

BELL SYSTEM PRACTICES
Outside Plant Construction
and Maintenance

SECTION G31.110
Issue 1, December, 1933
Standard

OPEN WIRE
STRINGING WIRE
(NOT POINT TRANSPOSED)

Contents	Page
General	1
Lengths and Weights of Standard Coils of Wire	1
Handling of Wire	2
Planning of Job	2
Position of Wires on Crossarm	3
Reel Setups	4
Stringing Wire—Small Jobs	6
Stringing Wire—Large Jobs	8
Stringing Wires Over Streets, Highways, or Railways	12
Stringing Wires Over Electric Light or Power Wires	13
Pulling Wires to Required Sag	16
Snubbing Wires	16

1. GENERAL

1.01 The methods of stringing wire provided for in this section apply to wires that are not point transposed. When the wires are to be point transposed, the work should be done in accordance with the instructions for this type of construction.

2. LENGTHS AND WEIGHTS OF STANDARD COILS OF WIRE

2.01 The approximate lengths and weights of standard coils of wire are as follows:

BARE COPPER WIRE

Size	Standard Coil				Feet of Wire Per Lb.	Approximate Weight Per Conductor Mile in Lbs.
	Maximum Length in Feet	Maximum Weight in Lbs.	Minimum Length in Feet	Minimum Weight in Lbs.		
080 Copper Wire	4660	90	4150	80	51.7	102
104 Copper Wire	5800	190	5500	180	30.5	173
128 Copper Wire	3830	190	3630	180	20.2	262
165 Copper Wire	2310	190	2190	180	12.2	435

BARE IRON WIRE

Size	Standard Coil		Feet of Wire Per Lb.	Approximate Weight Per Conductor Mile in Lbs.
	Approximate Length in Feet	Approximate Weight in Lbs.		
083 Galv. BB Wire	2640	50	53.3	99
109 Galv. BB Wire	2640	85	31.1	170
134 Galv. BB Wire	2640	130	20.5	258

Note: Each coil of 083 galvanized wire is split to form two connected, separately bound lengths of approximately equal weight.

3. HANDLING OF WIRE

3.01 The strength of wire is greatly reduced by kinking and nicking. Consequently, it is essential that precautions be taken in handling wire to avoid such injuries. If kinks and nicks occur, cut them out before the wire is placed.

3.02 Protect wire from injury during transit. See that wire is not subject to injury by tools or other equipment.

3.03 Do not step on the wire or permit it to be run over by vehicles.

3.04 Avoid kinking wire during unreeling.

3.05 Coils from which wrappings have been torn or partially removed during transit should be inspected for injury to the wire before use. Injured sections of wire should be cut out

4. PLANNING OF JOB

4.01 The procedure to be followed in stringing open wire depends on:

- The size of the job.
- The equipment available.
- The conditions existing on the job.

- 4.02 A job ordinarily falls in one of the following classes
- (a) Small or medium sized jobs requiring two or three men and a small amount of equipment.
 - (b) Large jobs requiring large crews and a considerable amount of equipment.
- 4.03 Reel setups will, in general, be governed by the following factors:
- (a) Total length of wire to be strung.
 - (b) Maximum length of wire that can be handled in one pull. The maximum length of wire to be strung in one pull shall, in general, be as near the length of wire in a standard coil as practicable. At times it may be necessary to pull shorter sections, but in all cases the length of wire to be run out shall be the maximum length practicable to handle. In determining the length of wire to pull, consider the following points:
 - (1) Number of wires to be strung.
 - (2) Locations of corners and amount of "Pull" on each corner.
 - (3) Method of pulling wires and method of mounting reels.
 - (c) Access to "setup" point for delivery of material and placing equipment.
 - (d) Hindrance to traffic. Set up along highways where practicable, but out of the way of traffic.
 - (e) Obstructions. Where practicable, set up the reels so that it will be necessary to pull only a few spans of wire over a highway or railroad and over or under electric wires. In hilly country, where practicable, set up the reels on the top of a hill.

1. POSITION OF WIRES ON CROSSARM

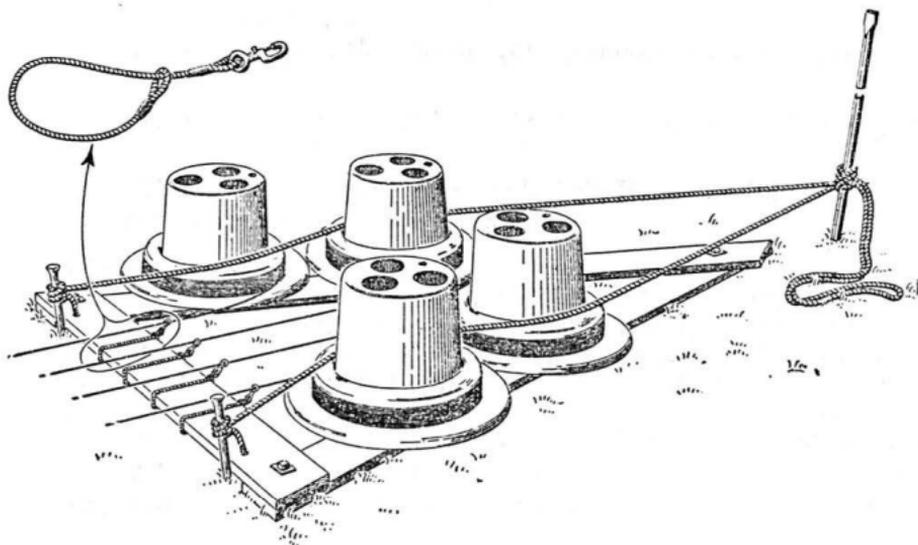
- 5.01 Place the wires in pin positions as specified on the detail plans or other instructions for each circuit.
- 5.02 In general the selection of the pin positions is based on the following:
- (a) Where there are toll and exchange circuits on the same pole line, the toll circuits shall occupy the upper cross-arms.
 - (b) Place the longest and most important of a particular class of circuits on the upper crossarm supporting that class of circuits.

