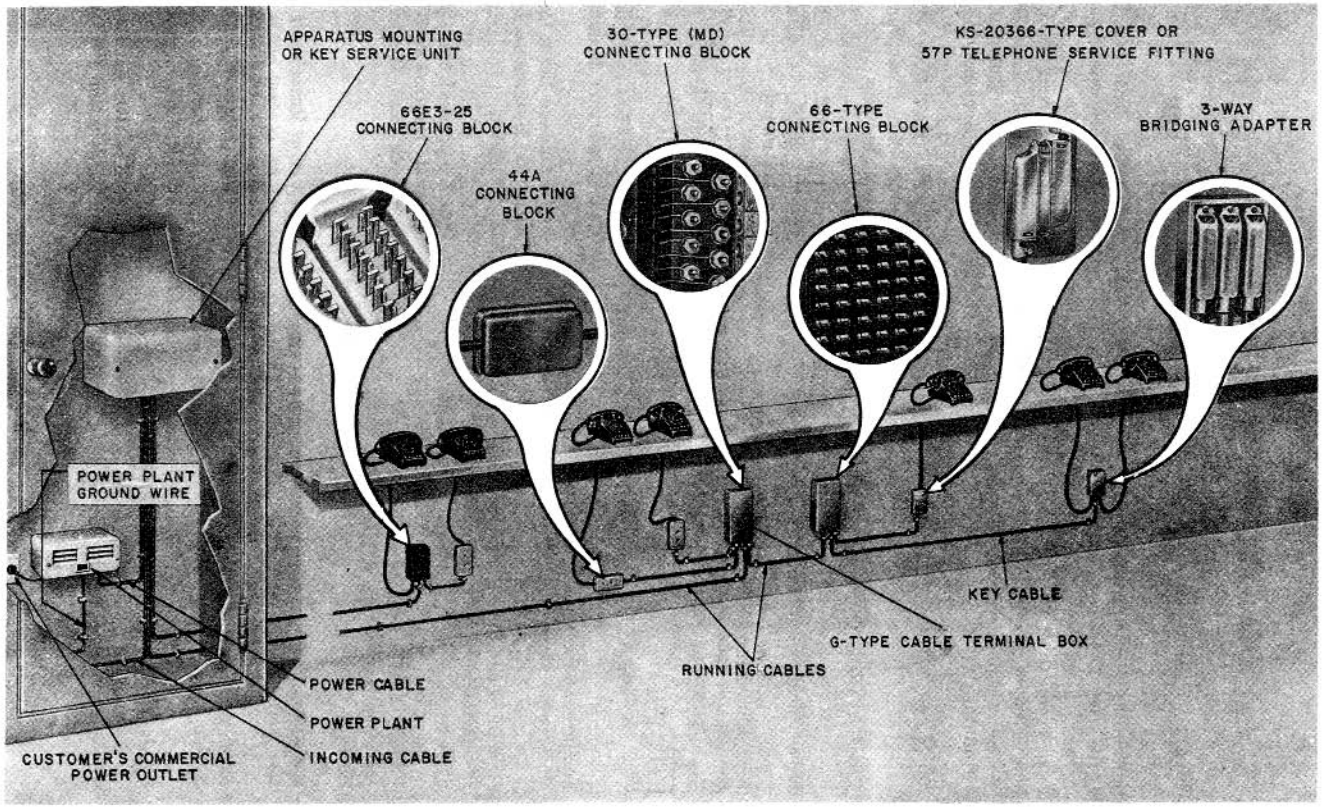

Fig. 1—Typical 1A1 Key Telephone System Installation

for the ***maximum*** number of ringing bridges permitted per line.

2.06 Table A lists approximate maximum distances between the 9- to 11-volt ac supply and the key telephone units.

2.07 Table B gives the approximate maximum cable length between key telephone units and signal lamps.

2.08 Table C shows the types of lamps most often required.

2.09 When more than thirty-six 51A lamps or more than thirty G2 lamps are fed from a J86731A or D power plant or 393B transformer, two circuits must be provided. Each circuit must be equipped with a 2-amp fuse.

INSTALLING

A. Mounting

2.10 The smaller sized KTUs can be mounted in various cabinets or on relay racks by using mounting bars. Large capacity (multiline) 23-inch wide units, designed for equipment cabinet and/or rack-mounted installations and not requiring mounting bars, can also be used. The cabinets and apparatus used can be wall- or floor-mounted. Figures 2 through 6 show various key telephone units and their mountings. ▶Figures 7 through 10 show the mountings available for mounting 400-type KTUs

TABLE A

MAXIMUM POWER CABLE LENGTH AC SUPPLY

AC POWER SUPPLY 9-11 VOLTS	NO. OF 51A LAMPS	NO. OF G2 LAMPS	LENGTH OF RUN FOR ONE PAIR OF 20-GAUGE* COPPER WIRES
			FEET
J86731A, L4 J86731A, L6 J86731B, L1 J86731D, L1 or J86471D, L1 Power Plant 393B Transformer	5	4	315
	10	8	155
	15	12	104
	20	16	78
	25	20	62
	30	24	52
	35	28	44
	40	32	39
	45	36	35
	50	40	24
	55	44	22
	60	48	20
	65	52	18
	70	56	17

* Cable [switchboard, 1450CL (MD), or 450M 6-conductor or 1451CL (MD), or 451M 12-conductor] is a 20-gauge cable suitable for use between power plants and key equipment.

