TELEPHONE
TERMINAL AND PROTECTION
HANDBOOK

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Recognizing the long standing need for a hand book whose practices would conform to the principles, engineering, and operating standards of the Independent Telephone Industry, Cook Electric Company has published the first comprehensive standard practice instruction covering the installation, maintenance, and operation of telephone protection and distribution devices.

The construction and practices illustrated and described in the following pages represent the general practices followed by a large number of operating companies. The methods outlined lead to maximum ease in installation and maintenance of equipment, as well as assuring the best possible service from the equipment.

It must be borne in mind that wherever State Commissions, or any other duly authorized body, have issued applicable rules governing construction or maintenance, these rules should take precedence at all times.

For additional information on the equipment shown herein, send for the Cook Telephone Catalog by addressing

COOK ELECTRIC COMPANY
2700 Southport Avenue
CHICAGO

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COOK INSTALLATION AND MAINTENANCE MANUAL

CONTENTS

Products of Telephone Division

Cook Electric Company — Chicago, U. S. A.

SECTION I

COOK XB CABLE TERMINAL

INDEX TO CONTENTS

SECTION I

DESCRIPTION OF COOK XB CABLE TERMINAL

The Cook XB Cable Terminal, Fig. 1, is manufactured in 6, 11, 16 and 26 pair sizes. Each terminal can be furnished with or without a 6 foot cable stub. The zinc hood is reversible to permit mounting the terminal with stub entering from top or bottom. Weather guards are provided for the drop wire openings to keep out rain, snow, sleet and insects. When required a detachable mounting bracket is furnished with the terminal. However, since the cable holding sleeve supports the stub cable at the cable chamber joint, the terminal can be installed easily without the detachable mounting bracket, and without danger of damaging the stub cable in the process. A chain attached to the hood and fastened under a lag screw of the mounting bracket holds the hood when it is removed from the terminal.

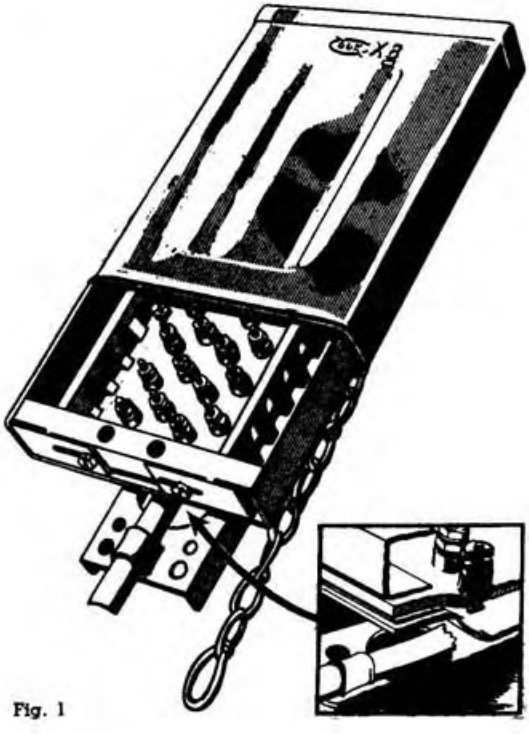

Fig. 1

STUBBING THE TERMINAL:

The stub cable should be installed before the terminal is mounted. Usually this can be performed best in the shop. However it may be done wherever the necessary tools and supplies are available.

PREPARATION:

Remove hood from terminal.

Remove face plate screws and take off face plate and rubber gasket. Fig. 2.

Remove any dirt or film in the drawn tinned recess where the cable enters the core box. This recess must be bright and clean.

Remove 10 inches of cable sheath for 6, 11 and 16 pair terminals.

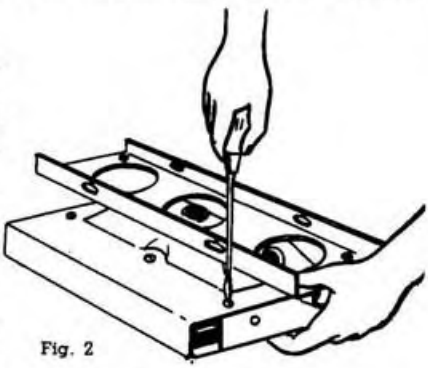

Fig. 2

Remove 13 inches of sheath for 26 pair terminals.

BOILING OUT TERMINAL END OF STUB CABLE:

Protect cable insulation at end of sheath with two layers of cotton tape freshly boiled in wax.

Remove paper wrapping on cable core up to the cotton tape binding at end of sheath. Fig. 3.

Start pouring wax heated to a temperature of 375 degrees to 390 degrees F. on the cable at a point about 6 inches back of end of sheath. Move forward gradually to end of wires. Continue pouring wax on wires until insulation on all wires is saturated completely with wax, and any moisture in the insulation is thoroughly removed. Next, bend cable in vertical position, separate cable pairs and pour wax into cable core. The wax that flows under the sheath forms a seal against moisture.

Scrape 3 inches of end of sheath bright and clean. Rub Stearine wickless candle over cleaned portion of sheath.

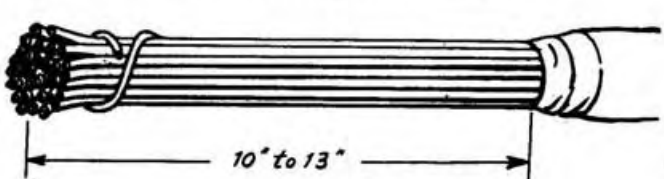

Fig. 3

ATTACHING CABLE TO CORE BOX:

Place cable through cable holding sleeve and into core box.

Tie asbestos rope (furnished with terminal) around exposed cable wires. The rope should overlap the cable sheath about ¼ inch.

Pull cable back out through core box opening until asbestos presses firmly against core box. The cable must be held in this position when the joint is made. Fig. 4.

Place terminal in vise or support by other means so that core box opening is in horizontal position. Fig. 5.

Heat core box and sheath by applying torch flame to upper portion of sides of core box. Keep flame moving over core box so as not to burn galvanizing. Do not touch cable with flame, to do so might ruin cable. Heat will be conducted to cable sheath thru metal of core box. Fig. 6.

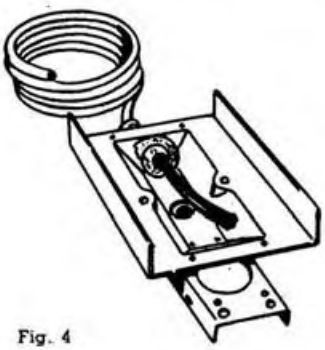

Fig. 4

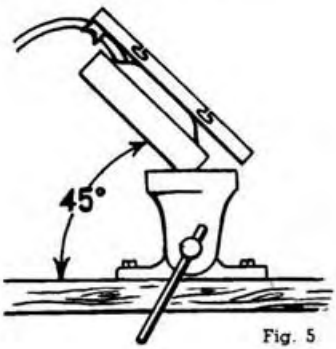

Fig. 5

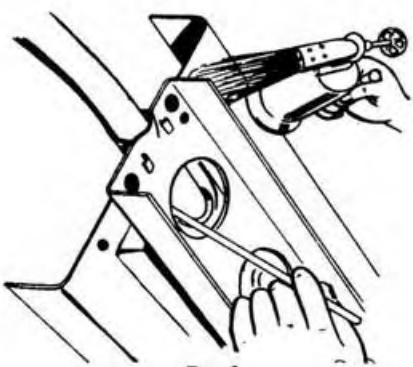

Fig. 6

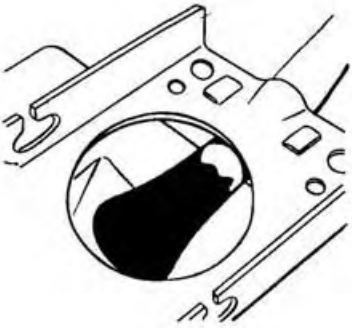

Fig. 7

Fig. 8

As the core box warms up apply a Stearine wickless candle to cable sheath. Let the candle wax run into recess in box. Continue heating upper portions of both sides of core box until recess is hot enough to melt plain wire solder.

Apply solder until recess is level full of molten solder. Continue to apply heat to core box until solder loses its pasty appearance and flows freely. Should solder start to run through the asbestos packing, stop and retie asbestos.

When solder is heated until it runs freely, remove heat and rub cable sheath near melted solder with a Stearine wickless candle. Candle wax will make solder run up cable sheath. Fig. 7.

NOTE: *If solder does not run up sheath the cause may be: The sheath was not correctly cleaned; solder was not hot enough or more candle wax is needed on cable sheath.*

When the solder solidifies and while core box is still very hot, wipe away all surplus candle wax.

TERMINATING CABLE WIRES TO TERMINAL STUDS:

Slide short pieces of cable guard tubing (furnished with terminal) over cable wires to cable sheath.

Lay face plate on terminal frame (On either side as suitable).

Fan out cable wires by color code or at random.

Start with lower pair of inner row of studs. Remove insulation at point to leave 1 inch of slack in each wire. Place wire around proper stud as shown in Fig. 8.

Solder inner row with rosin core solder before starting with outer row. Use only rosin flux. Do not use solder paste.

Finish terminating wires and solder outer row.

NOTE: *If wires are terminated by "tip" and "ring", remember, from back of face plate tip and ring are reversed as seen from front of terminal.*

Fig. 9

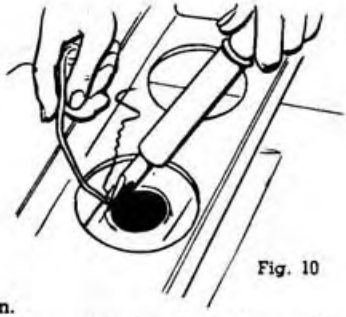

Fig. 10

RESETTING FACE PLATE:

Place rubber gasket in position.

Form cable wires so that, with face plate in place, they will not rest on bottom or sides of core box.

Refasten face plate screws previously removed. Be sure these screws are tight.

Place terminal on its face and fill chamber through hole in back with heated sealing compound. Allow compound to cool in core box then add more compound. (The compound shrinks as it cools, therefore refill at least once.) Fig. 9.

Solder metal disk (furnished with terminal) over chamber filling hole. Fig. 10.

The terminal is ready for installation.

INSTALLATION OF UNPROTECTED TERMINALS ON POLES

This section contains instructions for installation and wiring of unprotected terminals on poles.

DESCRIPTION OF POLE:

There are four sides to every pole, any one of which may be used as a mounting surface for distributing terminals. These sides as illustrated in Fig. 11, are as follows:

Cable Side — This is side of pole on which cable is attached.

Field Side — Side of pole directly opposite cable side.

Face — This is the side of pole that faces along the cable route towards the central office or exchange building.

Back — Side of pole directly opposite the face of pole.

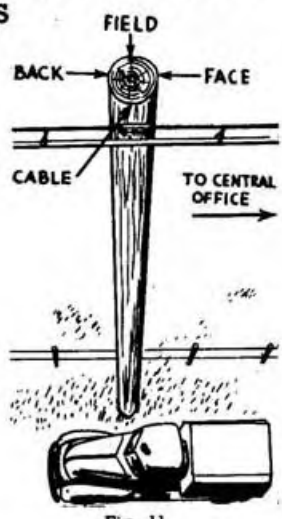

Fig. 11

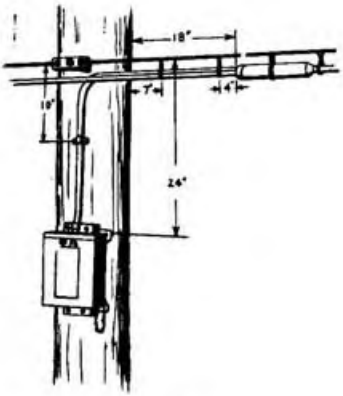

Fig. 12

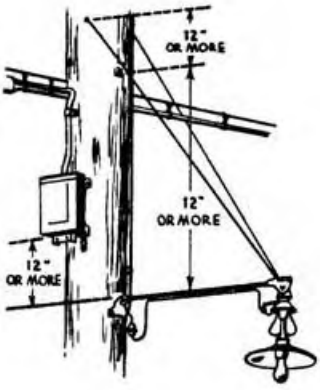

Fig. 13

LOCATING TERMINALS — ON POLES

TELEPHONE COMPANY POLES:

Poles in this category are those used exclusively by the telephone company. Preferably, locate terminal on cable side of pole as shown in Fig. 12. Place upper mounting holes of all terminals approximately 24 inches below the through bolt, or similar, strand support clamp.

JOINTLY USED POLES:

A minimum clearance of 12 inches or more must be maintained between cable terminals and electric, power or street lighting wires or fixtures placed on jointly used poles. See Fig. 13.

The terminal may be located higher or lower on pole in order to maintain minimum clearance between terminal and foreign wires or attachments. Recommended maximum and minimum distances between cable strand and upper mounting holes of terminal are given in table I.

TABLE I

Size of XB Terminal	*Separation between strand and upper mounting holes on terminal.*	
	Minimum	*Maximum*
6 Pair	10 in.	36 in.
11 Pair	12 in.	36 in.
16 pair	16 in.	36 in.
26 Pair	24 in.	36 in.

If a lower cable, foreign attachment or down pole feeder wire eliminates cable side of pole as a possible terminal location, select a location on face or back of pole (preferably the face) and place top mounting holes 24 inches from strand.

If foreign attachments are present, separation between top of terminal and strand may be secured according to the information contained in table I.

Where an end pole is raked (set on an angle to provide better pole line stability), and it would be inconvenient to work in a terminal placed on cable side of pole, place terminal on face of pole, with upper hole of mounting bracket 24" below cable, as in Fig. 14.

Where aerial cable is placed above trolley feeders, place terminals so that there will be a minimum of 40 inches separation between trolley feeders and lowest wiring ring under terminals. Fig. 15.

