AERIAL CABLING

CONTENTS

INTRODUCTION

The aerial cabling in this pamphlet refers only to lead cable suspended from a suspension wire; the modern methods, using self supporting aerial cable for local distribution, are dealt with in E.P. LINES 1/7.

The cable generally employed for aerial work is similar to underground cable, but has a lead-alloy sheath. The alloy usually consists of lead-antimony, containing 0.8% to 1.0% of antimony. Aerial cables are subjected to considerable vibrational stresses, and the addition of this small amount of antimony enables the sheath to withstand these stresses more readily than will a sheath or pure lead. These cables can be identified by the wrapping of red paper between the core and the sheath.

Aerial cable is used for loaded or unloaded circuits at audio frequencies, and its use is specially considered in the following cases:-

(a) Over river crossings where sub-aqueous cable would otherwise be used.

(b) Over bridges and railway crossings where no duct-space is available.

(c) For circuits where the erection of open wires would involve extensive tree-cutting.

(d) Where circuits are required on an open-wire line which is already fully-loaded; in such a case, as many of the existing open wires as possible are replaced by circuits in the new cable.

A method of supporting aerial cable is to attach it to galvanized-steel-strand suspension wire which is attached to the pole route. The size of the suspension wire is dependent upon the size of the cable and the distance between adjacent poles.

The suspension wire is attached by means of brackets bolted to the poles and at certain positions by terminating on the poles (wrapping the wire around the pole and then clamping). The cable may be suspended by cable rings clipped to the wire at 20 inch intervals, Fig. 1, or secured to the suspension wire by a continuous wire lashing.

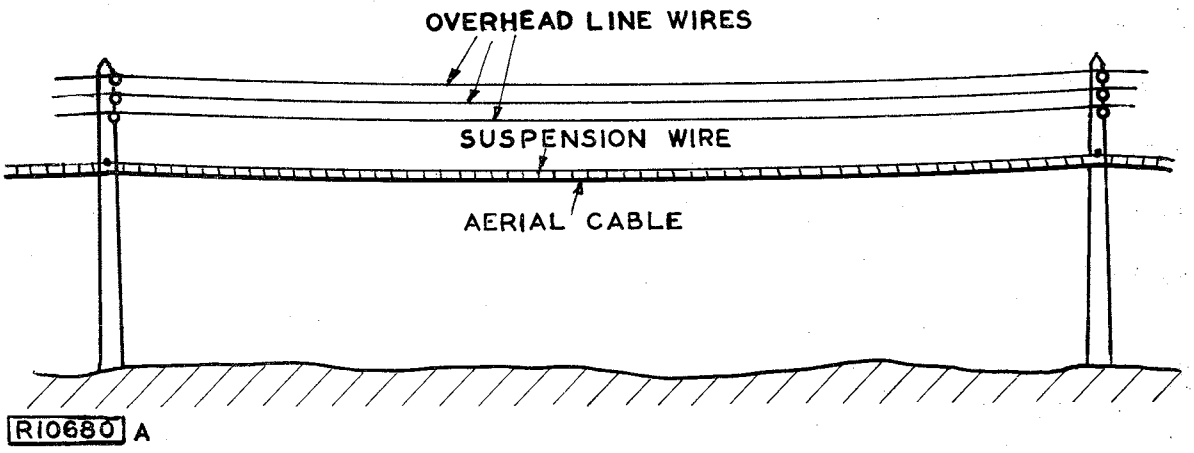


Fig. 1

ATTACHING SUSPENSION WIRE

The suspension wire consists of seven strands of galvanized high-tensile steel wire, and is available in five sizes, 7/16, 7/14, 7/12, 7/10 and 7/8. The diameter, weight and strength of each size are shown in Table 1.

TABLE 1

Size of wire	Diameter (in.)	Weight of 100 yds. (lb.)	Weight of 1 mile (lb.)	Length of 1 cwt. (yds.)	Minimum breaking weight (lb.)
7/16	0.192	23.2	407	484	3,520
7/14	0.240	36.5	642	307	5,700
7/12	0.312	61.8	1,085	182	8,700
7/10	0.384	93.8	1,650	120	13,000
7/8	0.480	148.1	2,606	77.5	22,000

The size of the wire to be used will depend on the weight of the lead-covered cable, together with the length of span. Table 2 indicates the range of weights of lead-covered cable which can be supported by each size of wire for spans up to 70 yds. in length.

TABLE 2

Length of Span (yds.)	Weight of lead-covered cable (cwts.) per 100 yds. length, to be suspended from				
	7/16 wire	7/14 wire	7/12 wire	7/10 wire	7/8 wire
Up to 40	Up to 2.9	2.9 to 5.81	5.82 to 9.27	9.28 to 14.3	14.4 to 25.2
40 " 45	" " 2.74	2.74 " 5.61	5.62 " 8.96	8.97 " 13.9	14.0 " 24.6
45 " 50	" " 2.59	2.59 " 5.39	5.40 " 8.59	8.60 " 13.4	13.5 " 23.8
50 " 55	" " 2.44	2.44 " 5.09	5.10 " 8.18	8.19 " 12.8	12.9 " 22.9
55 " 60	" " 2.29	2.29 " 4.75	4.76 " 7.67	7.68 " 12.1	12.2 " 21.9
60 " 65	" " 2.19	2.19 " 4.45	4.46 " 7.29	7.30 " 11.5	11.6 " 20.9
65 " 70	" " 2.09	2.09 " 4.11	4.12 " 6.86	6.87 " 10.7	10.8 " 19.8

The size of wire to be used throughout the section of line under consideration is that shown in the table as necessary for the longest span found generally in the line. If there are a few exceptionally long spans, and the table shows that they require a stronger wire than that indicated for the line as a whole, they are dealt with separately.

Attachment to poles

The suspension wire is attached to each pole either by means of a true termination or by means of a bracket. At certain poles the bracket attachment is reinforced by means of a false termination.

When true terminations are made, pole plates are fitted at the point where the wire is to be attached, to prevent the wire cutting into the pole. The plates are of galvanized mild steel and are curved to fit the surface of the pole. They are 4 inches x 2 inches and are supplied in two thicknesses, 12 and 20 S.W.G. The quantity and thickness of plates used will depend on the size of wire to be erected and on the diameter of the pole at the point of attachment, as shown in Table 3.

TABLE 3

Size of wire	Thickness of plates (S.W.G.)	Number of plates for	
		Poles up to 12 in. diam.	Poles over 12 in. diam.
7/16, 7/14 & 7/12	20	8	12
7/10	12	8	12
7/8	12	16	24

The plates are fixed with bonding nails, and are evenly spaced round the pole as shown in Fig. 2, the plates for 7/8 wire being fixed over one another in pairs to provide a double thickness between the wire and the pole.

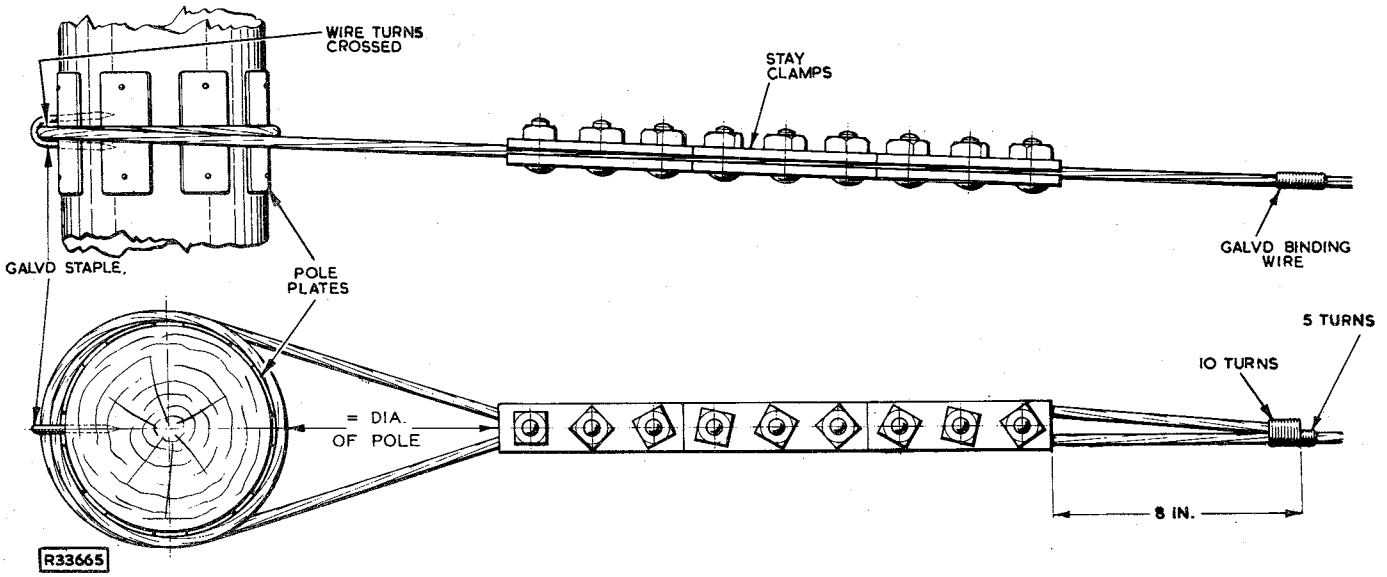


Fig. 2 - True termination for 7/12, 7/10 and 7/8 wire

True terminations

True terminations are made, as shown in Figs. 2 and 3, on poles at

(a) the beginning and end of an aerial-cable section,

(b) angle-poles where the "pull-on-pole" is 30 ft. or more,

(c) joins between lengths of suspension wire.

A true termination is made by passing the end of the wire twice round the pole, the second turn crossing the first, and securing it to the main wire by means of three stay clamps where 7/12, 7/10 and 7/8 wire is used. For 7/16 and 7/14 wire, three suspension wire clamps are used in place of the stay clamps.

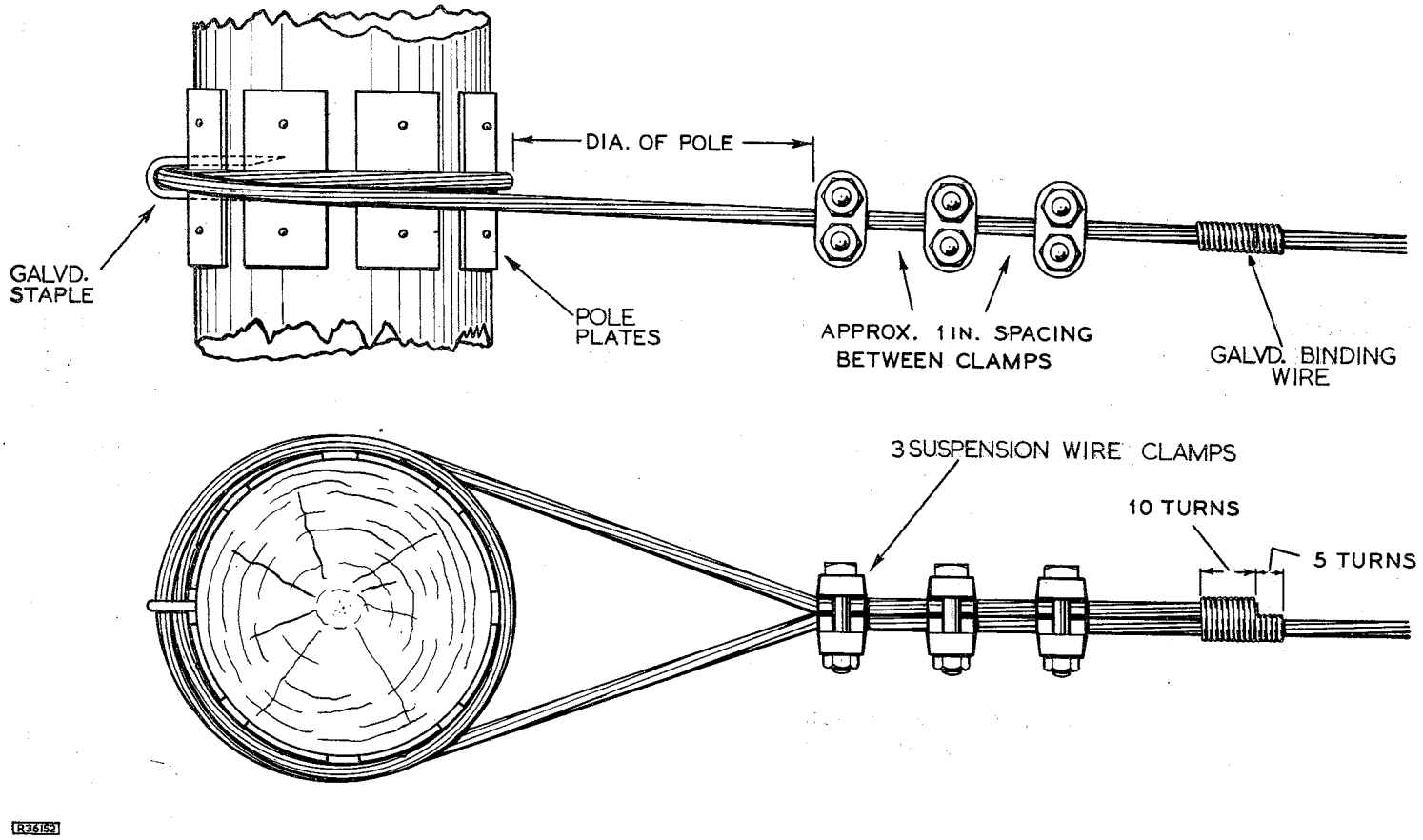


Fig. 3 - True termination, 7/16 or 7/14 wire

False terminations

False terminations are made, as shown in Figs. 4 and 5, at the ends of the spans crossing roads, navigable waterways, railways and buildings, and, where 7/8 wire is used, at angle-poles where the "pull-on-pole" is between 20 and 30 ft. and the pull is away from the pole. Poles fitted with false terminations are also fitted with back-stays. For 7/12, 7/10 and 7/8 wire, a false termination is made by passing a length of wire (of the same size and type as the main wire) twice round the pole and securing each end to the main wire with clamps. When making the terminations, the terminating wire is pulled as tightly as possible.