- (c) Never string exchange wires on crossarms supporting toll wires without special instructions.
- (d) The wires of a pair or group shall, where practicable, retain the same set of pin positions on the crossarms throughout the entire length of the run.

5. REEL SETUPS

5.01 The manner of setting up reels depends upon the size of the job, the equipment available, conditions encountered along the route, etc. Some typical reel setups are shown below. The coils of wire should be placed on the reels so that the wire feeds from the tops of the coils. In some cases the wire will feed from the opposite side of the reel rather than as shown in the illustrations. When it is necessary to splice the end of a new coil of wire to the end of a coil of wire on one of the reels, the attendant at the reels should signal ahead (see Paragraph 8.03) to have the pull stopped. After the pull is stopped place the new coil of wire on the reel, sleeve the ends of the wires and signal ahead to have the pull resumed.

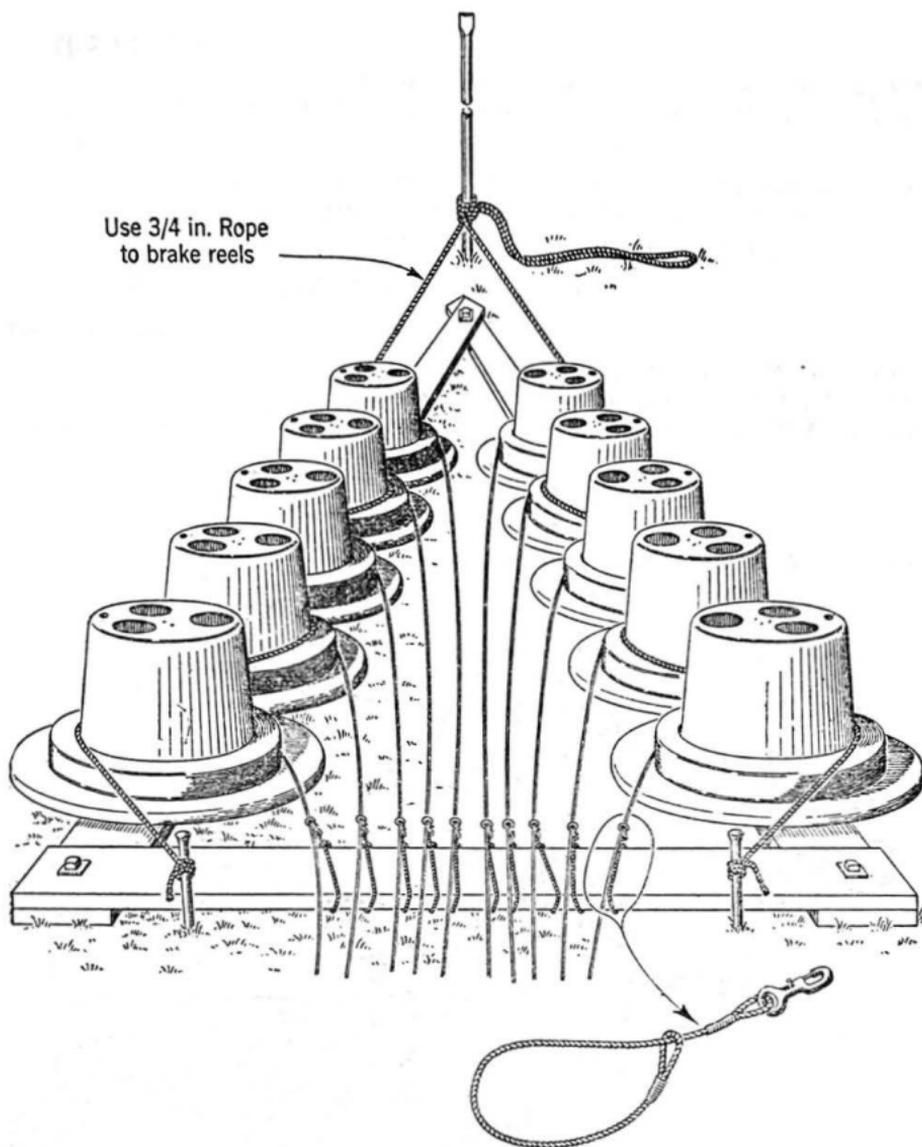
- (a) Two or four wires.