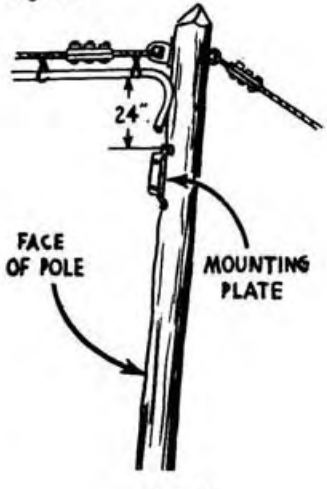

Fig. 14

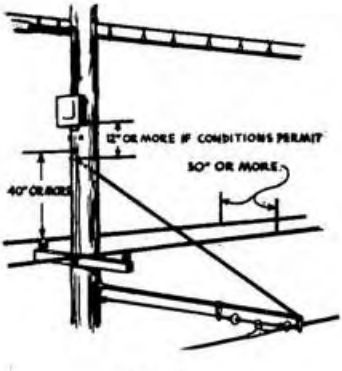

Fig. 15

MOUNTING COOK XB CABLE TERMINALS ON POLES

Weather guards always should be on lower end of terminal.

Tie stub cable to pole to prevent its bending sharply during these operations.

Fasten terminal to pole with four ¼ x 2½ inch lag screws. If pole is less than 4 inches in diameter drill ⅛ inch lead holes in pole before starting screws. For further information on fasteners see Section V "Fastening Devices".

If detachable mounting bracket is used, fasten mounting bracket with four ¼ x 2½ inch lag screws. Fig. 16.

Loosen 4 machine screws on mounting bracket.

Engage notches on back of terminal with screws on bracket. Fig. 17. Slide terminal downward to rest the top edge of notches on the screws. Tighten machine screws.

Fasten chain to pole with ¼ by 2½ inch lag screw, placed 1 inch from the right hand side of the bottom of the mounting bracket.

Place a cable cleat anchored with 1¼ inch galvanized nails, approximately, 10 inches below the strand. Fig. 18. Additional cleats should be placed every 16 inches where longer stub cable is used.

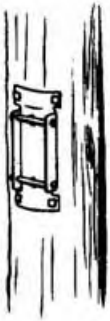

Fig. 16

Fig. 17

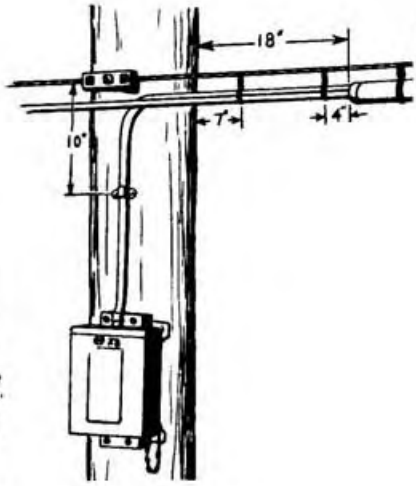

Fig. 18

Splice stub cable into aerial feeder cable. Locate splice with end of sleeve 18 inches from face of pole. However, if there already is a splice in the aerial cable at the pole where terminal is to be cut in, it usually is desirable to cut terminal into this splice. Under conditions of this nature, there will be times when stub will be spliced into the aerial cable with sleeve approximately 18 inches from back of pole.

When stub cable is cut into a passing aerial cable place stub cable behind aerial cable at pole and over aerial cable sleeve.

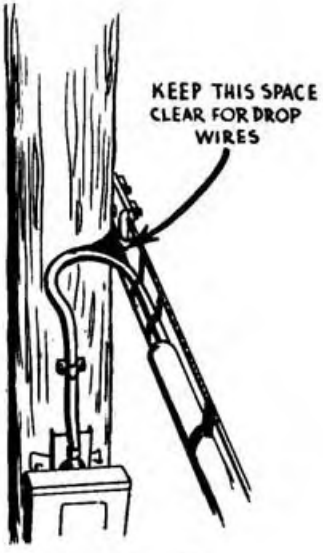

Fig. 20

Fig. 21

Place wire ties or cable straps, as shown in Fig. 18, to support sleeve, aerial cable and stub cable.

When terminal is placed on face or back of pole leave space for drop wires where stub cable leaves pole. Leave slack in stub cable to allow for cable movement, Fig. 20.

On end poles, or on poles where cable movement or creeping may be experienced, a 6 inch loop of slack in stub cable can be provided at upper turn where stub cable leaves pole to enter splice. Fig. 21.

MARKING COOK XB CABLE TERMINALS

MARKING TERMINAL NUMBERS:

Where poles are not numbered, or where terminal number does not correspond to pole number identification will be simplified by marking number on outside of terminal.

Mark terminal number on face of hood using stencils and black pencil paint. Use 1½ inch stencil numerals and space numbers evenly across lower portion of terminal hood. See Fig. 22.

MARKING CABLE NUMBER AND TERMINAL COUNT:

The cable pair numbers appearing in any distributing terminal constitute the terminal count. The terminal count should be marked at each terminal.

Place cable number, when specified, and number of first and last cable pair appearing in terminal on a lead terminal tag. Fasten terminal tag around stub cable adjacent to cable holding sleeve. See Fig. 23.

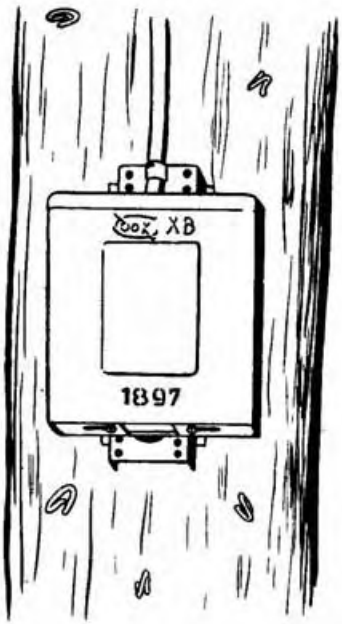

Fig. 22

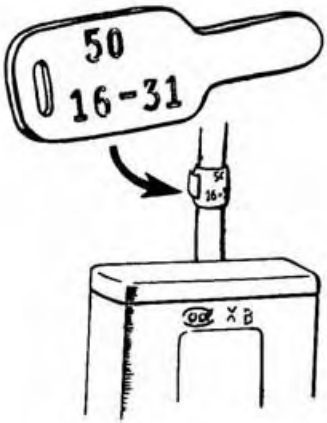

Fig. 23

WIRING COOK XB TERMINALS MOUNTED ON POLES

Orderly wiring of Cook XB terminals mounted on poles is dependent upon correct location and use of rings installed on the pole.

Place rings on poles, as shown in Fig. 24.

On poles equipped with 6, 11 and 16 pair Cook XB terminals use "C" bridle rings or ⅞ inch drive rings.

On poles equipped with 26 pair type XB terminals use "A" bridle rings or 1¼ inch drive rings.

Route all wires, whether or not attached to pole above or below strand through "cross-over" ring.

If drop is terminated on binding post in right hand row, place in rings as shown in Fig. 25.

If drop is terminated on binding post in left hand row, place in rings as shown in Fig. 26.

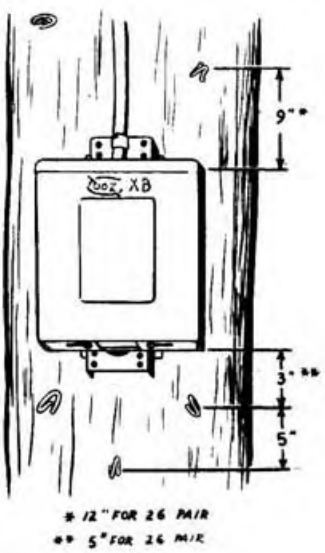

Fig. 24

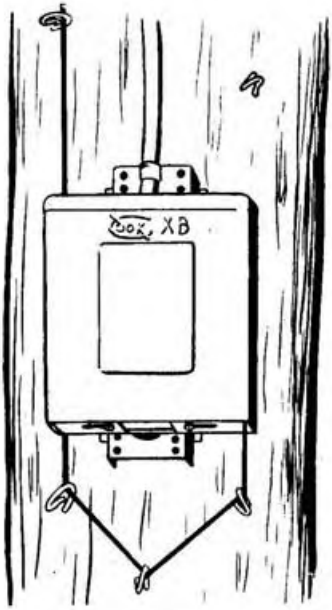

Fig. 25

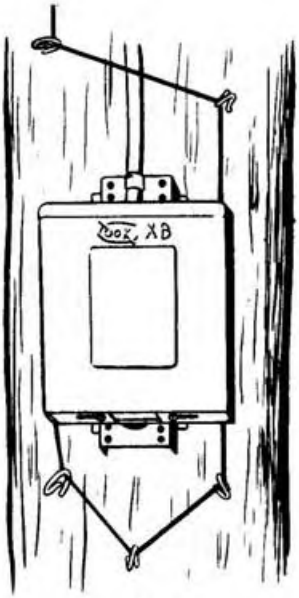

Fig. 26

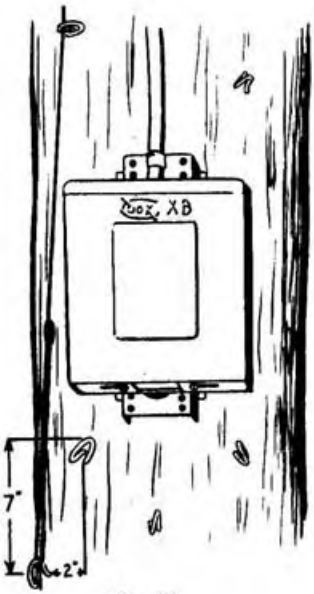

Fig. 28

Close weather guards on lower end of terminal. Fig. 27.

When disconnection is made at Cook XB terminal, remove free end of wire from terminal and tape ends of each conductor. Lay free end back about wire at a spare ring. Tape end of wire securely to supporting wire. Where parallel drop wire is used, tape should extend to approximately 1 inch over the braid. Fig. 28.

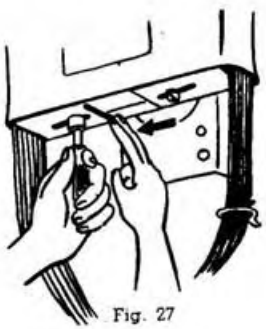

Fig. 27

TERMINATING WIRES AT COOK XB CABLE TERMINALS

This section describes how to terminate all insulated wires at Cook XB Cable Terminals.

When using twisted pair wire, remove approximately 2 inches of insulation and clean each conductor. Stagger the conductors ¾ inch as shown in Fig. 29A.

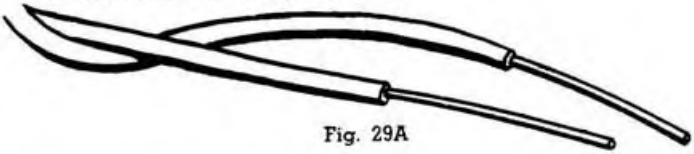

Fig. 29A

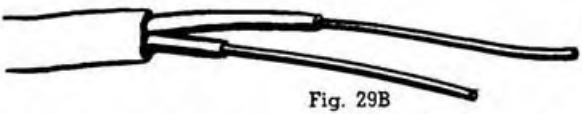

Fig. 29B

NOTE: *Do not use long nose pliers for cleaning conductors. Preferably, use diagonal cutting pliers. To prevent possibility of damaging the insulation on the wire, perform the above skinning and cleaning operation before inserting the wire in the fanning strip.*

When using parallel type drop wire, remove outer braid and skin and clean shortest conductor ½ inch from edge of braid. See Fig. 29B. By so doing, when wire is terminated braid will extend through fanning strip.

Loosen top nuts on both binding posts with No. 452-500 socket wrench.

Insert wire through fanning strip. Use opening in line with binding posts.

Place first conductor under lower washer and ¾ way around binding post in direction nut tightens. Leave ⅛ inch separation between insulation and washer. See Fig. 30.

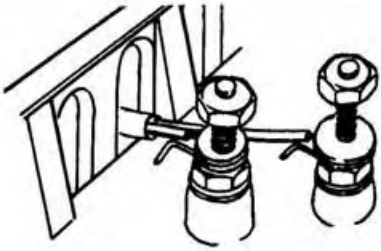

Fig. 30

NOTE: *To handle stiff drop wires safely proceed as follows:*
For binding posts in left hand row, grasp wire ½ inch beyond binding post with long nose pliers that are knurled inside at tip. Fig. 31.
To maintain knurled gripping surface, do not use long nose pliers to clean insulation from wires. Preferably, use diagonal cutting pliers.


Fig. 31


Fig. 32

Press wire down and against binding post. In so doing make a backwards bend with the pliers as shown in Fig. 32. Hand and pliers make about ¼ turn to left.
Maintain a firm grip on pliers.
Push wire down keeping jaws of pliers horizontal, see Fig. 33.
Continue movement to left and slightly upward firmly wrapping wire around binding post as in Fig. 34.
NOTE: *The backward bend made while handling stiff drop wire provides a shoulder to prevent the pliers slipping as they reach the danger zone. The danger zone is the upward motion of the terminating operation when, if the pliers should slip, they might strike the workman's face.*


Fig. 33


Fig. 34

Fig. 35

Bring wires parallel on left side of binding posts by grasping both wires between jaws of pliers. See Fig. 35.

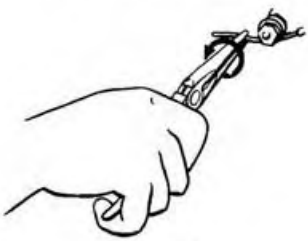

Fig. 36

For binding posts in right hand row, start wire on under side of binding post. Grasp wire as shown in Fig. 36.

Fig. 37

Make ¼ turn to left with pliers. Bring wire up and over binding post. Complete loop as shown in Fig. 37.

Fig. 38

Bring wire ¾ way around the binding post by grasping both wires with pliers. Proceed to tighten nuts firmly, Fig. 38, using No. 452-500 socket wrench.