TABLE B

MAXIMUM CABLE LENGTH AC SUPPLY

NO. OF LAMPS PER PAIR	LENGTH OF RUN FOR ONE PAIR OF 24-GAUGE CABLE
	FEET
1	470
2	235
3	155
4	115
5	90
6	75
7	65
8	55
9	50
10	45
11	40
12	35
13	35
14	30
15	30
16	25
17	25
18	25
19	25
20	20

Note: Not more than 20 lamps may be connected to any one line or intercommunicating circuit.

when adaptable 1A2 KTS features are added to 1A1 KTS installations.◀

2.11 Mount cabinets, apparatus mountings, relay racks, or apparatus boxes as described in Section 463-140-100.

B. Wiring

2.12 See appropriate sections for information on:

(a) Selecting, placing, and fastening of wire and cable

(b) Selecting A and/or B-type connector cables and/or adapters

(c) Connections for installation of the particular key telephone system

(d) Wiring of connecting blocks and terminals.

2.13 The use of connector cables and plug-ended key telephone sets is recommended wherever practicable.

2.14 The use of the proper 3-way bridging adapter makes it possible to have two key stations on one adapter or to extend cabling from one station to another.

2.15 For speakerphone connections using connector cables and 148- and 149-type adapters, see Section 461-200-102, entitled Adapters—For Use With Connector Cables.

2.16 Where possible, connecting blocks and connector cables should preferably be placed on walls adjacent to desks.

TABLE C

TYPE OF LAMPS MOST OFTEN REQUIRED

SIGNAL LAMP SUPPLY	LAMP IN TELEPHONE SET	LAMP TYPE INDICATOR AND/OR 101-TYPE KEY UNIT
10 volts ac	51A	G2
14 to 26 volts dc	52A	A3

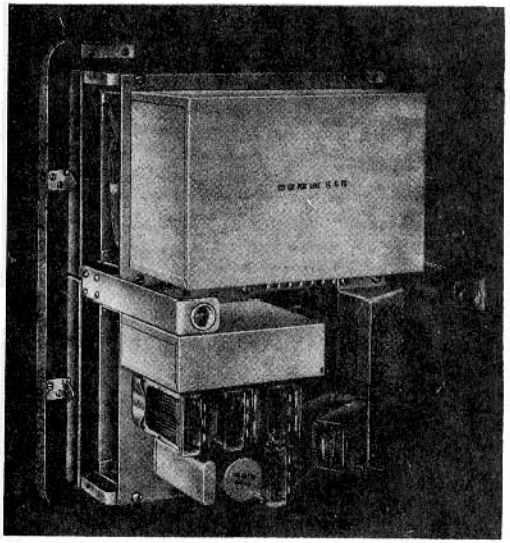

Fig. 2—Two 15A Apparatus Mountings on 173A Backboard

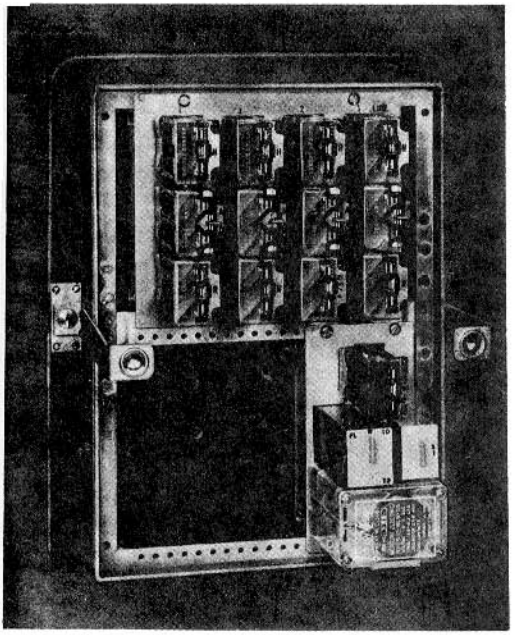

Fig. 3—31A(MD) Apparatus Mounting on 173B Backboard

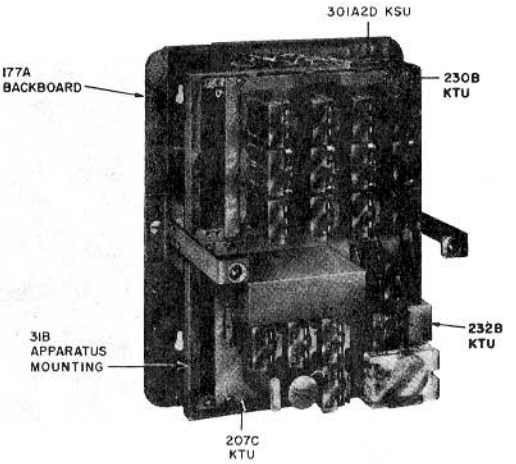

Fig. 4—31B Apparatus Mounting on 177A Backboard

2.17 Key cables may terminate beneath screw terminals of individual 200-type key telephone units, or on 66-type connecting blocks furnished in packaged units. They may also terminate at separate distribution terminals.