Note: Where the wire feeds from side of the reel opposite to that shown and there is interference between the wire and the adjacent reel, the boards on which the reels are mounted should be spread at the back to provide clearance between the reels and wires.

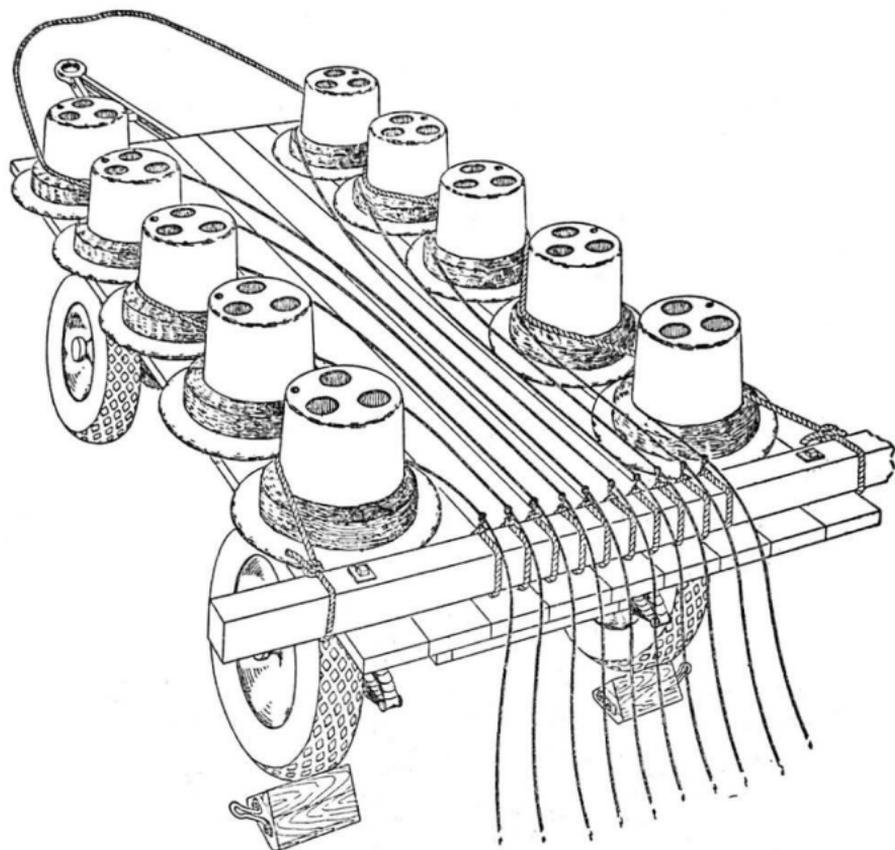
The men tending the reels should wear rubber gloves where there is a possibility of contact with power wires

(b) Ten wires, reels on ground.



Note: Where the wire feeds from side of the reel opposite to that shown and there is interference between the wire and the adjacent reel, the boards on which the reels are mounted should be spread at the back to provide proper clearance between the reels and wires. The men tending the reels should wear rubber gloves where there is a possibility of contact with power wires.

(c) Ten wires, reels on trailer or wagon

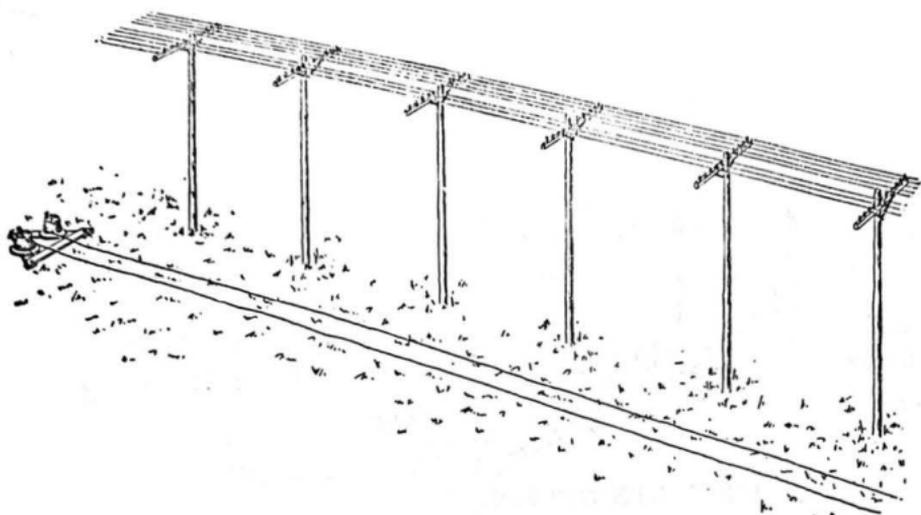


6.02 Where there is a tendency for the brake rope to climb up on the reel, the rope should be held down by loops of rope or eye-bolts secured to the boards on which the reels are mounted.

7. STRINGING WIRE—SMALL JOBS

7.01 Where two or four wires are to be placed in a few spans, either the following method or that described in Part 8 for larger jobs can be employed. The selection of the method should be based on local conditions.