Fig. 39

Trim wires and arrange conductors so they will not touch adjacent binding posts, Fig. 39.

When a second wire is to be terminated on a binding post, insert it between the washers. Arrange the wires so that conductors on right hand post of pair are not in contact with those on left hand side, or vice versa.

If, at a later date, lower wire is disconnected it is not necessary to move upper wire to the lower position.

INSTALLATION OF COOK XB TERMINALS — WALL LOCATIONS

Unprotected distributing terminals form a permanent part of the telephone plant. To select the proper location for Cook XB unprotected cable terminals, consider whether a particular location is suitable from an installation as well as a maintenance standpoint. Insofar as practicable, terminal locations should be selected in accordance with the following points:

LOCATE TERMINALS INSIDE:

On a firm mounting surface, where they will be accessible without use of a ladder and where good lighting conditions exist.

With at least 12 inches clearance from electric light and power wires or associated apparatus and other building equipment.

Where they will be least obvious and where the associated cable and wires will not be unsightly.

Where it will be convenient to run station wires to the terminal.

Where cover can be removed and workmen will not block passageway.

Where they will not be an accident hazard and where the terminal itself is not liable to damage from doors, hoists, automobiles, trucks or other moveable objects.

Where they will not be exposed to moisture or excessive heat.

NOTE: *The terminal itself will not be affected by moisture, but station wires deteriorate rapidly under such conditions.*

LOCATE TERMINALS OUTSIDE:

On a firm mounting surface about 5 feet above the ground where they will be accessible without use of a ladder. Increase this height if by so doing possible damage or an otherwise hazardous condition can be avoided.

Maintain 12 inches clearance from a corner of a building, electric light and power circuits or pipes or spouts on an outside building wall.

Where the 3½ inch projection of the terminal from wall will not represent an accident hazard, and where the terminal itself will not be damaged by doors, shutters, hoists, trucks or automobiles in driveways, material on platform trucks used on loading platforms, etc.

MOUNTING COOK XB CABLE TERMINALS — WALL LOCATIONS

USING DETACHABLE MOUNTING BRACKET:

Weather guards always should be on lower end of terminal.

Place detactable mounting bracket with bottom of bracket approximately 5 feet above floor or ground. Four fasteners are required. Select proper fastener from Table II.

TABLE II

Table of Fasteners for Cook XB Cable Terminals

On This Surface	*Use These Fasteners*
Masonry —	4 — ¼ x 1¼ Hammer Drive Anchors.
Wood —	4 — 1½ inch No. 14 R.H. Galv. Wood Screws.
Hollow Tile —	4 — ¼ x 3 inch R.H. Galv. Toggle Bolts.

For further information on fasteners see Section V, "Fastening Devices."

Hold bracket against mounting surface. Mark position of mounting holes. Drill lead holes for wood screws or necessary holes for toggle bolts or drive anchors. Locate anchors in center of bricks.

Hold bracket in position and place fasteners.

Loosen 4 machine screws on mounting bracket.

Remove hood and engage notches on back of terminal with screws on bracket. Slide terminal downward to rest top edge of notches on screws. Tighten machine screws.

Keep sharp bends out of stub cable.

Place a cable clamp approximately 8 inches from cable support loop. For this purpose use a standard cable clamp with drive anchor or screw. If wire route parallels cable, fasten cable with a cable clamp ring or a cable clamp held in place with a drive ring and drive anchor. If drive ring is used, select a ⅝ inch drive ring for 6 pair terminals, ⅞ inch drive ring for 11 and 16 pair terminals and 1¼ inch drive ring for 26 pair terminals.

Splice stub cable into feeder cable.

Place additional cable clamps with spacing of approximately 2 feet. Use drive rings or cable clamp rings wherever necessary.

WITHOUT DETACHABLE MOUNTING BRACKET:

The Base of terminal itself is fastened to mounting surface when installing terminal without using detachable mounting bracket. Use 4 fasteners as indicated in Table III.

TABLE III

Table of Fasteners for Cook XB Terminal less Mounting Bracket

On This Surface	*Use These Fasteners*
Masonry —	4 — ¼ x 1½ inch Hammer Drive Anchors.
Wood —	4 — 2 inch No. 14 R. H. Galv. Wood Screws.
Hollow Tile —	4 — ¼ x 3 inch R. H. Toggle Bolts.

For further information on fasteners see Section V, "Fastening Devices."

Hold terminal against mounting surface. Keep sharp bends out of stub cable. Mark position of mounting holes. Drill lead holes for screws or holes for toggle bolts or drive anchors. Locate anchors in center of bricks.

Hold terminals in position and place fasteners.

Place a cable clamp approximately 8 inches from cable support loop. For this purpose, use a standard cable clamp with drive anchor or screw. If wire route parallels cable, fasten cable with a cable clamp ring or a cable clamp held in place with a drive ring and drive anchor. If drive ring is used, select a ⅝ inch drive ring for 6 pair terminals; ⅞ inch drive ring for 11 and 16 pair terminals and 1¼ inch drive ring for 26 pair terminals.

Splice stub cable into feeder cable.

Place additional cable clamps with spacing of approximately 2 feet. Use drive rings or cable clamp rings wherever necessary.

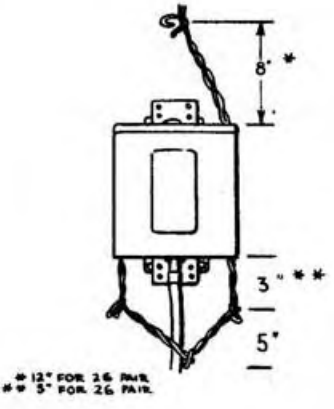

Fig. 40

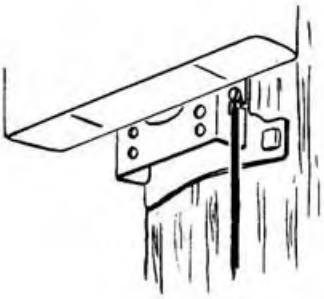

Fig. 41

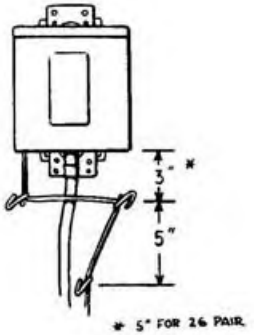

Fig. 42

WIRING COOK XB CABLE TERMINALS — WALL LOCATIONS

When entering from wire run above terminal, place wires in three rings below terminal. The first ring through which wire is passed should be on side opposite from where wire will be terminated. With rings properly spaced, slack can be obtained for transferring wire to any other binding post in terminal by using only two top rings. See Fig. 40. If splicing wire is necessary, make all splices in wire route above terminal.

When entering from wire run below terminal place wire first through lower of three rings then through ring opposite side on which wire will be terminated. See Fig. 41.

If splicing is necessary make splice in wire route below terminal.

If a connection for a signaling ground or a protector ground for an exposed drop fed from an unexposed terminal on outside wall is needed, proceed as follows:

(a) When detachable mounting bracket is used, loosen lower right hand machine screw on mounting bracket. Skin and clean end of No. 14 ground wire, place bared end of wire around screw in direction in which screw tightens. Tighten screw firmly. See Fig. 42.

(b) When terminal is mounted on wall without detachable mounting bracket solder wire to cable sheath.

NOTE: *This ground connection should not be used as protector ground for station lines run from an exposed cable terminal. Instead, use recommended protector ground, as covered in Section IV, "Sub-Station Protectors."*

MAINTENANCE OF COOK XB TERMINALS

The main items responsible for most cable terminal trouble are: defects caused by loose connections; wires skinned too far back, causing grounds or short circuits; wires connected to incorrect cable pairs and wires left connected when service has been terminated and station apparatus has been removed.

Preventive maintenance performed during the course of each visit to a cable terminal is the best means of improving terminal conditions and preventing service interruptions.

Distributing terminals, such as the Cook XB, with bakelite face plates and raised stud mountings eliminate surface leakage.

PREVENTIVE MAINTENANCE ROUTINE:

On each visit to a distributing terminal mounted outdoors, check weather guards at entrance openings. Unused openings should be completely closed. Openings in use should be closed as much as possible without damaging drop wire insulation. Insulation of drop wires is preserved if rain, sleet, snow, dirt and insects are kept out of the cable terminal. Fig. 43.

Check carefully for loose, poor or dirty connections.

Brush out all dirt.

Close cover of terminal.

Arrange ends of dead wires in a neat orderly manner. On poles all dead wires should be placed in a dead wire ring with free end of the wire wrapped around and taped to supporting wire.

Make sure terminal is mounted firmly. Tighten any loose fasteners and replace any that are missing.

Out-of-service conditions demand immediate attention.

Care for minor unsatisfactory items at time of inspection. If major repairs, such as replacement of wires, are necessary, take proper steps to have repairs made as soon as possible. Always be sure hood is in place when leaving terminal.

SECTION II

COOK S-20 PROTECTED POLE CABLE TERMINAL

INDEX TO CONTENTS

SECTION II

DESCRIPTION OF COOK S-20 PROTECTED POLE CABLE TERMINAL

The Cook S-20 Pole Cable Terminal is shown in Fig. 1. This terminal has a self-soldering nozzle through which stub cable is brought into core box.

The Cook H Protector Mounts, see Fig. 2, are installed as required.

Cook S-20 Pole Cable Terminals are available in the following sizes: 6, 11, 16, 26 and 51 pairs.

The mounting base is open at back adjacent to pole to prevent accumulations of ice, dirt or moisture. A separate mounting bracket shaped to fit the pole provides easy installation without gaining pole. Drop wires enter terminal through individual insulating knockout holes, at front of terminal.

STUBBING THE TERMINAL:

On all terminals received without stubs, place a 7-foot cable stub (or longer if required), before mounting terminal. Usually, this can be performed best in the shop. However, it may be done wherever necessary tools and supplies are available.

PREPARATION:

Remove hood from terminal.

Remove face plate screws and take off core box cover, rubber gasket, and front hood guide.

Remove end of cable sheath as specified in Table I.

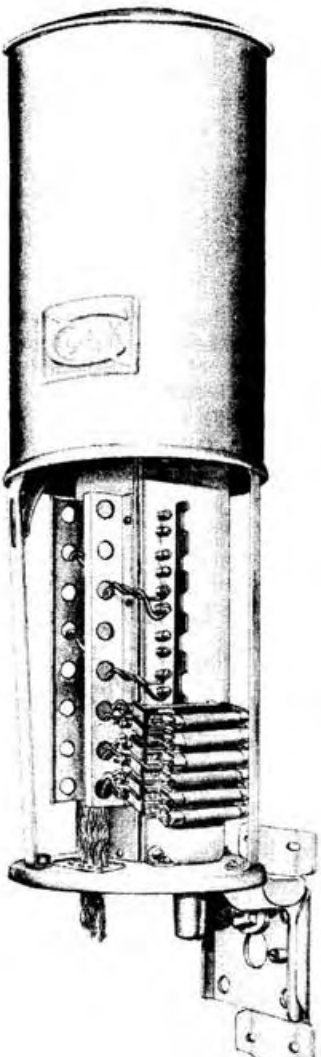

Fig. 1

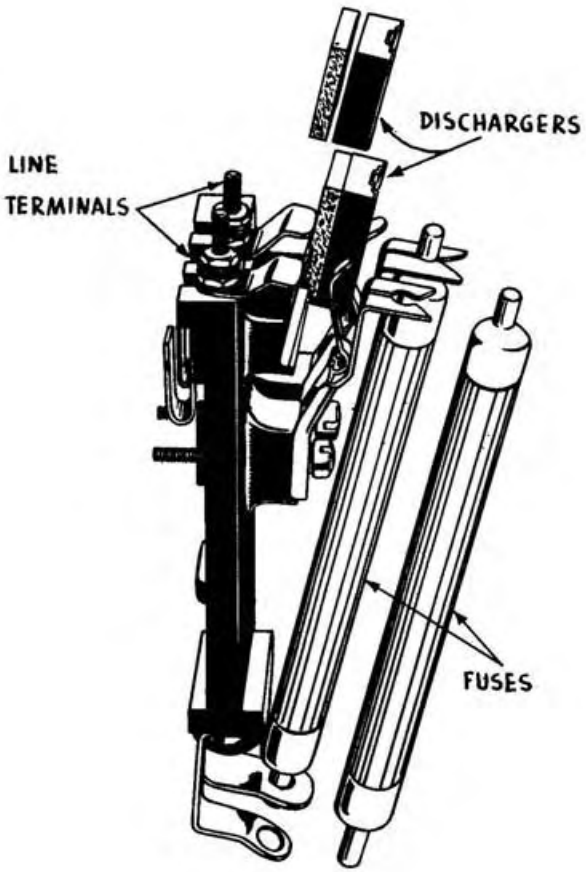

Fig. 2

TABLE I

For this size terminal	*Remove this much cable sheath*
6 pair	10"
11 pair	14"
16 pair	17"
26 pair	22"
51 pair	44"

BOILING OUT TERMINAL END OF STUB CABLE:

Protect insulation at edge of sheath with two layers of cotton tape freshly boiled in paraffin.

Remove paper wrapping on cable core up to cotton tape binding at edge of sheath, as shown in Fig. 3. Start pouring hot paraffin (heated to a temperature of 375° to 390°) at a point about 6 inches back of sheath. Move forward gradually to end of wires. Continue pouring paraffin on wires until insulation on all wires is saturated completely with paraffin, and any moisture in insulation is completely removed. Next, lift ends of wire over level of sheath and pour paraffin on wires close to end of sheath. Paraffin that flows under sheath forms a seal against moisture.

Scrape 3-inches off the end of the sheath bright and clean. Rub Stearine wickless candle over clean portion of the sheath.

