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FOREST SERVICE.

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DIRECTIONS AND SPECIFICATIONS FOR BUILDING TELEPHONE LINES ON THE NATIONAL FORESTS.

Telephone lines on and near the National Forests help in their protection and administration and make the Forests more useful to the communities whose interests they are to serve. The Forest Service will build telephone lines only where they are necessary for protective or administrative purposes, and then only where there is insufficient business to warrant commercial companies in putting up lines. Commercial companies and settlers should be encouraged to build lines on and near the Forests, and the Service will cooperate with them so far as possible, with the understanding that it shall have free use of such lines for official business. For the most part the lines of the Forest Service will be branches connecting supervisors' and rangers' headquarters with exchanges of commercial companies on or near the Forests. The lines of the Service must necessarily be of simple and cheap construction at first. The main thing is to get ready means of communication. This done, the equipment will be improved as fast as possible. The usual construction will be a one-wire line on brackets attached to poles or trees.

LOCATING.

The location of the line should conform as closely as may be to the following conditions. The line should—

- (1) Pass near lookout points, where they exist.
- (2) Follow roads and main trails.
- (3) Be direct, consistent with the above.
- (4) Be hitched to trees instead of poles.
- (5) Avoid steep slopes, cliffs, etc., and streams or canyons over 500 feet across.

If any part of the line is off the Forest, right of way must be obtained, drawn up on a regular form, which will be furnished by the Forester on request. A survey of the line may or may not be necessary. The line should, however, be carefully laid out, and stakes should be set showing the locations of the poles.

ATTACHING WIRES TO TREES.

Wherever possible lines should be attached to standing trees. The course of the line may be varied considerably in order to make use of trees where, in the opinion of the officer in charge, the cost of construction will thereby be lessened. If the tree so used is large, it should be trimmed 3 or 4 feet above the point where the bracket is attached; if the tree is small, it may be trimmed up the right height to form a pole.