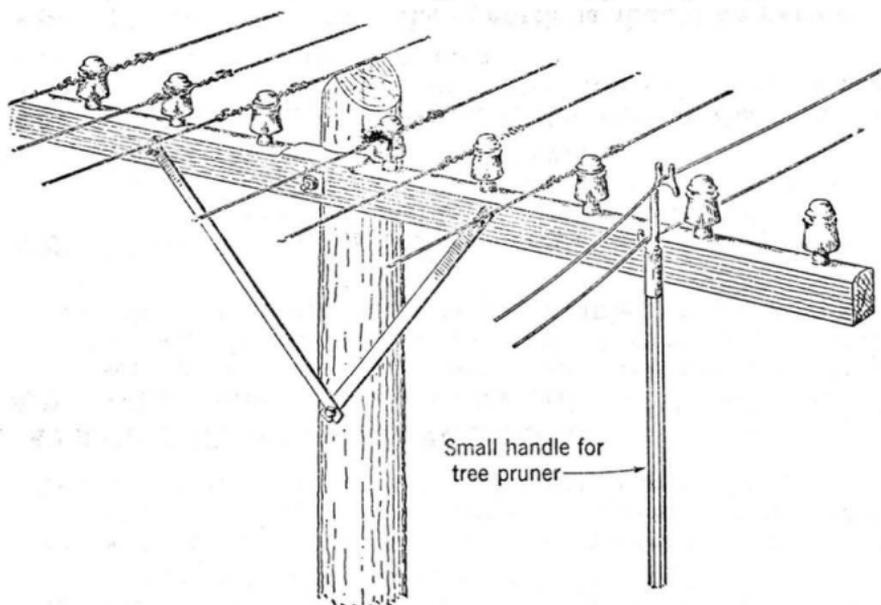
- (1) If there is no interference from trees, power wires or road crossings and it is practicable, run the wires along the ground.



Note: Paragraph 6.01(a) shows the details for reel set ups.

Note: For the small jobs (a few spans only) reels may not be required as the coils of wire can be handled by one man as another pulls it out along the ground. If desired the end of the coil can be snubbed around the pole and the coil carried along the line.

- (2) Raise the wires to the crossarm or pole brackets by means of a wire raising tool or equivalent device.



- (3) Pull wire to desired tension by means of Grips similar to the method shown in Part 12 for Snubbing Wires.
- (4) Where impracticable to raise the wires from the ground the wires should be pulled out over the crossarms similar to the methods shown for the larger jobs.

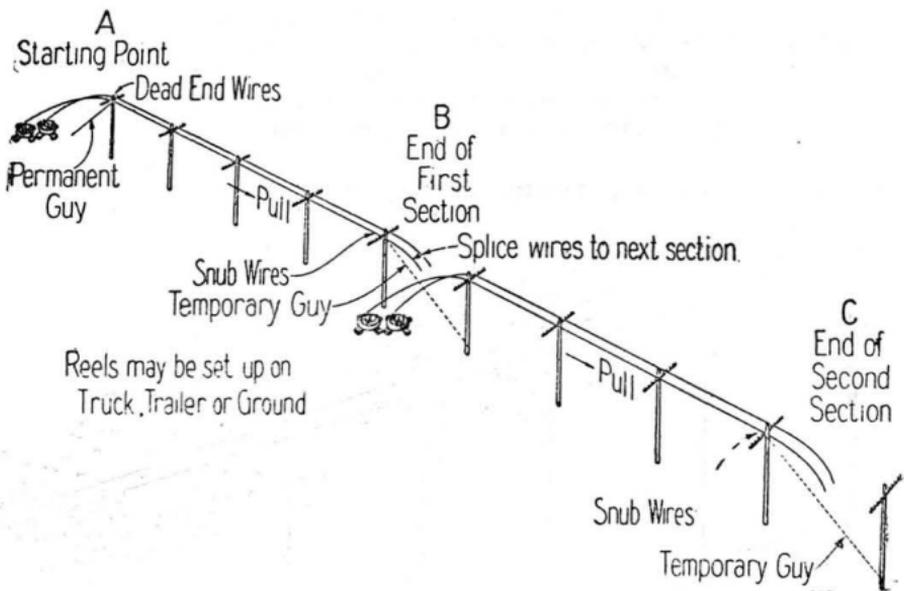
a. STRINGING WIRE—LARGE JOBS

8.01 Where pole lines are so located that the reels may be set up practically anywhere along the line, the stringing of the wire is usually started at the beginning of the line and the wire pulled out as far as practicable; then a new setup is made.

8.02 Where conditions do not permit the above procedure, the locations for setting up the reels should, in so far as practicable, be selected in advance so that the maximum length of wire can be strung in one pull.

