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T. P. T. & T. Co.

CABLE SPLICING

SPLICING CABLE WITH CHANNELL WIRE JOINING TOOL

Contents

1. GENERAL

1.01 The wire joining tools have been designed to automatically cut off the excess wire length, twist the conductors, and slide a cotton sleeve over the splice in one operation of a hand lever. The tools may be used on aerial, block, house, and underground cables. Normally it will not be found desirable to use joining tools to splice cables smaller than 200 pair.

1.02 There are three types of wire joining tools. The tools are essentially the same in appearance and operation. The main difference in the three tools is in the number and size of wires which may be spliced in one operation and in the number of cotton sleeves used per pair. Those joining tools which are capable of splicing a pair at a time may also be used to splice a single wire at a time, if desired. Tools are designated Types K, L, and M and their capacities are shown in the following table:

Wire Joining Tool Type	Gauge	Pairs in One Operation		Cotton Sleeves per Pair		Sleeve Banks
		Straight & Butt Splices	Bridge Splices	Straight & Butt Splices	Bridge Splices	
K	22	1	1/2	2	2	3
	24,26	1	1	2	2	3
L	22	1	1/2	1 *	2	2
	24,26	1	1	1 *	1 *	2
M	19	1/2	1/2	2	2	3

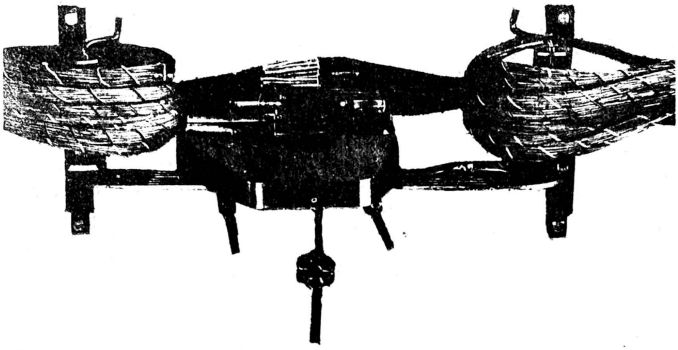
* Pulp insulated cables only

1.03 The methods of preparing the cable ends, setting up the joining tool, splicing the cable, removing the tool and covering the splice are practically the same for all three tools. The operations with a Type K tool will be explained in detail herein. Except for the difference in capacities and minor details the operation of the other two tools will be fundamentally the same.

1.04 The standard practices applying generally to lead covered cable splicing, apply also to cables spliced with a wire joining tool, except as otherwise provided for in this section or in the detail plans.

2. DESCRIPTION OF WIRE JOINING TOOLS

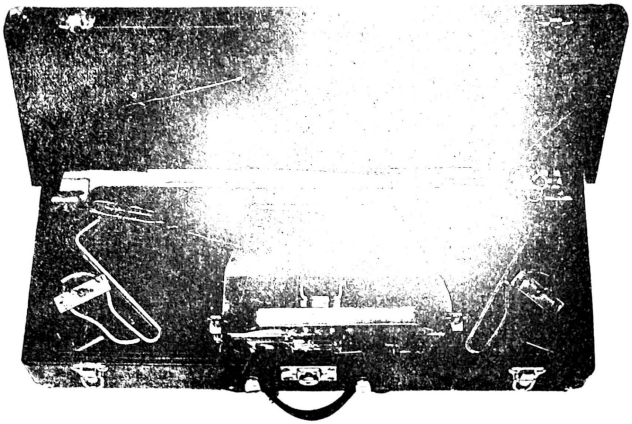
2.01 The wire joining tool consists of a mechanism for twisting the copper conductors and sliding an insulating cotton sleeve over the splice. The cotton sleeves are placed on the wires which are then placed in the tool, pulling off the paper insulation in one movement. Operation of a lever handle on the right hand side of the tool then cuts off the excess wire, twists the wires, bends over the splices, slides the insulating sleeves over the splices, and throws the splices out of the tool to the rear. The complete set up is illustrated in the following photograph.



2.02 The tool alone is approximately 12 in. x 4 in. x 21 in. including the handle. It weighs about 16 pounds.

NOTE: The joining tool contains a number of small parts, springs, gears, etc. and should be treated with care. It should not be submerged or dropped. It should be carried by the handle or by the handhole in the back of the base.

2.03 The joining tool is provided with a carrying case arranged for storing and transporting all parts. The complete equipment weighs about 40 pounds. The case is approximately 14 inches wide, 5 inches high, and 29 inches long. A handle is provided for carrying. The tool and all parts should be securely fastened down inside the carrying case when not actually set up for splicing cable. The arrangement of the parts in the case is shown in the following photograph.