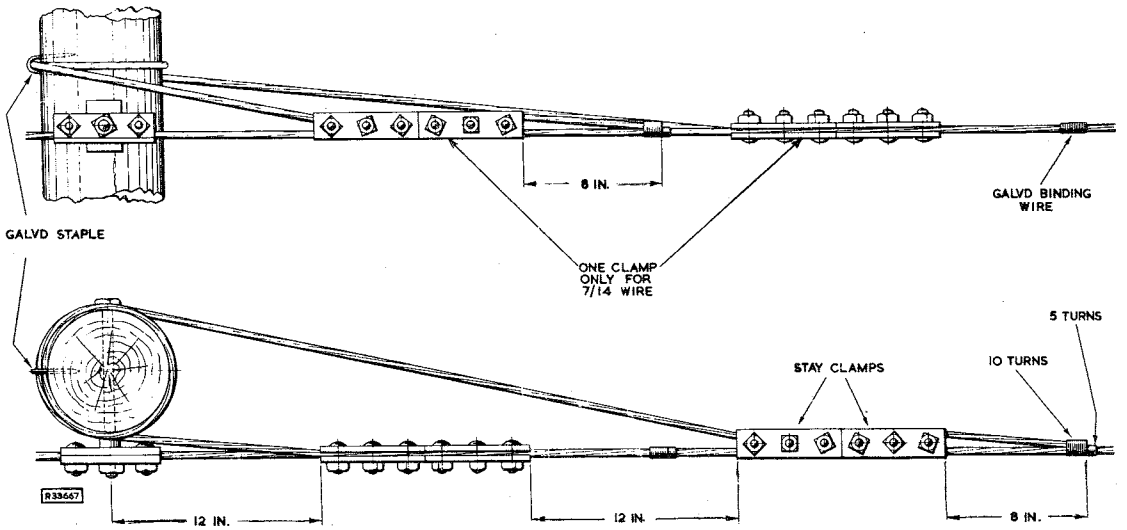


Fig. 4 - False termination 7/12, 7/10 or 7/8 wire

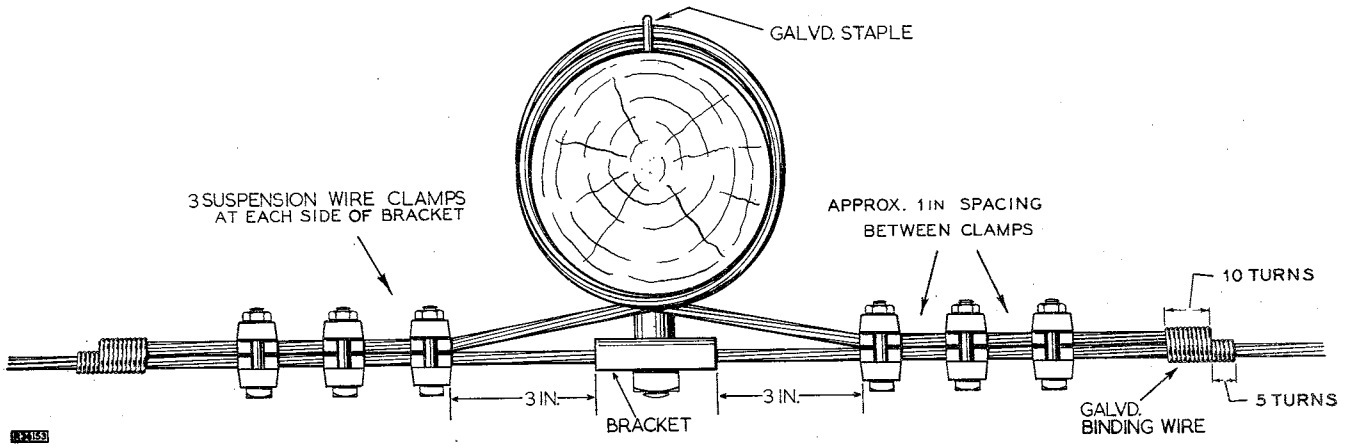


Fig. 5 - False termination 7/16 or 7/14 wire

For 7/14 and 7/16 wire, a false termination is made as shown in Fig. 5. The centre of a length of wire, of the same size and type as the main wire, is placed against the face of the pole at a point about two inches above the bracket; the two ends are passed behind the pole, crossed, brought back and crossed over the face of the pole between the first turn and the bracket. The suspension wire is stapled to the pole and clamped to the main wire as shown with three clamps, on each side of the bracket.

Brackets

Brackets are fitted on all poles except those on which a true termination is made. The brackets are fixed by means of arm-bolts and washers. One washer is a tubular spacing washer, either $\frac{3}{4}$" or $1\frac{1}{2}$" long. The shorter washer is used for cables up to 2 in. diameter, on straight sections of line, and on angle-poles where the cable is pulled away from the pole. The longer washer is used in all other positions, and for larger cables the head of the arm-bolt is on the same side as the first bracket to be fitted on any pole. Where a second cable is likely to be required, the bolt used is of sufficient length to secure the second bracket on the other side of the pole.

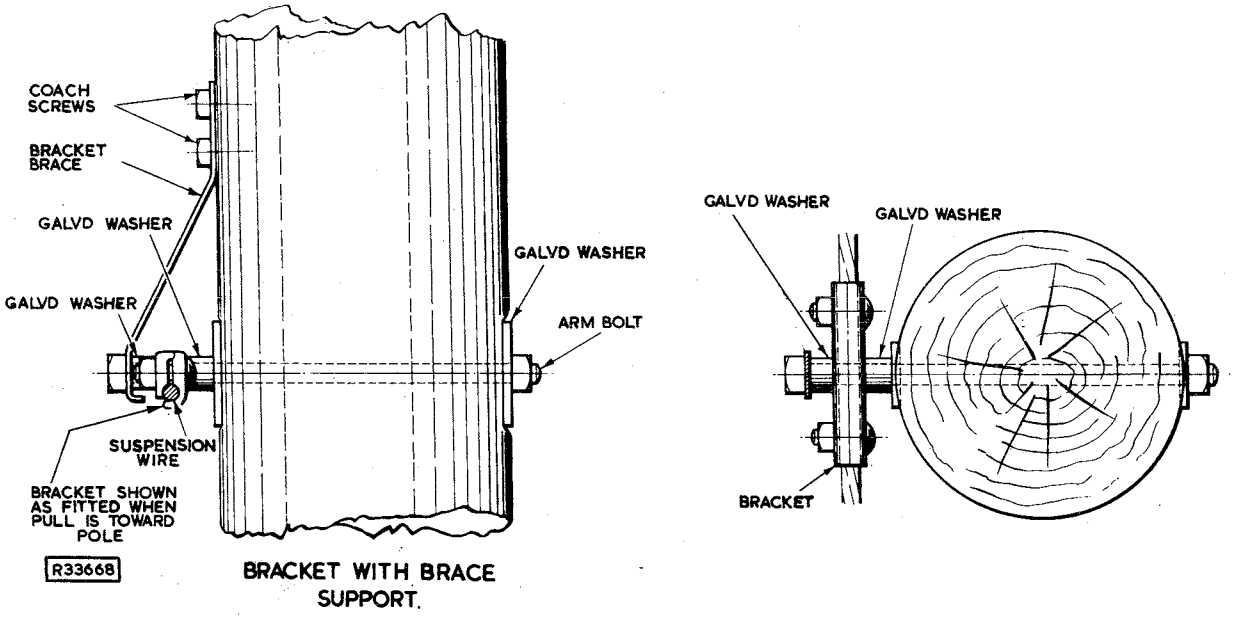


Fig. 6 - Supports for suspension wire

To prevent damage by rust, the threaded portion of the bolt is completely coated with a tallow, tar and pitch compound.

The brackets are all fitted on the same side of the poles throughout the line so that, if a second cable is erected, it will not cross the first.

When 7/10 or 7/8 wire is to be used, a brace is fitted to each bracket as shown in Fig. 6. The coach-screws are not fitted until the wire has been tensioned.

Paying out the wire

The wire is normally supplied in half-mile lengths on drums. If coils are supplied, a drum-barrow is used for paying out.

Where practicable the wire is paid out from the wire-drum mounted on cable-drum jacks on a lorry, the lorry moving along the line at an even speed, after the wire has been terminated. The wire, as it is paid out, is placed in the brackets as each pole is reached so that it will not cause an obstruction to traffic. The bracket bolts are screwed up hand-tight only, to allow the wire to slide through easily during tensioning. During paying-out, the wire is kept reasonably taut. At road crossings, the wire is prevented from sagging to a level dangerous to traffic by fixing a clamp to it close to the bracket on the first pole beyond the crossing. The fitting of this clamp on the side of the pole remote from the crossing stops any slip towards the road-crossing, but does not interfere with the subsequent tensioning. The clamp is removed when the wire has been tensioned and the brackets are being finally tightened.

Where the wire is to be erected on the field side of the line, or where stays or other obstructions prevent the use of the previous method, the wire-drum is mounted on jacks on the ground near the first pole, and the end of the wire pulled out along the line. Where possible, a vehicle is used for pulling out the wire and, to facilitate passing the end behind poles and other obstructions, the wire is attached to the vehicle by means of a length of rope, a clamp being fitted near the end of the wire to act as a stop for the rope.

As pulling out proceeds, the wire is supported on the tubular washers behind the brackets but, where this support is inadequate (e.g. at angle-poles) snatch-blocks are used. Flag-men are stationed at road crossings to warn approaching traffic should the sag in the wire reach a dangerous level.

When the length has been pulled out, the drum-end of the wire is terminated on the pole and the wire placed in the brackets, which are screwed up hand-tight only at this stage.

Tensioning

The wire is tensioned at all angle-poles where the "pull-on-pole" exceeds 20 ft. and, in sections where such angle-poles do not occur, at intervals not exceeding half a mile.

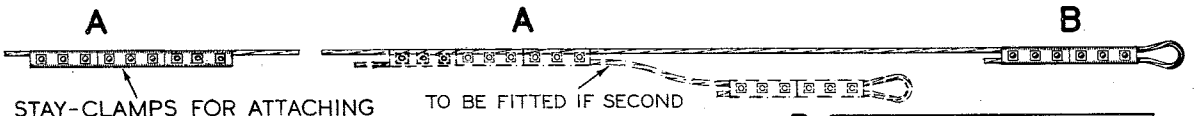
A check is made to ensure that all stays on terminal and angle-poles are adequately tightened, so that when the tension is applied to the wire the poles will not move.

Before the tensioning equipment is attached, the end of the wire is secured to the motor vehicle and any undue slack taken up. To prevent the wire slipping back in cases where it is to be tensioned at another point, e.g. at an intervening angle-pole, the end is secured, by means of rope, to the foot of the pole, a clamp being fitted to the wire to act as a stop for the rope.

The pulling-tail, assembled as shown in Fig. 7, is accommodated in a snatch-block, attached at the same height as the suspension-wire bracket, on the last pole of the section being tensioned. A second pulling-loop, as shown dotted in Fig. 7, is fitted only when the amount of slack necessitates a second pull by the chain-puller to obtain the specified tension. The pulling-tail acts also as a temporary anchorage until the next length of wire is tensioned.

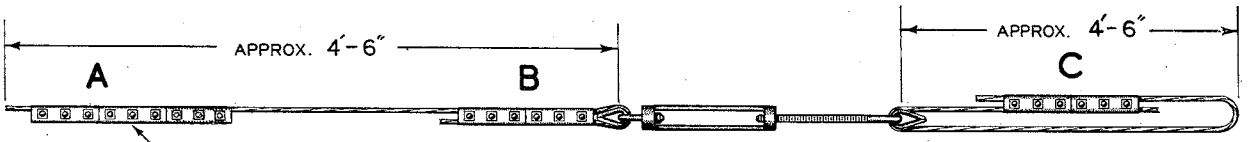
To retain the tension in the pulling-tail, a short tail is assembled as shown in Fig. 8, and used to by-pass the dynamometer and pulling-tackle, thus enabling them to be removed for use on the next length of wire. For 7/16 and 7/14 suspension wire 3 U-bolt clamps are used at each position.

Three U-bolt clamps are used instead of stay-clamps at the various positions A, B and C marked in Figs. 7 and 8 when 7/16 and 7/14 suspension wire is being used.



POSITION		NUMBER OF STAY-CLAMPS AT SIZE OF WIRE 7/12	7/10	7/8
A		3	3	4
B		2	3	3

Fig. 7 - Pulling tail



POSITION		NUMBER OF STAY-CLAMPS AT SIZE OF WIRE 7/12	7/10	7/8
A		3	3	4
B		2	3	3
C		2	2	3

Fig. 8 - By-passing tail

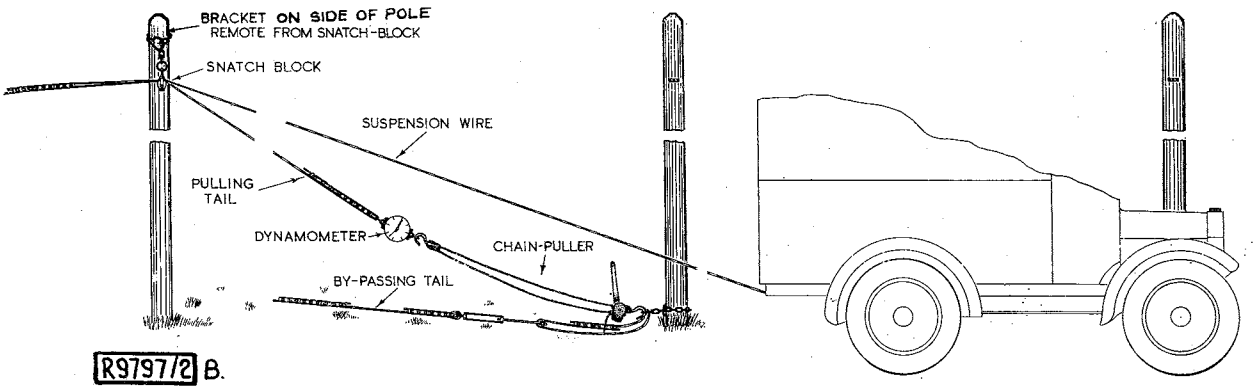


Fig. 9 - Pulling tackle attached after slack in wire has been taken up

The pulling tackle is anchored so that it is in line with the suspension wire. Anchorage is obtained as follows:-

(a) In straight sections of line, to the foot of the first pole beyond the section to be tensioned.

(b) At terminal poles, to the foot of an adjacent pole - the pulling-tail being passed through an additional snatch-block attached to the pole.

(c) At angle-poles and points where (a) and (b) are impracticable, to the bow of a stay-rod temporarily provided, where necessary, for the purpose.

