REPAIRING OF TELEGRAPH LINES.

CHAPTER LI.

Qualification and Duties of Repairers—Continuous and Uniform Metallic Conductors—The Joining of Telegraph Wire—Repairing a Break of the Line Wire—The Interruption of the Line by the Falling of Trees—The Great Sleet of 1849 and the Telegraph Lines—Destruction of the Telegraph Lines by Lightning—A Silk Cord Splice found in the Line—Novel Cases of Repairing the Line—Removal from the Line of all Foreign Conductors—To preserve the Insulation of Wire—To Secure the Permanency of the Structure of the Line.

QUALIFICATION AND DUTIES OF REPAIRERS.

THERE is no part of the telegraphic service more important than the repair of the line. Unless it is properly restored, when out of order, difficulties may be experienced for months, and even years thereafter. On a line of some five hundred miles, traversing wild and forest regions, a fault may escape discovery, perhaps for ever. The repairer of the line should have a reasonable knowledge of the science of electric currents; and, as the men engaged in this department are generally of but limited education, the operators in the stations ought to teach them as much as possible the science, so that their efficiency may be the greater for the general weal of the company. Unfortunately, however, the operators sometimes are too selfish to diffuse knowledge. They prefer to be wise themselves, looking to an increase of salary. Such acquisitive characters ought to be discountenanced by the principals of every telegraphic organization. In the long and varied career which I have had in telegraphing in different climes and on different continents, I have always endeavored to teach others to the fullest extent of my power. It has afforded me pleasure, and the recipient has felt a sense of gratitude. What higher consideration need we have in this world, than a consciousness of "doing unto others as we would they should do unto us?"

If the repairer is ignorant of the necessities of the telegraph, he may omit to do that which ought to be done, and he may do those things which ought not to be done, all resulting from an ignorance of the established science. I have too often felt the consequences of improper repairing. Some years ago, while acting as president of a telegraph range, I found it economical to employ men who understood the full requirements of the telegraph.

The duties of the repairer may be considered under the following heads, viz.:

1st. To maintain a continuous and uniform metallic conductor.

2d. To remove from the wire all foreign conductors, whether metallic or otherwise.

3d. To preserve a proper insulation of the wire.

4th. To secure the permanency of the poles and other structures of the line.

I will now explain these respective duties; and as to the first, *to maintain a continuous and uniform metallic conductor.* The voltaic electricity employed for telegraphic purposes, requires a uniform and continuous metallic conductor from station to station. When I say a uniform conductor, I do not mean to say that a wire of different sizes and qualities will not answer for transmitting telegraphic intelligence, but that a uniform metallic rod or wire will subserve the purposes better in the maintenance of an efficient current of electricity. Much might be written on the subject; but for practical purposes I need say but little in illustrating the established philosophy in the premises.

Suppose A B is a line of an indefinite length, the wires between A and *a* and *b* and B are the same in size; the wire between *a* and *b* of a much smaller size; the batteries are at A and B. The wire between *a* and *b* being small, I will suppose, can conduct but half or fifty per cent. of the electric current that the wires A *a* and *b* B can convey. Suppose *x* and *z* are faulty points in the wires A *a* and *b* B.

Ordinarily the small wire, *a b*, is called a wire of resistance, because the volume of the current is lessened to the conducting capacity of the wire, and as it cannot equal the powers of the wires A *a* and *b* B, it is called a resisting wire. The term is objectionable; but it has become a technicality in the art of telegraphing, and I use it as such.

In regard to the conducting functions of the respective sections given in the example, there seems to be a diversity of opinion. Some suppose the wire between A and *a* and *b* and B hold as fixtures their full quantity of the electric current. Place between *a* and *b* the larger wire, and the current will be uniform between A and B. On the other hand, it is believed that the batteries at A and B only generate a voltaic current in quantity or force, equal to the conducting power of the wire; thus, if a battery of fifty cups fully charges the wire to its complete capacity, whatever addition may be made to the number or size of the cups or cells of the battery, the plus will be inactive, electrically, notwithstanding there will be chemical action on the whole battery.

