TELEGRAPH CROSSINGS OVER RIVERS

CHAPTER XLVI.

Telegraph Crossings in Europe—The Great Crossing over the River Elbe—Wide Spans of Wire on the Continent—River Crossings in America—Description of the Great Mast on the Ohio River—Suspension of the Wire over the Masts—A Western Frontier Telegraph Crossing.

TELEGRAPH CROSSINGS IN EUROPE.

THE telegraph lines in Europe do not traverse very large rivers, compared with those of America. The Elbe, the Neimen, and the Dwina, are the widest crossed by the wires on masts. The telegraphs on that continent have, therefore, had but little experience in crossing rivers with the lines erected in the air. As a general thing, throughout the world, the use of masts has been abandoned, and submarine crossings adopted in their stead. In order, however, that the telegraph may be prepared to meet any emergency, I will explain in sufficient detail, the manner of using masts for long stretches over swamps or rivers.

In regard to the crossings of streams, the opinion entertained in Europe is, that rivers under twelve hundred feet in breadth, are to be crossed in this manner, in all cases where it is practicable, having reference to the height of the masts of the vessels passing under the line at the highest level in the rainy season.

It being impracticable to give precise rules applicable to each case, it will best fulfil the object of these pages to give an exact description of some remarkable river crossings effected in this manner in Europe.

The following are the details of the construction of the telegraph masts at Norwich.

The river is but 62 feet broad at high water, and then nearly level with its banks.

The masts, one on each bank, each of two spars, are 150 feet apart, and 100 feet above ground. The lower mast is 1 foot in diameter, 70 feet above ground, into which it penetrates 10 feet, and is stepped in a buried frame of two beams, crossed at a right angle, each 20 feet long, 6 inches square, the ends connected by four timber pieces, strengthened at the angles by wrought iron straps and bolts. There are four timber struts, each 12 feet long, one from each end of the cross piece, bolted to the mast, 2 feet below the ground. For the attachment of the stays, there are four piles at equal distances, each 8 feet from the mast, 1 foot square, 12 feet long, shod with iron, and provided with iron caps and bolts. A stay of one inch iron rope leads from the top of the lower mast to each of these piles.

The top mast is thirty-six feet long, and thirty feet above the lower mast; the compound mast being one hundred feet above the ground.

A cross stay of iron wire rope runs from mast to mast, 7 feet below the top. Two stays, also of iron wire rope, lead from the same part of the mast to two piles 60 feet from the lower mast, and of the same dimension as the other piles. The top mast is secured by four stays of iron wire rope, attached to cross-trees in the usual mode of mast rigging.

A spindle and vane, serving also as the point of a lightning conductor of iron rope, completes the mast.

The telegraph conductors are six wires of No. 8 galvanized iron of the best kind. They are led through brown stoneware insulators, attached to the mast at its highest part, and above the stays. The wires are strained tight, and led, each set, to a telegraph post one hundred feet from the mast, and thirty-five feet high. From these posts the wires join the lines at each side.

Instead of the expensive and troublesome plan of framing for the underground work above described, in India they employ the screw piles, six feet long. These piles carry a lower mast 35 to 40 feet high. Four of the ordinary small piles, 3 feet long, are first screwed into the ground, each at 20 feet from the spot where the mast is to be erected. The mast fitted in its pile is raised into its position, and steadied, tent-pole fashion, by four rope guys lashed, as required, to a short spar in the smaller pile; four loops of iron wire on an iron plate fitting loosely on a pin in the mast, serve for the attachment of the guys, and keep the mast perpendicular, while it is screwed into its place. This is effected by lashing a strong spar, by its middle, to the top of the pile, by a piece of chain, and a party of five men at each end man this spar, capstan manner. The screwing is easily accomplished in a stiff clay, sandy, or light gravelly soil, in five minutes. Four iron rope or rod iron jointed guys should then be permanently attached to screw piles of the three-feet pattern, planted obliquely in the ground. Each pile has a short wrought iron link for the attachment of the guy, and each guy has a tightening screw to regulate its tension.

THE GREAT CROSSING OVER THE RIVER ELBE.

The most remarkable crossing on masts, in Europe, is that over the river Elbe near Hamburg. I have frequently examined that crossing, and as it is regarded by the European telegraphers as a great achievement in the art, I will give the details of it as furnished by Mr. Gerk, the engineer of the line. The principal arm of the Elbe is about 1,200 feet wide, and is navigated by sailing vessels of moderate tonnage.