Where the poles are in soft ground or have been erected recently, it may be necessary to strengthen the anchorage by attaching a temporary stay between the foot of the pole used as an anchor and the foot of the next pole (see Fig. 10).

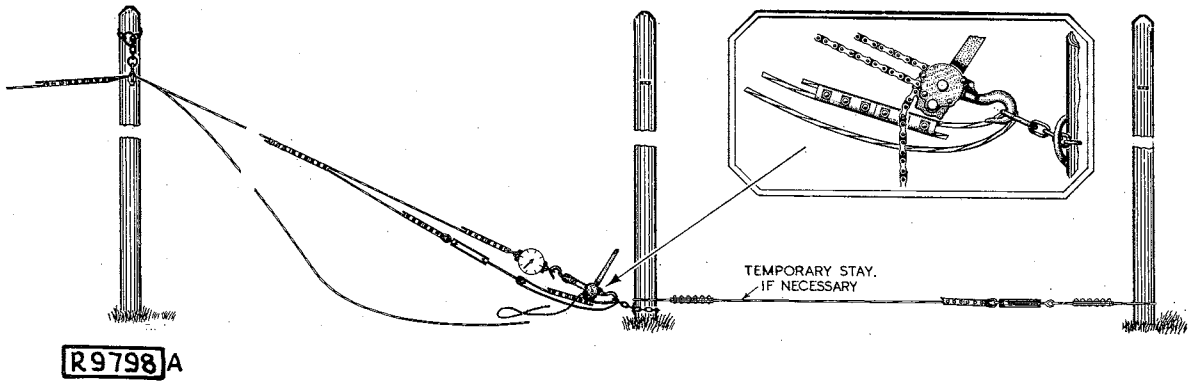


Fig. 10 - Tension applied by chain-puller, by-passing tail attached to pulling-tail

Tables have been prepared giving the required tension for various sizes of wire, span lengths, and temperatures. The section for lead-covered cables within the temperature range 41°F to 60°F is given in Table 4. The tension applied is that shown against the length of the longest span (excluding any spans where special construction methods are to be used) in the section being tensioned and for the temperature prevailing at the site.

TABLE 4

Span length (yds.)	Tension (lb.) to be applied at 41°F - 60°F				
	7/16 wire	7/14 wire	7/12 wire	7/10 wire	7/8 wire
Up to 40	780	1800	2680	4350	5600
40 " 45	690	1610	2440	3850	5600
45 " 50	600	1450	2220	3500	5600
50 " 55	510	1310	2020	3210	5600
55 " 60	440	1180	1830	2950	5600
60 " 65	400	1060	1670	2720	5410
65 " 70	375	940	1510	2500	5220

The application of the tension specified ensures that, when the cable is in position, the maximum tension in the suspension wire under the most adverse weather conditions likely to be experienced, will not exceed half the breaking weight of the wire. A greater factor of safety obtains for 7/8 wire, the tensions for which have been determined with the object of keeping them within the range of the tensioning tackle already available.

Where the section being tensioned includes an angle-pole having a "pull-on-pole" under 20 ft., a tension 300 lb. greater than that specified is applied and then gradually reduced to the specified value, to equalize the tension throughout the section.

Where a true termination is to be made after tensioning, the value of the tension applied is increased by 50 lb. for 7/16 and 7/14 wire and by 100, 150 or 200 lb. for 7/12, 7/10 or 7/8 wire, respectively, to allow for the tension lost in the make-off.

When the required tension has been applied, the following operations are performed:-

(a) The by-passing tail is attached and tightened, if the tensioning appliances are required for use on another section. To release the tensioning appliances, the swivel of the by-passing tail is tightened until the needle of the dynamometer falls by approximately 100 lb. The chain-puller may then be slackened and removed.

(b) The arm-bolts and brackets supporting the tensioned wire are fully tightened.

(c) The coach-screws are fitted to the bracket braces where required.

(d) The next length of wire is tensioned, or a true termination made, as necessary.

The pulling and by-passing tails remain in position until the next length of wire has been tensioned, or until the wire has been terminated.

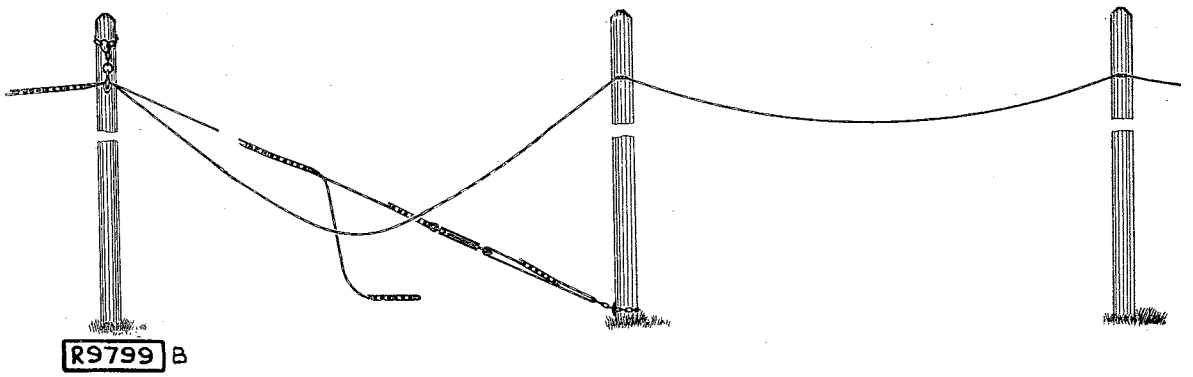


Fig. 11 - By-passing tail taking load, next length of wire run out to next tensioning point

(The chain puller and the dynamometer have been removed for use at the next tensioning point).

ATTACHING CABLE TO SUSPENSION WIRE BY RINGS

This method has now been superseded in the British Post Office, with the exception of some special cases, by the "cable lasher" method described later. The rings are available in two types as shown in Fig. 12, and are supplied in five sizes, designed to fit the four types of 7-strand suspension wire in use. The odd ring is a small one, used for supporting cable up to 0.77 in. diameter on 7/14 wire, and designed to avoid ring-cutting commonly caused by using large rings on small cable. The rings will accommodate cable of the maximum size specified for their appropriate wires.

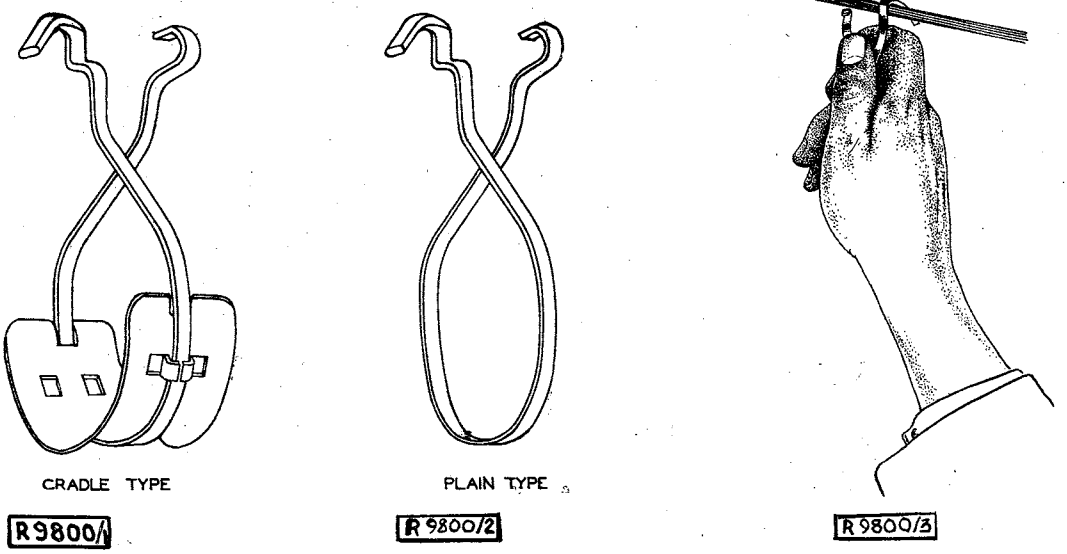


Fig. 12

Before the rings are attached, the draw-rope for the cable or, where an appreciable length of wire is to be ringed before cabling commences, a draw-wire or a sash line, is run out along the section and strung from pole to pole. At angle-poles where the suspension wire has been secured by means of true terminations, the draw-rope passes round the inside of the angle.

Attachment of rings

The rings, with the draw-rope or wire enclosed, are attached by placing the longer hook around the wire and then springing the shorter hook into place, as shown in Fig. 12. The rings are so placed that the shorter hooks are towards the point to which the cable is to be pulled.

Placing of the rings is carried out with the aid of a ringing chair (Fig. 13), in which the ringer is seated. A safety belt, worn by the ringer, embraces both the top bar of the chair and the suspension wire. It is generally convenient for the ringer to propel himself along the wire, but where assistance is required (e.g. on gradients) it is provided by a man on the ground by means of a rope attached to the chair and passed over the tubular washer between the pole and suspension-wire bracket of the next pole.

The first and last ring of each span is attached 10 in. from the centre of the suspension-wire bracket - or equivalent position at true terminations - except at cable terminations, where the first and last ring is placed at the end of the bend in the cable. On the remainder of the span the rings are 20 in. apart, except in spans crossing railways where the spacing is 12 in.

Regular spacing of the rings is obtained by the use of a marked horizontal measuring wire, attached to the framework of the chair, as shown in Fig. 13.

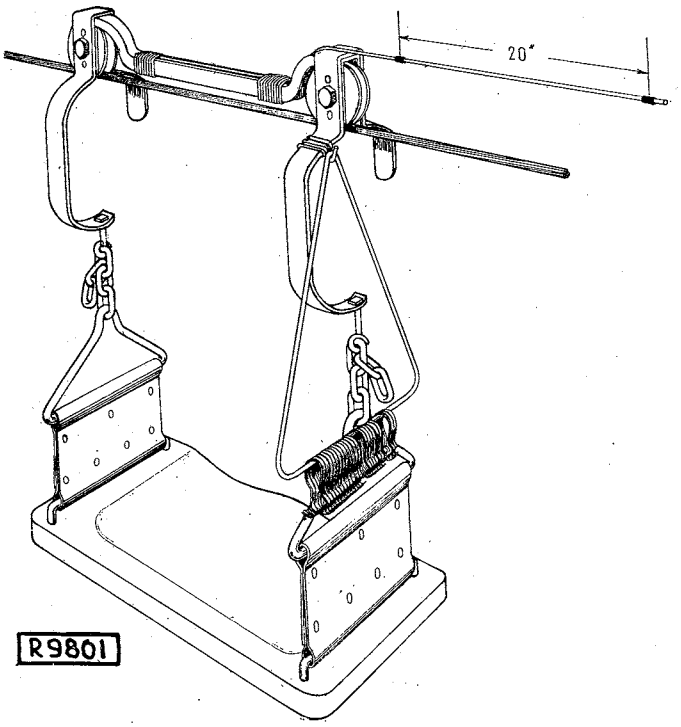


Fig. 13 - Ringing chair

Erection of aerial cable

The length of cable which can be pulled-in in one operation is dependent on the size of cable and the number of angle poles in the section. For cables up to $\frac{3}{4}$ in. diameter the length varies from 500 to 800 yards, and for larger cables from 250 to 350 yards. The location of joints for balancing, and the requirement that all joints shall be at poles, will generally determine the length. In the case of a balanced cable a length of 250 to 350 yards is regarded as a maximum.

Before pulling-in is commenced, all stays are tightened to prevent the deflection of poles due to stresses resulting from pulling-in operations.

Where practicable all cable lengths are pulled-in in the same direction, normally with the "clockwise" end towards the "UP" station to facilitate jointing procedure, but in certain cases it may be necessary to depart from this rule, e.g. when cabling on a gradient and pulling down the incline will be easier than pulling up. To avoid displacement of the cable rings it is arranged that the cable is always pulled in the direction from the longer hooks of the rings to the shorter hooks.

Equipment at cable-drum end

The equipment necessary at the cable-drum end is shown in Fig. 14.

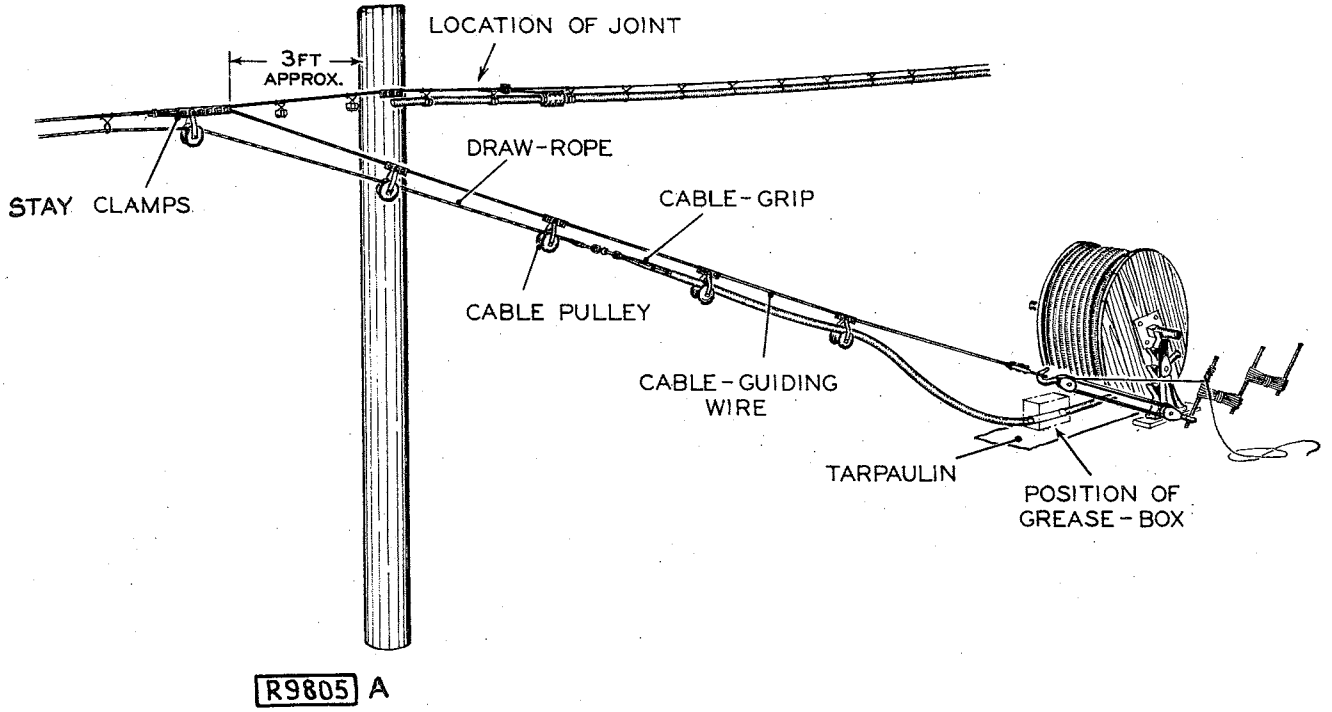


Fig. 14

As shown in Fig. 13 the cable drum is mounted on jacks about 30 ft. behind the first pole, such that the cable will leave the drum from the underside. A cable guide wire is attached to the suspension wire by means of stay clamps, and the lower end is connected to blocks and tackle. Cable pulleys are attached to the guide wire. The cable is lubricated by feeding it through a grease box containing petroleum jelly. The draw rope, which is placed through the rings during ringing operations, is attached to the cable as follows:-

(a) For smaller size suspension rings, the cable end is bent back for about 9 in., and the loop is secured to the ring of a swivel by a number of loops of G.I. binding wire. The cable loop is dressed down and tightly bound with linen tape.