It is not material for me to determine, at the present time, which of these opinions is correct. The operator at the apparatus readily perceives the increase or the decrease of the elective force on the line; and when the conducting medium is disturbed, the effect is instantly observable in the adjustment of the relay magnet of the apparatus. There can be no mistake in the opinion, that lesser sized wires are, technically, resistants to the flow of the voltaic force.

In the diagram above given, the current sent from A to B or from B to A will be effective, in proportion to the conductibility of the wire between *a* and *b*. Suppose there is a bad joint at *x*, the current transmitted from A through *a b* will reach *x* much enfeebled, or in other words, in less quantity or volume. Much of the current passes away on the route, by heat, fog, rain, and contacts of various kinds. Besides this loss of current, the intensity sufficient to overcome distance becomes lessened. When, therefore, the current arrives at *x*, it is so feeble, that it is difficult for it to overcome the fault, and in such cases B receives the dispatch with much difficulty. If there is a fault at *z*, the full voltaic force is hindered, and the volume or quantity of the flow from A, beyond *z*, is not commensurate with the exercise of the functions of the battery. A line thus situated is very inefficient, and the remedy for the case is only by the repair of the line, or by the establishment of relay stations at *x* and *z*, or at some other part of the line. Suppose the line is perfect from A to *x*, but the fault at *x* is a metallic contact, shorter, but inferior to the remainder of the line. In this case, B will receive, if at all, with difficulty; but A will receive from the battery of B with less hindorance. The quantity of the current in proximity to *x* is so great, that its intensity overleaps the oxidation, or passes through the inferior conductor at the point *x*, and goes on to A

On the other hand, the battery at A is too far off to be thus effective. It must always be remembered, that there are two elementary organizations of the voltaic force, namely *quantity* and *intensity*. Philosophers have discussed these two classifications in the most extended sense. I will not enter into a discussion of them here, and in their use, I will be plain, though at the risk of criticism. Some scientific gentlemen dislike to see technical terms made common, but I have no other alternative left me. This book is written for the practical telegrapher, who has to work day by day in the mysterious agency of a science, the explorations in which have been but limited. Besides this reason, many of the technicalities in the electric science have different definitions, are differently applied, and are differently understood by scientific gentlemen. It is my aim to use terms and language that can be understood by the reader, and I hope my purpose will be appreciated.

In order to have *intensity* sufficient to overcome a given distance, a commensurate current of *quantity* must be generated by a voltaic battery. Some batteries generate currents of *greater quantity* and *less intensity* than others. To attain the *greatest intensity*, scientific gentlemen have been experimenting for many years, and to some extent with success.

From what I have said in the above, it will be seen that it is important to maintain a uniform metallic conductor on a line of telegraph. To the consummation of this end, it is the duty of every repairer to exert his energies, and never to omit the correction of a faulty place in the wire.

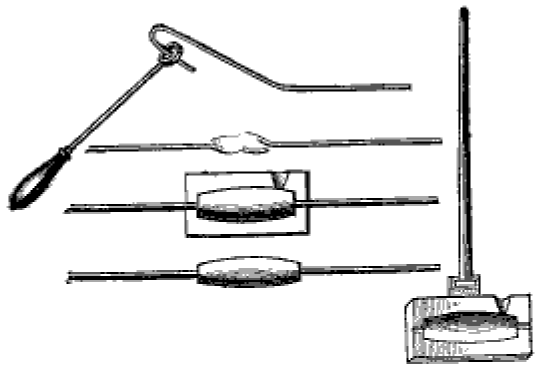
THE JOINING OF THE TELEGRAPH WIRES.

Telegraph wire is manufactured and delivered upon the route in lengths to suit the constructors of the line. Many of the joints are made at the manufactory, and many have to be made along the line as the wire is placed upon the poles. No joint should be made unless soldered; but the conveniences usually had heretofore for this process along the line, have been but few, and, therefore, a line of some five hundred miles has had, perhaps, some several hundred joints not soldered.

In America, we have had our full share of experience upon the subject. Having built in a few years more lines of telegraph than elsewhere in the world, we have had full scope for experiment. The early lines were not so carefully constructed, owing to the great haste required in their completion, especially on rival routes. I have had lines constructed having thousands of joints not soldered, and they worked very well. It cannot be denied, but what those lines would have worked much better, had the joints been well soldered.