For rivers averaging 1,500 feet in breadth Mr. Gerk advises the use of masts strongly and substantially built, and from 30 to 40 feet higher than the highest masts of the vessels which have to pass below. This is necessary to allow for a deflection of one fiftieth in the wire, which, when of the very best description, can be strained no tighter, without great risk of fracture by storms, or by the weight of icicles in northern climates.

Five masts, such as I will proceed to describe, were erected in 1848 for the crossing of both arms of the Elbe.

Each mast penetrates 10 feet in the ground, and is there wedged down between strong cross beams, and the whole covered with heavy stones or concrete. About 16 feet from the end of each beam a pile is driven deeply and obliquely into the earth for the attachment of the stays, which are iron rods, one inch diameter below, three fourths of an inch in the middle, and half an inch at top. These stays lead from the piles to the top of the lower mast, where they are attached to a wrought iron collar with four eye-bolts and rings. At 9 feet from the ground each stay is provided with a straining screw by which it is tightened to the required degree.

The masts described and figured by Mr. Gerk are 180 feet high, in several pieces bound together by wrought iron rings, 2 feet in diameter at the ground, tapering to 4 inches at the top. The first set of cross-trees is at 70 feet from the ground. Four beams, each of 36 feet long, are laid cross-tree fashion at the surface of the ground, the mast in the centre; from each end of these beams a prop is bolted to the mast at 25 feet above the ground, and stays lead from the mast at 70 feet high.

The first cross-trees for the support of the shrouds, are four oak pieces, each 18 feet long. The second cross-trees are 8 feet long, and are attached to the mast 150 feet from the ground. Above this point the spar rises 30 feet, and carries a wrought iron cap and pin, with a porcelain or stone ware insulator of the Prussian pattern.

Mr. Gerk employs a compound wire of 3 strands of No. 19 best charcoal iron, twisted together. According to his own experiments, wire of this gauge withstands strains, storms, and casual pressure, better than any other kind.

MODE OF ELEVATING THE WIRE.

Mr. Gerk erects the wire in the following manner:

The wire is held ready wound on a reel, like that which ropemakers use, mounted on an axle, so as to let the wire run freely off.

The man who ascends the mast winds the end round his left arm in a knot, taking care that in drawing it after him it all runs free, especially of the backstays. When he reaches the top, he draws the end through the lignum vitæ sheave which is placed there, and either takes it with him below, or else fastens it at once by means of brass double screws to theo ther end of the conducting wire, which ascends from the last bottom peg, or out of the ground. In the latter case the point of connection will be in the first or second cross-tree. As soon as this is done, two men, holding the reel by means of the staff on which it is centred, get into the boat which is lying ready, and a third, or the man on the mast, takes care that the wire runs freely off during the passage over to the other side. If the river is broad, and there is a chance of ships passing by, the wire, of which there must be at least 400 feet over length, is allowed to run free in the water, while the person who remained behind at the first mast holds fast, until all is so far in order by the other mast that the fixing-on can take place. But if the river is narrow, and there is no danger of ships passing by, the wire should be held as long as possible above the water, because a possible entanglement in the bed of the river will thus be avoided. As soon as the other bank is reached, about twice the length of the mast is let run off the roller, or, if there is more on, the necessary quantity must be drawn out of the river. To avoid risk of the wire breaking, two men go back in the boat, and, while one rows, the other lets the wire glide through his hands, in order to lift it from the ground.

If all is so far arranged, the mast-climber commences in the same manner as before to ascend with the end of the wire, in doing which he, as well as those below, ought to take care that the wire runs free, and especially that it does not hook behind the eyes of the backstays. As soon as the end is brought through the sheave, the man descends with it to the next cross-tree, binds a weight on, and lets it glide down to the man who is standing on the bottom cross-tree, who takes hold of the wire and removes the weight. A strong iron pin must be fixed in a sloping direction to the under cross-tree, in such a manner that the conducting wire may touch no other substance, and particularly no piece of metal. The iron pin is covered with an insulating cap, round which the man below lays the wire, while the one above climbs up as high as he can, and while he lays his breast against the top of the mast, stretches out his arms as far as he can, and draws to him the wire, unhindered by friction of any kind, out of the water or through the air; while the man below draws to him the wire thus gained, lays it round the insulator, and holds it tight, to prevent its sliding back again. If the wire is now so tight in its stretch across the stream that the man above cannot pull it further in with his hands, he fixes a vice to it as far out as possible, with flat teeth, and pulls in the wire as far as it will go without breaking. The proper measure is naturally the height of the ships which have to pass under with the highest high water, where a tide exists If the wire has now its proper stretch, the man below wraps the same several times round the insulator, nips the end which hangs over pretty long off, and makes the connection to the general line.