(b) For larger cables, the cable end is dressed down and a cable grip is used as shown in Fig. 15.

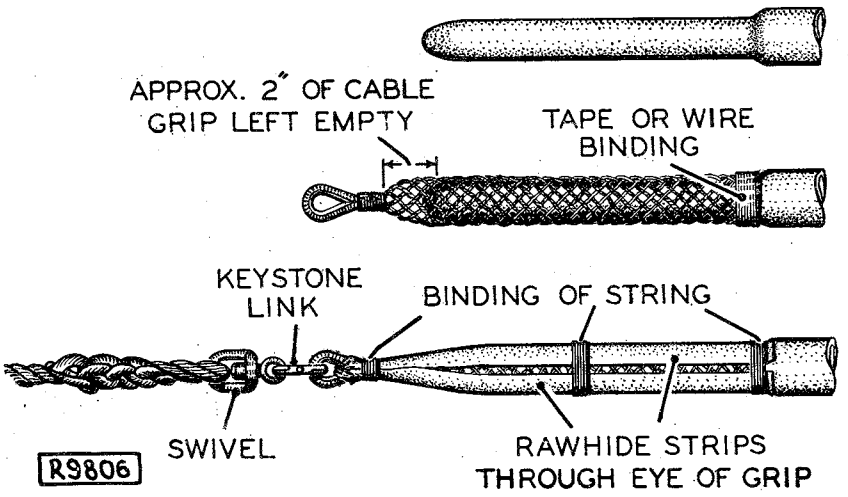


Fig. 15

Equipment at pulling end

The draw rope is passed through a cable pulley which is attached to the suspension wire as near as possible to the last pole, on the side of the pole nearest the cable drum. The end of the rope is attached to either (a) a winch, or (b) a motor vehicle of 30 cwt. or greater capacity, the rope being attached to the drawbar.

(a) When a winch is used it is anchored near the foot of the next pole following the last pole in the section being cabled, a snatch block being attached to the foot of the pole. If this is not practicable, due to obstructions, the snatch block is attached to the foot of the last pole in the section.

(b) Motor vehicle: where conditions make it impracticable or difficult for the vehicle to travel in the same direction as the cable, the draw rope is passed through a snatch block attached to the foot of the last pole. The cable is pulled-in at an even speed of about 3 m.p.h. To avoid obstructing side roads it may be necessary to

carry out the operation in a series of short pulls, the vehicle returning to its starting point at the end of each pull. Where a bend in the road would cause the draw rope to cross the carriageway it may be necessary to secure the rope to the foot of conveniently placed poles by means of snatch blocks.

Equipment at angle poles

Where a cable is being pulled round the outside of an angle, which is sharp enough to cause the cable to rub against the pole, a lubricated fibre mat is attached to the pole as shown in Fig. 16. Fig. 16 also shows the protection of rawhide strips provided at such a pole after pulling-in the cable.

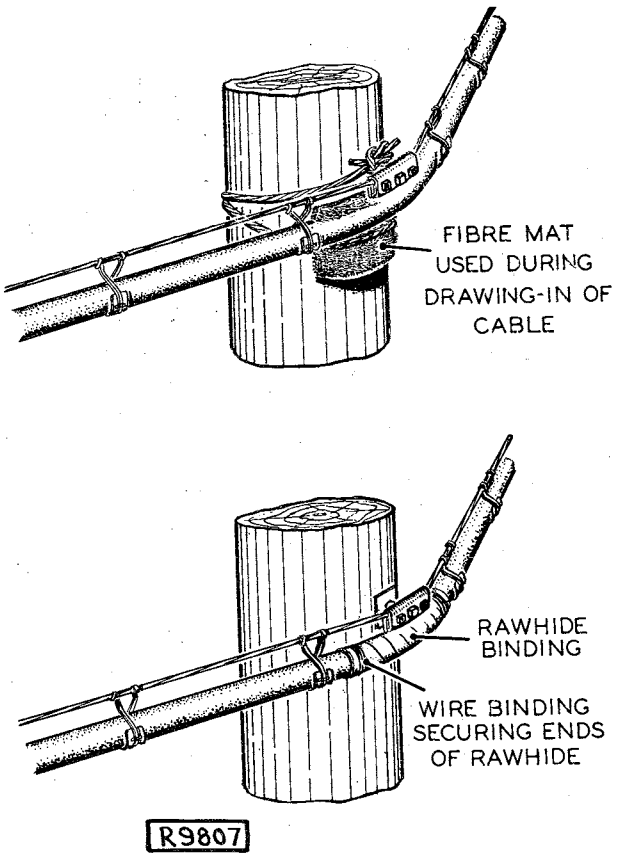


Fig. 16

When pulling-in on the inside of an angle pole it may be necessary to attach cable pulleys to the suspension wire to guide the cable.

Anchoring of aerial cable

Unless precautions are taken, the aerial cables will creep through the cable-rings towards the lowest points in the spans. This results in the rings cutting the cable. Small cables, i.e. those up to 1" in diameter, are therefore clamped direct to the suspension-wire by a double clamp which can be seen in Fig. 17

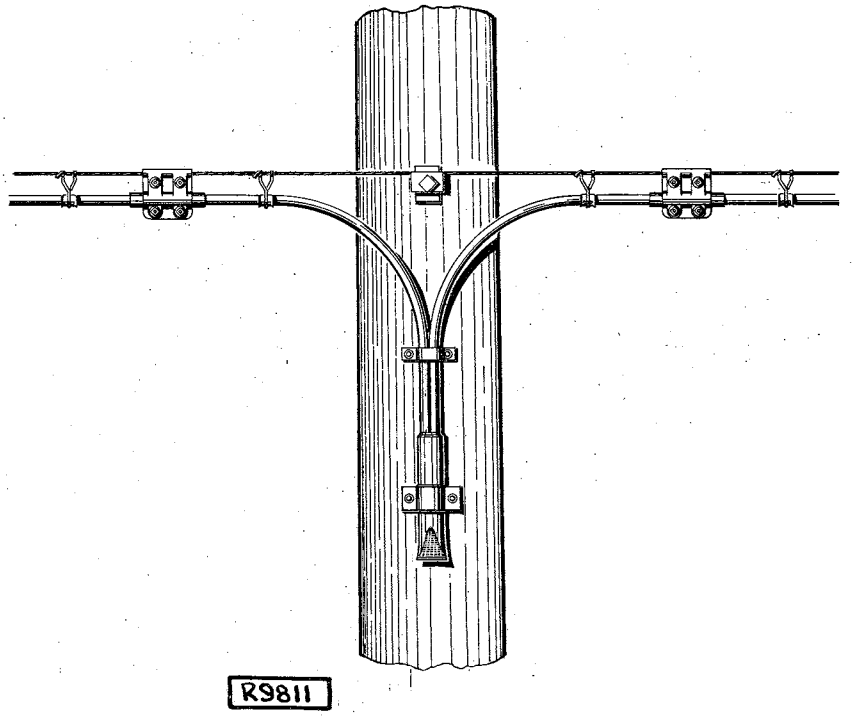


Fig. 17 - Anchoring at vertical joints

In the case of larger cables, an insulating-gap coupling, normally employed in underground cable practice, is used. Here it forms a single clamp on the cable, and is tied to the suspension-wire by a length of 7/14 galvanized-iron wire and a U-bolt clamp. For examples, see Figs. 18 and 19.

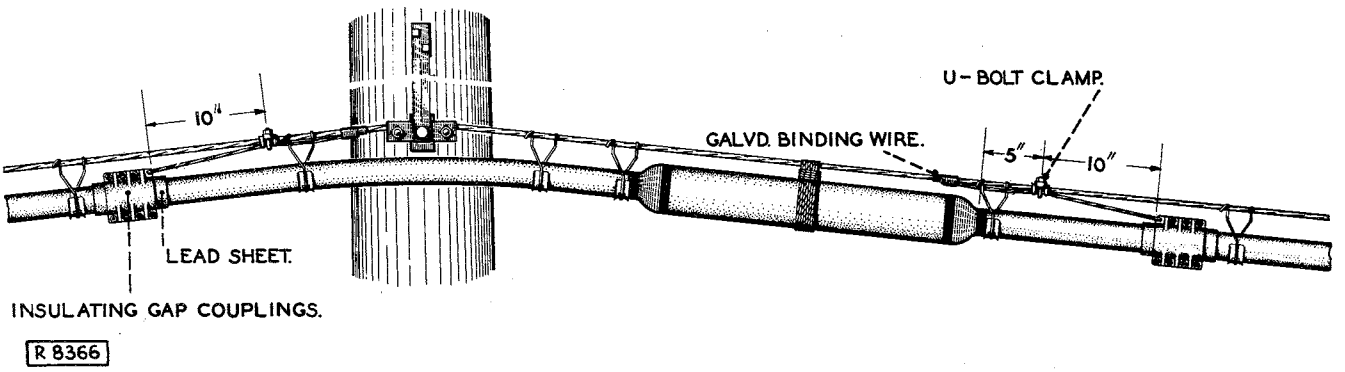


Fig. 18 - Anchoring at horizontal joints

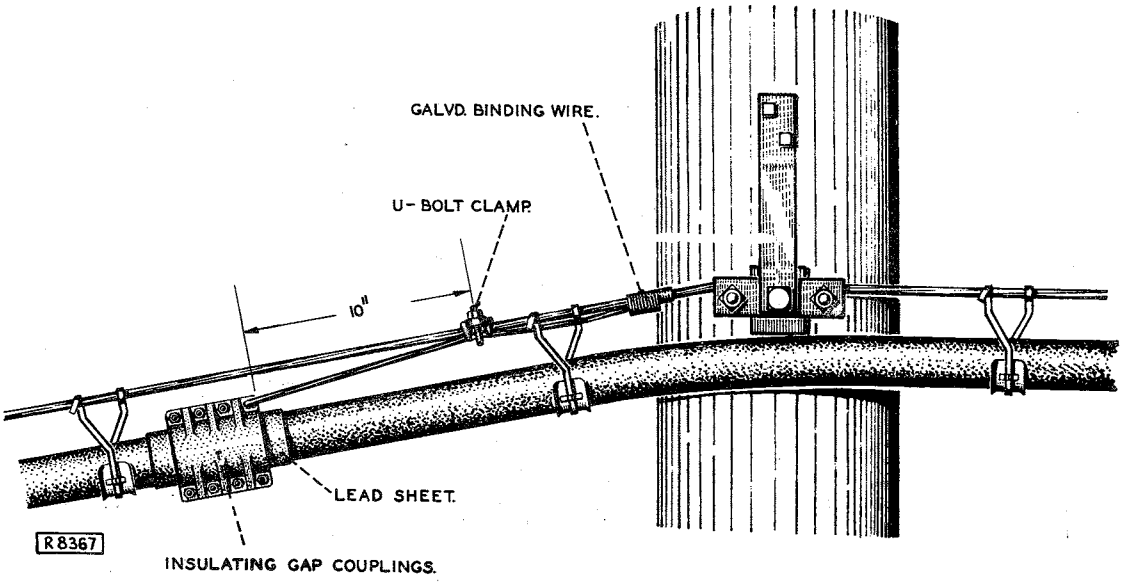


Fig. 19 - Anchoring at a gradient change

Lead sheet is always used as a packing and protective material between the cable and the clamp. These anchoring devices are attached to the cable when it is erected, and are not afterwards disturbed.

Aerial cables are anchored at joints in the cable, to take the inevitable cable tension off the joint. They are anchored at loading-coil points for the same reason. Where the cable terminates, it is anchored. Other anchoring points are where the difference in height between the two ends of a span exceeds 1/25th of the span length, and where the deviation of the line at an angle-pole is such that true or false terminations are required on the suspension-wire.

ATTACHING CABLE TO SUSPENSION WIRE BY CABLE LASHER

In this method the cable is lashed to the suspension wire along the whole of its length by a spiral lapping of wire. This lashing wire is either a heavily galvanized mild-steel wire, or a galvanized mild-steel wire with a P.V.C. covering. The lashing is performed by a machine called a cable lasher, drawn along the suspension wire.

The Cable lasher

Figs. 20 and 21 give a general impression of what a lasher looks like and how it is used.