On a line built by Mr. Tanner and myself, in 1848, the wire was delivered by the manufacturer on reels, in lengths of six miles. The joints were made in the egg form, as seen in fig. 1.

Fig. 1.



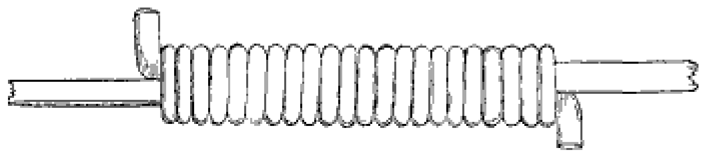
The first example in the figure is the process of bending the wire, the second is the hook joint made ready for the solder, the third is the joint soldered in the mould, the fourth is the point finished, and the fifth, to the right, is a half of the mould showing the handle. This was supposed to be the best joint that could be devised. In order to make the solder adhere to the iron, the ends of the wire were immersed in chloride of zinc. The chloride is of a pasty nature, readily attracts moisture from the air, and should be kept in bottles. It is made by dissolving pieces of zinc in dilute muriatic acid.

On the Hindostan lines, in Asia, Dr. O'Shaughnessy adopted the egg joint, and he has expressed himself pleased with it, as a success on No. 1 wire. It is not used on the European lines. In America, we found it objectionable; the wire broke at many of the joints. Proper care was not taken at the manufactory in cleaning the wire. Many of the joints were made with the ends of the wire covered with a thick coating of oxyde. But, under any circumstances, this joint is objectionable. The solder is an inferior conductor; and, besides, there will not be a complete metallic connection between the wire and the solder. The iron contact is small. The hook presents but little iron surface for a contact, and the metallic conductor is, therefore, only equal to the surface contact at the hook. If but one third of the metal or the surface of the wire is brought into contact, the conductibility of the wire is lessened in proportion to the said contact. If the wire at the hook is covered with an oxyde, a long line would be difficult to work. Having fully tested the egg joint, and at a very great sacrifice, I abandoned it, and substituted the twist joint.

The object in using solder, is not so much to make a metallic connection with the solder metal, but it is to prevent the wire from oxydation, thereby securing a continuous and extended iron connection, commensurate with the full conductibility of the iron wire employed upon the line.

On the English lines, the joints are all soldered and carefully made. Fig. 2 represents a joint formerly quite common on the English lines.

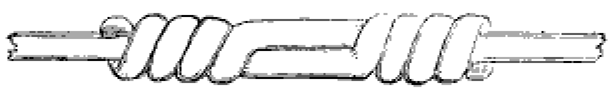
Fig. 2.



The line wires were laid together for two inches, and the ends were turned up, as seen in the figure. The binding wire was of a lesser size, and galvanized. Over these wires was placed the solder. When a strain was placed upon the line, the binding wire was closely pressed together. The solder did not always reach the line wires. This joint was better than the twist joint not galvanized.

In latter years, the joint most universal is that represented by figure 3.

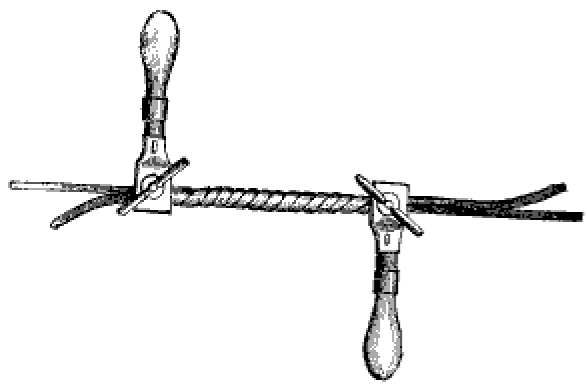
Fig. 3.



The wires are laid together, and held by a clamp in the middle, about half an inch in width. The wires on each side of the clamp are then twisted together. Before the wires are united, they are always filed until they are bright and free from rust. When thus cleaned, they are ready for splicing in whatever form desired. After the splice is made, and the ends cut off, as seen in fig. 3, the next process is putting on the solder. The wire being heated, the chloride of zinc is spread over it; the solder is then touched to the wire, it melts and spreads over the joint, and the whole surface becomes tinned. Sometimes the wire is immersed in melted solder. When thus coated with the solder, the bright metallic contact of the wire remains perfect forever, and the voltaic current can pass without any hinderance on account of a deficiency of metallic substance, either as to extent of surface or metal.