2.18 Screw terminals on most 200-type KTUs are arranged to terminate up to six key cables (Fig. 11). In many installations, however, there are considerable advantages in providing a running cable and a supplementary distributing terminal to avoid congestion within the equipment cabinet (Fig. 12).

2.19 Place the distribution terminal in a convenient and accessible location. If possible, centralization of the terminal with respect to station cables served from it is desirable. For information on centralization, refer to Section 518-010-101 entitled Centralized Key Telephone Installations.

2.20 Figures 11, 12, and 13 show the method of cabling to apparatus mountings. Cables may enter from top to bottom.

2.21 Tag or otherwise identify all cables at distribution terminals or on key telephone units.

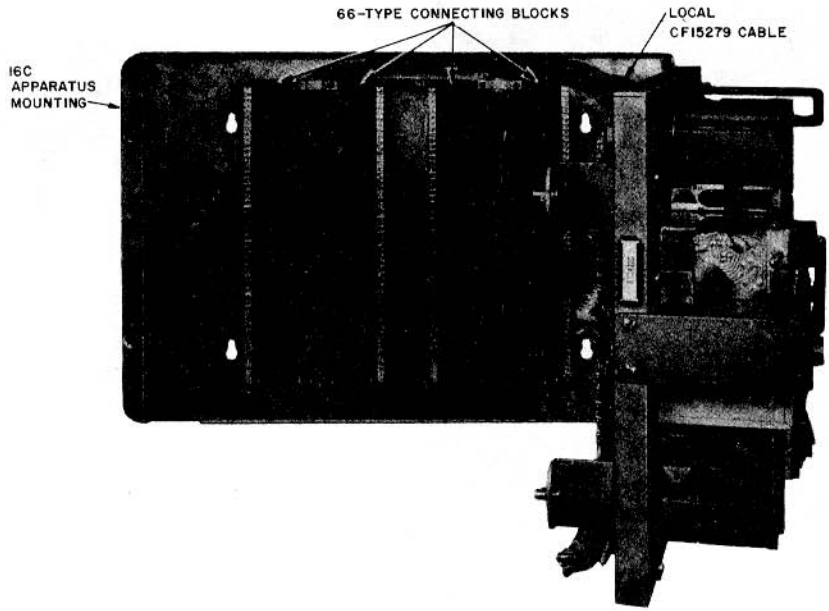

Fig. 5—66-Type Connecting Blocks Mounted Within 16C Apparatus Mounting

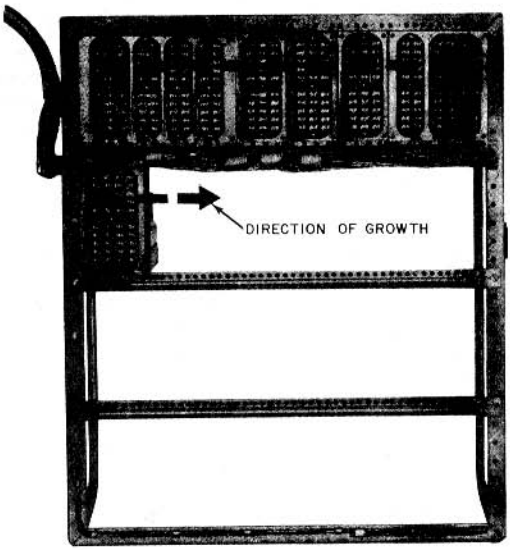

Fig. 6—26A Apparatus Mounting (Showing Direction of Growth)