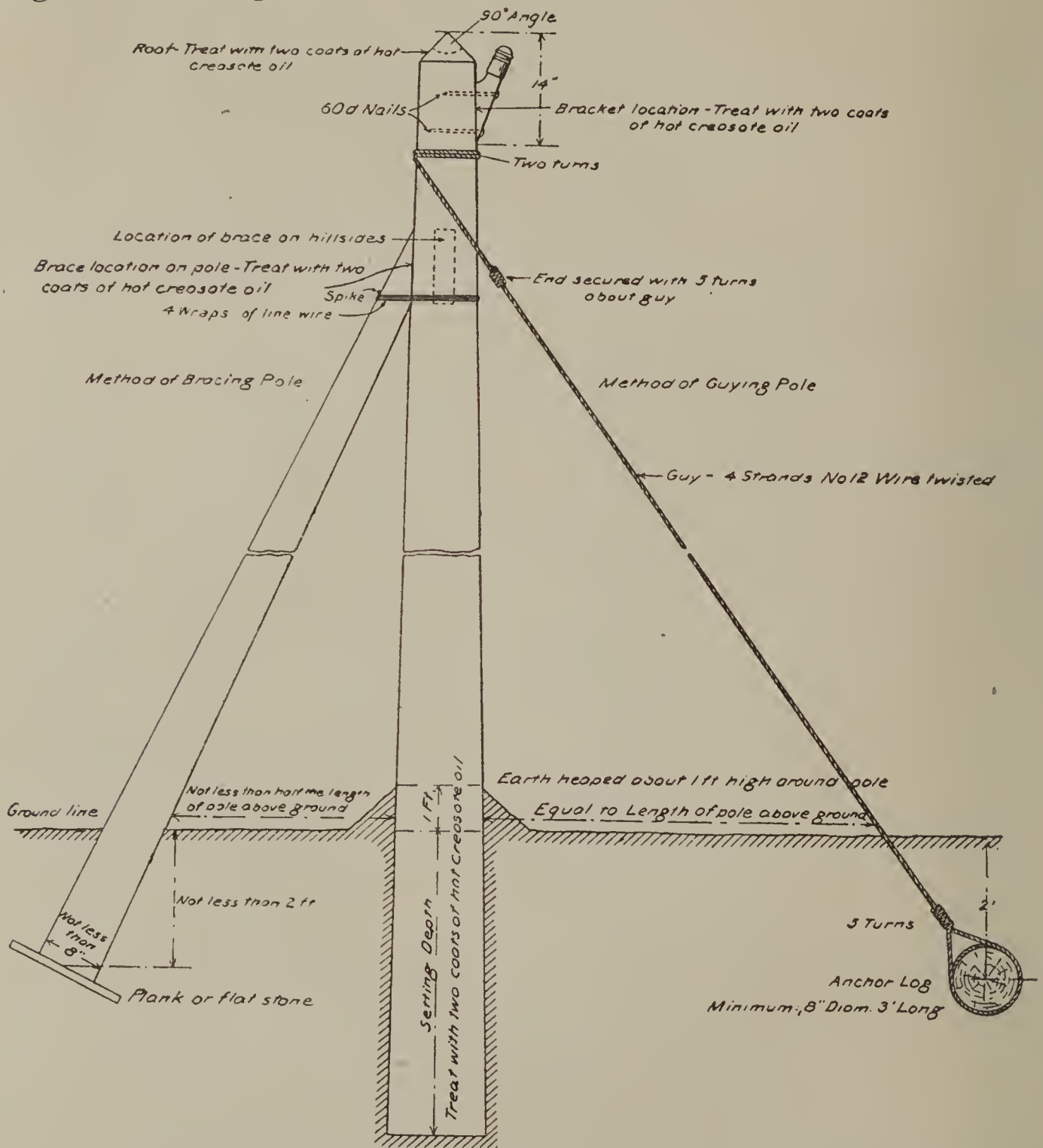


FIG. 1.—Diagram showing method of setting, guying, and bracing pole and locating bracket.

CUTTING, SEASONING, AND TREATING POLES.

Cutting.—Poles should be cut near the place where they are to be set in the line. When possible poles and braces should be cut in winter or spring. They should be peeled as soon as cut and all knots trimmed close. The butts of the poles should be cut square and the tops cut slanting on both sides to form a right-angle "roof." (See fig. 1.)

Skidding and seasoning.—When a number of poles or braces can be collected at one point and can be distributed along the line at the time of building, without undue expense, they should be piled tier upon tier, with a space of at least 6 inches between poles in the same tier and between tiers. The bottom tier should be of sufficient height from the ground to allow of the free circulation of air under the poles. They should be seasoned at least two months and as much longer as possible.

When it is not feasible to collect poles or braces at one point they should be peeled and raised off the ground or leaned against trees or rocks in an open position to season. If sound dead timber is available, it is to be preferred because it will not be necessary to season it.

Treating.—After seasoning, poles and braces should be treated with coal-tar creosote according to the following directions:^a

Heat the creosote in an iron pot to about 175° F., being careful that the temperature does not at any time exceed 200° F. or fall below 150° F.

Apply the hot creosote, with iron-bound brushes 4 to 5 inches wide, to the outside of the pole from the butt to a point at least 1 foot above the depth to which the pole will be set. Take particular pains to fill all seasoning checks and knot holes. After an interval of at least twenty-four hours the pole should be treated with a second coat, applied in the same manner. The top of the pole and the places where the brackets and braces will be attached should also be treated with two coats of hot creosote. (See fig. 1.) The preservative should never be applied when the surface of the pole is wet from rain, snow, or frost, or when the pole is frozen.

Braces should be treated in the same manner as poles and in addition two coats of hot oil should be applied to the slanting top which is fixed against the pole.^b

CLEARING RIGHT OF WAY.

A right of way wide enough for a bridle trail should be cleared when the line runs through dense underbrush or chaparral. On account of the expense of cleaning, the line should be run, so far as possible, to avoid underbrush or chaparral.

When the line runs through dense timber, trees must either be cut or branches lopped off high enough to prevent their touching the wires. No branches or underbrush should be closer to the wire than 4 feet. All growing trees leaning toward the line, and all dead or dying trees liable to fall on the wires, should be cut.

^a Creosote can usually be bought to the best advantage through the Washington office.