WIDE SPANS OF WIRE ON THE CONTINENT

The longest span, even greater than the Elbe, in Europe, is that over the river Niemen, at Kovno in Russia. From pole to pole it is estimated at 1,700 feet, though the river is not more than half the width. A very tall tree on a very high hill is used on the west side, and a very high pole on the east side. The river Niemen is navigated by very small sailing and steam vessels. The crossing over the Dwina at Dunaburg, Russia, is another of the principal spans, though not so wide as the Elbe. The next, is that over the Vistula in Prussia. Neither the Dwina nor the Vistula is navigated by vessels with very high masts. The crossings over these rivers are, for the large wire, full long; nevertheless equal, and even greater distances are spanned from the tops of houses in Paris, and over the Alpine regions of Switzerland. From mountain to mountain the iron thread is suspended, and on witnessing the electric cord elevated high from the green vale below, stretching from the snow-clad summits, it often occurred to me that the means used by man for the spread of the telegraph over the earth—traversing the seas and mountain barriers—was as sublime as the lightning, which Providence had made subservient for the diffusion of light and knowledge.

RIVER CROSSINGS IN AMERICA.

From what I have stated, the reader will see that there are no very extensive crossings in Europe compared with those of America. I will now describe a few of those on the western continent. It will be inconvenient to refer to them in the order as to the time they were respectively constructed. I will, therefore, refer to them as to facts, with the general remark, that those to which I refer were all built between the years 1846 and 1850.

The crossing of the rivers by the telegraph has been from the commencement of the enterprise a source of much annoyance and a vast expense. I think it would be safe to say, that the American telegraph companies have lost and expended more than half a million of dollars in connection with river crossings. On the extension of the experimental line between Washington and Baltimore to Philadelphia in 1845, the Susquehanna river occasioned some difficulty and considerable expense. The line was constructed some distance from the direct route in order to cross the river at a practicable point. The next formidable difficulty was that of the Hudson river at New York City. For a long time the dispatches were carried over the river by messengers in boats; but finally, the line was submerged by Mr Ezra Cornell in leaden pipes, the wire being covered with cotton, and insulated with Indiarubber. This was November 20, 1845. There were two cables thus formed, and they worked very well for several months, until they were carried away by the ice in 1846. They crossed the Hudson at Fort Lee, some 12 miles above New York City. When these cables were broken, high masts were erected and wire upon them was stretched across the river. Men were in attendance all the time to repair the wire when broken by vessels. It was the custom to let the wires down into the water for vessels to pass and then draw them up again. This was practicable in tide water, but not so with the inland rivers. The Hudson river at the place of crossing was 2,700 feet wide.

These masts were constructed under the directions of Mr. Henry J. Rogers, the energetic superintendent of the telegraph. In 1847 another effort was made to cross the Hudson with a cable, and to that end a copper wire, covered with gutta percha by Mr. S. T. Armstrong, was purchased and submerged by Messrs. T. M. Clark and J. W. Nortons for the Magnetic Telegraph Company. The cable was placed across the river at the foot of Cortlandt st. It worked a day, and was then torn away by an anchor.

On the lines constructed by Mr. Henry O'Rielly, throughout the great West, many rivers had to be crossed, over which the wire was stretched. The widths of these streams were from 1,000 to 3,000 feet. The first crossing was that at Wheeling, over the Ohio river, 1,300 feet; the next was that over the Ohio at Louisville. The latter was one of great expense. From the Indiana shore to an island it was 2,100 feet, and from the island to the Kentucky shore it was 1,300 feet. High masts had to be erected to support the wire, so that the steamers with their chimneys 90 feet above deck would not touch it. At first, a large cord, made of three No. 18 wires twisted together, was used, but its great weight prevented it from being drawn to the required elevation. Small steel piano-wire was then employed singly, and with that the full height desired could be attained, but in cold weather it contracted by the frost and frequently broke. After this experiment No. 16 iron wire was adopted and proved the most serviceable in every particular, and on all subsequent crossings this sized wire was adopted.

About the same time the crossing was made over the Wabash river at Vincennes, and then followed the spanning of the Mississippi river at St. Louis. From the Illinois shore to Bloody island it was 2,700 feet, but this arm of the river was not navigable. From Bloody island to St. Louis shore it was 2,200 feet. The mast on the Illinois shore was 160 feet high. On Bloody island it was 185 feet high and on the St. Louis shore a shot tower of equal height was used.