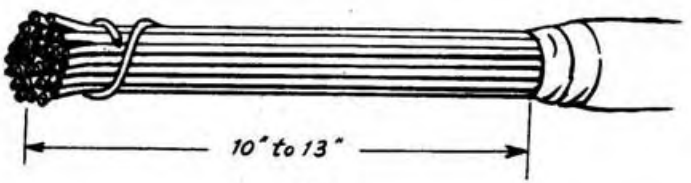

Fig. 3

ATTACHING CABLE TO SELF-SOLDERING NOZZLE:

Place cable through Self-Soldering nozzle and through Solder Sleeve which is inside nozzle. Sheath should extend ½ inch above top of nozzle inside of core box.

NOTE: *The solder sleeve has flux already applied.*

Place a 5 inch length of ⅛ inch rosin core wire solder in vertical position in nozzle toward back of cable in core box. When this piece of solder has melted it indicates that solder sleeve in nozzle has melted. See Fig. 4.

Wrap piece of asbestos rope, furnished with terminal, tightly around cable and outside end of nozzle. Fasten asbestos with wire so that melted solder will not leak out lower end of nozzle. See Fig. 5.

On Self-Soldering nozzles equipped with a bell type cable guard, pack the asbestos firmly between the bell type guard and cable. Do not puncture cable sheath with a sharp tool while packing the asbestos in place.

Place the terminal in a vertical position with nozzle down. Apply torch flame to outside of nozzle. Remove heat as soon as solder sleeve has melted. Flame must be kept in motion over nozzle to prevent burning the galvanizing or injuring cable. Do not touch cable with flame, to do so might ruin cable. See Fig. 6.

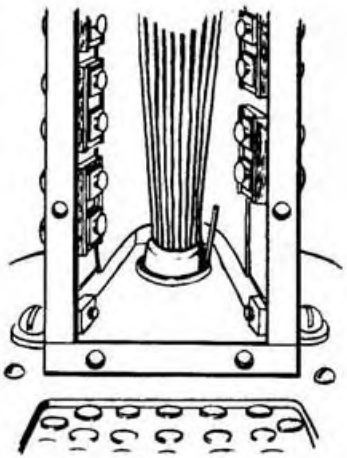

Fig. 4

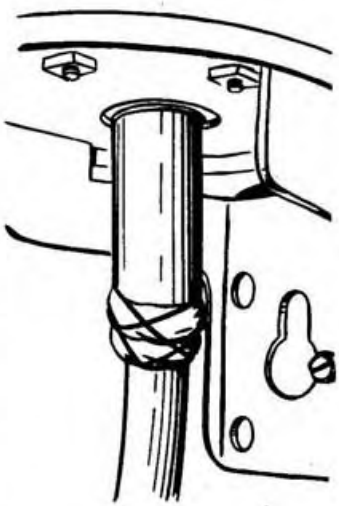

Fig. 5

Allow nozzle to cool. Then remove asbestos.

Flood floor of core box with cable compound to seal cable.

TERMINAL CABLE WIRES TO TERMINAL STUDS:

Fan out cable wires by color code or at random.

Start with lower pair of studs on left hand side of terminal. Remove insulation and place each wire around proper stud as shown in Fig. 7. Terminate tip conductor on top stud of pair and ring conductor on bottom stud of pair. Continue to top of left hand row, then start with first pair on top of right hand side and continue down until all pairs are fastened to their proper studs.

NOTE: *If connections are made with left hand, start with the lower right hand pair of studs.*

Solder all connection with rosin core solder.

Use only Rosin Flux, do not use solder paste.

Fig. 6

Fig. 7

RESETTING CORE BOX COVER AND FRONT HOOD GUIDE:

Be sure treated paper insulator is in place in rear of cable chamber.

See that cable wires are not resting against core box.

Position rubber gasket and replace core box cover.

Replace front hood guide.

Be sure all cover screws are tight.

The terminal is ready for installation.

LOCATING COOK S-20 POLE CABLE TERMINAL

In general, when locating Cook S-20 Pole Cable Terminals, make sure there is sufficient room overhead, so that hood may be removed completely as needed. The clear overhead space required for various size terminals is indicated in table No. I.

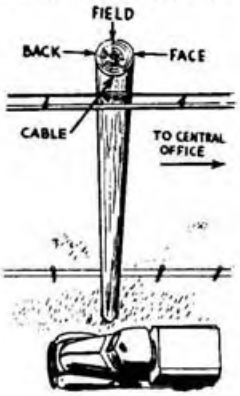

Fig. 8

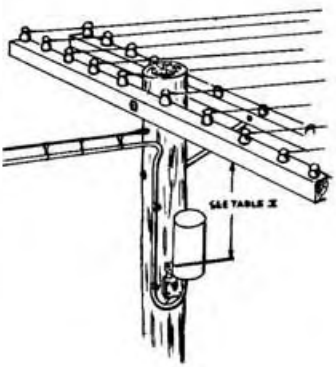

Fig. 9

TABLE II

Size terminal	*Overhead space required (measured from top bolt hole on mounting bracket)*
6 Pair	24 inches
11 Pair	28 inches
16 Pair	33 inches
26 Pair	48 inches
51 Pair	86 inches

The above table should be used when mounting space is limited or when it is desirable to get as close as possible to a cable or crossarm overhead. See Fig. 9.

DESCRIPTION OF POLE:

There are four sides to every pole, any one of which may be used as a mounting surface for Cook S-20 Cable Terminals. These sides, as illustrated in Fig. 8, are as follows:

Cable Side — This is side of pole on which cable is attached.

Field Side — Side of pole directly opposite cable side.

Face — This is the side of pole that faces along the cable route towards the central office or exchange building.

Back — Side of pole directly opposite the face of pole.

In addition to the above general requirements, certain specifications are applicable to various uses to which the terminal may be adapted.

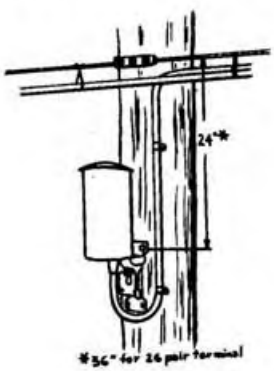

Fig. 10

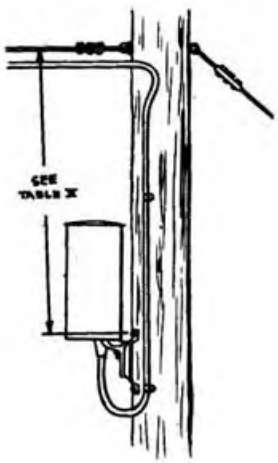

Fig. 11

AT JUNCTION OF OPEN WIRE AND AERIAL CABLE:

Place the terminal on what normally would be the cable side of pole if cable were extended beyond junction pole. In choosing cable side, be governed by position of cable on next pole along cable route.

WHEN USED ON TELEPHONE COMPANY POLES as distributing terminals along an aerial cable route, for 6, 11 and 16 pair terminals, place the top screw hole of the mounting bracket 24 inches below the three bolt clamp. Increase this distance to 36 inches for the 26 pair size terminals. See Fig. 10. Preferably, place terminal on cable side of pole.

Where an end pole is raked (set on an angle to provide better pole line stability), and it would be inconvenient to work in a terminal placed on cable side of pole, place terminal on face of pole. See Fig. 11.

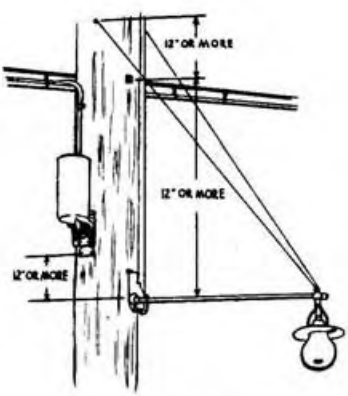

Fig. 12

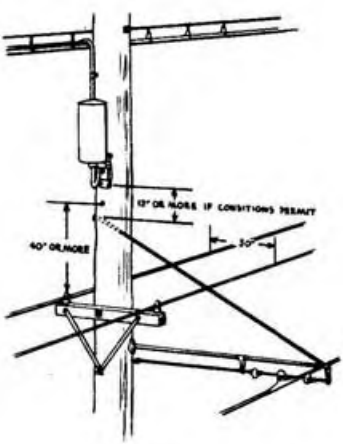

Fig. 13

On jointly used poles, a minimum clearance of 12 inches or more must be maintained between terminals and electric, power or street lighting wires or fixtures. See Fig. 12. Clearance between a wire run and a through bolt placed for a power company guy wire should be ⅛ of pole circumference or a minimum of 2 inches.

Where aerial cable is placed above trolley feeders, place terminals so that there will be a minimum of 40 inches separation between trolley feeders and lowest wiring ring under terminal. See Fig. 13.

MOUNTING COOK S-20 POLE CABLE TERMINAL

A separate mounting bracket is furnished with all Cook S-20 Pole Cable Terminals. By using this bracket, terminal can be installed without gaining pole.

Attach mounting bracket to pole with four ¼ x 2½ inch lag screws. Fig. 14. Locate top screw holes of bracket in accordance with instructions given in the section entitled, "Locating Cook S-20 Pole Cable Terminal".

For further information on fasteners, see Section V "Fastening Devices".

Loosen nut on mounting bolt.

Slip bayonet hole in terminal bracket over mounting bolt and tighten nut. See Fig. 15.

NOTE: *The four bosses on mounting bracket do not line up with bolt holes in terminal. They act as separators between the two brackets to prevent corrosion.*

Make a smooth bend and fasten stub cable on most convenient side of terminal. Generally, this will be the side nearest face of pole. Place a cable clamp at point where cable straightens out for run up pole. The loop in stub cable should extend 1 to 2 inches below terminal bracket. Fig. 16.

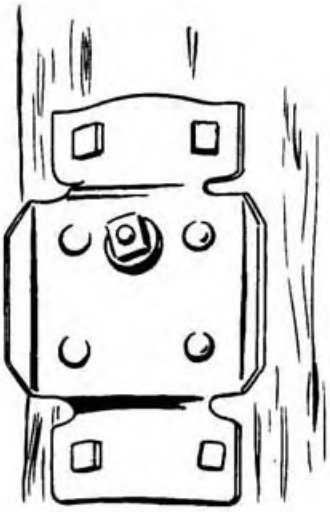

Fig. 14

Fig. 15

Place a cable clamp approximately 10 inches below messenger strand. If necessary, place additional cable clamps so that spacing between clamps is not over 16 inches. See Fig. 17. Splice stub cable into aerial feeder cable. Locate splice with end of sleeve 18 inches from face of pole. However, if there already is a splice in the aerial cable at pole where terminal is to be cut in, it usually is desirable to cut terminal into this splice. Under conditions of this nature there will be times when stub will be spliced into aerial cable with sleeve approximately 18 inches from back of pole.

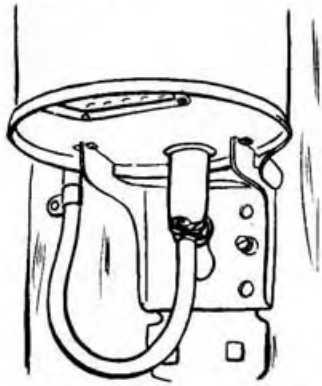

Fig. 16

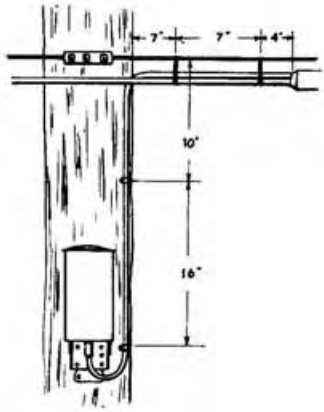

Fig. 17

When stub cable is cut into a passing aerial cable, place stub cable behind aerial cable at pole and over aerial cable in sleeve.

Place wire ties or cable straps, as shown in Fig. 17, to support sleeve, aerial cable and stub cable.

When terminal is placed on face or back of pole, leave space for drop wires where stub cable leaves pole. Fig. 19.

On end poles, or an any poles where cable movement may be experienced, a 6 inch loop of slack in stub cable can be provided at upper turn where stub cable leaves pole to enter splice. Fig. 20.

Fig. 19

Fig. 20

PLACING GROUND WIRE FOR COOK S-20 TERMINAL

The successful operation of the arrester unit of Cook S-20 Pole Cable Terminal depends upon a good connection to ground. The resistance to ground should not exceed 5 ohms. For information on how to measure resistance of ground see Section IV. "Sub-Station Protectors". Place a No. 6 solid copper wire from ground post on terminal, Fig. 21 to a ground rod located 2 feet from base of pole. Rod and ground wire should be buried at least 3 inches below surface of earth. To splice ground wire to wire tail on ground rod, clean 5 inches of end of both tail wire on ground rod and ground wire.

Twist the two wires together making at least 4 complete turns. Then solder the joint. Fig. 22.

Fasten ground wire to the pole with galvanized guy wire staples. Space fasteners approximately 16 inches apart.

If ground wire is subject to damage protect with standard ground wire moulding.

At terminal, clean 1 inch of end of ground wire. Loosen nut on ground terminal, insert wire through hole in stud and tighten nut.

Fig. 21

Fig. 22

MARKING COOK S-20 POLE CABLE TERMINALS

MARKING TERMINAL NUMBER:

Where poles are not numbered, or where terminal number does not correspond to pole number identification will be simplified by placing a number on outside of terminal.

Mark terminal number on hood using stencils and black stencil paint. Use 1½ inch stencil numerals, and space numbers approximately ½ inch apart across lower portion of hood. Fig. 23.

MARKING CABLE NUMBER AND TERMINAL COUNT:

Place cable number, when specified, and number of first and last cable pair appearing in terminal on a lead terminal tag. Fasten terminal tag around stub cable between pole and self-soldering nozzle. Fig. 24.