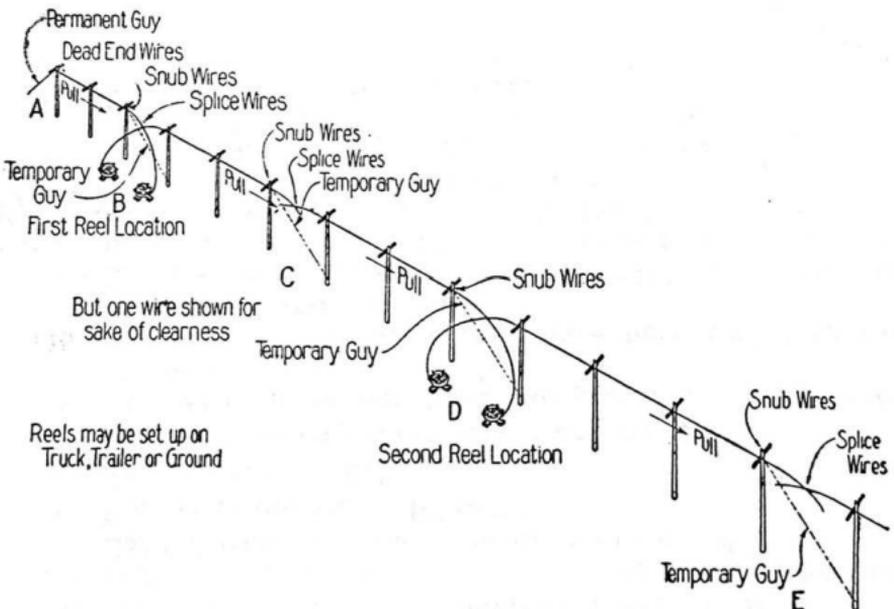
8.03 In all stringing jobs, organize the work so that signaling to source of pull will promptly stop pull. Each signalman must be seen by the next man.

8.04 The order in which the operations should be performed is as follows:



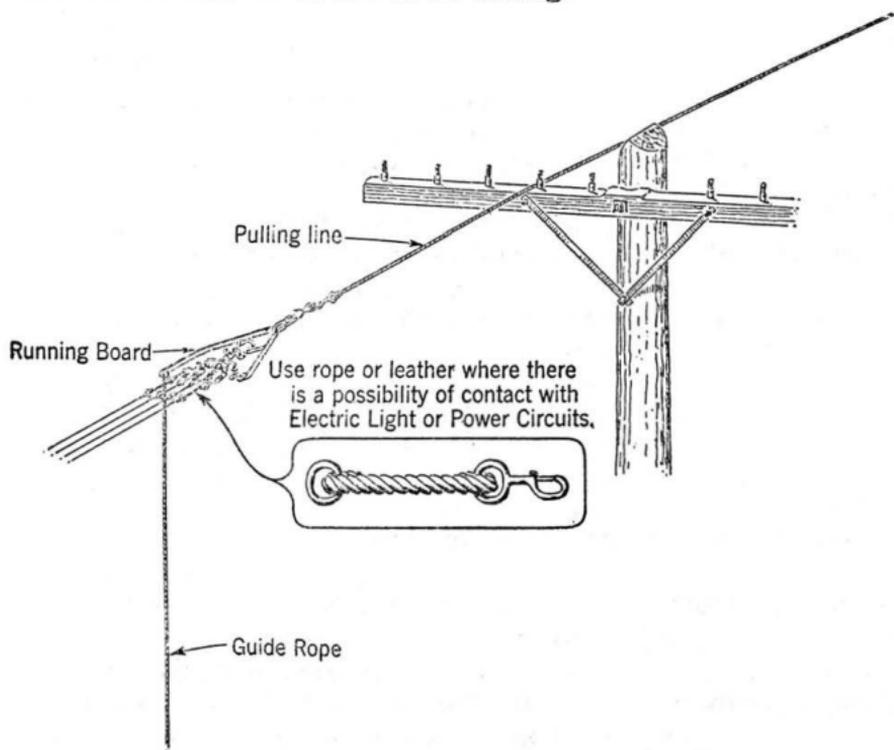
- (1) Set up the reels at a starting point, "A."
- (2) Pull the wires out through the first section, the length of which is determined by the conditions encountered.
- (3) Dead end the wires at the starting point "A," and where necessary, place a temporary guy on pole at the end of the first section, "B."
- (4) Pull the wires to the sag specified in Section G31.115, in the first section, locating the apparatus for pulling at the end of the section "B," and snub the wires at "B."
- (5) Tie in the wires after they have been pulled up to the proper sag and snubbed.
- (6) Continue the operation in the succeeding sections in the same manner, except that the wires should be spliced to the wires of the preceding section instead of dead ending them as at the starting point.
- (7) Remove temporary head guys as the job progresses.

8.05 Where the conditions are such that only specific points are available for setting up the reels and it is practicable to select points from which the wire can be run out in both directions, the order in which the operations of stringing wire should be performed is as follows:



- (1) Select first reel location, "B," near enough to the starting point "A," to permit pulling the wire back to the starting point, and at a point which will permit pulling out the wire in both directions.

- (2) Set up the reels at first reel location "B."
 - (3) Pull wires out from "B" toward "A" and dead end the wires at "A."
 - (4) Where necessary, place temporary guy at "B."
 - (5) Pull wires in section "A-B" to sag specified in Section G31.115 from "B" and snub the wires at "B."
 - (6) Pull wires out from "B" to "C."
 - (7) Splice wires at "B."
 - (8) Where necessary place temporary guy at "C."
 - (9) Pull wires in section "B-C" to proper sag from point "C" and snub wires at "C."
 - (10) Tie in the wires after they have been pulled to the proper sag and snubbed.
 - (11) Move reels to second reel location "D" and proceed as outlined for first reel location, except that the wires shall be spliced at "C" instead of dead ended.
 - (12) Remove temporary head guys as the job progresses.
- 8.06 Equip with a snap fastener each of the wires to be pulled. Fasten the wires to one running board as shown when five or less wires are to be strung.