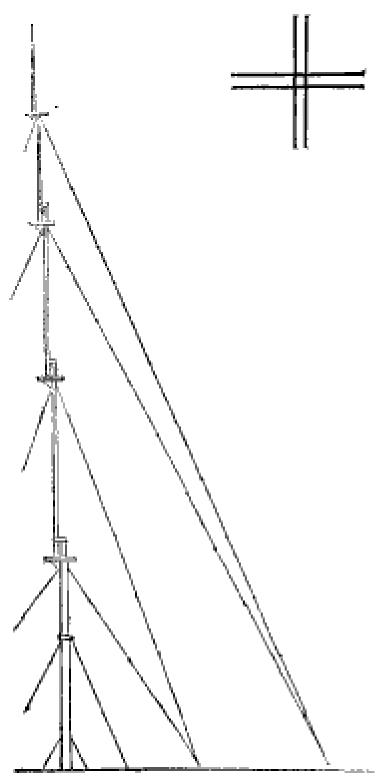
Crossings have also been made over the Ohio river at Maysville and at Parkersburg, the Niagara near Buffalo, the St. Lawrence near Montreal, the smaller bays of the Gulf near New-Orleans, the Mississippi at Hannibal, and many others, some of which I will now proceed to explain more in detail.

In 1849 and 1850, Messrs. Shaffner and McAfees, constructors of a telegraph south of St. Louis, to connect with New-Orleans, traversed with their line the Mississippi, Ohio, Tennessee, and Cumberland rivers, all within a distance of one hundred miles. The Mississippi river was crossed near Cape Girardeau, in the State of Missouri. The width of the span was 2,980 feet.

The mast on the Illinois shore was 210 feet high, and that on the Missouri shore was 205 and on an elevation of 110 feet, making the whole height from the water 315 feet. The Ohio crossing was at Paducah, for which three masts were employed, one being placed on a sandy island. The mast on the Kentucky shore was 307 feet high and on a bank 32 feet above the water, making an elevation for the wire 339 feet. The mast on the island was 205 feet, and the one on the ,Illinois shore was 215 feet. The width of the river between the Illinois shore and the island was 2,400 feet and between the island and the Kentucky shore it was 3,720 feet. The Tennessee river was crossed near Paducah. On one side a tree, 90 feet high, situated on a bank, 120 feet high, was used and on the other side a mast 160 feet high. The width of the river was 2,300 feet. The Cumberland river was crossed in the same manner as the Tennessee. The width of the river was 1,850 feet.

DESCRIPTION OF THE GREAT MAST ON THE OHIO RIVER.

Fig. 1.



Having referred to the crossings respectively, I will now describe the construction of the mast at Paducah, upon the principles of which all the others were erected.

Fig. 1 represents an outline representation of the mast, 307 feet high. The cross timbers, fastened at the foot, are seen to the right and above in the figure. These cross timbers were fastened to 20 large cedar logs, placed perpendicularly 12 feet in the earth and 2 feet above the earth. The cross timbers were 12 inches square, 25 feet long, and were fastened to the upright posts with large iron straps. In the little square centre, 15 inches in diameter, the foot of the mast was fitted; braces of strong timber, 8 inches square, were then placed between the cross timbers and the mast, well fastened with irons. It will be seen from this arrangement, that the foot of the mast proper did not enter the earth, but that its compound footing comprised 20 large cedar logs, united by the cross timbers, and they were united to the mast by the braces.

The first or main spar, letters *a b*, was 110 feet, the second, *c*, 70 feet, the third, *d*, 57 feet, the fourth, *e*, 43 feet, and the fifth, *f*, 27 feet. The first and second pieces were spliced, as follows. The main spar was composed of two logs, one of which was 75 feet long, 20 inches diameter at base, and at top 17 inches diameter, and the other log 17 inches at base, and 15½ inches at top. The splice section was seven feet, both spars being cut diagonally, so as to fit together and make a uniform size with the remainder of the log. The ends of the logs were not chamfered at their ends, but were made so as to rest on a shoulder. Three large iron bands were then placed around the section united. Besides these bands, the whole place of splicing was surrounded with No. 10 iron wire closely wound. The bands of iron and of the wire were sufficient for the purposes; but as the main piece was very long, and had to sustain a heavy weight, it was apprehended that it might bend. To prevent this, iron braces, commonly known in America as hog chains, were fastened to the mast, bracing 30 feet of the centre; and then, as a further security, iron guys, 1½ inches diameter, were fastened at *b* to the spar, and to the ends of the cross timbers below. The top of the main spar was also sustained by 4 iron guys, an inch in diameter. The second piece was spliced by the winding of the wire around it, as was done with the main mast, but there were no iron bands used. From the top of each spar ran 4 separate and independent iron guys, which were fastened to substantial piles buried 15 feet in the earth. The top guys were quarter-inch rods. To each and all of the guys straining screws were attached, by which they could be tightened at will.