^b It should be borne in mind that the application of preservatives to the outside of green timber seldom, if ever, produces good results; in fact, in the majority of cases hastens decay, and therefore under no circumstances should green timber be treated with preservatives applied with brushes to the outside.

BUILDING DIRECTIONS.

Length of poles.—The standard pole will be 22 feet long, and should be used in all but special cases, where longer poles, of lengths to be determined when locating the line, should be used. In case 22-foot poles are not available, and shorter poles are, the shorter ones may be used, but only with the approval of the Forester.

The special cases where poles longer than 22 feet will be used are as follows:

(a) Where the underbrush exceeds 10 feet in height use poles that will keep the lowest wire at least 4 feet above the highest brush at the middle of the section.

(b) Where snow is liable to drift to depths exceeding 10 feet use poles that will keep the lowest wire at least 2 feet above the maximum depth of the drift at the middle of the section.

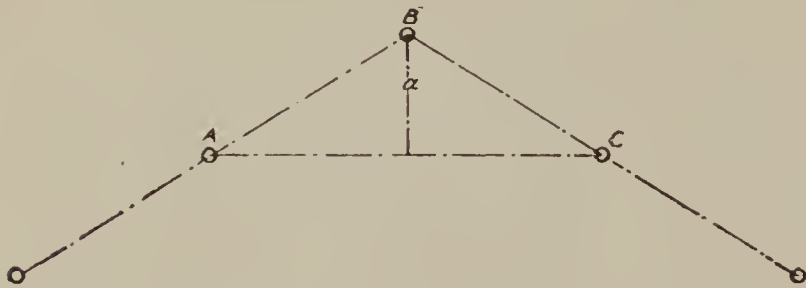


FIG. 2.—Diagram showing method of determining "pull" at corners.

(c) Where it is necessary to grade the line to overcome abrupt changes in level.

(d) Where the line crosses wagon roads or railways use poles that will keep the lowest wire at least 14 feet above the road

and 26 feet above the railway at the middle of the road or track, unless otherwise required by State laws.

(e) At the ends of long spans across rivers, canyons, etc. Special poles or construction to be determined by the Forester will be used at these points.

Distribution of poles.—Place poles as near as possible to the holes where they are to be set. Poles between the minimum and average size should be used on straight sections; poles above average size should be used on curves, at corners, and at the end of long spans; extra strong poles must be used in exposed positions and where there is danger of heavy storms.

Spacing.—On straight sections 30 poles per mile should be set, which will give a spacing distance of 176 feet. Where it is necessary to make any change in the direction of the line, care should be taken to make the change gradually by spreading the curve over as many poles as possible. If sharp bends are unavoidable, proper guys or braces, or both, must be provided. On curves and corners where the pull is from 10 to 30 feet the pole spacing should be 100 feet. (By the term "pull" is meant the distance a , fig. 2.) Where the pull is over 30 feet the bend should be made on two poles.

At right-angle corners the section on either side next to the corner pole should not be over 100 feet in length. On spans from 200 to 250 feet the last section on either end will be 100 feet.

On spans from 250 to 500 feet, two sections on either end should be 100 feet. On spans above 500 feet special construction, to be determined by the Forester, should be used.

On steep slopes sections will be so proportioned as to avoid abrupt changes in the level of the wire. Thus it follows that where crossing a ridge where the slope at the top is steep, it is better to space the poles so that one is set on each side of the summit of the ridge, than to set a pole on the top. This prevents a sharp angle in the line. If necessary, use long poles to obtain the desired clearance in the span.

Digging holes.—On straight sections holes should be dug straight and of full size from top to bottom, so that earth thrown in the hole may be evenly tamped around the pole for the total depth of the hole. They should be dug large enough to admit the pole without stabbing or hewing, and of the following depths:

Length of pole.	Depth of hole.	
	In earth.	In rock.
<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>
18	3½	3
22	4	3
25	4½	3½
30	5	3½
35	6	3½

On hillsides the depth of the hole should be measured from the lower side.

Where it is not possible to dig to the required depth, the pole should be securely braced or guyed, and stones and earth heaped around it and well tamped.