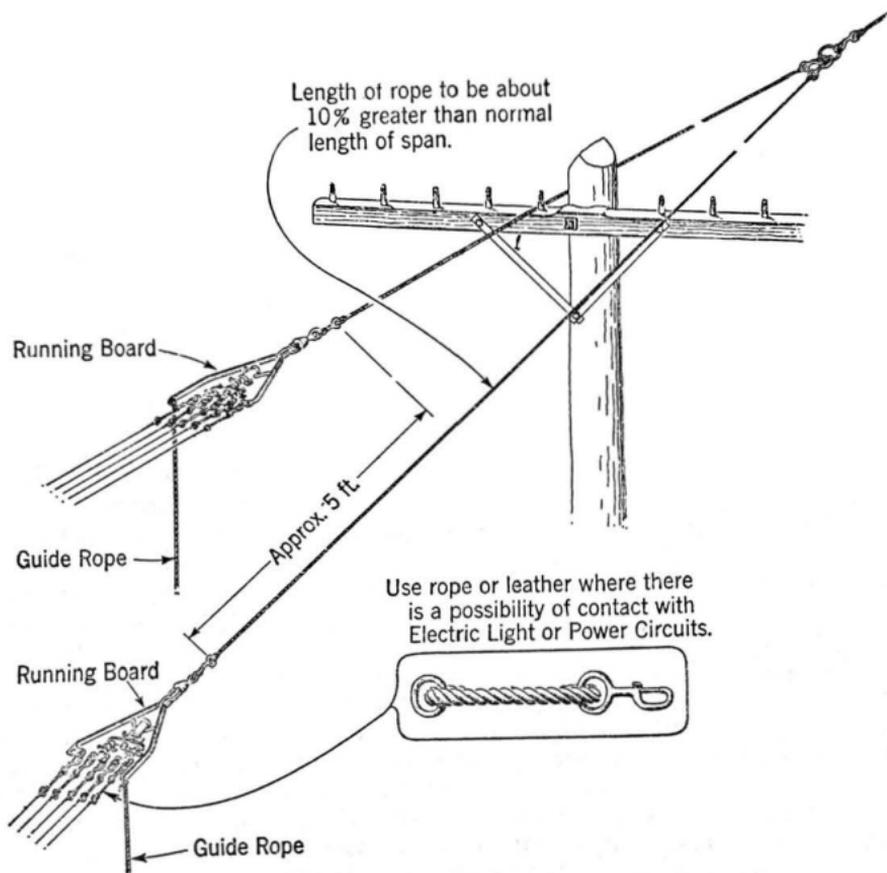


8.07 Equip the end of the pulling line with a snap fastener.
Use a 5/8-inch Manila Rope, free from metallic strands, for the pulling line. The length of line depends upon the number of linemen available and the length of spans. In general, five spans of line will be sufficient.

8.08 The rope hanging from the running board assists in preventing the running board from turning and can be used in guiding the wires from the ground. If the running board is turned, the position of the rope will determine the direction in which the running board is to be turned back.

8.09 Ease the running board over the crossarm, and place the wires in the proper pin positions, after the board has passed over the crossarm. The lineman should preferably face the running board as it approaches the pole.

8.10 Where the circuits being strung are located on pins on opposite sides of the pole or on different arms, attach the wires to two running boards, except where only one wire is located on the opposite side of the pole. Attach each running board to the pulling line by means of a 5/8-inch Manila Rope, free from metallic strands. The ends of each of these ropes should be equipped with snap fasteners. One rope should be about five feet longer than the other. The length of the longer rope should be approximately 10 per cent. greater than the normal span length. The use of a rope of this length on the second board permits the lineman on the advance pole to pass the second line to the other side of the pole or to the other crossarm while the lineman at the running boards is fanning out the wires on the first board. The second running board should be pulled past the crossarms for a distance of about four feet before stopping the pull and fanning out the wires to their proper pin positions.



8.11 If transpositions are to be made, reverse the wires at transposition poles so that it will not be necessary to cut the wires. Section G31.145 describes the various types of transpositions

8.12 Where guys and other interfering objects are encountered, unsnap the pulling line and pass it around the interfering objects to avoid cutting the wire.

8.13 Where, on account of obstructions or right-of-way, the pulling line cannot be pulled straight ahead in line with the lead, pull it back through a snatch block fastened near the base of the pole.

8. STRINGING WIRES OVER STREETS, HIGHWAYS, OR RAILWAYS

9.01 In stringing wires the reels should be braked. When stringing wires over streets, highways, or railways, brake the reels sufficiently to avoid any excess sag in the wires. Hold the pulling line taut at all times.

9.02 Station a man at such crossings during the time that the wires are being pulled across, to warn traffic and passers-by, should anything go wrong. This man should be equipped with standard signaling equipment.