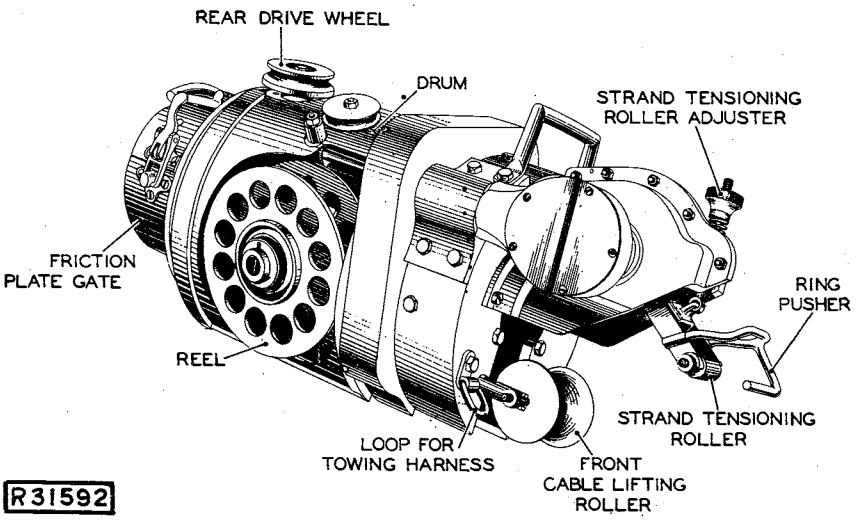

REAR DRIVE WHEEL
DRUM
STRAND TENSIONING ROLLER ADJUSTER
FRICTION PLATE GATE
RING PUSHER
REEL
STRAND TENSIONING ROLLER
LOOP FOR TOWING HARNESS
FRONT CABLE LIFTING ROLLER
R31592

Fig. 20

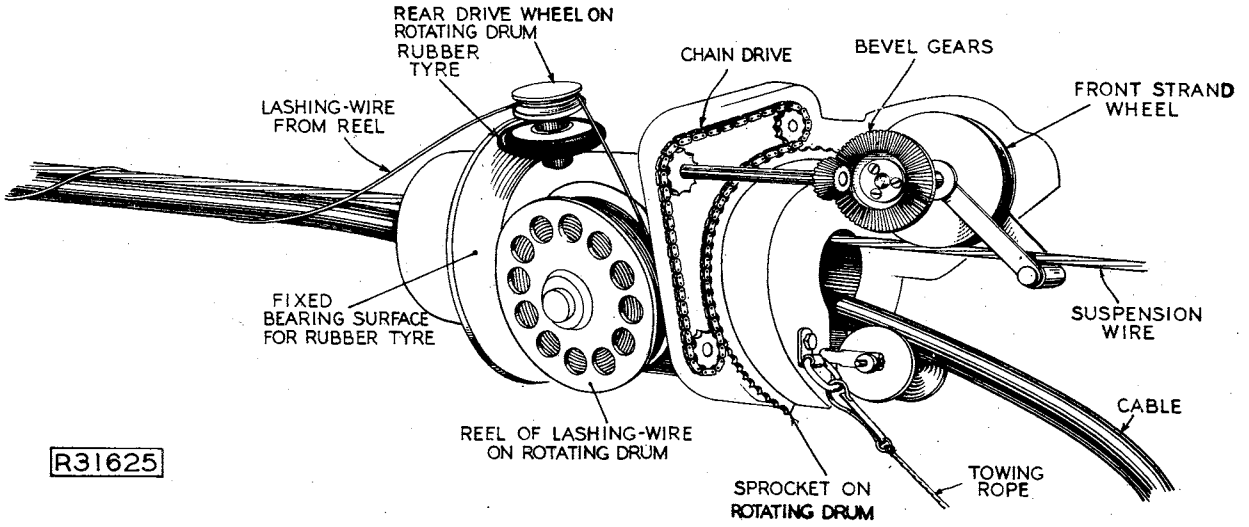

REAR DRIVE WHEEL ON ROTATING DRUM
RUBBER TYRE
CHAIN DRIVE
BEVEL GEARS
FRONT STRAND WHEEL
LASHING-WIRE FROM REEL
FIXED BEARING SURFACE FOR RUBBER TYRE
SUSPENSION WIRE
CABLE
REEL OF LASHING-WIRE ON ROTATING DRUM
SPROCKET ON ROTATING DRUM
TOWING ROPE
R31625

Fig. 21

It is made mainly of aluminium alloy (for lightness) and consists of two main parts:-

(a) A carriage which runs on the suspension wire and which raises and supports the cable at the level of the suspension wire.

(b) A drum which carries the coil of lashing wire and which rotates as the machine is pulled along, thereby wrapping the lashing wire around both cable and suspension wire.

The mechanism by means of which the drum is rotated can be seen in Fig. 21. When the carriage is pulled along the suspension wire, the front strand wheel rotates and the drive is transmitted through bevel gears and a sprocket to a chain which engages with a sprocket on the drum. Another drive is obtained by passing the lashing wire round the rear drive wheel. The end of the wire is secured at the pole and when the machine is pulled away from the pole, the rear drive wheel, around which the wire passes, rotates, and the rubber-tyred wheel fixed to this pulley bears on the friction plate which forms part of the carriage and causes the drum to rotate round the carriage.

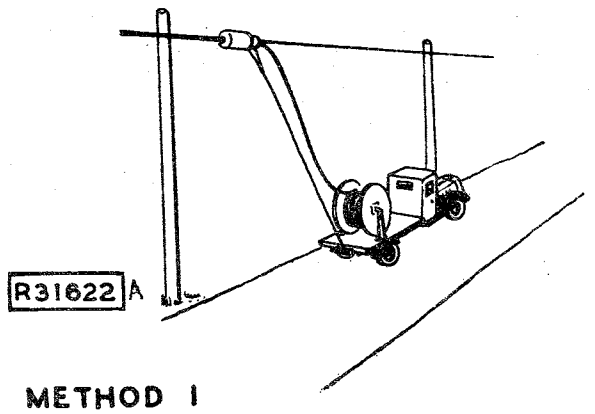
Erection of cable

The principle is that when the lasher is pulled along the suspension wire it raises the cable to the level of the suspension wire and wraps the lashing wire tightly round the suspension wire and cable with a lay of approximately 15 inches.

There are three methods of erecting the cable by means of the machine:-

Method 1

The cable drum is mounted on a motor vehicle or trailer which is moved along the route. As the cable is paid off, the machine lashes it to the suspension wire. Fig. 22 illustrates this method.



It is used to erect cables up to 1 in. diameter when all the following conditions apply:-

(a) the road is sufficiently wide to permit other traffic to pass the vehicle

(b) the road is conveniently near the poles

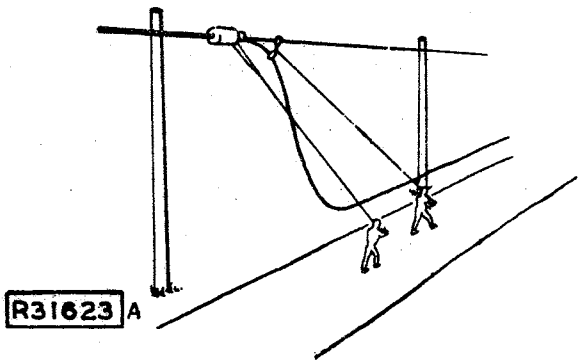
(c) the suspension wire is on the road side of the poles

(d) there is no obstruction between the road and the suspension wire.

Fig. 22

Method 2

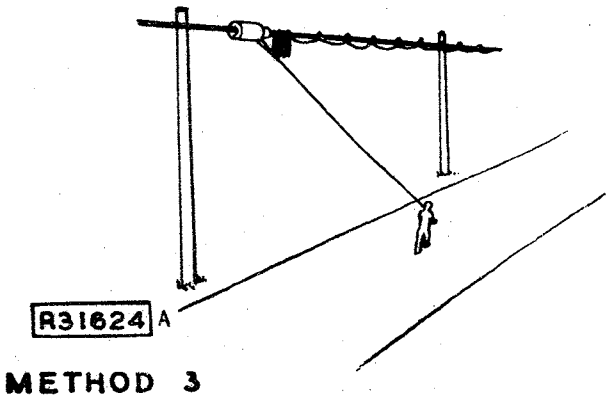
The cable is first laid out on the ground under the suspension wire and subsequently lashed in position. Fig. 23 illustrates the arrangement.



This method is used to erect cables up to 1 in. diameter when any of the conditions of method 1 cannot be met and when the cable will not suffer damage in being laid-out or pulled along the ground.

Fig. 23

Method 3



The cable is erected temporarily in wire rings; the machine subsequently pushes the rings away and lashes the cable in position. Fig. 24 illustrates the arrangement.

This method is used to erect cables which are greater than 1 in. diameter, and for cables less than 1 in. diameter when methods 1 or 2 cannot be used.

Fig. 24

When the cable is erected temporarily in wire rings, the rings are spaced at 6 ft. intervals along the suspension wire and the cable is pulled through them in one complete operation. Scrap suspension wire is cut into lengths of approximately 17 in. and the strands separated. A length of spun yarn or strong marline at least 4 yds. longer than the span concerned should be attached to the wires by making clove hitches round the mid-point of each wire, in turn, so that the wires are spaced along the yarn at 6 ft. intervals commencing 6 ft. from end. The wires are then formed into the shape shown in the inset of Fig. 25 the small loop being made by bending the wire at the clovehitch round a combiner bolt or arm bolt.

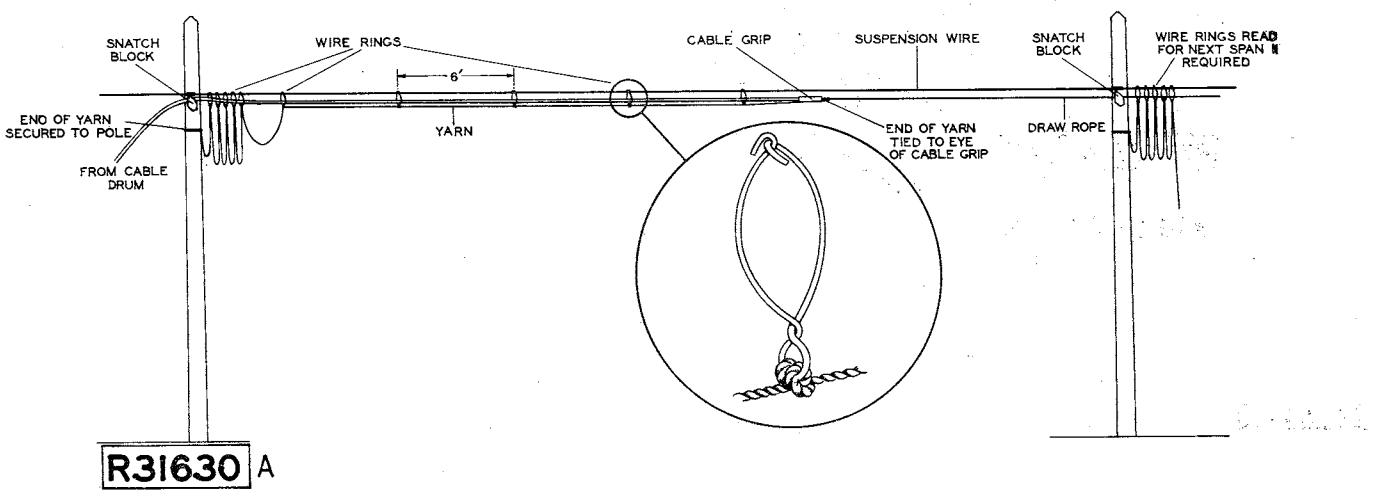


Fig. 25

All the rings of a set should be clipped round the suspension wire close to a pole, the rings being placed in position on the suspension wire in the order in which they are tied together. The line from the ring nearest the pole should be tied to the pole so that the length of line from the ring to the point of attachment on the pole is approximately 6 ft. The sets of rings on the other spans should be placed in a similar manner.

The draw rope is now passed through all wire rings, snatch blocks, etc., and the cable is attached to the draw rope. The end of the yarn (on which the rings are tied) is fastened to the cable grip as shown in Fig. 25. The cable is then drawn in and the rings spaced at 6 ft. intervals by uniform pulling on the draw rope.

Positioning of joints

Lengths of lead sheathed aerial cable are jointed horizontally where the cable diameter exceeds one inch, or a double stub loading pot is provided, or where a joint is made on an existing straight-through position. The joint must be located so that the whole of the joint is within 5 ft. of the pole. When the joint is completed the lashing wire is tightly wrapped round the joint and suspension wire and made-off on the suspension wire. Fig. 26 shows this arrangement.

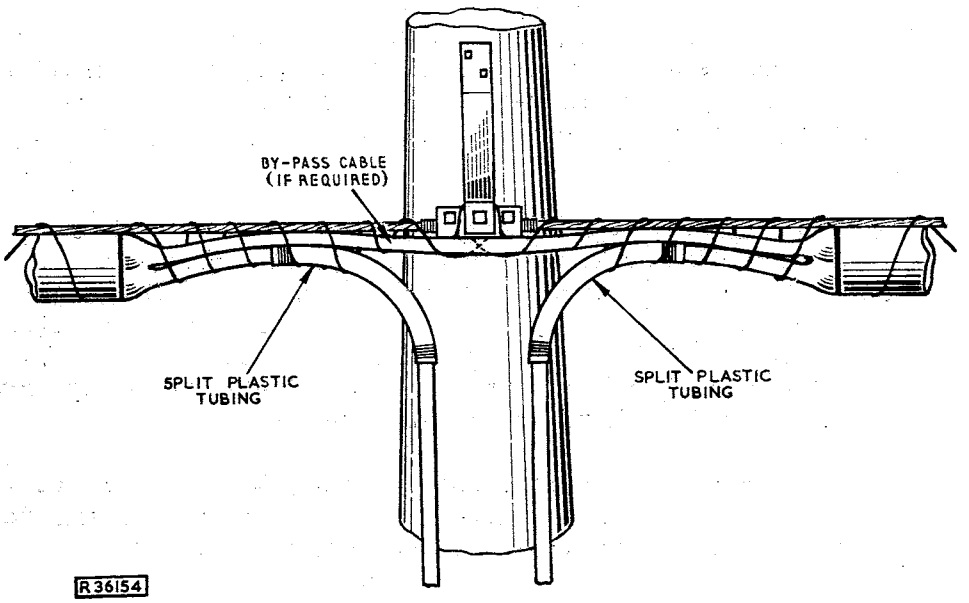


Fig. 26 - Horizontal joints

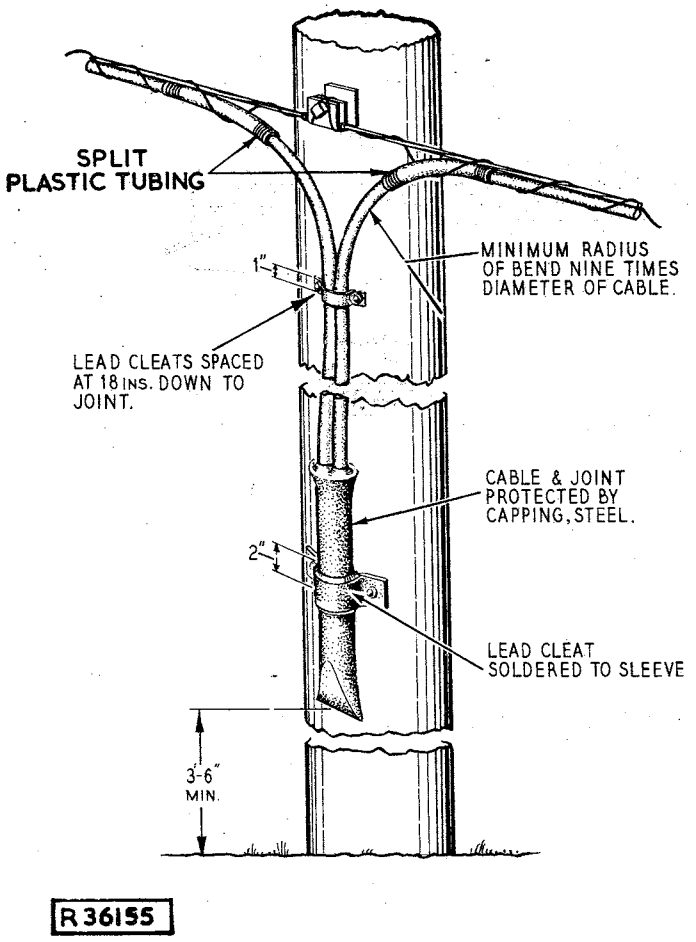


Fig. 27 - Vertical joint

In other cases i.e. when the cable is less than one inch diameter, or a single stub loading pot is provided, a vertical joint is made. When the joint is completed, the lashing wire is wrapped round the cable and the suspension wire to the point where the cable is bent away from the suspension wire. From this point to the pole the lashing wire is wrapped round the suspension wire alone, and made off it the bracket or clamp, as shown in Fig. 27.