Where the line crosses solid rock for a distance not more than 250 feet a span of that length may be used, but for greater distances it will probably be advisable to blast holes in which to set the poles. Where it is necessary to blast many holes, special construction, to be determined by the Forester, may be resorted to, and instructions should be asked for before taking up the work.

In such cases consider the use of gas-pipe poles, which may be clamped to the rock and thus render blasting unnecessary.

SETTING POLES.

On straight sections poles are to be set vertically. Corner poles are to be raked (inclined outward from the center) when set. When the "pull" is less than 5 feet the rake should be about 10 inches; when the pull is 5 to 10 feet the rake should be about 15 inches, and when the pull is over 10 feet the rake should be about 25 inches.

Filling and tamping.—When the pole has been set in the hole it should be “trued” and held in position while the hole is being filled and the filling tamped. The filling should be done by one man, and the earth firmly tamped by two. When the hole is filled, earth should be piled about the pole and firmly packed.

Attaching brackets.—Brackets are to be placed upon the same side of all the poles except at angles, crossings, or curves, where they should be so placed that the strain when the wire is strung will tend to press the insulator toward the pole.

They should be nailed to the pole with two 60-penny galvanized nails at the places previously treated. The base of the bracket should be about 14 inches below the top of the pole. Brackets should be attached and insulators screwed on before the pole is erected.