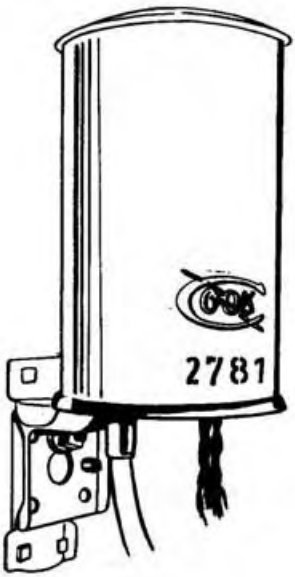

Fig. 23

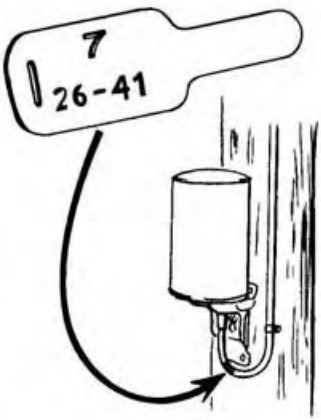

Fig. 24

WIRING COOK S-20 POLE CABLE TERMINAL

Uniform wiring of Cook S-20 terminals will use less space on the pole and will require less maintenance.

Place rings on poles as shown in Fig. 25.

On poles equipped with 6, 11 and 16 pair terminals use "C" bridle rings or ⅞ inch drive rings.

On poles equipped with 26 pair Cook S-20 terminals use "A" bridle rings or 1¼ inch drive rings.

When protection is required, remove screw from each binding post of cable pair, and install a Cook H protector mount. Fuses must be removed to perform this operation. Fig. 26.

Replace fuses. Insert end of fuse first into hole in contact spring, then press other end of fuse into slotted contact spring. Be sure arrester units are in place.

Bring drop wires or bridle wire jumpers into terminal through individual fibre knockout holes in base.

Place wire in deep trough in front of terminal and through fanning strip hole in line with binding posts on Cook H protector mount.

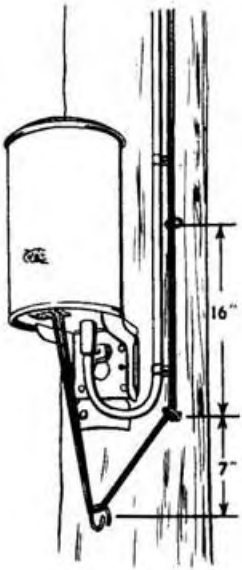

Fig. 25

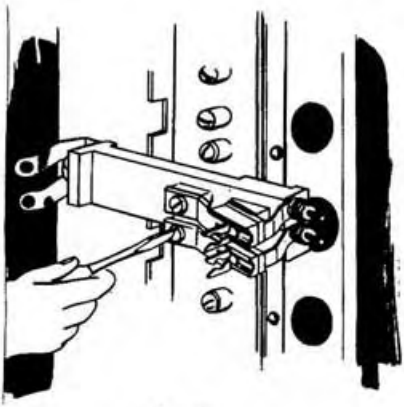

Fig. 26

Extend braid through fanning strip. Place skinned and cleaned end of each conductor under bottom washer and ¾-way around binding post in direction in which nut tightens. Leave ⅛ inch separation between insulation and washer. Fig. 27.

If protection is not required terminate wire directly on binding post. Fig. 28.

When disconnection is made at Cook S-20 terminal, remove free end of wire from terminal and tape the ends of each conductor. Lay the free end back about the wire at a spare ring placed 7 inches below and 2 inches further from terminal than the vertical wire run, as shown in Fig. 29.

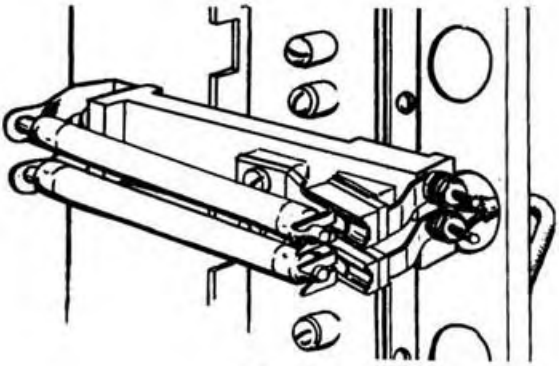

Fig. 27

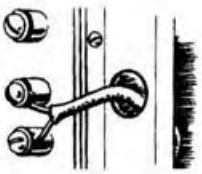

Fig. 28

MAINTENANCE OF COOK S-20 CABLE TERMINALS

The main sources of trouble at Cook S-20 Pole Cable Terminals are loose connections; wire skinned too far back causing grounds or short circuits; wires connected to incorrect cable pairs and wires left connected when service has been terminated and station apparatus has been removed.

Preventive Maintenance performed during the course of each visit to a cable terminal is the best means of improving terminal conditions and preventing service interruptions.

Check all wire connections to make sure they are tight.

Open, clean and reconnect any wires that have become corroded.

See that Cook H protector units are fastened firmly.

If terminal is loose on pole tighten lag screws or take up nut on mounting bolt. If neither of these correct the condition install longer lag screws.

When marking is required see that terminal is marked correctly.

Inspect the ground connection at terminal, Fig. 30, and ground wire run down pole. It is assumed that ground rod installation will be examined during a yearly routine pole inspection.

Replace fibre drop wire entrance insulator if it is broken or if several wires have been removed from terminal.

Always be sure hood is in place when leaving pole.

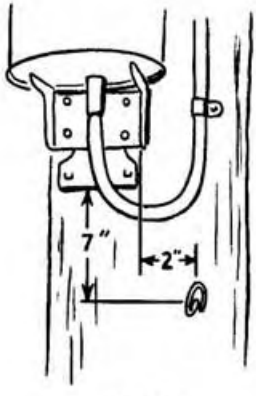

Fig. 29

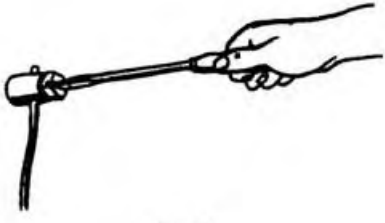

Fig. 30

SECTION III

COOK No. 7 LIGHTNING ARRESTER

INDEX TO CONTENTS

SECTION III

COOK No. 7 LIGHTNING ARRESTERS

DESCRIPTION OF COOK No. 7 LIGHTNING ARRESTERS:

The Cook No. 7 Lightning Arrester, complete with hood, chain and discharge blocks, is illustrated in Fig. 1.

Individual Seal Gap Arresters or two-piece Tru Gap dischargers and carbon blocks, Fig. 2, are furnished.

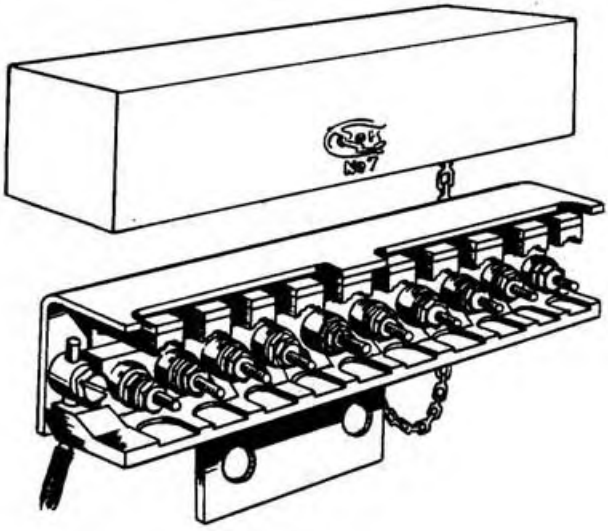

Fig. 1

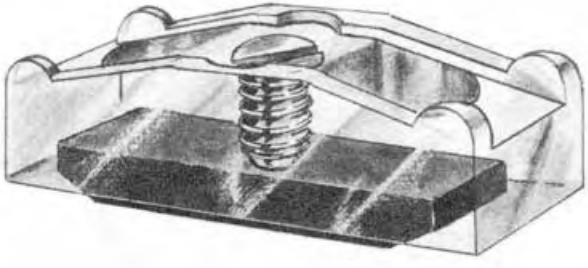

Fig. 2

LOCATION OF COOK No. 7 LIGHTNING ARRESTERS

POLES ON OPEN WIRE ROUTE:

Place Cook 7 Arrester parallel with wire route and 10 inches below cross arm. Fig. 3.

POLES ON AERIAL CABLE ROUTE:

If unprotected terminal is mounted on cable side of pole, place the Cook 7 Arrester with top mounting screw approximately 10 inches below bottom mounting screw of terminal. Fig. 4.

When terminal is mounted on face or back of pole locate Cook 7 Arrester on cable side of pole with bottom mounting screw, in line with bottom mounting screw of terminal. Fig. 5.

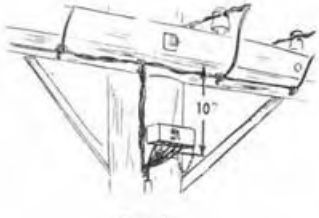

Fig. 3

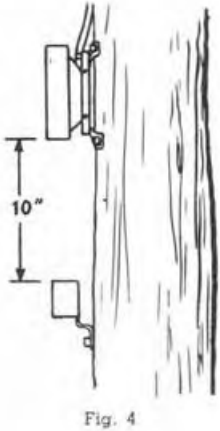

Fig. 4

MOUNTING COOK No. 7 LIGHTNING ARRESTERS

Fasten Cook 7 Lightning Arrester to pole with two 3-inch, No. 14, R. H. Galv. Wood Screws. For further information on fasteners see Section V, "Fastening Devices."

Where more than one arrester is required, space arresters 10 inches apart down the pole.

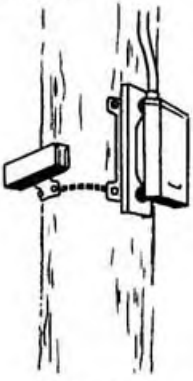

Fig. 5

PLACING GROUND WIRE FOR COOK No. 7 LIGHTNING ARRESTERS

POLES ON OPEN WIRE ROUTE:

Low resistance to ground is essential to proper operation of No. 7 Lightning Arrester. Refer to the section on Sub-Station Protectors for method of measuring your ground rod resistance.

The resistance of the ground should not be over 5 ohms.

For information on how to measure resistance of ground see Section IV, "Sub-Station Protectors."

Connect a No. 6, solid copper wire from the ground post on the arrester, Fig. 6 to the ground rod located at least 2 feet from base of pole. The top of the ground rod should be buried at least 3 inches below the surface of the earth.

To splice ground wire to wire tail on ground rod, clean 5 inches of end of both ground wire and tail wire.

Twist the two wires together making at least 4 complete turns, then solder joint. Fig. 7.

Fasten ground wire to pole with galvanized guy staples. Space fasteners at approximately 16 inches apart.

At terminal, clean 1 inch of ground wire. Loosen nut on ground terminal, insert wire through hole in stud and tighten nut.

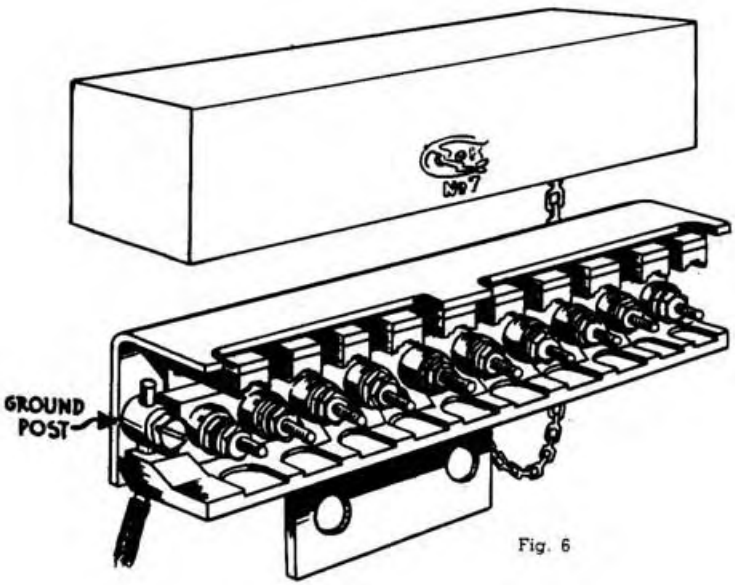

Fig. 6

Fig. 7

POLES ON AERIAL CABLE ROUTE:

Connect ground terminal to suspension strand by means of No. 6 solid copper wire.

Use a continuous piece of wire without splice.

Select as direct a route as practicable from arrester to suspension strand.

Attach ground wire to suspension strand with a strand ground clamp.

Clean wire for a length of approximately 5 inches. Bend the end of ground wire back on itself for about 2 inches.

After placing strand ground clamp over strand, insert doubled end of wire between strand and bolt and tighten bolt. Fig. 8.

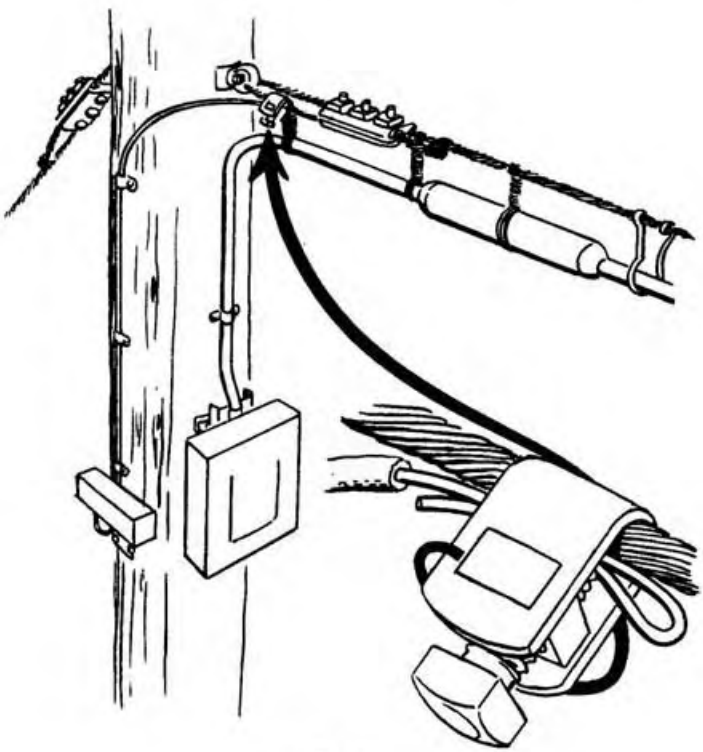

Fig. 8

Where strand is dead ended with an eye bolt, place strand ground clamp on necks of suspension strand dead end. If there is not sufficient room at that point, place strand ground clamp just beyond 3 bolt clamp used to fasten the dead end. Fig. 8.