The joint represented in fig. 4 is common upon many lines. It has much merit, and it is much easier made. The two wires are placed side by side, and then the two clamps are made fast to them, tightened by the screws seen in the figure.

Fig. 4.



The handles are then turned in opposite directions, until the twist is complete, as seen in the figure. The ends are then cut off with a file, the solder applied, and the joint is complete. By this arrangement, one man can make a joint with considerable facility; but to make the joint as fig. 3, two men are necessary to accomplish the same speed attained by the one using the clamps, as represented in fig. 4.

I have been particular in describing the mode of making joints, because it is the most important part in the construction and the repairing of a telegraph line.

REPAIRING A BREAK OF THE LINE WIRE.

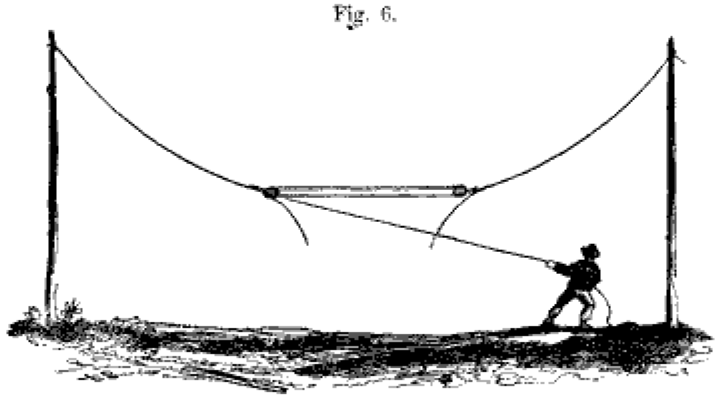
At the principal stations, men are under employment expressly to repair the lines. At the local or interior stations, the operators perform that service. The stations are at various distances apart, extending to fifty and sixty miles distant from each other. Suppose the stations be fifty miles apart, the operator will have twenty-five miles of line on each side of his station, or fifty miles of line, to keep in repair. When the line is found to be down on any given section, the operator immediately prepares his implements, and proceeds on horse to mend the line. He carries around his shoulders a bundle of wire, some fifty feet in length. In his saddle-bags, he has his vices, hammer, hatchet, nails, insulators, file, clamps, climbers, pulleys, and soldering apparatus. He is mounted, as seen in fig. 5.

Fig. 5.

Being thus prepared, he proceeds at a rapid gait along the highways, through uninhabited forests, or wherever the wire runs, until he finds the place of difficulty. No one unacquainted with the business of telegraphing, can appreciate the labors of the repairer. While others are comfortably seated around the fireside, the operator has to traverse forest and wild regions in rain, snow, and hail. Through the cold, chilling blast, he wends his way along the wire thread, anxiously seeking for the break. Solitary and alone, he thus nobly performs his task. The break being discovered, he proceeds to draw the ends together, as represented in fig. 6.

The pulleys are made fast to the ends of the wire, as seen in the figure, leaving loose about two feet, to enable him to make the joint. When drawn together sufficiently close, the rope he holds is fastened to the pole or to something, until the joint is made. This process of mending the wire is more suitable for the open or groove insulators through which the wire runs. If the tie insulator is used on the line, the wire should be untied

Fig. 6.



from some three or four poles, and then drawn together on the earth. After it is united, the wire can be elevated to the top of the poles without difficulty.

It often occurs that a bracket is broken from the pole, or from the tree, and the wire falls to the earth, preventing the transmission of the voltaic current. In such cases, the operator or repairer must ascend the pole, and replace the bracket. To do this, climbers with spurs are used, by the aid of which, the pole is climbed. These climbers are made of iron, in form as represented by figs. 7 and 8.

Fig. 7.

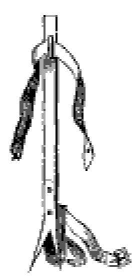
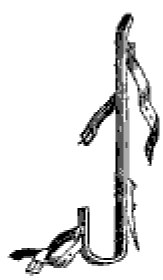


Fig. 8.