A rope and pulley were fastened to the top of the mast, so that a man could ascend at pleasure. Some ill-disposed persons one night pulled the rope out of the pulley. I employed an expert climber, who ascended to the top, aided only by the telegraph spurs, described in the chapter on line repairing. He remained till the rope was replaced, and then descended by it.

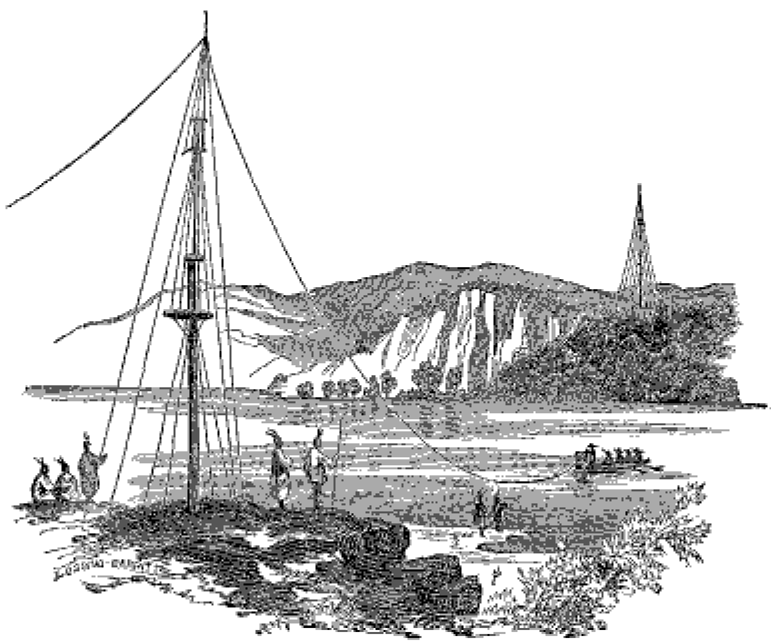
SUSPENSION OF THE WIRE OVER THE MASTS.

The masts being constructed, the next to be done is the suspension of the wire over the stream. To explain this process, suppose the masts A and B are on the respective sides of the river; the wire is to be placed in the top of each through the open insulator. Beyond A it should be "made fast" to the line wire. Beyond B the wire should be held by two or more men. The ends between A and B are loose at the ground. A small reel, containing the wire, should be suspended in a frame at the stern, of a small boat—for example, a skiff or yawl. The end of the wire upon the ground at A is then spliced carefully to the end of the wire on the reel. The boat is then rowed across the river to the mast D, where the loose wire, hanging from the top of B, is spliced to the reel wire. Immediately after they are united, the men beyond B pull the wire through the open insulator at the top of the mast B, until it is above the river a sufficient height. In crossing the river, care must be taken not to let the wire get into the water, particularly if there is a current; as, in such cases, it is often carried down stream, and is liable to catch in roots or rocks at the bottom; besides, it may be broken by the current, especially while being elevated. The wire used for the great crossings was No. 16 iron, unannealed. It was my practice to coat it with linseed oil

A WESTERN FRONTIER TELEGRAPH CROSSING.

Before concluding this chapter, I must refer to the crossing at Kansas, Missouri, constructed in 1851, then on the verge of

Fig. 2.



civilization. The Missouri river was about 2,100 feet wide, and one of the most turbulent streams in America. On the south bank of the river, the line was built to the frontier; and to avoid traversing the Indian territory, the wire was stretched across the river, and then built to St. Joseph, some seventy miles further westward.

Since that time, brief as the period is, a wonderful change has taken place in that part of the country. In places where I saw the Indians as the sole inhabitants, and the whole broad-spread prairies beautifully adorned with the varied flowers and green grass, now the white man has full possession, and villages have sprung up as by magic, and the ploughshare upheaves the soil so lately traversed with the red man armed with his deadly weapons, the tomahawk and the bow. On that very soil, but a few years since, the blood of the father, mother, and child, dripped from the scalping-knife, while fiendish beings danced with joy around the trophies cut from the heads of the murdered. To-day civilization reigns supreme over that same land, and the tomahawk, the scalping-knife, and the iron-pointed arrow, have been bound together with the olive branch, and now move by the breath of the Creator at the top of the sacred spire