3. PREPARATION FOR SPLICING

3.01 Form cable into position for splicing as provided in other sections of the Bell System Practices. A 24 inch overlap of the cables is sufficient. No special racks, hooks, supports, or other materials are required.

3.02 In all manholes a protective water-resistant piece of canvas approximately 24 in. x 30 in. should be hung on the wall behind the splice. On aerial cables the standard practices in setting up the cable should be followed.

3.03 Remove cable sheath to provide the size opening between the sheath ends shown in the following table. The use of one cotton sleeve per pair of wires with the Type L tool will permit the use of a size smaller diameter lead sleeve than the standard sleeve generally used in hand splicing.

Type of Wire Joining Tool	Sheath Opening (Inches)	Lead Sleeve	
		Length (Inches)	Diameter
K	21	24	Standard
L	19	22	1/2 in. smaller than standard
M	21	24	Standard

3.04 Prepared cotton sleeves of the size shown in the following table should be used:

Type of Wire Joining Tool	Types of Splices	Size of Cotton Sleeves
K	All	Standard
L	All	Standard
M	All	1/4 in. Single Wall

3.05 The conductors should be treated with paraffin or cold stripping oil. The color groups in unit type cables should be segregated in both cables to be spliced, tied and laid back alongside the cables as for hand splicing. Layer type cables should be divided approximately through the middle vertically and the color groups then segregated and tied so that about one half of each color is in the rear bunch.

3.06 Cut off one or two inches of the right hand conductors to remove damaged ends and facilitate placing the prepared cotton sleeves. Slide sleeves on the conductors on the right in accordance with the table in Paragraph 1.02 and the type of splice involved. If only one sleeve is being used per pair (Type L tool), the tip and ring wires should not be untwisted or separated in the operation of placing the sleeve. When two sleeves per pair are to be used, slide the sleeves without untwisting the wires more than is necessary to start the sleeves on the wires. The sleeves should be so located that when the wires are placed in the tool the sleeves will be just to the left of the sleeve pusher with the tool properly positioned for the sleeve bank that will be used for the group. Where bridged or butt splices are to be made refer to the paragraphs covering these splices.

NOTE: It will be found advantageous in most cases to have a helper placing the sleeves on the wires for the splicer. As the splicer finishes one group the next group should be ready with the sleeves in place.

4. PLACING TABLE FOR WIRE JOINING TOOL

4.01 After the cables have been prepared for splicing, attach the wire joining table. The tool parts and the operations described in this sub-section are the same for all three types of tools.

4.02 One table support is placed on the cable sheath at each end of the splicing position. Loosen the wing nut and open the clamp sufficiently to place it over the cable from below with the wing nut on the far side. The slot should be vertical with the round hole at the top.

(a) Place one support 1-1/2 inches from the end of the cable sheath where the splice opening is 21 inches. Where the opening is 19 inches, the support should be placed 2-1/2 inches from the end of the cable sheath. Tighten the wing nut hand tight on the first clamp when in position.

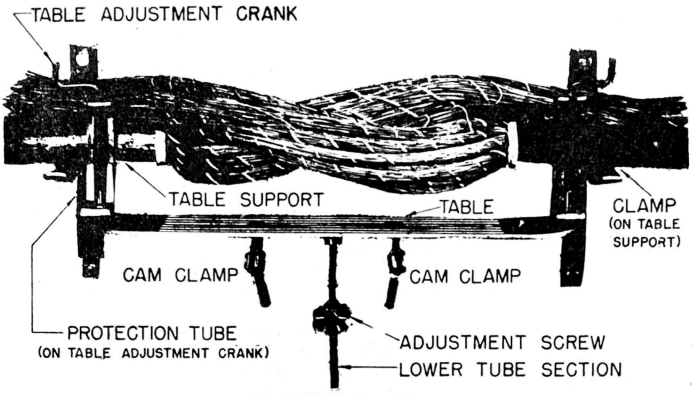
(b) Place the second support on the other cable approximately 2 inches from the end. Tighten the wing nut sufficiently to hold the support upright but still loose enough that the support may be moved easily sideways.

NOTE: On small cables it may be necessary to build up the diameter of the cable with wrappings of muslin until the clamps will fit.

4.03 Place the table on the table supports with the corrugations on the top side and the end pieces vertical. The button on the back of one of the vertical end sections should be placed through the hole at the top of the slot in the table support which was tightened in place. With the table held approximately horizontal, move the loose support until the button on the back of the other vertical end section of the table can be inserted in the hole at the top of the slot in the table support. Allow the table to slide downward until it reaches the bottom of the slots in the supports. Tighten the loose table support.