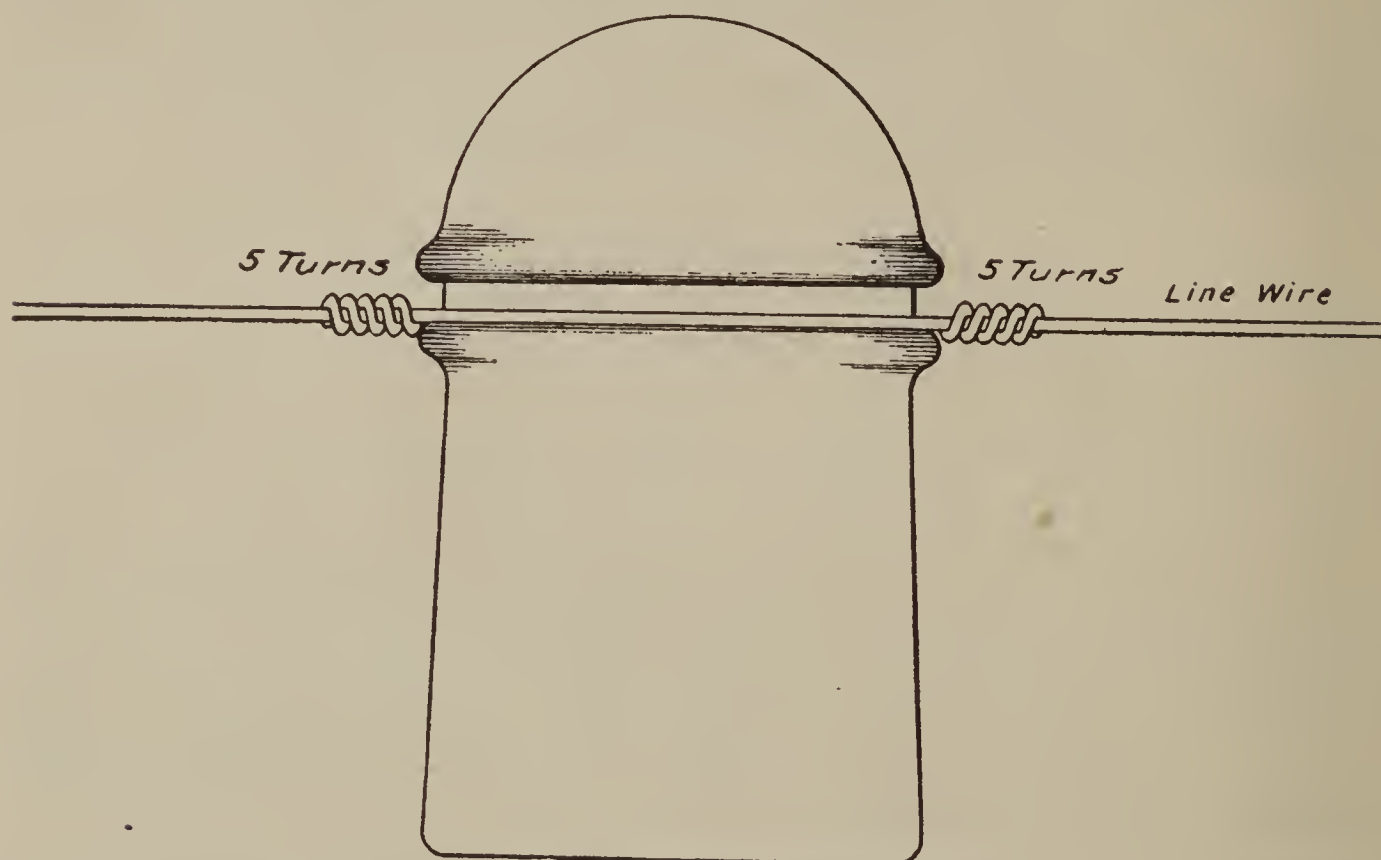


FIG. 3.—Method of tying wire to insulator.

Stringing wire.—When possible a reel containing as much wire as can be carried by two men should be carried along the line; when there is dense underbrush a coil should be carried by one man. Care must be taken that all kinks are straightened before the wire is stretched.

Tying wire.—Wire should be tied to insulators with tie wires of No. 12 B. W. G. iron wire cut into 12-inch lengths, as shown in figures 3 and 4. Start tying from the standing end and allow the proper amount of sag between each pole. The sag of wire can be determined from the following table, taking the length of span and the temperature at the time of building. In very dry climates or where there is no great variation in temperature wire may be strung using the sag given under -10° in the table.

[Temperatures in degrees Fahrenheit.]

Length of span.	Sag at—								
	− 30 de- grees.	− 10 de- grees.	0 de- grees.	+ 10 de- grees.	+ 30 de- grees.	+ 60 de- grees.	+ 65 de- grees.	+ 80 de- grees.	+ 100 de- grees.
	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
100 feet.....	2	2½	.....	3	3	4½	.....	5½	7
150 feet.....	4½	5	.....	6	7	9	.....	11½	14
175 feet.....	6	7	.....	8	9½	12	.....	15	18
200 feet.....	8	9	.....	10½	12	15½	.....	19	22½
250 feet.....	14	16	.....	18½	21	26½	.....	31	36
300 feet.....	22	.....	27½	.....	33	.....	44	.....	55
350 feet.....	31	.....	39	.....	46	.....	61	.....	76
400 feet.....	43	.....	52	.....	60	.....	78	.....	96
450 feet.....	58	.....	68	.....	78	.....	96	.....	120
500 feet.....	72	.....	84	.....	96	.....	120	.....	150

For spans up to 500 feet No. 12 B. B. iron wire should be used. Where spans of over 500 feet occur, instructions from the Forester should be asked for in advance, in every case giving the length of



FIG. 4.—Method of tying wire to insulator.

span required and the approximate height from water surface of river or bottom of canyon to a straight line between supports.

Joining wire.—Iron wire should be joined by making a standard Western Union joint, as shown in figure 5.



FIG. 5.—Method of joining wire.

Bracing and guying.—Braces are preferred to guys and should be used whenever possible. Braces or guys should be used on poles in the following positions:

- (a) On curves or at corners where the pull exceeds 30 feet.
 - (b) At road crossings.
 - (c) The two end poles of spans between 200 and 250 feet.
 - (d) Two poles on either end of spans between 250 and 500 feet.
- (Special construction, to be determined by the Forester, should be used at the ends of spans over 500 feet.)

(e) All poles on steep slopes where short sections are used. Anchor guys may be preferably used in these cases, or a head guy from the top of one pole to the base of the pole next above it may be used.

(f) Alternate poles in exposed positions.

(g) In swamps or on loose ground where necessary.

Braces should be at least 8 inches in diameter at the butt, and should be cut slanting at the top to fit close to the pole; but the pole must not be cut. They should be set at least 3 feet in the ground, with the butt end resting against a flat stone or a plank. They should be attached to the poles with a cross-arm bolt having a washer at each end, as shown in figure 1. This bolt should be at the lowest point of joint. If necessary, notch the brace in order to get it in the location. Never cut the pole.