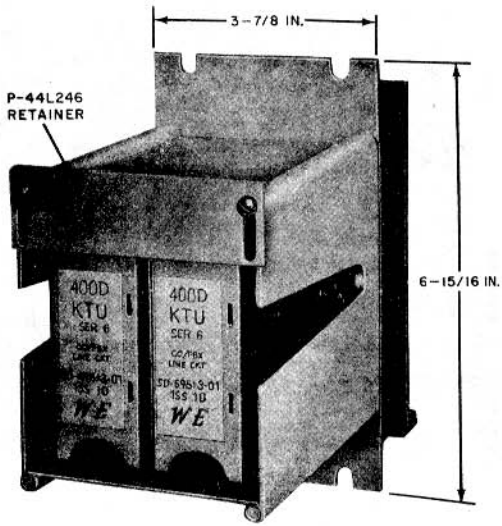

Fig. 7—◆259-Type KTU For Mounting 18 or 20 Contact KTUs◆

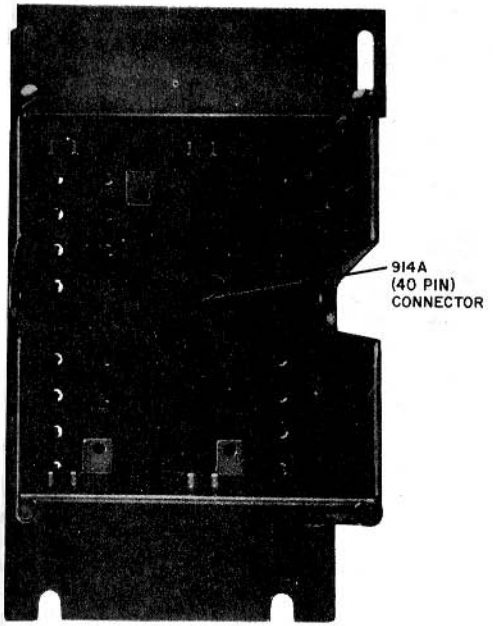

Fig. 8—▶272A KTU For Mounting 40-Pin KTUs◀

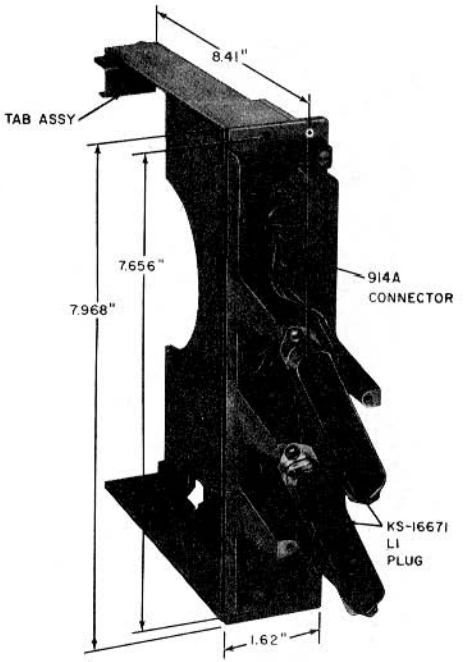

Fig. 9—▶69D Apparatus Mounting For 8-Inch KTUs◀

2.22 Use distinctive colors of 24-gauge BG or BW wire for strapping and cross-connecting key telephone units:

- Red for battery leads
- Black for ground leads
- Green for all other leads.

C. Power

2.23 The basic power requirements for a key telephone system are:

- Relay—14 to 26 volts dc
- Lamp—9 to 11 volts ac or 14 to 26 volts dc
- Ringer—105 volts, 20 Hz
- Buzzer or bells—14 to 28 volts dc or 15 to 25 volts ac.

2.24 More than one key telephone system can be fed by the same power plant provided that:

(a) The power plant has adequate current capacity.

(b) Each key telephone system is fused separately.

2.25 Determine the power supply arrangement to be used by referring to Section 518-010-106.

2.26 Use a 20-gauge wire, or equivalent, between lamp power supply and key telephone units. Figure 14 shows a J86731A, List 4 power plant with power cable and ground wire terminated. Refer to Section 518-010-105 for grounding of the power supply.

2.27 A generator resistance lamp unit should be used when the 105-volt 20-Hz supply is from the central office or PBX. A 211A key telephone unit (ringing lamp unit) can be used when the

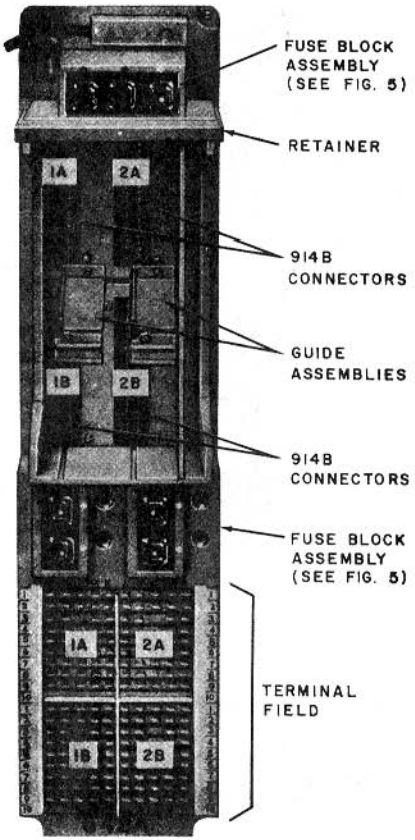

Fig. 10—◊642A Modular Panel For Mounting 8-Inch KTUs◊

105-volt 20-Hz is supplied from a J86731A, List 4 or 5 (107B frequency generator), or a J86731C, List 1 or 2 power plant [107C(MD) frequency generator].

D. Final Tests

2.28 Upon completion of a system installation, check that all features of the system operate properly at each station.

2.29 Check that all stations are equipped with the correct designation cards and strips.

2.30 On systems using commercial power, disconnect the power cord and check that outgoing calls can be made on all lines.

2.31 Before leaving the job, be sure that the customer fully understands the method of operation of the system and its limitations during power interruptions.

In any key system where common audible signals are provided by means of locally furnished power, interruption of this power supply will render ALL visual and audible signals inoperative during the period of power failure. Standby power provisions and/or the use of appropriate power failure switching equipment and/or connection of line ringers, where necessary, will minimize customer inconvenience during interruption of the normal source of power to the installation. This, of course, does not limit the customer from making outgoing calls at any time.