When strand is wrapped around pole, place clamp on cable side of neck of dead end. Fig. 9.

On intermediate poles, install the strand ground clamp between 3 bolt clamp and adjacent aerial cable ring. If cable is lashed to strand ground cable, carefully place one side of clamp between strand and cable.

Attach ground wire to pole with galvanized guy staples spaced about 16 inches apart.

At terminal, clean 1-inch of end of ground wire. Loosen nut on ground terminal, insert wire through hole in stud and tighten nut.

Fig. 9

Where more than one Cook 7 Lightning Arrester is installed on a pole, solder a piece of No. 14 copper ground wire to the main ground wire approximately 6 inches above the first arrester. Then run wire to ground terminal in additonal arrester as specified previously.

WIRING COOK No. 7 LIGHTNING ARRESTER

POLE ON OPEN WIRE ROUTE:

Cook No. 7 Lightning Arrester used for protection only on open wire route. A separate bridle wire jumper connects each pair of open wire to separate pair of binding posts in arrester unit.

Place a "C" bridle ring or a ⅞ inch drive ring approximately 1 inch from left end of arrester and 2 inches below mounting screws. Place a second ring directly above first ring and 10 inches below cross arm. Fig. 10.

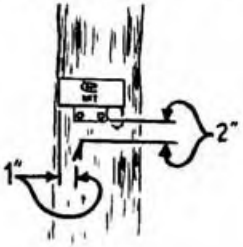

Fig. 10

Connect bridle wire jumpers to open wire with bridging connectors, as shown in Fig. 11.

Use a screw driver or knife to break out openings in moulded base of arrester under binding posts to be used.

Loosen nuts on binding post.

Remove insulation from wire and place it under bottom washer and ¾ way around post in direction that nut tightens. Leave insulation ⅛ inch away from washer. Tighten nut.

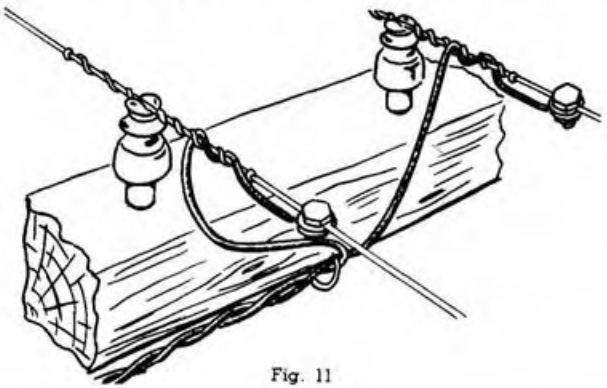

Fig. 11

POLES ON AERIAL CABLE ROUTE:

When Cook No. 7 Lightning Arresters are required at unprotected terminals, drop is brought first into arrester from which it is looped into terminal.

Break out a large enough opening in the moulded base to permit looping drop wire through arrester in this fashion.

When arrester is located below terminal on cable side of pole, place "C" bridle rings 1 inch from each end and 2 inches below lower mounting screws of arrester. Fig. 12.

When arrester is located on face of pole with lower mounting screws in line with lower mounting screws of terminal, place "C" bridle ring under side of arrester nearest terminal. Fig. 13.

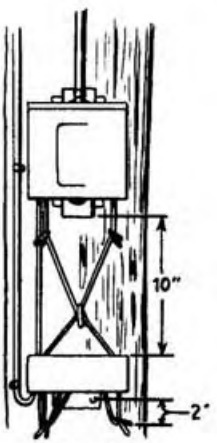

Fig. 12

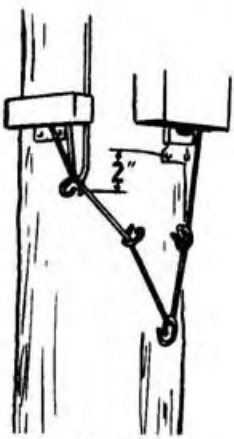

Fig. 13

MAINTENANCE OF COOK No. 7 LIGHTNING ARRESTERS

Preventive maintenance carried out during each visit to a pole equipped with lightning arresters provides extra assurance that the arrester will always be in proper working order.

Replace missing protector blocks with individual plastic arrester units or tru gap arrester blocks.

Arresters with any burned or broken holding springs should be replaced with new Cook 7 Lightning Arrester.

Inspect the strand ground clamp. It should be tight and all fasteners should be in place.

Check the ground connection at the terminals.

See that the arrester is fastened securely.

See that the hood is in place after each visit to the arrester.

SECTION IV

COOK SUB-STATION PROTECTORS

INDEX TO CONTENTS

SELECTION OR PROPER SUB-STATION PROTECTOR

Table I, will be helpful in selecting the correct Sub-Station Protector for a specific installation. A type U Sub-Station Protector should be installed originally where it is obvious that 4 or 5 exposed lines will be required eventually at a given location.

TABLE I

Number of Protectors to be installed		*Use this Sub-Station Protector*	
Now	*Possible*	*Quantity*	*Type*
1	3	1	O or R
2	3	2	O or R
3	3	3	O or R
		or	
		1	U
1-5	4-5	1	U

INSTALLATION OF SUB-STATION PROTECTORS:

The best location for a sub-station protector is on an outside building wall directly under the first drop attachment on building. Occasionally, the presence of a window or doorway under drop attachment will make it necessary to run drop wire a short distance along the wall to a safer and more readily accessible location. However, in all instances, make drop exposure on building as short as possible.

HEIGHT ABOVE GROUND:

Locate bottom screw of mounting bracket 5 feet above ground. This is a convenient working height and, also, the protector will be out of reach of small children.

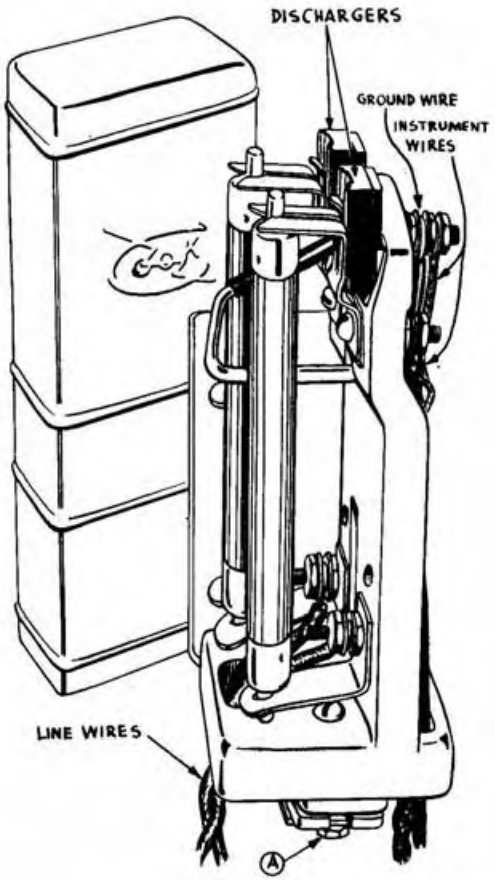

Fig. 1

TO INSTALL COOK TYPE O SUB-STATION PROTECTOR:

Loosen 2 nuts (A) holding protector to bracket. Fig. 1.
Slide protector out of bracket.
Mount bracket on wall. Use 4 fasteners as selected from Table II. For further information on fasteners see Section V, "Fastening Devices".
Slide protector in place.
Tighten 2 nuts (A) to fasten protector to bracket, Fig. 2.

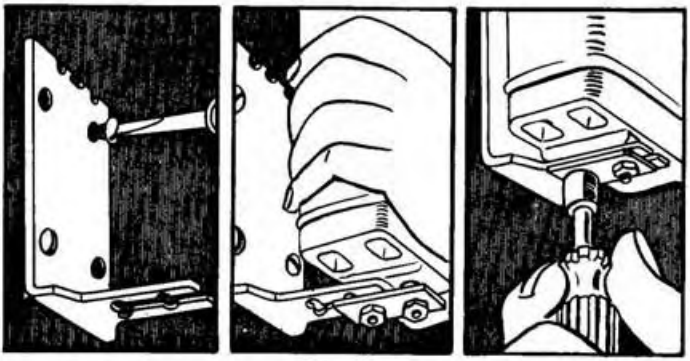

Fig. 2

WIRING:

When terminating wire on protector binding posts, place bared end of wire under washers and ¾ way around binding post in a clock-wise direction (direction nut tightens), leave insulation ⅛ inch back from washer. See Fig. 3. Place socket wrench over binding post nut, push washers and wire back to seating position to prevent wire becoming caught between washers and threads of binding post, and tighten nut firmly.

Terminate ground wire and terminate instrument wires, Fig. 4.

NOTE: *3 conductor station wire is shown. If 2 conductor wire is used disregard connection to ground for metallic circuits or one line connection in the case of ground return circuits.*

Remove fuses and terminate line wires.

Replace fuses. Insert end of fuse first in lower contact spring then press other end of fuse into upper contact spring.

Place cover on protector.

The protector installation is completed.

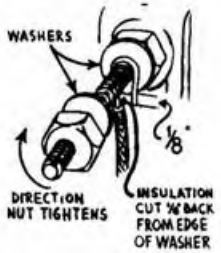

Fig. 3

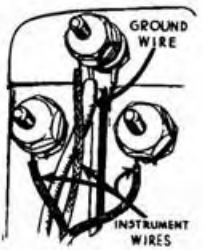

Fig. 4

TO INSTALL COOK TYPE RO SUB-STATION PROTECTOR: (Refer to Fig. 5):

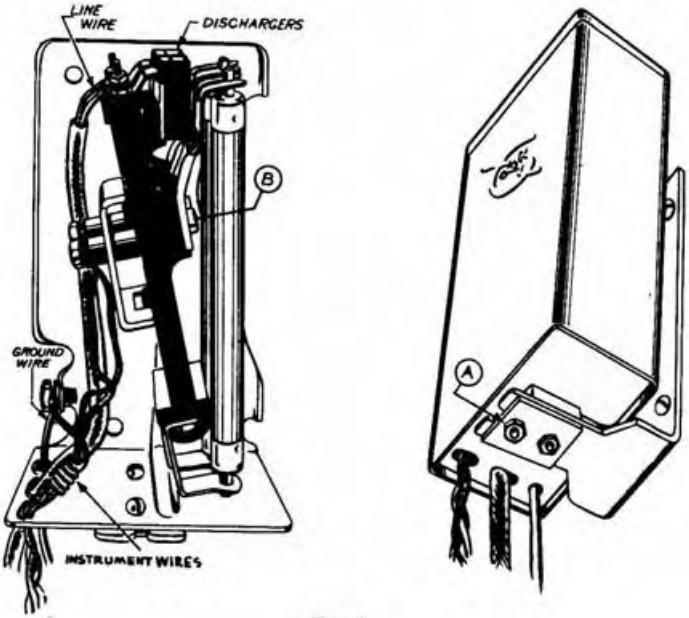

Fig. 5

Loosen 2 nuts (A) holding protector frame to mounting bracket. Mount bracket on wall. Use fasteners as selected from Table II. Slide frame in place. Tighten 2 nuts (A).

Remove fuses from Type H Protector Mount.

Install Type H Protector Mount on frame with 2 screws (B). Replace Fuses. Insert end of fuse first into lower contact spring then press other end of fuse into upper contact spring.

WIRING:

Terminate ground wire. Terminate instrument wires.

NOTE: *3 conductor instrument wire is shown. If 2 conductor wire is used disregard connection to ground for metallic circuits or one line connection in the case of ground return circuits.*

Terminate line wires. Place cover on protector.

TO INSTALL COOK TYPE U SUB-STATION PROTECTOR:

Mount Protector on wall. Use 4 fasteners as selected from Table II. Leave protector frame attached to brackets. For further information on fasteners, see Section V, "Fastening Devices".

Remove Fuses from Type H Protector Mount.

Install Type H Protector Mount on frame with 2 screws (A). Fig. 6.

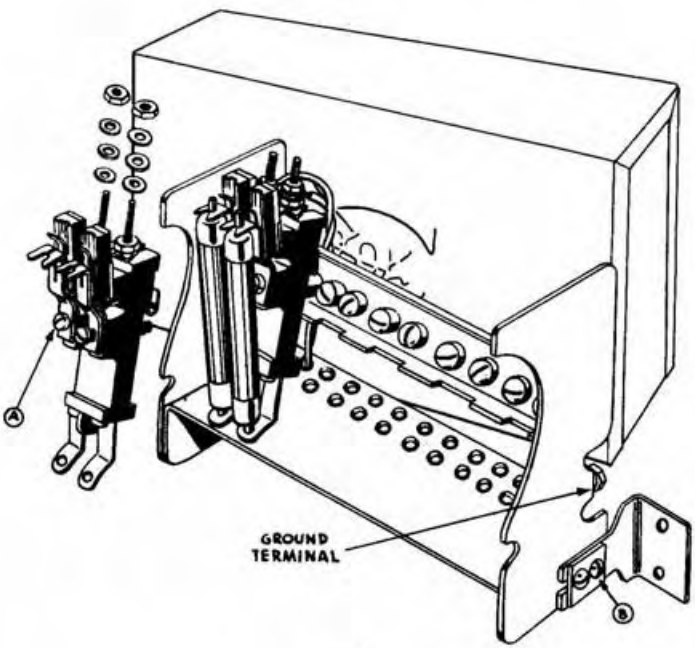

Fig. 6

Replace fuses. Insert end of fuse first into lower contact spring, then press other end of fuse into upper contact spring.