4.04 Place a table adjustment crank downward through the hole at the top of each table support. Place a protection tube over the threaded end of the crank and screw the crank shaft into the hole in the base of the table. Adjust the cranks until the lower ends are flush with the bottom of the table. Thereafter turn both cranks at the same time to make adjustments up or down.

4.05 Screw adjustable leg into the threaded hole in the center of the underside of the table. After it is hand tight, loosen the adjustment screw and allow the lower tube section of the adjustable leg to slide to the floor. Tighten adjustment screw to support table firmly.



4.06 Form the conductor groups from the left cable over the top of the wire joining table and to the left across the protection tube leaving out the rear lower group as the first group to be spliced. Form the right hand conductors similarly. The group to be spliced should be bent back behind the adjustment cranks and over the top of the cable. All but the group or bunch to be spliced should be tied to the cable, out of the way, with a piece of house-line, or cord.

5. PLACING WIRE JOINING TOOL IN POSITION

5.01 Place the wire joining tool, with the mechanism on top, handle to the right, across the table. Insert the head of each cam clamp through the hole at the end of the slots on the under side of the tool. Sufficient slack can be secured to do this by turning the handle of the cam clamp to the position where the handle points away from the operator and the round portion of the cam is upward. Slide the tool toward the center of the splice until it is in the proper position and then lock in place by pulling both cam clamp handles through an arc of about 90 degrees toward the operator. The buttons on the bottom of the joining tool should fit into the grooves in the table in order to hold the tool firmly.

5.02 The joining tool should be positioned so the farthest side or back of the tool is approximately in line with the centers of the cables. The top of the gear box should be on the same level or approximately even with the center of the group to be spliced. In this position the wires will have the correct amount of slack to form the splice properly. The tool may be raised or lowered by loosening the adjustment screw on the adjustable leg and turning both table adjustment cranks in the proper direction. The joining tool should be approximately level. The adjustment screw should be tightened again before splicing.

5.03 Marks are provided along the edge of the table to aid in spacing the banks of sleeves evenly. When three banks are to be made the right hand lower edge of the machine should be placed over the center mark on the table to place the wire splices in the center position. The left hand mark should be used for the second group and the right hand mark for the third group, repeating as often as necessary to complete the splice. Where only 2 banks of sleeves are required the left hand mark should be used first and then the right hand mark.

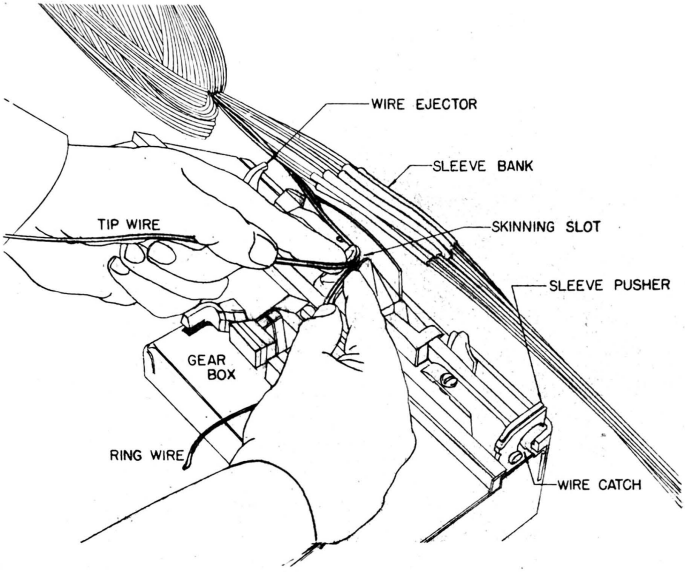
5.04 The tool may be moved by loosening both cam clamps, sliding the tool to the new position, and again tightening the two clamps.