3. MAINTENANCE

A. Relays

3.01 Key telephone system apparatus is designed and manufactured to tolerances and specifications which insure reliable operation and good service with extended useful life. Improper or careless handling of this equipment can result in costly damage. This is particularly true of wire spring relay apparatus. Inspect carefully for:

- Transposed (crossed) contact springs
- Broken actuating cards
- Slipped coverplates
- Jammed cards
- Cracked plastic parts
- Improper position of contact spring.

3.02 When necessary, relays shall be tested and adjusted in accordance with information contained in related subsections of Division 040 of

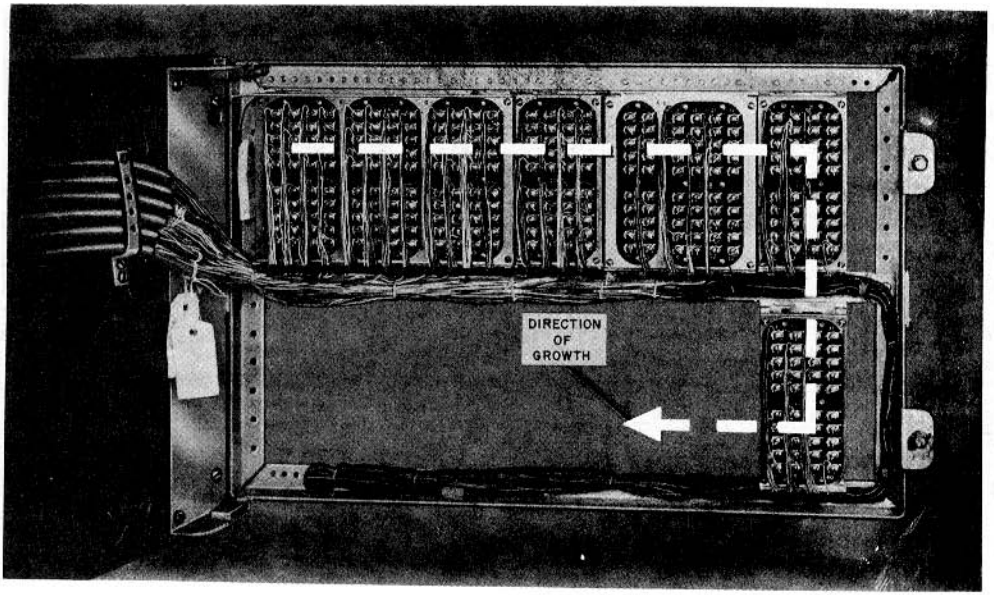

Fig. 11—Key Cables Run Directly to Apparatus Mounting

the Plant Series. Relay operating requirements for specific relays used in various system circuits are listed in the circuit requirement tables. These tables are associated with the various SD drawings concerned.

3.03 The 4A(MD) and 4B cover clips shown in Fig. 15 and 16, respectively, are used to minimize displacement of core plates and contact springs of wire spring relays during shipping and handling. Clips of early manufacture are shown in Fig. 15 (A) and Fig. 17 (A); those of later manufacture in Fig. 15 (B) and Fig. 17 (B). They are interchangeable.

3.04 To place clips:

(1) Slide the clip over the lower end of the cover enough to engage the tang

(2) Press the upper end of the clip over the cover until the tang engages with a snap.

3.05 To remove clips:

(1) Hold clip with left hand. Disengage the top tang and slide clip up and off. [See Fig. 17 (A) and (B).]

3.06 Check position of the plastic cover after placing or removing the 4A(MD) or 4B clip.

3.07 To minimize damage or misplacement of cards due to mishandling in transit, 4A(MD) or 4B clips may also be applied to relays returned to the storeroom.

B. Nonpolarized Electrolytic Capacitor

3.08 A polarized electrolytic KS-14136 capacitor had been used in the early manufacture of some 211A key telephone units. This capacitor has been replaced by a nonpolarized KS-16485 capacitor.

3.09 For a time, the Western Electric Company modified KS-14136 polarized capacitors. Modified capacitors are marked with a red "P"