WIRING:

Remove rear mounting screw (B) on each side of protector frame. Fig. 6.

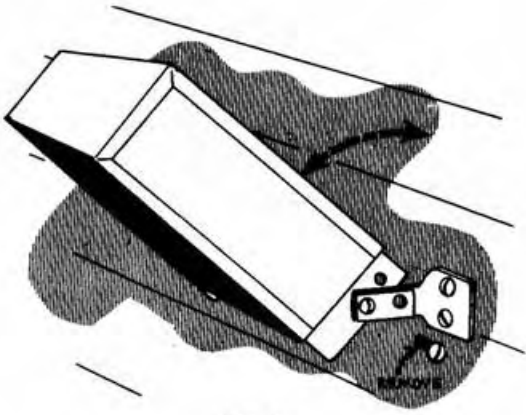

Fig. 7

Tip entire unit forward, Fig. 7. The front mounting screws act as pivots.
Terminate ground.
Terminate station wires. Fig. 6.
Designate instrument wire by address or telephone number with linen tag or lead markers tag. Tie tag to station wire.
Terminate line wires.
Swing entire unit back into position and replace rear mounting screws. Be sure all mounting screws are tight.
Place cover on protector.
The protector installation is completed.

TABLE II

FASTENERS FOR COOK SUB-STATION PROTECTORS WITH MOUNTING BRACKETS

On this surface	*Use these fasteners*
Wood	1 inch No. 8 R. H. Galv. Wood Screws.
Masonry	1¼ No. 8 R. H. Galv. Wood Screws with 6-8 by 1½ inch lead screws anchors or equivalent.
Tile	⅜ by 3 inch R. H. Galv. Toggle Bolts.
Asbestos Shingles	1½ inch No. 8 R. H. Galv. Wood Screws.
Asphalt Siding	2 inch No. 8 R. H. Galv. Wood Screws.
Metal Siding	1 inch No. 8 R. H. Sheet Metal Screws.

NOTE: *For complete instructions on how to place each of these fasteners, see Section V.*

SUB-STATION PROTECTOR GROUNDS:

A good, permanent ground is essential to the proper function of any protection equipment. For this reason, installation of ground clamps, ground rods and ground wire should be given careful consideration and execution.

To establish a good protector ground at a given location, select the best combination of the following factors:

LOW RESISTANCE GROUND:

Resistance of ground should not exceed 5 Ohms.

DIRECT ROUTE:

There should be no more than 3 right angle direction changes in the ground wire route between protector and ground connection. This may prove to be the factor directing a decision to use a ground rod instead of a water pipe ground connection.

WIRE CAPACITY:

No. 14 rubber-covered or equivalent ground wire is adequate for 3 Type O or Type R Sub-Station Protectors.

No. 12 rubber-covered or equivalent ground wire is adequate for 1 Type U Sub-Station Protector.

RECOMMENDED GROUNDS:

Unless there are local ordinances or restrictions to the contrary, recommended grounds for sub-station protectors, in the order of their preference, are as follows:

PUBLIC WATER SYSTEM:

Make attachment to cold water pipe in regular service.

Connect to main or street side or any rubber or insulating joint.

Where supply tank is used, make connection only to inlet pipe.

PRIVATE WATER SYSTEM:

Use only if 10 or more feet of metallic pipe is buried in moist earth at a depth where it will not freeze.

Attach to cold water pipe in regular service.

Make connection to well supply pipe or inlet side of storage tank.

GROUND ROD:

Use a 5 or 6 foot ground rod for each sub-station protector where only mild freezing weather is experienced.

Use an 8 or 10 foot ground rod where freezing conditions are severe.

An 8 or 10 foot ground rod is recommended at all public coin stations. (To insure better operation of coin relay when one side of line and ground is used.)

Where adjacent sub-station protector are installed at the same location, place strap between protector ground terminals in addition to using separate ground rod and ground wire for each protector.

GROUNDED METALLIC STRUCTURES:
(Pipes, Conduits, Tanks, etc.)

Use these structures only if of a permanent nature and only when this ground would be better than a ground rod.

CAUTION:

There are a few precautions to observe when selecting a sub-station protector ground. Do not make connection to the following:

PUBLIC GAS SYSTEM PIPES:

Generally, pipes used in public gas systems are of black iron. For this reason, they often are covered with rust which tends to increase the overall resistance to ground both at the ground wire connection and through various pipe joints and other connections. Since other methods are available, gas pipes should not be used for sub-station ground connections.

HOT WATER PIPES:

STEAMPIPES:

COLD WATER PIPES NOT REGULARLY IN USE:

BUILDING SIDE OF INSULATING JOINTS:

BURIED TANKS USED FOR STORING INFLAMMABLE LIQUIDS:

MAKING CONNECTION TO GROUND

SELECTION OF GROUND:

If possible, use cold water pipe in basement or cellar, and locate ground clamp where it not likely to be disturbed. However, a well-placed ground rod should be used if any one of the following conditions prevail:

Water pipe ground is prohibited.

Buried pipe of water system is less than 10 feet in length.

Water pipe is over 40 feet from protector.

Ground wire route would make more than 3 right angled turns between protector and ground connection.

PLACING GROUND CLAMPS:

Scrape off paint or rust to width of clamp. Then clean this surface of black, galvanized or lead pipes with abrasive cloth. On brass or copper pipes apply only soft pressure on abrasive cloth.

Clean chromium or nickel plated pipes with damp cloth. If tarnished, chrome and nickel can be cleaned with any commercial polishing or cleaning paste.

Place set screw and terminating lock nut of clamp on top or side of pipe.

NOTE: *On under side of pipe these vital parts of the clamp would be exposed to constant moisture or condensation that gathers on cold water pipes.*

On pipes ¾ inch and larger, clamp can be drawn up tight so that it will not turn on pipe. Test tightness of clamp by grasping pipe with fingers and pushing on clamp with thumb, see Fig. 8. On pipes under ¾ inch in diameter, draw up clamp to snug fit, although it still may be possible to turn clamp under pressure. CAUTION: Drawing up clamp too tight may dent brass or copper tubing.

Place a warning tag to advise customer to call Telephone Company if clamp or wire is loose or must be removed, see Fig. 9.

Fig. 8

Fig. 9

PLACING GROUND RODS

A ground rod, well placed in moist earth, makes a good ground connection. It is important to select location where ground rod will not be subject to damage or tampering. After the rod is installed, the ground resistance should be measured to determine whether or not the installed ground has a resistance of 5 Ohms or less.

Observe the following clearances when placing a ground rod:

Minimum distance to —

Foreign ground rod system (Power, Lightning, Radio, etc.)	6 Feet
Another Telephone Ground Rod	12 Inches
Building Wall (Outside)	18 Inches *
Wooden Poles	24 Inches

* A ground rod placed 18 inches from building wall will be out beyond overhanging eaves. In this location, ground is kept moist by regular rainfall. Hence, a better ground is obtained.

INSTALLATION PROCEDURE. See Fig. 10:

Remove sod and dig narrow trench 6 inches between wall or pole and rod location.

Before driving rod, make sure tail wire is not broken loose. Wrap soldered tail wire joint with one layer of ¾ inch friction tape, extending tape 2 or 3 inches out on tail wire. This will prevent soldered joint from loosening because of vibration set up during driving operation.

Angle rod slightly away from building and drive rod to a depth of approximately 3 inches below ground surface. Stand on ladder to start driving 8 to 10 foot rods or use sectional rods.

Attach ground wire to tail wire with twist sleeve or pressed sleeve splices.

Bury splice and replace sod in trench.

Place ground wire fastener on wall as near as possible to ground surface level. Space additional fasteners every 16 inches up side of wall to protector location.

Fig. 10

MEASURING RESISTANCE OF GROUND:

Be sure ground resistance is 5 Ohms or less.

Do not attempt to guess the electrical characteristics of the soil in which a ground rod is placed. To do so may result in serious errors. There are two accepted methods of measuring resistance to ground, namely, Direct Reading and Voltmeter-Ammeter.

DIRECT READING METHOD:

The direct reading method of determining ground resistance should be used wherever possible. Instruments used for this test give accurate direct readings in Ohms. Thus, there is no chance of making an error because of a mistake in computation of figures obtained by more complicated methods.

To make the direct reading ground resistance test, as shown in Fig. 11, place 2 reference or auxiliary ground rods, 2 or 3 feet in length, at least 5 feet from ground being tested and from each other.

Attach insulated test leads to each of the three grounds and terminate leads on terminals of testing instrument according to instructions supplied by manufacturers of these instruments.

Test current is furnished by a battery or hand generator built into the instrument.

The instrument meter reading indicates the resistance to earth of ground being tested.

VOLTMETER — AMMETER METHOD:

Measure the resistance between A and B denoted as "X" in Fig. 11.

Measure the resistance between A and C denoted as "Y".

Measure the resistance between B and C denoted as "Z".

Add resistance "X" and "Y" together and subtract resistance "Z" from the sum.

Divide the remainder by 2. The quotient is the resistance to ground of ground "A".

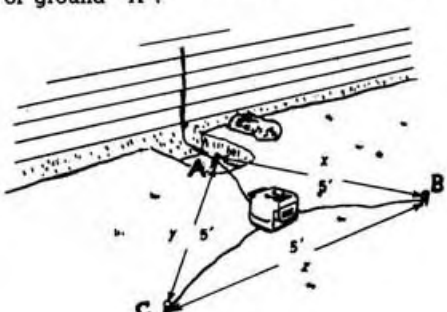

Fig. 11

LOWERING RESISTANCE OF GROUND

USE OF ADDITIONAL GROUND RODS:

If the measured resistance to earth of the protector ground is more than 5 Ohms, installation of a second ground rod connected to the protector ground wire (in multiple with first rod)will result in considerable reduction in the resistance to earth.

If necessary, additional rods connected in multiple will result in further reduction of resistance.

TREATMENT OF SOIL:

In some localities soil treatment is the only means of lowering resistance of high resistance grounds.

Crystals of Magnesium Sulphate, Copper Sulphate or Common Rock Salt are recommended for treating soil around a ground rod. If these crystals are placed in direct contact with a ground rod there is the possibility that corrosion may destroy the rod. Therefore, crystals should be placed a few inches away from the rod.

TRENCH METHOD, Fig. 12:

Remove sod and dig a circular trench around ground rod approximately 42 inches outside diameter and 18 inches inside diameter.

Fill trench 10 inches deep with soil treating crystals.

Replace layer of dirt and sod.

Soak treated area with water. Normal rainfall should be sufficient to continue carrying solution into earth.

CONTAINER METHOD, Fig. 13:

The method should be used where space is insufficient to permit use of trench method.

Place standard length of 8 inches glazed tile flush with ground approximately 4 inches from rod.

Fill tile to within 4 inches of top with soil treating crystals.

Fill tile with water.

Place perforated removal cover over top of tile. Yearly, or under severe conditions every 6 months, retest resistance to earth of treated grounds, and replenish treating crystals as indicated by these tests.

Fig. 12

Fig. 13

FASTENING GROUND WIRE BETWEEN PROTECTOR AND GROUND CLAMP

These instructions continue from the point where ground wire was terminated at protector. If more convenient, place ground wire before connecting to protector.

In many localities splicing of ground wire is prohibited. Where it is allowed, make a splice only when 10 or more feet of good wire can be reused. New wire added should be same gauge as that already in place.

Run ground wire open. Wire must be visible except where it passes through wall or partition. The only alternative is placing in an approved conduit.

Select shortest and most direct run. There should be no more than 3 right-angled or equivalent turns in wire route.

Maintain minimum (greater if possible) clearances or apply additional protection to wire as indicated in Table No. III.

Place ground wire under separate standard ground wire fasteners. Protector ground wire may be in contact with or may pass through same hole with station wire, however, do not twist ground wire and station wire together.

When wire is within 5 feet of floor, space fasteners 16 inches apart. If wire is more than 5 feet above floor, fasteners may be spaced 24 inches apart.

Place a fastener 1 inch in each direction from corner or turn in wire run.

To prevent pipe vibration from breaking ground wire, allow at least 6 inches between clamp and fastener. When pipe is subject to undue vibration place clamp near a pipe support.

Terminate wire on clamp. Remove insulation from end of wire; place wire under washer and ¾ way around binding post or set screw of clamp in clockwise direction (direction nut tightens): leave insulation ⅛ inch from washer and tighten lock nut. 2 inches of slack can be provided by placing terminating lock nut of clamp on side of pipe opposite that from which the wire approaches. Do not form wire in a spiral or wrap it around pipe to provide slack. To do so may cause the ground wire to fail under load of lightning discharge.

TABLE III

Locate obstruction in first column.

Check minimum clearance shown in second column.

If minimum clearance cannot be secured, apply extra protection on ground wire as specified in third column.