Guys should be made of four pieces of No. 12 iron wire twisted together, and should be sufficiently long to reach from the top of the pole to the ground at a distance equal to the height of the pole above ground. Guys should be attached to poles at a point immediately under the bracket by making two turns around the pole and wrapping the end five times around the guy. The turns should be secured by three 2-inch galvanized-iron staples. The other end of the guy should, if possible, be attached in the same manner to a tree trunk in the opposite direction to the pull, otherwise to a log not less than 8 inches in diameter and 3 feet long buried at least 3 feet in the ground.

Lightning rods.—Lightning rods, to be placed on the pole before erection, should be made of one piece of No. 12 iron wire of a length sufficient to reach from 3 inches above the top of the pole to the bottom of the pole. The rod should be held in place by 2-inch galvanized-iron staples, and so placed that the line wire, should it become detached from the insulator, can not come in contact with the rods. The best location is one-fourth of the distance around the pole from the bracket, for if put on the opposite side from the bracket the line wire, should it be thrown to that side of the pole, would touch it, thereby grounding the line.

Lightning rods will be placed upon every tenth pole where the line is in the open and exposed to frequent thunderstorms. In ordinary situations every twentieth pole will be equipped with a lightning rod.

INSPECTION AND TESTING.

A regular inspection of the whole line should be made every month during the season of fire danger, and two inspections should be made at equal intervals during the remainder of the year. The person making these inspections should call terminal stations of the Forest Service line from each substation to test the instruments and connections.

Special inspections of the line should be made in each district by the ranger, or other officer in charge, immediately after severe wind, snow, or lightning storms, and after fires.

Rangers, forest guards, and others of the reserve force should examine the line wherever it is encountered during the discharge of their regular duty. They should also test the line every morning, if possible, to be sure that it is in working order.

EMERGENCY REPAIR.

Each member of the reserve field force should keep on hand at his headquarters 200 to 300 feet of No. 12 B. W. G. iron wire, 6 brackets, 6 insulators, and a supply of nails, staples, etc., to be used for the temporary repair of breaks. He should carry a small quantity (10 to 20 feet) of wire at all times while on patrol or inspection duty, in order to immediately repair any breaks in the line.

RECORDS.

For each new piece of line built records should be prepared and submitted with the annual report, or at such times as the Forester may require. These records should be made in the following form:

POLE-LINE CONSTRUCTION.

Report for the year 19_____.

----- Forest Reserve.

Name of line -----
 Length of line -----
 Construction begun ----- Finished -----
 Kind of timber ----- Length and size of standard pole -----
 Cost, total and per mile -----
 Stations installed:

OFFICIAL.

PRIVATE.

Report by -----
 Official title ----- Date -----

SPECIFICATIONS.^a

Poles.—All poles should be cut from sound dead or live trees, and should be free from rotten knots and other defects which would

^a If the supervisor does not know where to procure brackets, wire, insulators, and similar supplies, he should write the Forester for information.

weaken the timber. They should be reasonably straight, peeled, with branches trimmed close, and of the following sizes:

Length.	Top diameter.
<i>Feet.</i>	<i>Inches.</i>
18	5
22	5
25	5½
30	6
35	6

Brackets.—Painted oak brackets conforming to specifications of the American Telephone and Telegraph Company should be used.^a

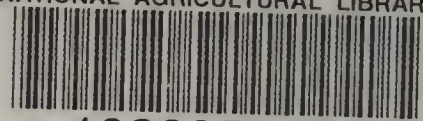
Wire.—No. 12 B. W. G., galvanized iron wire, quality B. B., conforming to specification of the American Telephone and Telegraph Company, should be used, excepting on long spans over 500 feet, where special instructions from the Forester should be asked for by the supervisor or man in charge of telephone work.

On lines up to 90 miles in length No. 12 B. W. G. iron wire should be used. Above 90 miles the kind and size of wire should be determined by the Forester.

Insulators.—Line insulators of the type known to the trade as “Standard Pony” insulator, conforming to specification of the American Telephone and Telegraph Company, will be used.

^a It is necessary only to mention this company's specifications in ordering. They need not be quoted.

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