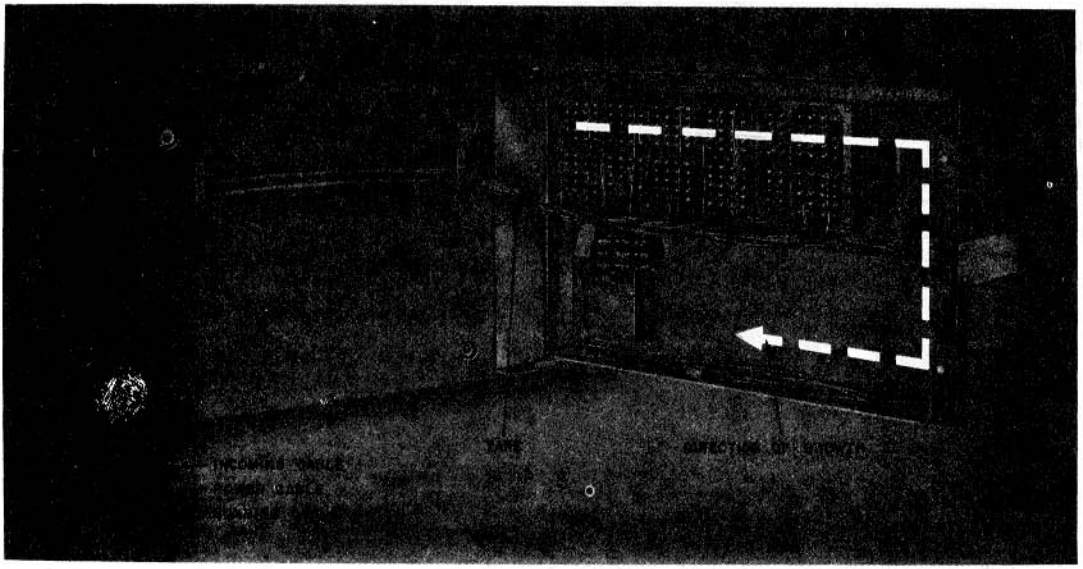

Fig. 12—Installation of Cables on 16-Type Apparatus Mounting

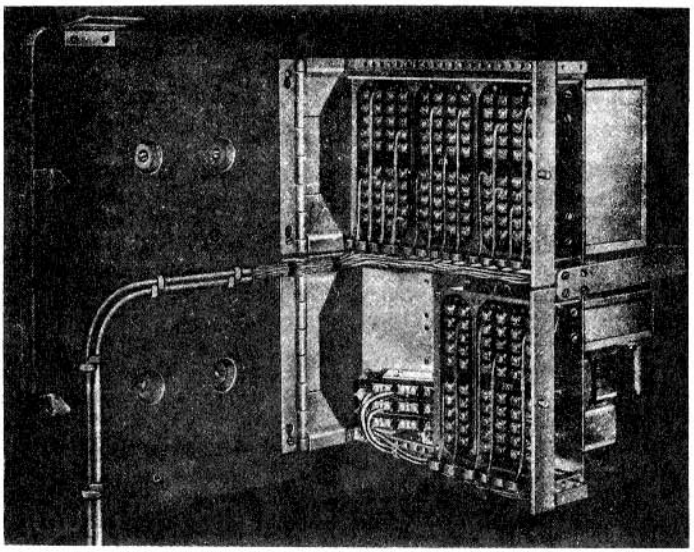

Fig. 13—Method of Cabling on 15A Apparatus Mounting, Right Hinge

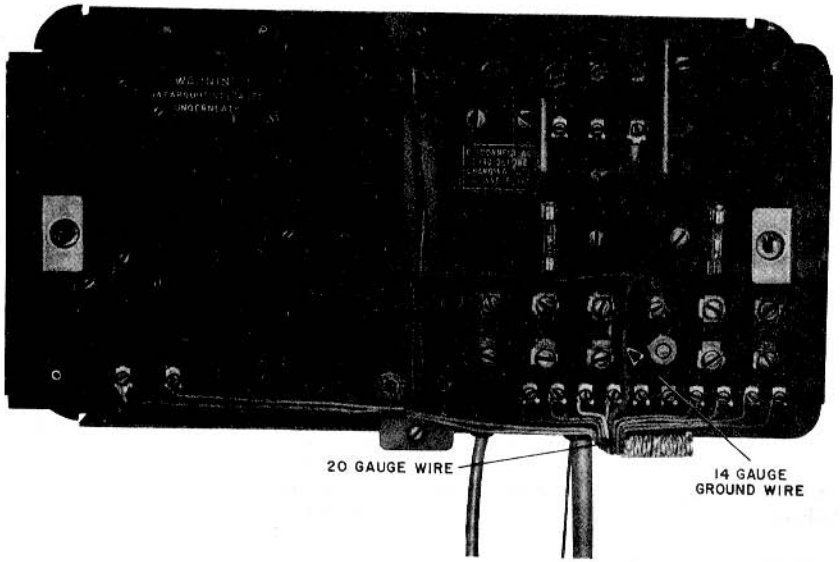

Fig. 14—101G Power Plant With Power Cable Terminated

TABLE D

NOISE ISOLATORS USED WITH KTU'S

KTU	NOISE ISOLATOR ASSEMBLY
207A (MD)	813717063 (P-37A706)
207B (MD), 207C	813821030 (P-38B103)
209A (MD)	813810199 (P-38A019)
210A	813810207 (P-38A020)
212A (MD)	813722345 (P-37B234)

stenciled under the KS number at end of the capacitor.

Do not modify the KS-14136 capacitor in the field.