NOTE: *This same table can be used for station wires as well.*

TABLE III

Minimum Clearances for Telephone Ground Wires
Ground Resistance 5 or less Ohms

Type of Obstruction (Crossing or Paralleling)	*Maintain This Minimum Clearance*	*Or Apply This Protection to Wire*
Lightning Rod System	6 Feet	None. Maintain 6 ft. separation.
Telephone Ground Rod to Other Ground Rod	6 Feet	
Neon Signs	6 Inches	Use lead cable and ground sheath.
Radio Wiring	4 Inches	
Open Power Wiring (Not over 750 Volts)	2 Inches	Place ground wire through porcelain tube. 2 inch lap each side of obstruction.
Open Signal Wires (Extended beyond building and not equipped with approved protector.)	2 Inches	
Exposed Telephone Wiring	2 Inches	
Steam Pipes (Not insulated)	½ Inch	
Electric Conduit (All types)	½ Inch	
Other Foreign Wiring and Ground Wires (except radio)	½ Inch	2 layers of friction tape over 2 layers of rubber tape. 2 inch lap each side of obstruction.
Open Signal Wires (Interior or equipped with approved protector at building entrance)	½ Inch	
Pipes (Gas, Oil, Sewer, Water)	½ Inch	
Metal Beams	½ Inch	
Around Sharp Corners, Through Metal Gratings, Behind Fire Shutters, etc.	———	2 layers of friction tape. 2 inch lap each side of obstruction.

INSTALLING SUB-STATION PROTECTORS AT INDOOR LOCATIONS

The installation of sub-station protectors on outside building walls offers many advantages to the building owner and to the Telephone Company from a protection viewpoint, from an appearance and cost standpoint and accessibility for maintenance.

INDOOR LOCATIONS:

Maintain a minimum of one foot separation between protectors and electric light or power meters, wires, switch boxes, etc.

Be sure protector cover will come off.

Locate protectors at least 6 inches from window curtains.

Conditions encountered only at indoor locations that should be avoided are:

Locked storerooms.

Coal or wood storage bins — empty or full.

Locations over laundry tubs, sinks, stoves, furnaces, boilers, ovens, etc.

Surfaces under leaking water pipes.

Places exposed to escaping steam or chemical fumes.

Storage racks where tools, lumber, pipe or similar merchandise would damage protector or wiring.

Places within easy reach of children.

Joists of sub-flooring over unfinished basements.

(A protector installed on a joist or sub-flooring over an unfinished basement, may be "buried" when the ceiling is finished. "Buried" protectors must be relocated, therefore, before using one of these locations determine whether or not the basement is finished.)

FROM A SAFETY STANDPOINT:

Avoid places where workmen would be exposed to hazard of power wires, moving machinery, compressors, exhaust fans, power transmission belts, etc.

Avoid locations where inflammable materials would rest against an open protector, also rooms where dust or combustible gas is present.

INSTALLATION AND WIRING:

Install and wire all sub-station protectors at inside locations in same manner as instructions indicate for outdoor location.

INSPECTION AND MAINTENANCE OF SUB-STATION PROTECTORS

During each maintenance visit or service visit to a subscriber's premises, inspect the sub-station protector and its related parts. Routine inspection helps insure that the sub-station protector installation is in proper condition.

If any discrepancies are found in the protector installation make necessary repairs at once.

Check the following at each installation:

Remove any dirt collected on the protector unit or mounting bracket.

Inspect fuses.

Carbon blocks that are missing or pitted should be replaced.

Protectors with badly cracked or chipped porcelain bases should be replaced.

Be sure the cap over the dischargers is in place.

Inspect all wire terminals. Connections should be clean and tight. Check with No. 452-500 handy socket wrench.

Insulation on wires should be cut back 1/8 inch from binding post washers.

Trace ground wire from protector to ground clamp or ground rod. Install proper mechanical protection on wire where there is not adequate clearance from foreign wires or other objects. Place additional fasteners where required.

Inspect ground clamp. If badly corroded or broken install a new ground clamp. If in good condition but loose, remove clamp, clean pipe surface, replace clamp and reterminate wire.

At some station installations it will be found that, because of alterations, the protector ground wire may pass an approved ground before it reaches the ground clamp as originally placed. Conditions of this sort should be corrected by placing a ground clamp at the new location; cutting back ground wire and terminating it at newly placed clamp.

Inspect ground rod. Ground resistance does not remain constant, therefore, resistance test should be made at least once a year and high resistance corrected.

SECTION V

FASTENING DEVICES

INDEX TO CONTENTS

SECTION V

FASTENING DEVICES

This section tells how to install fastening devices specified for mounting sub-station protectors, Type XB and Cook S-20 Terminals, and No. 7 Lightning Arresters. The type and size of fastener to use with any particular unit is listed in the section devoted to that unit.

WOOD SCREWS:

Used in wood or in screw anchors.

The wood screw is one of the most popular of all fasteners used in the telephone plant. Its greater holding power as compared with a common nail lies in the fact that it cuts a thread in the wood fibre into which it is installed.

INSTALLATION PROCEDURE:

Drill lead hole one half diameter of screw being used.

Force small amount of lubricant — soap, paraffin or beeswax —into lead hole. Lubricant makes the job easier. Also, it helps the screw cut, instead of "chew" its way into the wood fibres. Thus, the screw develops greater holding power.

Use screwdriver with blade as wide as screw slot. Blade should be properly sharpened. Check it with a new screwdriver.

Work directly from shoulder. Keep face out of line of work to prevent injury in case screwdriver should slip.

Turn screw slowly with little downward pressure. Hold screwdriver bit in screw slot until screw is well started. See Fig. 1.

Slide hand back on shank of screwdriver as a safety guide while seating screw. Fig. 2.

Fig. 1

Fig. 2

INSTALLATION OF WOOD SCREW ON ASBESTOS OR RIGID SHINGLE AND STUCCO

These surfaces are extremely brittle, therefore, do not use hammer during any of the operations.

INSTALLATION PROCEDURE

STUCCO:

Drill clearance holes for all screws placed in stucco. Use twist drill for this operation.

Drill lead hole one half diameter of screw into wood backing and continue with normal installation of wood screw.

If stucco appears loose, relocate mounting bracket on substantial wood trim.

ASBESTOS SHINGLE:

Solid section is within ¾ inch of lower edge of each shingle. Locate lower screw holes of mounting bracket within this area. See Fig. 3.

Drill a clearance hole through shingle. This hole should be large enough to permit screw to enter freely without forcing against shingle. Ue a twist drill for this operation.

Drill lead hole one half diameter of screw into wood backing and continue with normal installation of wood screw.

Draw up screw snug, but not tight.

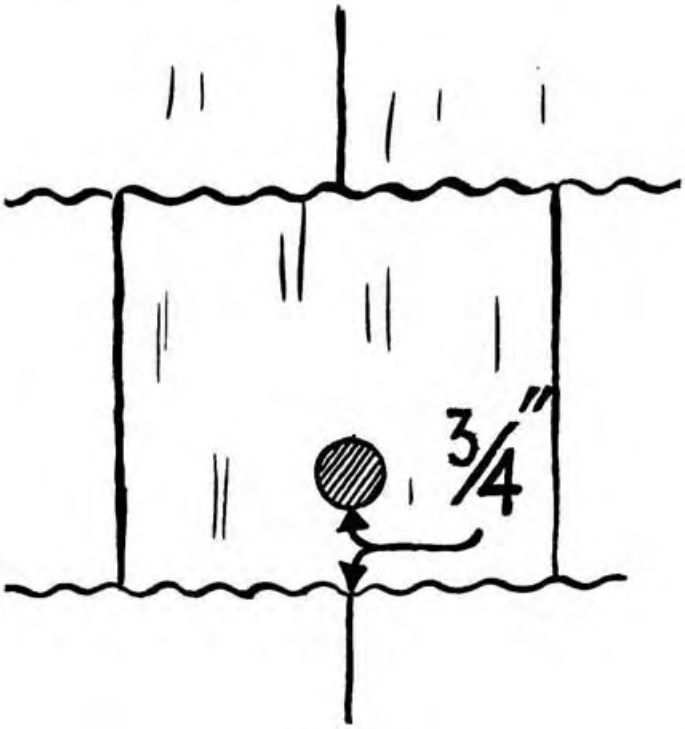

Fig. 3

SCREW ANCHORS:

Screw anchors are used to fasten mounting brackets to solid masonry surfaces. A hole, with a diameter to accommodate the anchor and a depth sufficient to allow anchor and wood screw to be installed full length, is drilled in the masonry. When the screw is inserted in the anchor it acts as a wedge to make a firm fastening combination.

INSTALLATION PROCEDURE:

Select anchor and screw as specified for a particular mounting bracket.

Use masonry drill as determined by measuring outside diameter of unexpanded anchor.

6-8 anchor requires ¼ inch hole, 10-12-14 anchor requires 5/16 inch hole.

Drill masonry (center of bricks) to depth required to permit anchor and screw to be installed full length.

Place anchor in hole . If necessary, tap lightly to make it flush with mounting surface. Fig. 4.

Insert screw through mounting bracket into anchor and turn it down with screwdriver until the head seats firmly against bracket. Fig. 5.

If bracket is to be removed, back out the screw with screwdriver.

DRIVE ANCHORS:

Drive anchors are used to fasten mounting brackets to solid masonry surface. A hole, with a diameter to accommodate the anchor and a depth sufficient to allow anchor and nail to be installed full length, is drilled in the masonry. When the nail is driven into the anchor it acts as a wedge to make a firm fastening combination . Generally, drive anchors can be installed in less time than screw anchors.

Fig. 4

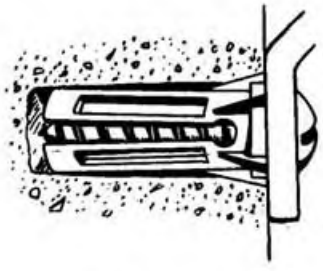

Fig. 5

INSTALLATION PROCEDURE:

Select drive anchor as specified for a particular mounting bracket.

Use masonry drill as indicated by diameter of anchor.

Drill masonry (center of bricks) to depth required to permit anchor and nail to be installed full length.

Insert anchor through hole of mounting bracket and into drilled hole. If necessary, tap lightly until flange rests against surface of mounting bracket. Fig. 6. Insert nail into the anchor and drive it in until the head seats firmly. Do not strike the nail after it is seated firmly. To do so will tend to loosen the anchor. Fig. 7.

To remove anchor, loosen nail with cold chisel, insert jaws of standard claw hammer between nail head and flange of anchor and pull out nail. After all nails have been removed mounting bracket and anchors can be pried loose.

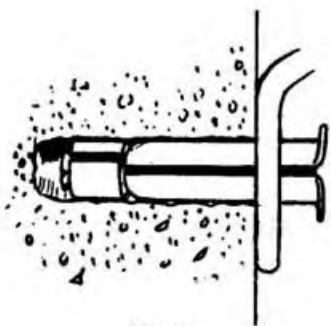

Fig. 6

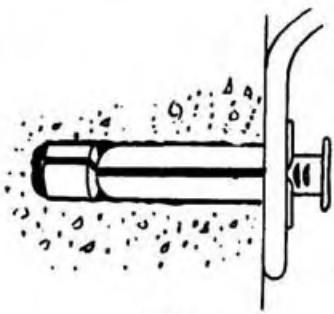

Fig. 7

TOGGLE BOLTS:

Toggle bolts are used to fasten mounting brackets to hollow tile and similar surfaces. There are two general types of toggle bolts, namely, the spring type and the gravity or flop-over type. Fig. 8. The strength of the completed toggle bolt installation depends upon obtaining a secure bearing area for the toggle head inside the hollow space of the wall. To obtain a secure bearing area for the toggle head requires that the hole drilled in mounting surface be of minimum diameter and that there is a hollow space inside the wall to allow toggle head to open or flop over.

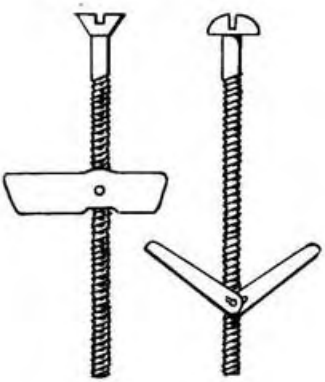

Fig. 8

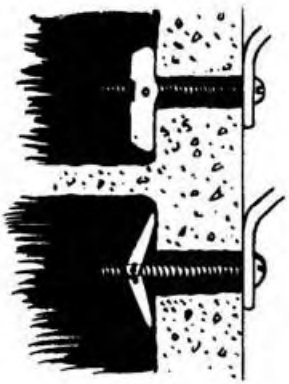

Fig. 9

INSTALLATION PROCEDURE:

Select proper size toggle bolt as specified for a particular mounting bracket.

For ⅛ inch toggle bolt drill ½ inch hole. For ¼ inch toggle bolt drill ¾ inch hole.

If star drill is used on hollow tile apply light taps with hammer and rotate drill slowly. If a partition is struck tilt drill toward hollow chamber to left or right.

Remove toggle head. Measure depth of hole with bolt to be sure bolt can be seated properly.

Insert bolt through mounting hole of bracket. Start toggle head on end of bolt. If bolt is too long, cut off excess length after toggle head is replaced on bolt.

Insert toggle head through hole into hollow chamber. Toggle head will assume holding position after it enters hole. Fig. 9.

Fig. 10

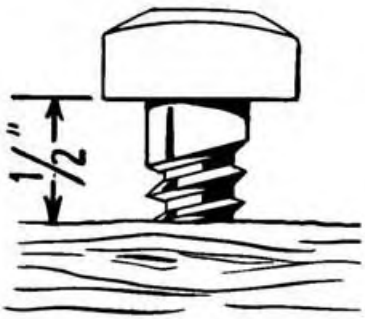

Fig. 11

Draw toggle head back against bearing surface to prevent it from turning and turn down bolt until head seats firmly. Fig. 10. Some toggle bolt manufacturers furnish a small metal clip with each box of bolts to facilitate this part of the operation.

LAG SCREWS (Sometimes called lag bolts or drive screws):

There are heavy screws with square heads used to fasten terminal mounting brackets to poles. Fig. 11.

INSTALLATION PROCEDURE:

Drive in screw with hammer until within ½ inch of head. Fig. 12.

Seat screw firmly by turning with wrench.

To remove turn out screw with wrench.

If pole is less than 4 inches in diameter, drill lead hole one half diameter of lag screw.

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