6. SPLICING CABLE

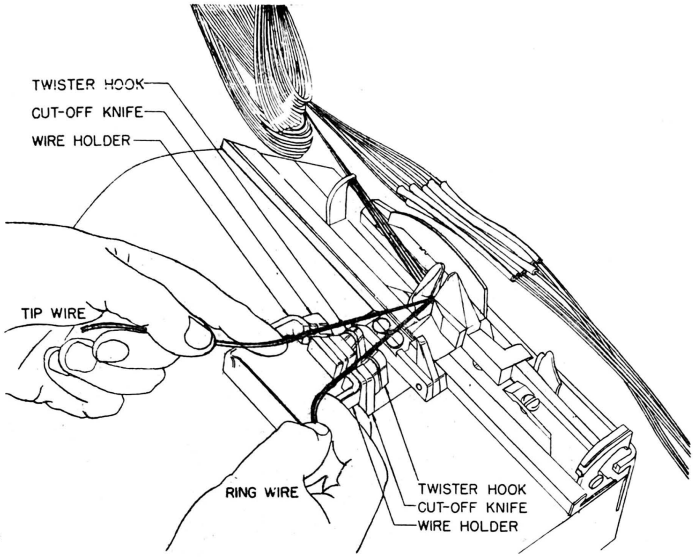
6.01 Straight Splices

The splicing of conductors (one pair, 2 cotton sleeves) with the Type K tool involves the following operations.

(a) Select a pair from bottom of left group to be spliced. Separate the pair to a point about half way between the skinning slot and the wire ejector, finishing with the ring wire in the right hand and the tip wire in the left hand. Bend both wires and place through the skinning slot - ring wire first.



Still holding one wire in each hand, break the insulation on the wires by bending the pair to the left about 45 degrees. (Wires from the left cable are always bent to the left in this operation and those from the right cable are bent to the right.) Then straighten the pair and pull the insulation straight back about 3 inches (just outside the cut-off knives).



Place the ring wire in the slot of the right hand cut-off knife and bend the wire around to the right under the wire holder. Place the left hand (tip) wire through the left slot and under the holder in the same manner except that the wire is bent to the left.

(b) Select a pair from the right on the bottom of the group to be spliced and pull the cotton sleeves to the left over the edge of the tool. Place pair through the wire catch of the sleeve pusher and slide the sleeves up against the left side of the pusher. Separate the wires of the pair, holding the ring wire in the right hand and the tip wire in the left hand. Place both wires through the skinning slot, ring wire first, and strip the insulation by first bending to the right and back as just described for the left wires. Again place the ring wire in the slot of the right hand cut-off knife and bend the wire around to the right under the wire holder. Place the tip wire

in the same manner as the tip wire from the left.

(c) Pull lever handle toward operator as far as it will go and return to its original position. The joining tool automatically cuts off the excessive wire, makes the wire twist, slides the sleeves over the twist, and throws the completed splice out to the rear of the tool.

6.02 Splice the next pair in the same manner, working upward through the group.

6.03 If a wire breaks during the insulation stripping operation, it should be removed from the joining tool and spliced by hand.

6.04 Slide a cotton sleeve aside occasionally and inspect the condition of the twist. Should there be any question about the twist being satisfactory, notify your supervisor.

6.05 If wires do not twist off properly, it is probably due to slow operation of the handle or a piece of wire caught in the twister hook. In the latter case, clear the twister hook. It is desirable to make frequent observation of the twisting operation of the tool.

6.06 The operations involved in making a splice with the Type L joining tool are similar to those with the Type K except for the following changes.

(a) The Type L tool is equipped with two skinning slots, the right hand slot being used for the ring wire and the left hand slot for the tip wire. Otherwise, the operation of stripping and placing the left hand wires is the same as described in Paragraph 6.01(a).

(b) On pulp insulated cables only one cotton sleeve is used with the Type L joining tool except on bridge splices, to protect the splices of both wires of a pair. Place the right hand pair through the wire catch, slide the sleeve up against the pusher, and then separate the wires of the pair almost to the left end of the sleeve. Hold the ring wire in the right hand, the tip wire in the left and place the wires in the two skinning slots, finishing the operation as described in Paragraph 6.01(a).

6.07 The type M wire joining tool is designed to splice only one side of a pair of 19 gauge wires

at a time.

(a) Separate the wires of the pair on the left and place one of the wires, preferably the ring wire, in the tool with the right hand. Choose the corresponding wire, ring or tip, from the selected pair on the right and place this wire in the tool. Splice these wires and then splice the mate wires of the pair.

6.08 On 600 pair and larger, unit type cables, splice a 100 pair group with the tool in one position, then move the tool for the next group. Cables smaller than 600 pair should be spliced in approximately 50 pair groups.

6.09 Layer type cables should be separated through the middle vertically and the wires spliced in approximately 50 pair groups. Move the wire joining tool to the next position as a change is made from one color group to the next. (Do not divide the color group into 2 banks of sleeves except that a color group in the front half of cable need not be in the same sleeve bank as that in the rear half.)

6.10 Adjust the joining tool vertically as required when changing to a new group. When about half the cable has been spliced move the tool toward the operator one groove on the table. Thereafter, move the tool whenever the size of the splice makes it necessary.