Some of the climbers have one spur, others have two, as seen at the lower end. The spur is pointed with steel, and made very sharp. The straps are made to fasten around the leg. The spurs placed on the inside, and thus fixed, the pole can be ascended easily. There are other contrivances for climbing, but those represented above are the most approved. When thus prepared with the climbers, he places a belt of leather around his body and the pole loosely; the wire is placed over his shoulder, and he then ascends the pole, step by step, until he attains the height desired. By adjusting the weight in a proper angle on the spurs and the belt, there will be no danger of falling, and the work can be performed without difficulty. Fig. 9 represents the repairer mounted twenty feet or more up the pole or tree, arranging the bracket. The wire lies over his shoulder. Sometimes the wire is laid on the belt between the body and the pole.

Fig. 9.

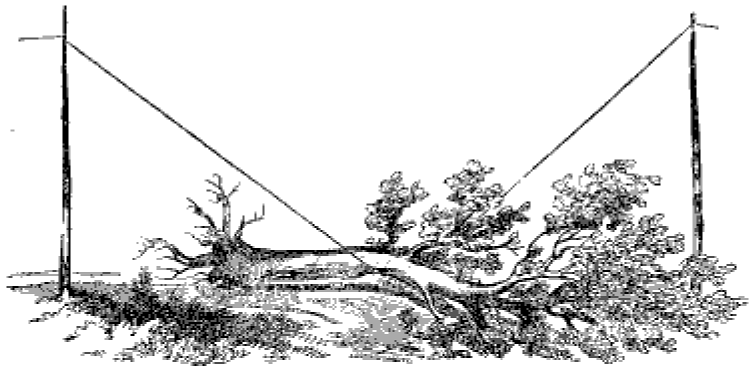
Having completed the necessary repair of the line, he returns to his office, and assumes a more pleasing duty—the transmission of the accumulated business.

THE INTERRUPTION OF THE LINE BY THE FALLING OF TREES.

Many lines in America are constructed along the ordinary highways through the interior, and often the wires traverse the grain fields and forests, regardless of roads of any kind. Trees frequently fall over the line, and in their fall the wire is brought to the earth, as seen in fig. 10.

In case the repairer finds a tree upon the line, as is frequently the case, there are two modes of making the repair, either by cutting the tree at the wire, and allowing it to rise, or to cut the wire and mend it again. The first is the best, but often attended with much more labor. An operator unaccustomed to the axe, will find it very laborious to cut through a tree some

Fig. 10.



two or three feet in diameter. In case the tree is cut, care must be taken not to stand in the line of the ascent of the wire. On several occasions, I have known the axe-man to be thrown by the wire from five to ten feet high. With care there will be no danger. In case the wire has to be cut, the following should be observed: the pulleys should be "made fast" to the wire, as in fig. 6 preceding, eight or ten feet from each side of the tree, the ropes should then be drawn as taut as possible and tied. The wire can then be cut, and the ends joined and soldered. When the joint is finished, a rope should be placed over the wire, and the ends fastened to the tree with a noose. The pulleys should then be taken off. The strain of the wire will then be wholly on the rope tied to the tree, which, on being untied, the wire will ascend with great force, and vibrate like the string of a violin when touched. The slack once between the poles at the tree will be diffused over a mile of wire, but to the eye none can be seen, the whole appearing to be as taut as when first put up. From this description, the process may seem difficult, but practically such is not the case. After a line has been constructed a year or more, the wire elongates, and there is much spare slack, so much in fact, that it would be well to tighten the wire occasionally, when the line is generally repaired. This slack of the wire presents an opportunity to the repairer to take out of the line bad joints, and the making of better ones.

THE GREAT SLEET OF 1849 AND THE TELEGRAPH LINES.

The most serious misfortune that ever befell the telegraph in a single night was that produced by the great sleet of 1849, in the Southwest. The lines in every direction through Tennessee, Kentucky, Northern Mississippi, and Alabama, were levelled to the earth in a few hours. The wire employed on the lines was number ten, averaging in strength some ten hundred pounds. In the States mentioned the climate is mild, and heavy sleets

Fig. 11.

seldom occur. The ice formed upon the lines, as seen in fig. 11, and the wire was broken between hundreds of the poles. In woodland countries, where the ice failed to break the wires, the limbs of trees were broken down, and falling upon them, aided in the general disaster. It was a sad time for telegraphers. For about four weeks, all business in the transmission of dispatches was suspended, and all employés were engaged in the restoration of the lines. Several hundred men additional were employed; and although the work was equal to rebuilding the line, some twelve hundred miles of telegraph were repaired in the remarkably short time of one month.