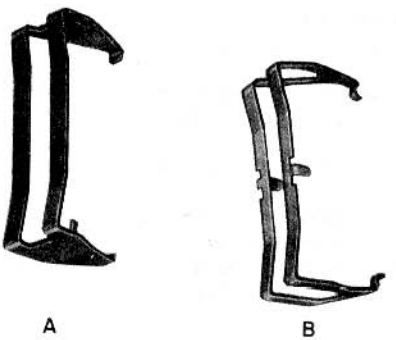

Fig. 15—4A(MD) Cover Clips

3.10 The KS-16485 capacitor, while 1/2-inch longer, is the same diameter as the KS-14136 capacitor and mounts interchangeably with it.

3.11 Replace KS-14136 polarized electrolytic capacitors in all unmodified 211A key telephone

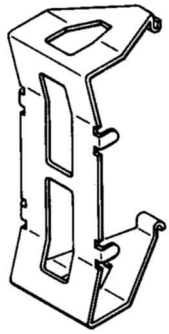

Fig. 16—4B Cover Clip

units. This should be done at the most opportune time, as follows:

(1) Disconnect battery from the working circuit.

(2) Discharge KS-14136 capacitor by momentarily shorting terminals with an insulated-handle screwdriver or equivalent tool.

(3) Disconnect leads from capacitor and remove from mounting.

(4) Mount replacement KS-16485 capacitor in its place and reterminate leads.

(5) Solder all connections.

Since the KS-16485 capacitor is nonpolarized, it is not necessary to determine polarity before reterminating disconnected wires.

(6) Reconnect battery to circuit.

C. Radio Signal Interference

3.12 Radio signal interference may be experienced during talking or when a distant station places a hold on the line. When interference is experienced, refer to Section 500-150-100, entitled Radio Signal Suppression for Telephone Sets.

D. Line Noise

3.13 Some system installations wired for metallic ringing may produce objectionable line noises attributable to the use of unfiltered battery supply on the LK lead. This lead furnishes battery to the locking winding of the R relay. Noise is induced onto the ring side of line (grounded ring option) or on both tip and ring sides of line (metallic ringing option) as the result of transformer action between primary and secondary windings of R relay. This induced noise is heard by the calling party during the silent interval of the ringing cycle until the R relay is released when the called party answers.

3.14 Where this sort of noise is encountered, check to see if unfiltered B battery or filtered A battery is supplied on the LK lead to the R relay. Interference can normally be minimized by connecting filtered battery to the LK lead. Where noise caused by unfiltered battery is present in installations using a 232A(MD) KTU, connect filtered battery on terminal 39 of the 232A(MD) KTU.

3.15 Noise isolators may be used to reduce objectionable noise of operating relays and selectors. Figure 18 shows a typical installation. Table D lists the types of noise isolators used with specified key telephone units.

E. False Hold

3.16 Circuit variables such as line voltage, relay adjustment, contact adjustment, capacitance, etc, may cause the line circuit of 202C(MD), 230A(MD), and 233A(MD) key telephone units to be susceptible to false hold. This condition occurs when the H relay operates falsely, generally caused by:

(a) The amount of ringing bridge capacitance on the station side of the line circuit, or

(b) Switchhook bounce or handset fumble at connection station.

3.17 The false hold condition may be corrected by replacing a 202C(MD) or 230A(MD) KTU with a 202D or 230B KTU or minimized by placing a P-16A279 buffer spring on the H relay of 202C(MD), 230A(MD), or 233A(MD) KTUs (Fig. 19). Although it does not eliminate false holds under all circuit conditions; it is desirable from an economic standpoint to try the buffer spring on in-place units.

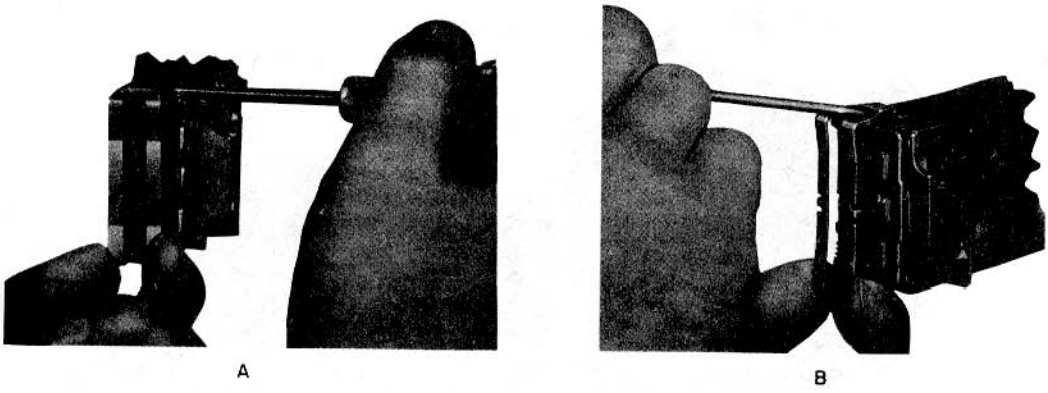

Fig. 17—Removing 4A(MD) Cover Clip

3.18 To test for false hold condition caused by ringing bridge capacitance on 1A1 line circuit:

(1) Set up a condition of maximum current flow in the circuit by using the line to be tested to establish a call over central office trunks to another station line on the same premises.