General information

At all points where the cable runs close to a bracket or clamp and also at vertical joints, the cable should be protected against damage, due to chaffing, by folding a layer of plastic strip round the cable before lashing it to the suspension wire. The plastic strip is secured to the cable by three ties of lashing wire.

To transfer the machine from one span to the next, the lashing wire is secured by tightly wrapping a few turns of insulating tape around the cable, suspension wire, and lashing wire. Sufficient wire is then pulled off the reel to enable the lashing to be completed by hand and the wire is cut. The machine is transferred to the next span, the binding wire is again made off and the lashing in of the next span is commenced. When the lashing of the previous span is completed by hand and the end of the wire made off, the insulating tape is removed.

Whenever lashing wire is made off it is always wrapped ten times round the suspension wire alone, the first turn being close up to a bracket or clamp to prevent it slipping along the suspension wire and becoming loose.

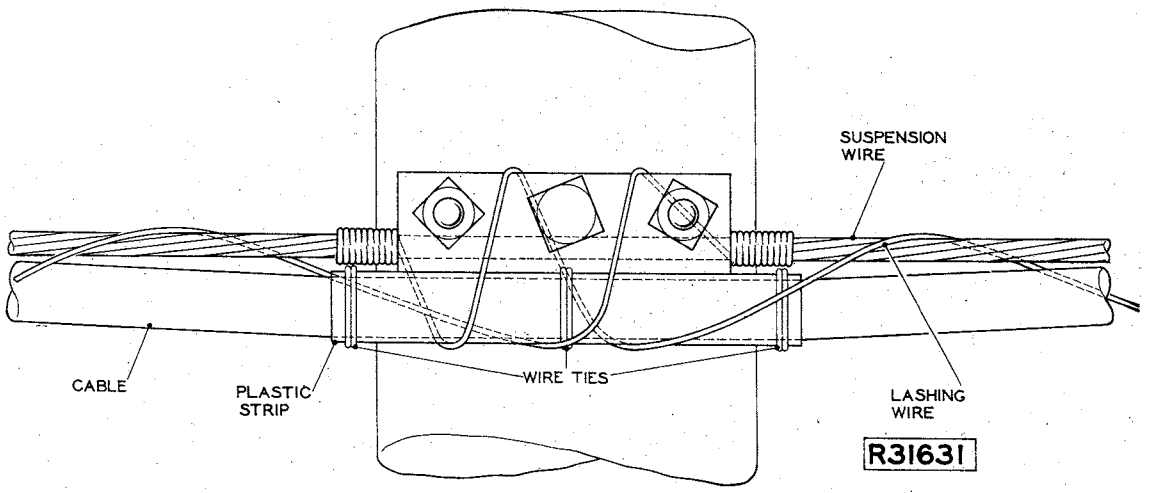


Fig. 28

Fig. 28 illustrates the method of making off the lashing wire at intermediate poles and false terminations.

Fig. 29 illustrates the method of making-off the lashing wire at true terminations.

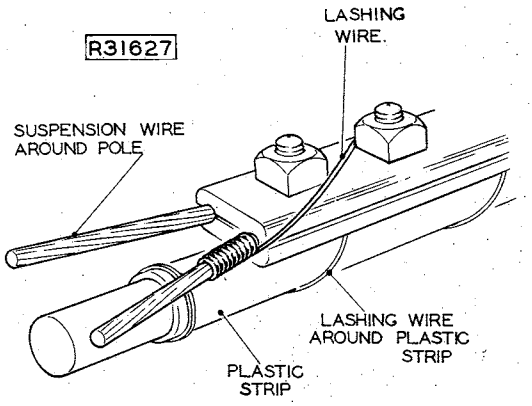


Fig. 29

RAILWAY CROSSINGS

The general requirements governing railway crossings are that:-

(a) the span to be as short as possible, with 55 yards as the maximum length,

(b) when the cable diameter is less than 2 inches single poles are provided on each side of the crossing, but if the diameter exceeds this, or two cables with their combined diameters exceeding 2 inches, the British Transport commission may request H-poles,

(c) and the poles supporting the crossing span must be transversely stayed, and have a longitudinal stay attached on the side remote from the crossing.

Cables of up to one inch diameter are erected in the usual manner as already described. Larger cables, however, are suspended in the crossing span by two suspension wires. Both wires are of the same size, and each is capable of independantly supporting the cable under storm conditions. The main suspension wire is erected in the normal manner, and the auxiliary wire and aerial cable are erected temporarily in wire rings. The auxiliary wire is terminated permanently just above the main suspension wire bracket on one of the poles as illustrated in Fig. 30, the space between the clamps and the pole being approximately 3 inches.

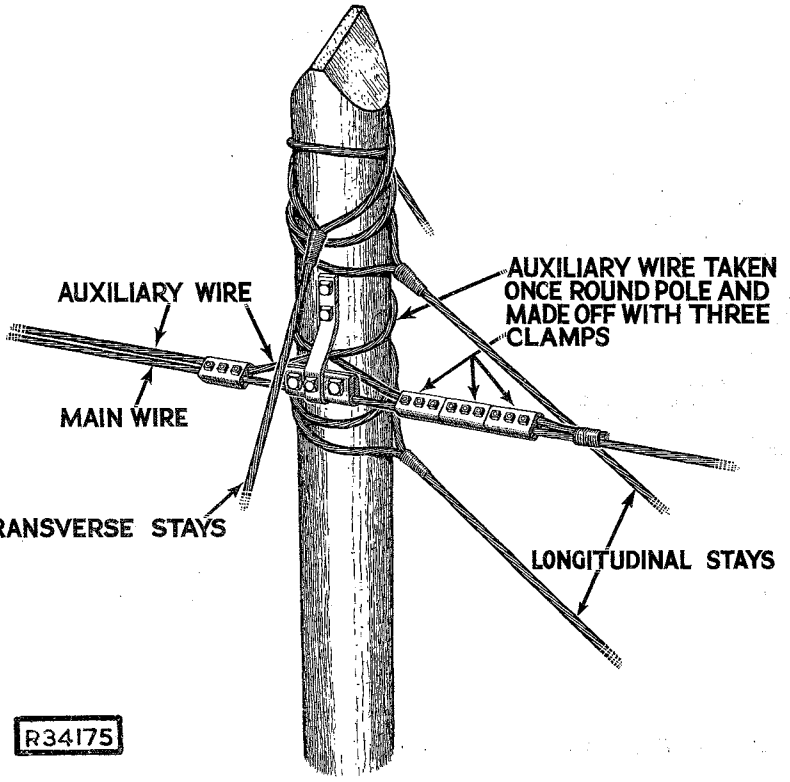


FIG.2

Fig. 30

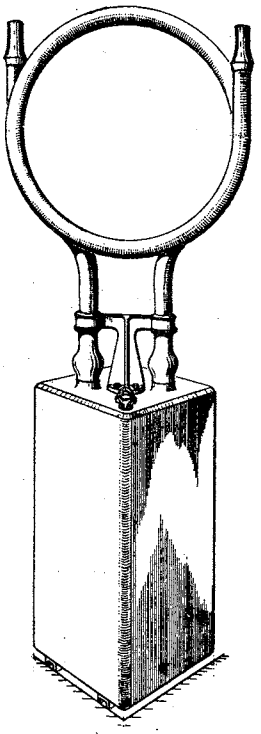
The lasher, with the ring pusher attached, is placed on the main suspension wire as near as possible to the pole on which the auxiliary wire is terminated. The auxiliary wire is placed between the sides of the strand tensioning roller and the ring pusher to prevent one suspension wire twisting round the other. The lashing wire is made off at the single clamp and the cable is lashed in.

When the lasher reaches the distant end of the span, the auxiliary suspension wire is terminated at the pole in the manner previously described and the lashing is completed by hand, the lashing wire being made off at the single clamp as before.

When this lashing has been completed the cable is lashed in a second time. For the second lashing the ring-pusher and front strand tension roller are removed from the cable lasher, to enable it to ride satisfactorily over the suspension wire and the existing lashing wire. The second lashing is completed by hand and made off at the brackets as shown in Fig. 30.

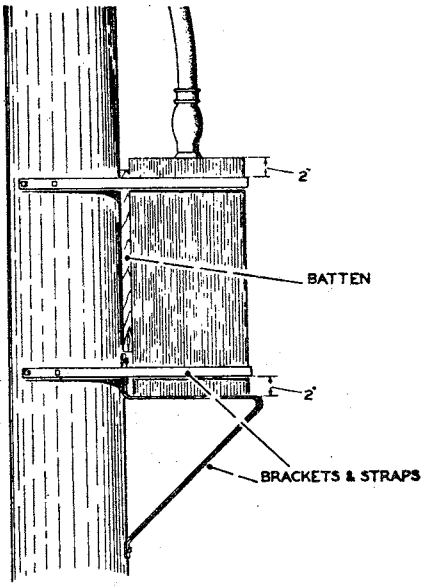
MOUNTING OF LOADING POTS

The type of loading pot used for mounting on poles for aerial cable is shown in Fig. 31. It is similar in construction to the type installed in manholes, except that it has a painted finish instead of fabric covering, and has no particular base.



R9808 A

Fig. 31



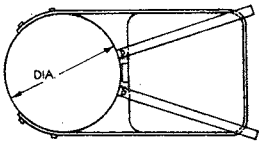


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Fig. 32

Bracket mounting is used for cases weighing not more than 320 lb. A stronger mounting, known as an auxiliary-pole mounting, is used for cases exceeding 320 lb. in weight. Where practicable the loading pot is fixed on the same side of the pole as the cable to which it is connected. Where conditions preclude this arrangement, e.g. where two pots are connected to the same cable, or a pot would overhang the carriageway, the position selected is such that (a) access to line wires will not be obstructed and (b) stub cables will be in a position least liable to damage during operations on poles. The loading pot is fixed so that the top is approximately 3 ft. below the suspension wire. Where two bracket-mounted cases fixed at 90° would foul each other if fixed at the same level, clearance is obtained by fitting one pair of brackets below the level of the other. Where a pole has to be erected, e.g. on new pole lines or on rearrangements, every effort is made to maintain the standard spacing of 2,000 yds. between loading points. Approximately 1% variation in the loading coil sections is permissible for P.C.Q.T. cable. It may be necessary to erect additional poles on existing routes to keep within this limit. The pole is adequately stayed before the loading pot is fitted.

Bracket mounting

This method of mounting loading pots on poles is illustrated in Fig. 32. The brackets and straps used are shown in detail in Fig. 33.

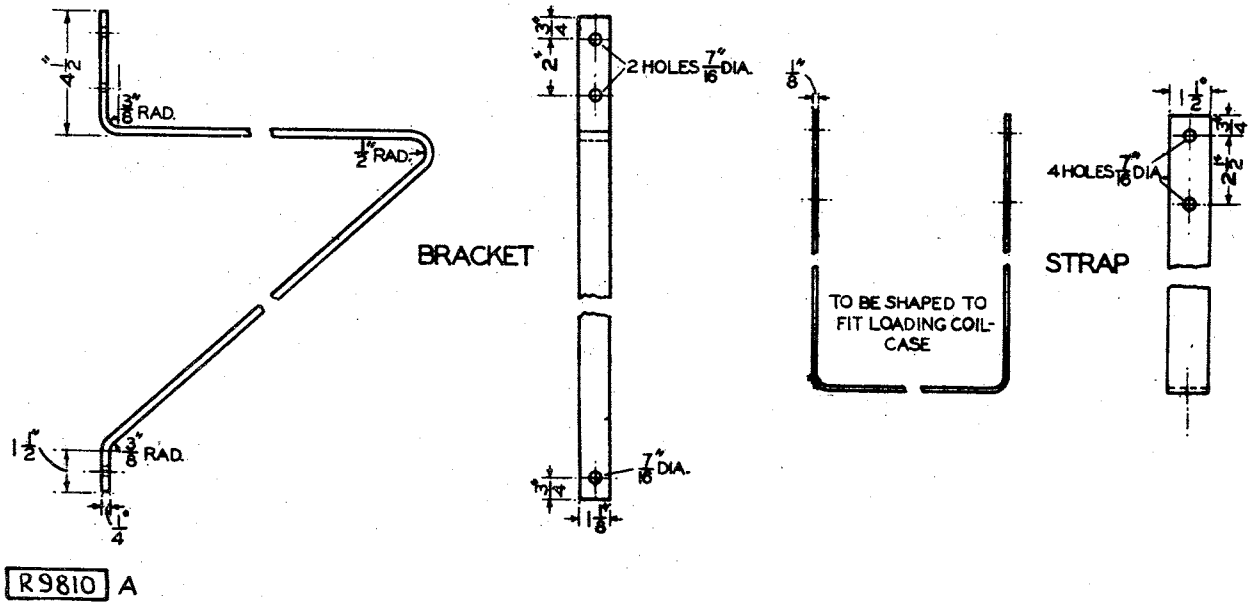

Fig. 33

The brackets are fixed by coach-screws in the positions shown in Fig. 30. The spacing of the two brackets depends on the diameter of the pole. A wooden template is often used to facilitate the fixing of the brackets in the correct positions. A batten, approximately 6 in. less than the height of the loading pot, is nailed to the pole to provide a bearing surface for the back of the case clear of the coach-screws. Two straps, shown in Fig. 31 are used for securing the loading pot to the pole.