DESTRUCTION OF THE TELEGRAPH LINES BY LIGHTNING.

In the Southern and Western States, the lightning is severe upon the electric telegraph. Many times the wires are struck and burnt. I saw a piece of wire that had been matted or fused together; it was twenty feet long; and how it became drawn into a mass of some two feet in diameter, resembling a tangled string, no one, save Divinity, can comprehend. On one side of the wire there were bubbles. The poles were torn to pieces for about a mile. In most cases the wire is left uninjured, but it is common for the poles to be split and scattered about on the earth. Sometimes the poles are mostly split at or near the earth. Great care has to be taken to preserve the apparatuses in the stations; but the means of protection will be explained elsewhere.

A SILK CORD SPLICE FOUND IN THE LINE.

A vexatious interruption took place on one of the lines a few years ago, which for a time defied discovery. On testing the line in the morning, at an interior station, the line was found to be broken, and, as supposed, the end of the wire was suspended in the air. No circuit could be formed with the battery. As soon as possible, the operator was travelling upon the route of the line, in search of the place of difficulty. He proceeded to the end of his section, twenty-five miles, where he met the operator of the next station in course. Each reported his section in order. The wire was cut, and one section was found to be perfect and the other not. Diligent search was made by the operator of the section at fault on returning to his station, but nothing could be found. No foreign matter touched the line, and the wire was seen properly suspended between every pole. The next day was spent in vain search for the fault. The office was again examined, and all was right there. It was then supposed that some joint was imperfect. The operator, with others to assist, proceeded to examine the joints on the line. He cut the wire five miles distant from the station, and found that the difficulty was farther off. At the end of the next five miles, he cut the wire, and found that it was between him and his office. He returned, and cut the wire every mile, until he found the quarter of a mile on which was, beyond doubt, the place he was searching for with so much solicitude. Finally, he found it. It was a silken cord, the size and color of the wire, about one hundred feet long. The joints were made as the other wire, but covered with white paint, to resemble the solder.

NOVEL CASES OF REPAIRING THE LINE.

Col. Speed has reported a singular case of repair. A man had cut a tree, which, in its fall, broke the wire. He was anxious to mend it as speedily as possible. He was not able to get the ends together, and, as a substitute, he generously placed a rusty chain to complete the connection. Had the chain been bright, the line would have worked; but the dry rust between any one of the links was, perhaps, sufficient to prevent the passage of the electric current. The repairer passed the place several times without seeing it. Finally, however, the chain was discovered; and on telling the man who placed it there that it had interrupted the communication over the wire, he responded, that it could not be possible, for the chain was much *stronger* than the wire.

Another case has been reported to me by Col. Speed, where the fault baffled for days the greatest energy for its discovery. On many of the lines brackets are nailed to trees; the wire passing through one of these brackets, which had been nailed to an elm tree, touched the head of a nail, thereby causing an earth connection with the sap of the tree. Sometimes, by the force of the wind, the wire was removed from the nail, and then full communication was restored.

A case has been reported to me by Mr. Talcott, of the Washington station, where the repairer found the wire broken, but was unable to get the ends together. He was some twenty miles distant from a station; and for a temporary substitute, he purchased a stove-pipe. After perfecting the metallic connection between the sections of the pipe, he fastened it to the line wires, and communication was restored.

On one occasion, when repairing a break in the line, I was unable to get the ends of the wire together. Only one foot was needed. In this dilemma I lashed the iron climbers hereinbefore described, and by using them a good metallic connection was made, and communication over the wire restored.

On another occasion, I had not line wire sufficient to unite the ends. About five feet were needed. I cut a small pole, some two inches in diameter, and tied the ends of the wire to the pole. When in practical telegraph service, it was my custom to carry in my pocket some fifty or a hundred feet of the fine wire taken from the rejected relay magnets. With this fine wire I connected the line wires, lashing it around the pole, to prevent it from being broken. This fine wire perfected the metallic circuit, and communication was continued over it until a piece of large wire could be substituted for it, which was done on the next day.