6.11 Bridge or Multiple Splices

(a) The splicing can be facilitated by forming branch cables into the right hand side of the splices. Here, the helper can select the wires from both the main cable and the stub to be bridged, separate, and match the tip and ring wires when placing the cotton sleeves. If the branch cable enters from the left, it is necessary for the splicer to select and segregate the wires as each pair is spliced.

(b) Bridge splices on 22 gauge cables should be made one side of a pair at a time with both the K and L type joining tools. 24 gauge or smaller wires may be spliced in the same general manner as a straight splice. Stub cables of 22 gauge or 24 gauge may be spliced to 19 gauge cables with the Type M tool.

(c) The same number of sleeve banks used in straight splicing should be formed for a bridge splice. Locate the tool so as to make the bridge splices in the banks of sleeves farthest from the stub cable end. Divide the straight pair splices, so approximately the same number of splices are in each bank of sleeves.

6.12 Butt Splices

(a) In making butt splices it is desirable, although not necessary, that the cables to be spliced be on the right. In this position the helper can select and separate the wires to be spliced, placing a sleeve over the two ring wires and another sleeve over the two tip wires. If the Type L tool is being used, the helper places the two pairs to be spliced in one sleeve, the splicer separating the tip and ring wires when placing the wires in the joining tool. When the cables are on the left, it is necessary to place the cotton sleeves by hand on the wires after splicing.

(b) Locate the joining tool so as to form the butt splices in the sleeve banks farthest from the stub cable end. Divide the straight pair splices among the sleeve banks as in Paragraph 6.11(c).

(c) If both cables for a butt splice are on one side only and neither runs through, place a piece of cable or wood on the opposite end of the splice to provide a means of attaching the table support. In this case, divide the splices evenly among the sleeve banks.

6.13 Quadded Cable Splices

(a) Prepare quad groups for splicing in accordance with the detail plans for the cable.

(b) A cotton sleeve should be placed on each wire of the cable on the right, maintaining the original quad identification.

(c) The splicer selects a quad from the left hand cable, separates the wires, places one wire in the tool, and strips the insulation as previously described. The proper right hand wire is then selected and placed in the tool. After this wire has been spliced, the other 3 wires of the quad are spliced before a new quad is selected.

7. REMOVAL OF JOINING TOOL

7.01 When the wire splicing operation has been completed the wire joining tool, adjustable leg, table, and supports should be removed, in that order. If the tool is not to be used again at the same location within a reasonable length of time it should be returned to the carrying case. The tool and the carrying case shall not be left in a manhole overnight or under any other conditions where it might become submerged.

8. COMPLETING SPLICE

8.01 The wrapping of the splice, placing of desiccant, and covering of the splice should be done as prescribed in other standard Bell System Practices. The size of lead sleeve required is shown in Paragraph 3.03.

9. CARE OF THE WIRE JOINING TOOLS

9.01 Wire joining tools should be handled carefully. Although ruggedly constructed, they are precision tools with some delicate parts, and should be treated with care. Do not drop a joining tool or place it where it might fall.

9.02 The tool should be transported by hand or in the carrying case. It should not be placed loose in a truck or splicer's trailer.

9.03 When required for use aloft or in a manhole, the joining tool should be raised and lowered in the carrying case by means of a handline. When working in shallow manholes, the tool may be passed into the manhole by hand.

9.04 Do not leave joining tools in manholes overnight or expose to rain or snow.

NOTE: Cover the tool with a small tarpaulin when not in use temporarily or remove and place in the carrying case. Keep the joining tool in the case when it is not in actual use.

9.05 The joining tool should not be placed where it may become coated with paraffin which might interfere with smooth operation.

9.06 Precautions should be exercised to exclude dirt and grit from the mechanism. Do not set the

wire joining tool down in dirt or sand.

9.07 The joining tool needs very little lubrication. About 2 drops of light oil of the common sewing machine type should be placed on the sleeve slide at the start of the day's work.

NOTE: After about 5 days' use place 2 drops of light oil on the pins and bearings accessible on the under side of the tool.

9.08 Wipe off the joining tool with a cloth at the end of the day or when the splicing work is completed and the tool is to be placed in the case.

9.09 Carrying cases should not be left exposed to rain or snow.

10. REPAIR OF JOINING TOOL

10.01 Do not attempt to take the wire joining tool apart.

10.02 No repairs or replacement of parts of the wire joining tool should be attempted by the field forces. If any part of the tool is not working properly, return the tool through the regular supply channels in accordance with the established routine to the Western Electric Company for repairs. The joining tool with all accessories should be returned in the carrying case to minimize damage in transit. A tag should be securely attached to the tool stating the reason for its return.