Auxiliary-pole mounting

In this method a second pole is erected close to the main pole and the pot mounted on a platform between the two poles. The auxiliary pole should be of approximately the same diameter as the line pole to ensure that the arms forming the platform are parallel, this being particularly necessary where two pots are mounted on opposite sides of the line pole. When setting the auxiliary pole the requirements are as follows:-

(a) The pole, which should be vertical, is set at a depth appropriate to the line pole.

(b) A firm fotting is essential to ensure that the platform remains level, and, where necessary, the pole should be blocked.

(c) The distance between the poles should be $1\frac{1}{2}$ in. more than the width of the pot so that the pot can be placed in position without difficulty.

(d) The auxiliary pole is braced to the line pole by means of the tie bolts.

Where auxiliary poles can be erected beside the pole line the layout is as shown in Fig. 34.

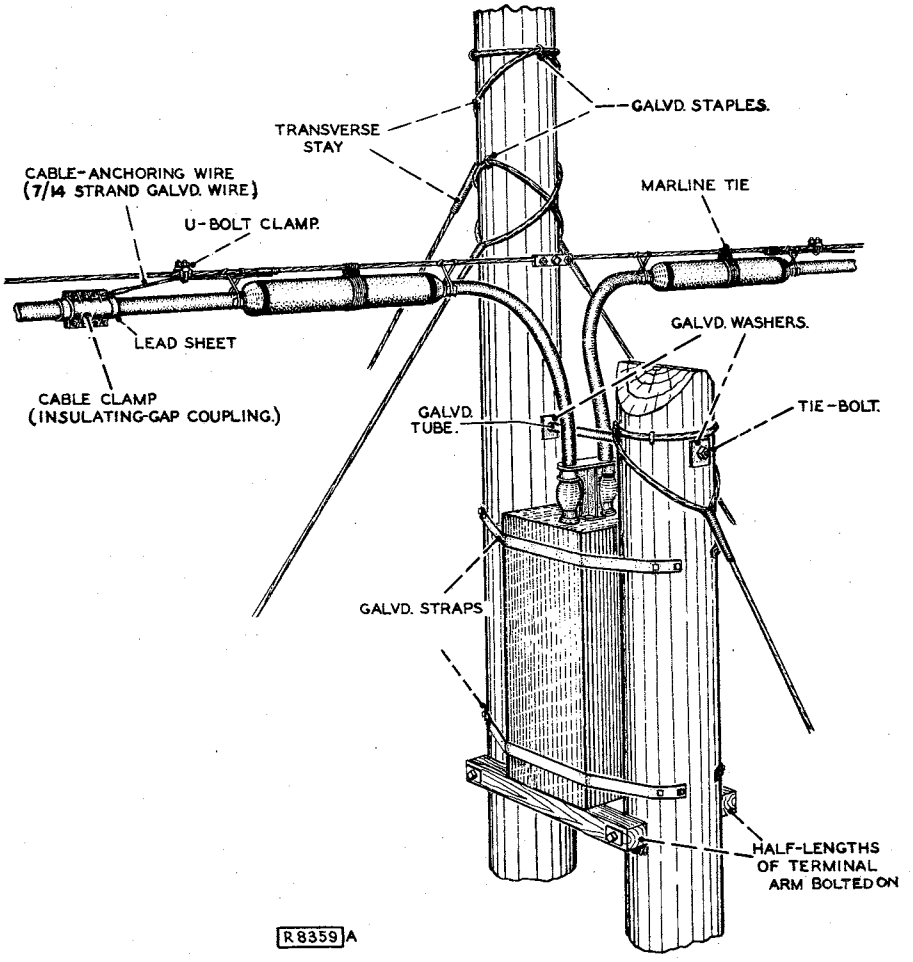

Fig. 34

Where it is necessary to erect auxiliary poles in the direction of the line, the arrangement is shown in Fig. 35.

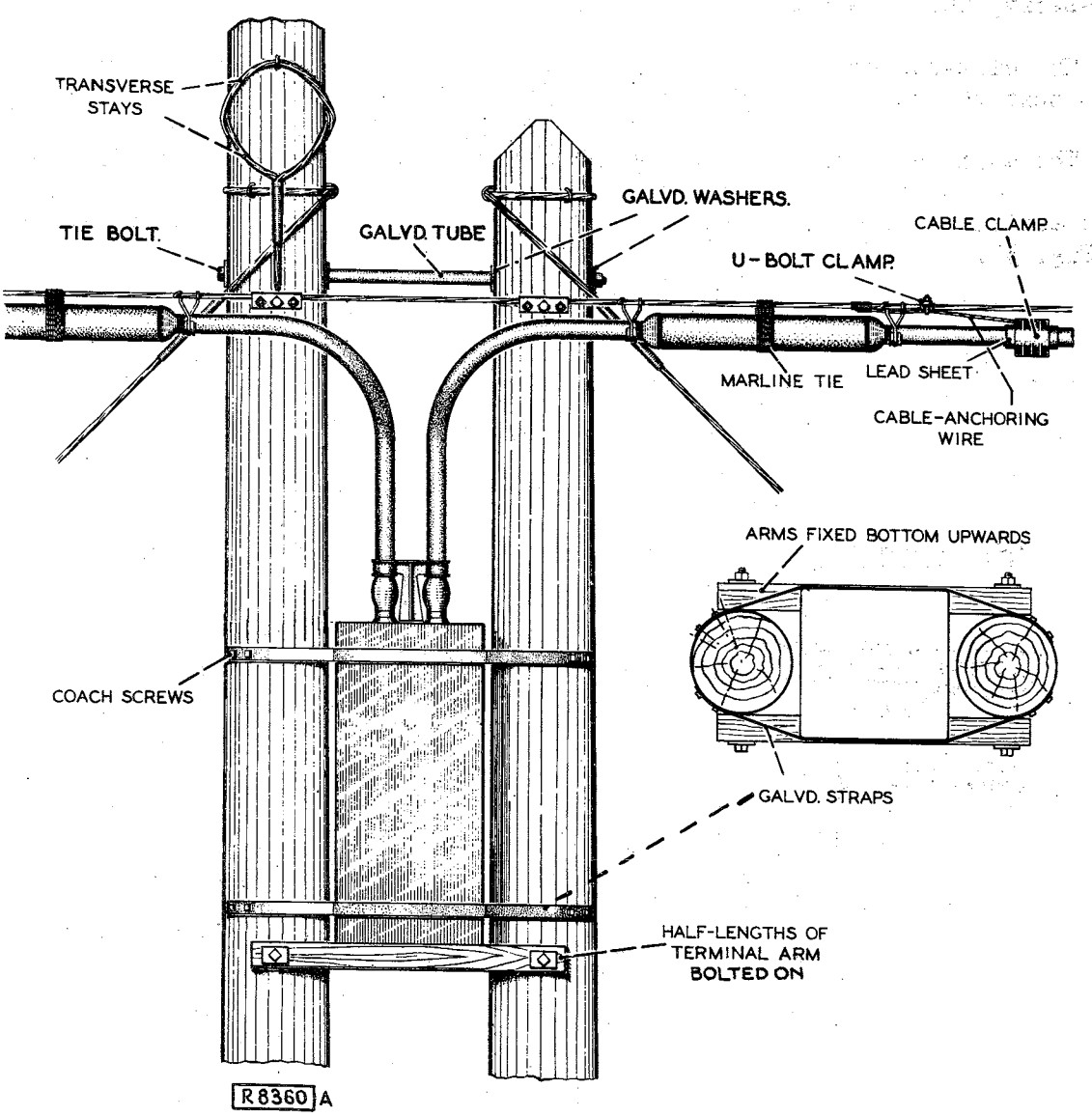

Fig. 35

Where only one loading pot is required, half lengths of 3 in. x 3 in. arms are fixed to the poles with arm bolts (Figs. 34 and 35). Where two pots are mounted on opposite sides of the pole, two full-length terminal arms are fixed by means of three arm bolts to the line pole and two auxiliary poles. Accurate boring of both the arms and poles is necessary to ensure that the platform is level. When the width of a pot to be fixed beside the line pole, or the width of a pot to be fixed in line with it does not exceed the diameter of the pole by 3 in., additional bearing surface is provided by fixing lengths of terminal arm across the platform as shown in Fig. 36.

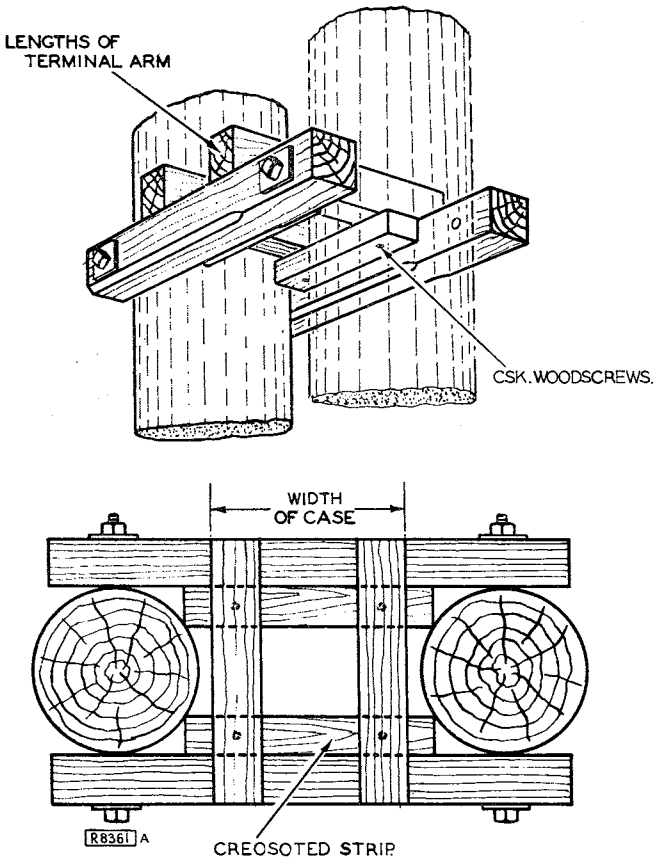

Fig. 36

The loading pot is secured by means of four straps as shown in Figs. 34 and 35.

While only one pot is generally required on any one pole, the methods of mounting, already described, can be used for fitting more than one, the actual number being dependent on the facilities for, and type of, mounting. Where bracket mounting is employed, up to four cases can be fitted. Where auxiliary-pole mounting is required, two cases can be fitted on opposite sides of the line pole.

Lifting loading pots into position

The loading pots are lifted into position by means of a sling chain and blocks and ropes. For cases on bracket supports, the tackle can often be attached to an arm (which should be braced) directly above the bracket supports. Where an arm cannot be used, and for heavier cases, (i.e. all cases on auxiliary-pole supports) the sling chain and tackle are attached direct to the pole. To provide a bearing for the chain such that the tackle is suspended centrally over the loading pot position, stayblocks or a short piece of pole should be lashed to the pole. When a case is being raised it should be guided by hand or guy lines to avoid damage to the stub cables.

JOINTING PLATFORMS

The platform, which is used by jointers when working on aerial cables, and consists of wooden floor sections supported by tubular iron framework, is either:-

(a) clamped to a pole at one end and supported at the other end by a pair of tubular struts (which are clamped to the pole) and by a ladder to which the platform is lashed, as shown in Fig. 37; or, where clamping one end to the pole is not practicable,

(b) suspended from the aerial cable suspension wire by means of two wire slings and supported by a ladder at each end as shown in Fig. 38. (This method should not be used on 7/14 suspension wire).