9.03 Where the traffic at the crossings is heavy the methods outlined in Part 10 can be used to advantage.

10. STRINGING WIRES OVER ELECTRIC LIGHT OR POWER WIRES

10.01 It is necessary to take special precautions in stringing wires over electric light or power wires, to prevent contact. The practice outlined should be rigidly followed in order to avoid contacts with supply circuits.

10.02 When wires are being strung over electric light wires of any voltage all men handling the wire must wear rubber gloves until the wires have been tied in and spliced through.

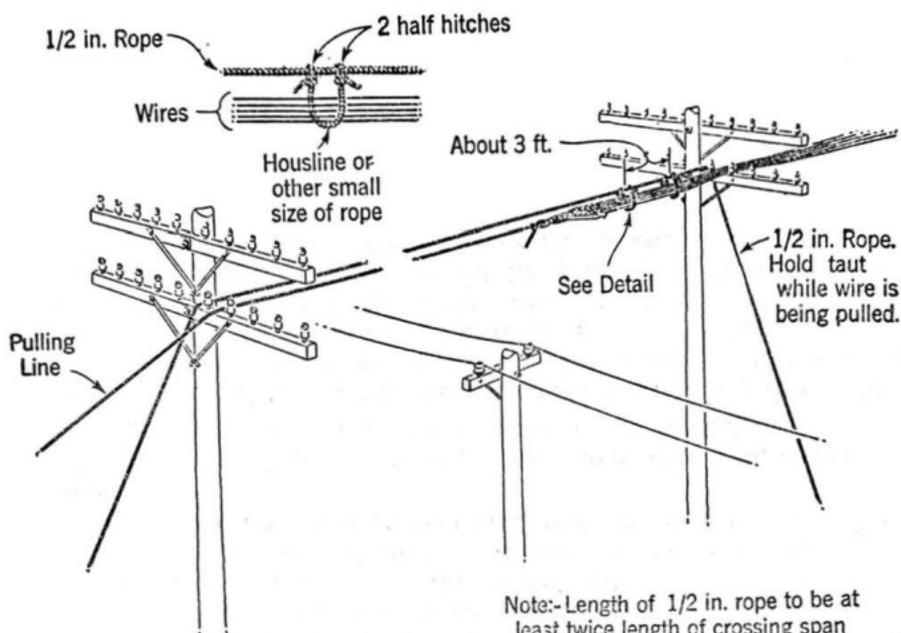
10.03 The steps to be followed in stringing wires under these conditions are as follows:

(1) Place the pulling line and a 1/2-inch rope over the crossarms of the crossing poles. If practicable, these lines should be placed between pins 4 and 5, or 6 and 7, or corresponding pin positions on lower arms. **These lines should be dry manila ropes, free from metallic strands.**

(2) The length of the 1/2-inch line should be equal to at least twice the length of the crossing span plus twice the height of the wires above ground. All of the surplus length of this rope should be stored on the reel side of the crossing, except enough to reach the ground on the pulling side.

(3) Attach pulling line to running board or to loops securely formed in the ends of the wires to be pulled.

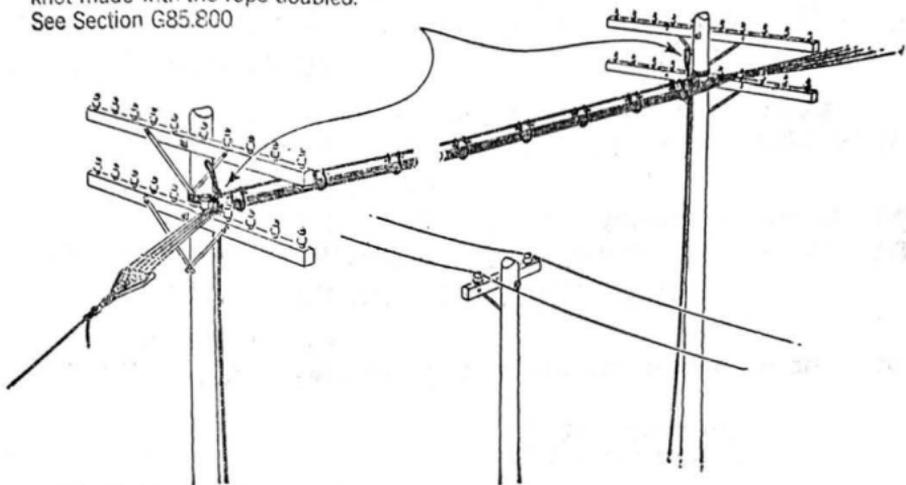
(4) Pulling of the wires may commence at this point. Place a loop of houseline or other small rope around wire as close as practicable to the running board. Attach each end of this loop to the 1/2-inch rope by means of two half hitches. Similar loops should be placed at three-foot intervals as the wire is pulled over the span.



Note:- Length of 1/2 in. rope to be at least twice length of crossing span and twice height of wires above ground. All excess length required on reel side of crossing except enough to reach ground at other pole.

- (5) As the wire is pulled, the hand line should be held taut and pulled across the crossing span at the same rate as the wire.
- (6) When the running board has reached the pole on the pulling side of the crossing the 1/2-inch rope should be made fast at each end.