(2) Hang up on call by rapidly switching to another line button with handset off-hook. If line circuit being tested is subject to false hold from capacitance, it will be indicated by:

(a) (Set illuminated.) A hold lamp indication.

(b) (Set not illuminated.) Absence of dial tone when line key is reoperated, unless equipment is served by a manual PBX or CO.

(c) Operation of H relay (if possible to observe relay equipment while above test is being performed.)

3.19 To test for false hold condition caused by switchhook bounce or handset fumble:

(1) Lift handset from its cradle or mounting and replace it in a rough or abnormal manner—sufficient to cause momentary reoperation of switchhook contacts before handset comes to rest on-hook. If line circuit being tested is subject to false hold, it will be indicated as listed in paragraph 3.18(2).

3.20 If it appears that false hold is due to ringer capacitance, it is recommended that the associated line ringer be wired via a separate cable pair from line side of the affected key telephone unit.

3.21 Where rewiring line ringers is not practical or has no bearing on condition, change the unit to a 202D or 230B KTU or add a P-16A279 buffer spring to the H relay.

3.22 Adding or removing buffer springs is a simple operation. See Fig. 19 for proper position of buffer spring. Adjust the buffer spring tension only a small amount at a time while testing the hold feature as outlined in paragraph 3.18. Apply only enough tension to overcome the false hold condition.

3.23 Where line circuit is capable of being switched to lines of differing loop resistance, the relay must be tested for the variable voltage that may be impressed on the relay winding (ie, for both minimum and maximum current condition). For example, after placing buffer springs on relays for PBX station lines, test for proper holding on station-to-station lines as well as calls to connecting central offices. This avoids the possibility of leaving the H relay in a marginal state to the extent that it will fail to hold properly.

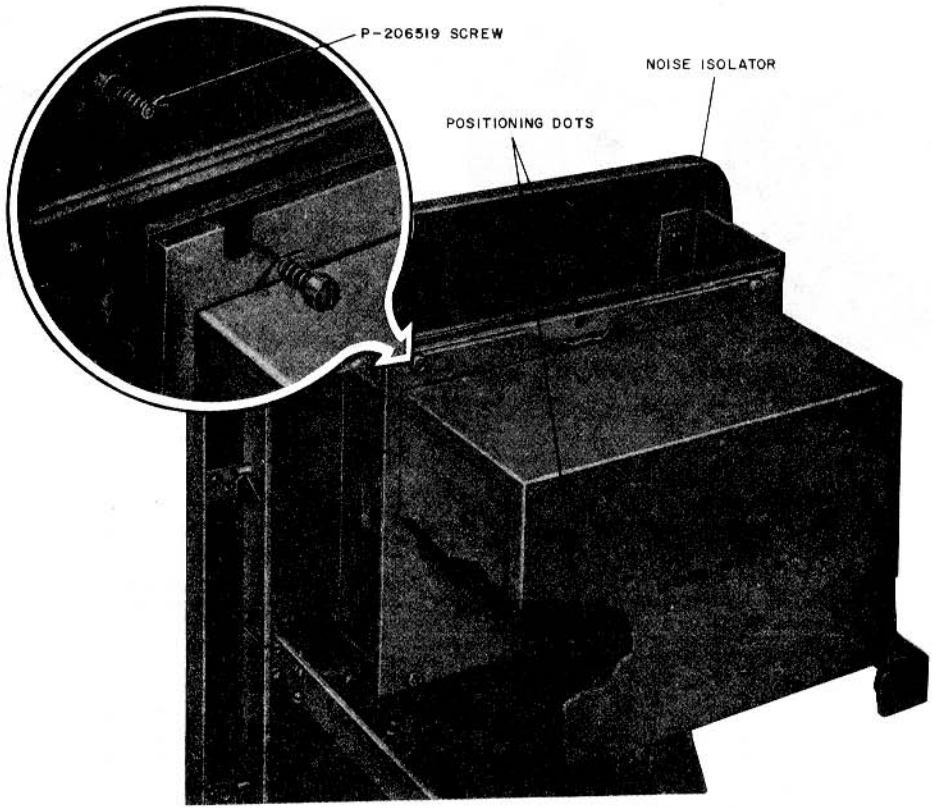

Fig. 18—Noise Isolator Assembly

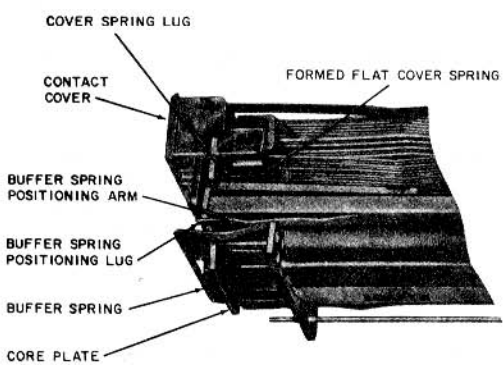

Fig. 19—Positioning of Buffer Spring

In all instances, when a KTU has been modified, tag the unit in a conspicuous location. Enter on the tag sufficient information to easily identify the modification performed. Example: H relay modified with P-16A279 buffer spring because of false hold.