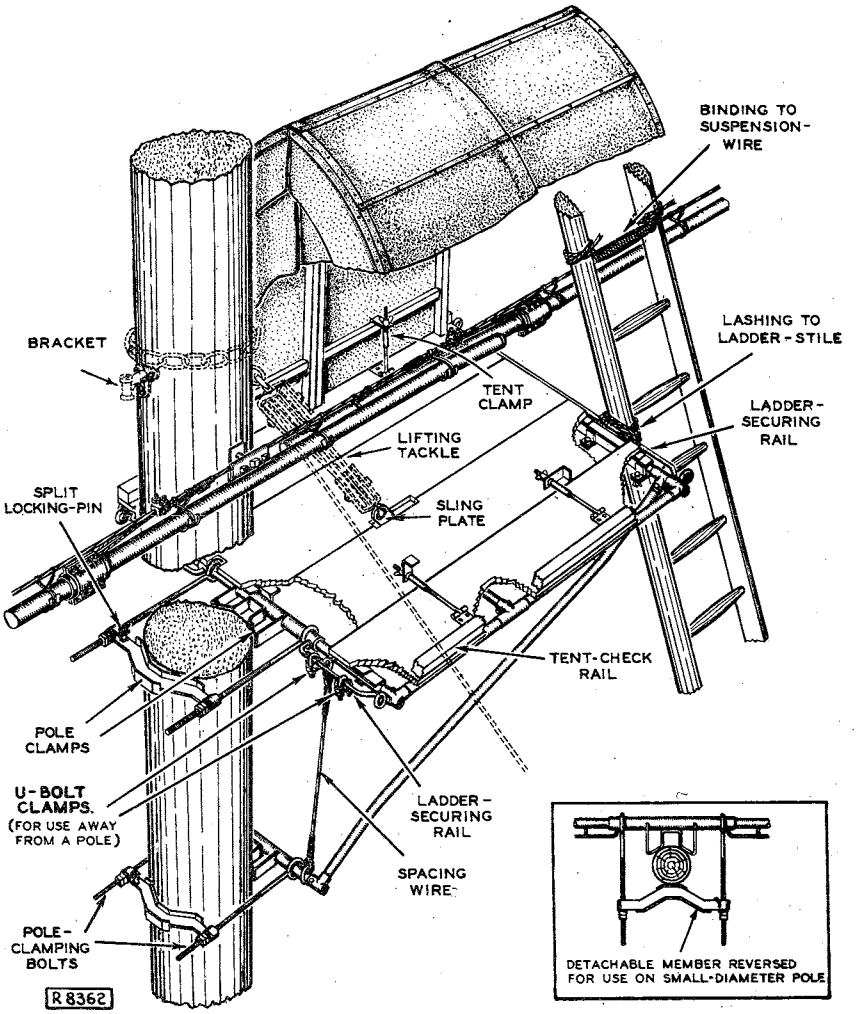

Fig. 37

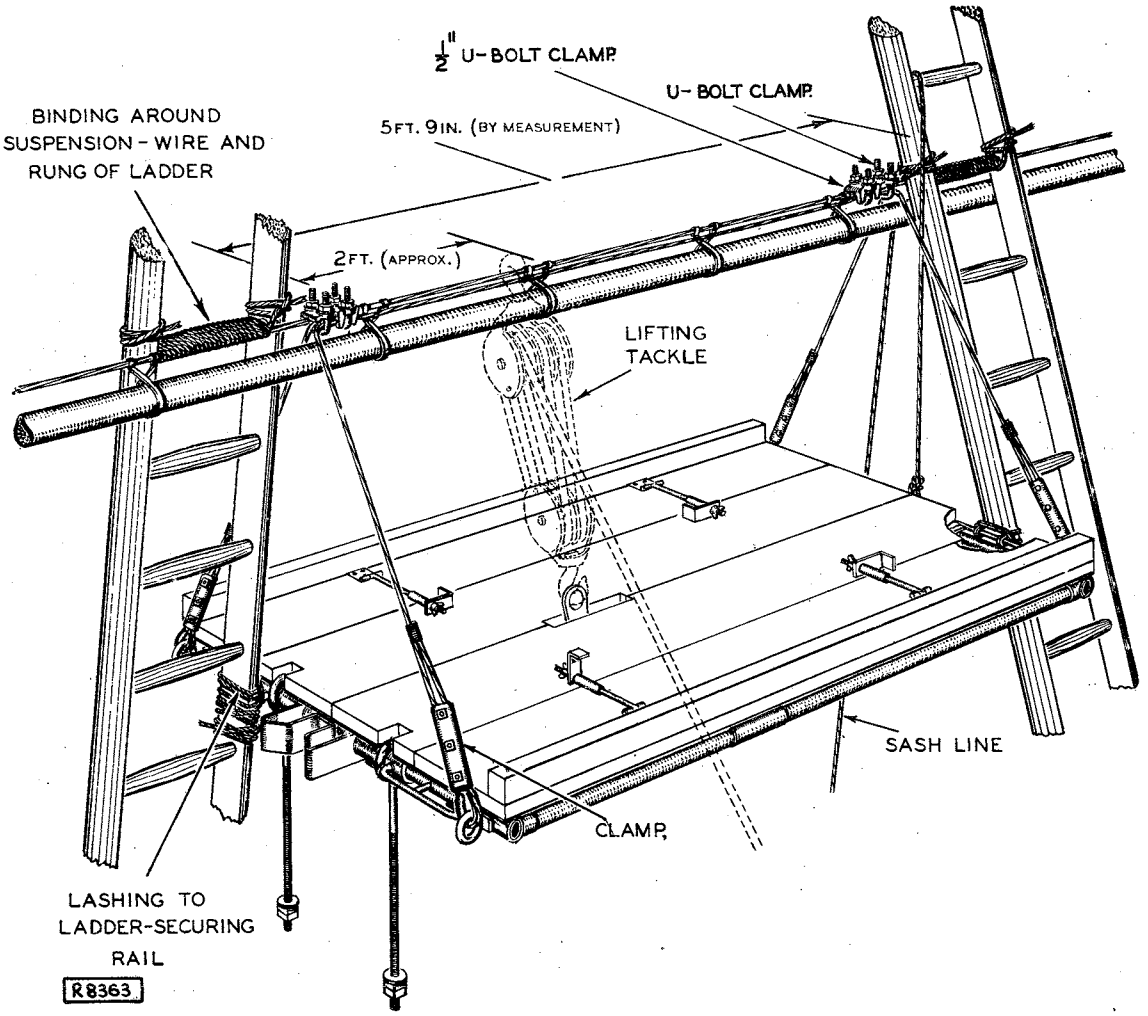

Fig. 38

Construction of platform

The framework and struts consist of tubular members welded together except at certain points where nuts and bolts are provided so that the tubes can be separated when erecting the platform around stay wires. A sling plate attached to the centre of the middle cross member for the attachment of tackle, is turned down into a slot in the floorboards when the platform is in use. The floor consists of four wooden sections, each section being secured to the outer cross members of the frame by a fixed bracket at the end carrying the pole clamps, and an adjustable clamp at the other end. Clamps are provided on the two outer sections for securing the tent. The pole clamps consist of a fixed member welded to the framework and a detachable member which engages with two clamping bolts (Fig. 39). The clamps are designed to provide a secure fixing irrespective of the size of pole, and to avoid interference with pole steps and loading pots on poles. The fixing to poles of small diameter is made by reversing the detachable member as shown in the inset of Fig. 37.

Erecting Platform

At a pole

Generally, the platform is fixed approximately 2 ft. 6 in. below the cable joint. In unobstructed situations the platform is erected briefly as follows:-

(a) A ladder is erected on the opposite side of the pole from where the platform is being erected.

(b) A sling chain is placed around the pole about $3\frac{1}{2}$ ft. above the suspension wire. The lifting tackle used consists of a treble block attached to the sling chain and a double block to the sling plate on the platform.

(c) The platform is hoisted into position and secured to the pole by the four pole clamping bolts.

(d) A stout ladder is erected and lashed to the suspension wire at the end of the platform remote from the pole, and the platform is lashed to the ladder (see Fig. 37).

Away from a pole

For maintenance purposes it may be necessary to erect the platform on the suspension wire, away from a pole. It is usual to remove the struts and pole clamps in order to facilitate handling and to reduce the weight of the platform. The platform is erected as follows:-

(a) The ends of two 14 ft. 6 in. lengths of stranded G.I. wire 7/14 are secured with stay clamps to the four eye bolts at the ends of the platform to form a sling as shown in Fig. 38.

(b) Two ladders are lashed on opposite sides of the suspension wire 5 ft. 9 in. apart. Lifting tackle, consisting of treble and double blocks, is attached to the suspension wire and platform.

(c) The platform is hoisted into position, and the slings are secured to the suspension wire by means of U-bolt clamps, as shown in Fig. 39.

(d) The ladder-securing rails on the platform are lashed to the adjacent sides of the ladders.

The tent

The sections of a tent are hoisted by a sash line, and the tent is secured to the platform by the tent clamps provided.

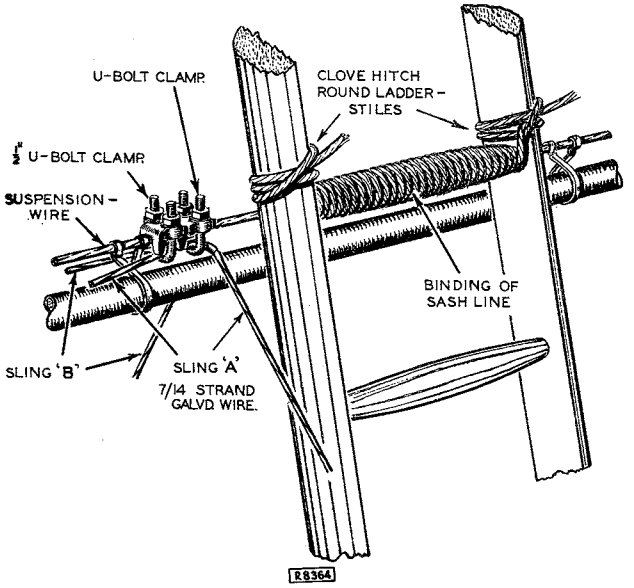

Fig. 39

PRECAUTIONS WHEN WORKING ON AERIAL CABLES

Before work is carried out aloft on aerial cables or suspension wires precautions must be taken to ensure that the loads imposed can be adequately supported.

Suspension wires should be examined, from the pole at each end of the span, for any signs of weakening before any work is carried out on them or the cables they carry. Special care should be taken where one part of a span is exposed to excessive corrosion, e.g. at railway crossings. Work on or inspection of a cable which cannot be done from a pole and for which a jointing platform is not used should be carried out from a mobile platform or turntable ladder wherever possible.

Ringing chains or similar devices should not be used and ladders should not be erected against:-

(a) Self-supporting aerial cable.

(b) 7/16 suspension wires, laden or unladen.

(c) Any suspension wire to which a polythene cable is or has been lashed.

(d) Any suspension wire where serious weakness is suspected.

For (a) to (d) where no mobile platform or turntable ladder is available and the cable cannot be readily and safely lowered to the ground, an auxiliary 7/14 suspension wire should be erected above the existing strand at a tension of 2000 lbs. The auxiliary wire should be true terminated at each end and the supporting poles should be temporarily stayed. The wire may then be used to support a ladder.

MECHANICAL AIDS

Work on aerial cabling is often facilitated by the use of an elevating platform. A jointing platform, for example, takes some considerable time to erect, but an elevating platform can, however, be quickly moved to any required position where the vehicle can obtain access.

This mechanical aid, shown in Fig. 40, consists of a platform attached to a hinged boom which is mounted on a turntable. The turntable is mounted directly on

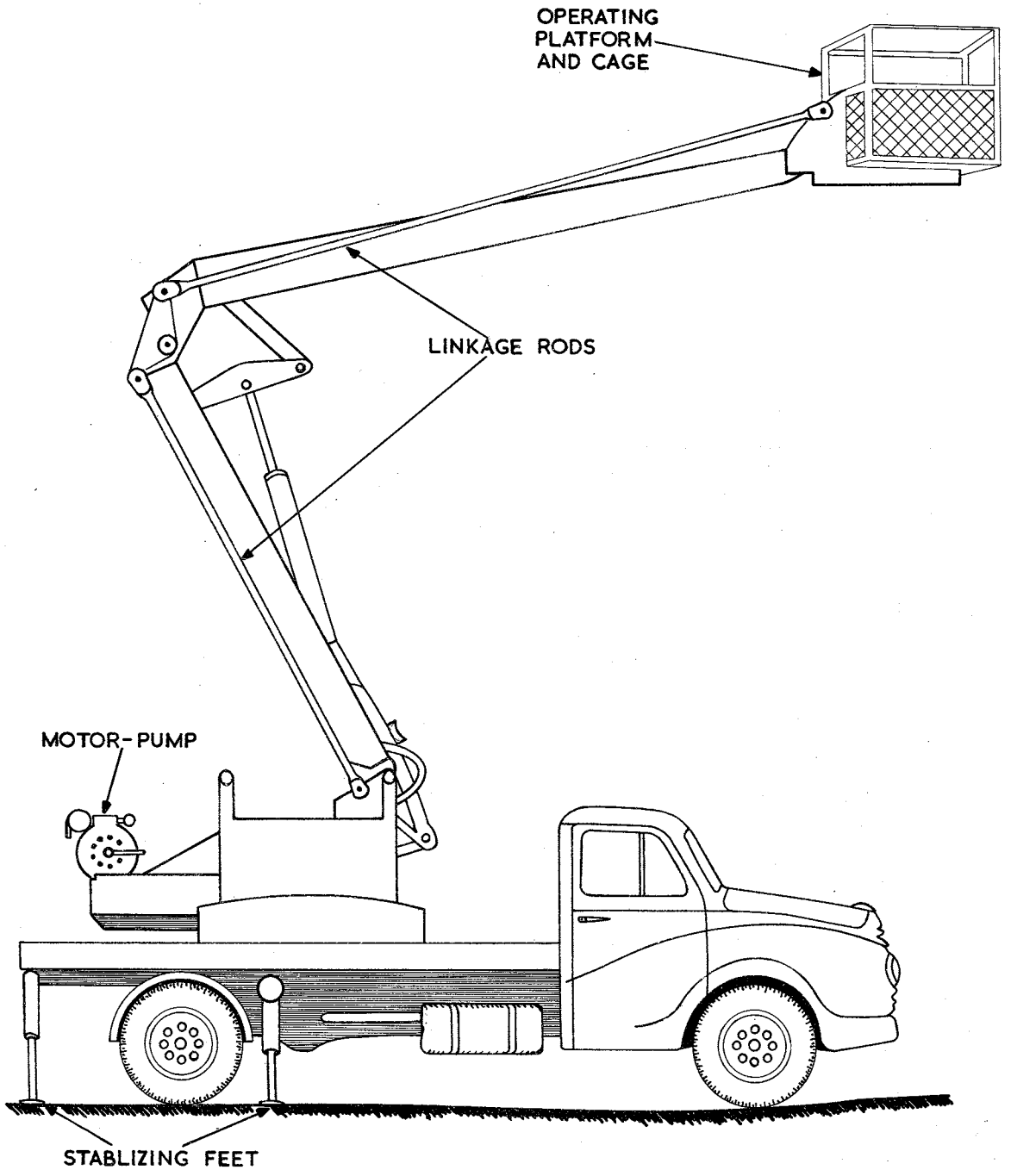

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Fig. 40

the chassis of a 5-ton long wheel base lorry, and is capable of rotating through a full circle. The boom is raised and lowered hydraulically, the power being supplied by a 10 h.p. petrol engine driving a hydraulic pump. This engine, which also rotates the platform, has two sets of controls; one on the turntable, and the other in the form of foot pedals, and knee operated rotation control on the platform itself. This allows the user to position the operating platform in the exact position required. The machine has a wide range of movements, giving the operator a maximum working height of 40 ft. and a maximum working radius of 25 ft. The floor of the operating platform is maintained horizontal, irrespective of the angle or position of the main boom, by means of linkage rods.

A number of safety devices are built into the machine covering failure of the motor or pump, together with a cut-out stop should the platform be lowered onto a solid obstruction. To stabilize the lorry when the platform is in use, stabilizing feet are provided on each side of the vehicle. Additionally, the springs are locked by a hydraulic ram which bridges the chassis and the rear axle. The maximum load with the stabilizing jacks in use is 750 lb. For travelling, the boom is folded down over the vehicle chassis, and the operating platform cage is folded down to reduce the overall clearance height.

END

Reference:- E.P. - Draft Series LINES 1/7