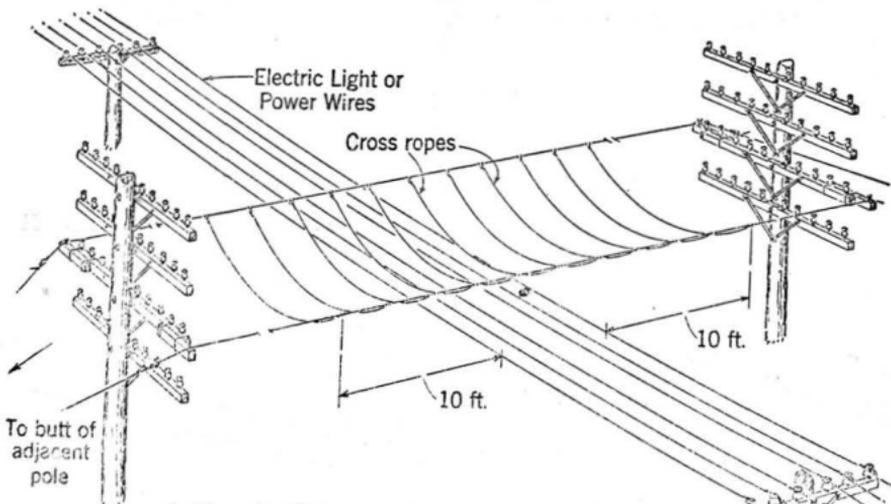
Secure 1/2 in. rope by platform guy-knot made with the rope doubled.
See Section G85.800



(7) Pulling of the wire may then continue

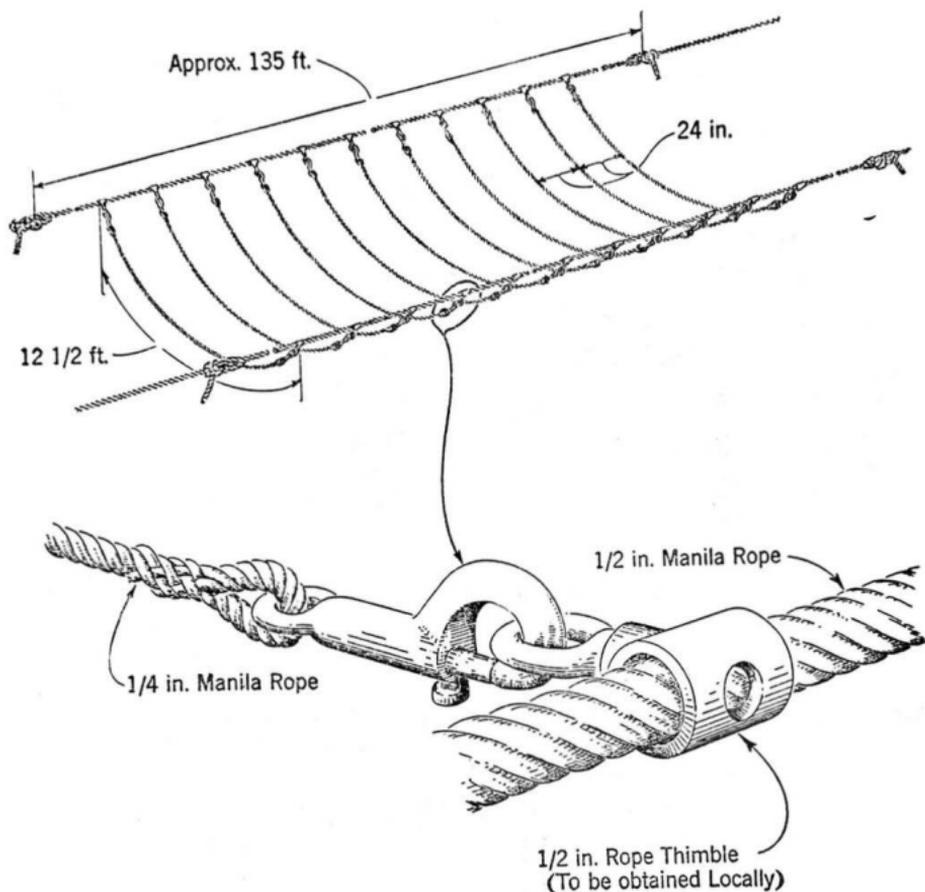
(8) After the wires have been drawn taut and snubbed securely so as to prevent their sagging into contact with the power circuits, the 1/2-inch rope may be withdrawn from the crossing span.

10.04 In the larger jobs, a rope screen, as shown below, can be used if desired to prevent contact between the wires being placed and the electric light or power wires.



Place a sufficient number of cross ropes to protect crossing span 10 ft. each side of Electric or Power Wires.

10.05 Attach cross members of rope screen as shown below.



Note: The Harness Snaps shown above should be obtained locally.

11. PULLING WIRES TO REQUIRED SAG

11.01 The system of rigging described in Section G85.800 may be used for equalizing the tension in wires and pulling them to the required sag.

11.02 Wires of different gauges should be pulled separately, otherwise the sag will not be uniform in all wires.

12. SNUBBING WIRES

12.01 After wires have been pulled to the proper sag, it will generally be desirable to snub them as shown in Section G85.800, until such time as they are tied in and spliced to the next section.