It was my practice to use this small wire in connecting the ends of the wire, the moment I found the break, or before I cut the line wire, when that formality had to be resorted to. By that means, the line was brought into immediate use, long before the line was properly mended. In my administration of the telegraphs, I always found it advantageous to provide the repairers with more or less of this small wire.

Numerous cases might be cited showing ingenious remedies resorted to, in order to perfect the line sufficient to secure the transmission of dispatches temporarily. The cases cited prove the necessity of the employment of men for repairers capable of meeting cases in any emergency.

Having thus lengthily discussed the first duty of the repairer, I will now briefly consider the others; and as to the second,—*to remove from the line all foreign conductors.*

The repairer of the line should be very careful to remove from the wire all limbs of trees, and everything else, so as to have the wires suspended from the insulators, and nothing else. In cities I have often seen kite-strings fastened to the different wires, by which, when wet, the electric current passes from one wire to the other. This should not be the case under any circumstances. These strings may lead off the whole current, thereby preventing communication. An impression is very often entertained by operators, that their batteries will "drive over" the string conductors. This is possible in certain cases, such as where the batteries are near the difficulties. But, suppose the battery is one hundred miles distant, and a heavy rain falls, a stream of water will run from the upper wire to the lower along the kite-string. When this is the case, communications on either wire at the same time will be interrupted. When the like occurs, the remedy is only to be found in detaching one of the wires from the earth circuit, leaving the end at the station suspended in the air. If the string conducts the current from wire No. 1 to No. 2, and the latter is disconnected as above stated, communication on No. 1 will be uninterrupted.

Great care should be observed to preserve the wire from contact with nails, sides of trees, houses, and other things. Through the Southwest, young trees grow so rapid, that they need to be cut from beneath the line in the fall of every year.

And, thirdly, *to preserve a proper insulation of the wire.*

With reference to this subject, I would refer the reader to the article on insulation. Whatever the insulator may be, care should be observed to keep it in or on every pole. I have known lines to work tolerably well with many of the insulators out of the poles, the wire resting upon the wood. This ought not to be the case. The line will work as long as it is dry, but as soon as the wood is wet, the line will not work. A good and faithful repairer will, at any time, travel five or ten miles to place in the pole a single insulator. Nothing in the art of telegraphing is more important than a perfect insulation. Suppose the iron hook insulator be used, if the glass be broken, and a rain falls, it will be impossible to communicate over the wire.

In a word, the repairer should see that the wire is insulated by a non-conductor from everything that is a conductor throughout the whole line.

Fourthly, and finally—*to secure the permanency of the structures of the line.*

On every line of telegraph, some of the poles will decay before others. When such cases occur, new poles should be substituted without delay. If they are permitted to remain, the wind will sooner or later level them to the earth. Communication will then be interrupted, perhaps for a day or more, until the poles are replaced by others. As a question of economy, no one can doubt but what it will be much better to replace the decayed pole before its fall, bringing with it to the earth the wire, and interrupting communication.

It is often the case, that the water settles around the foot of the post, and, the earth yielding to the pressure, the pole bends over, or perhaps falls. The repairer should watch for such cases, and immediately rearrange the earth around the pole, or place stones around it, or drive small pieces of timber into the loose earth, to make it more compact, and to serve as braces to the pole. On lines using the open or groove insulator, it often occurs that the strain of some half mile of the wire will be on a single pole, placed at an angle. When this is the case, the pole is sure to bend or warp, and perhaps force through the earth. In such contingencies, the wire on the next poles, on each side, should be keyed, so that the strain upon the one pole will not be more than the two stretches.

I have now sufficiently explained the duties of a repairer. If what I have said be properly studied and practised by those employed in that particular service, I think the lines will be benefited, their economy will be subserved, and the public good will be greatly promoted by the increased facilities for telegraphing.

On lines where there are not employed special repairers, a corps of men should travel over the whole route in the spring and in the fall, and perfect the line in every particular, as herein before mentioned. This should be considered by every company as indispensable.

There are many telegraph lines in America, built with galvanized wire. Some telegraphers are of the opinion that the joints made of this wire do not require to be soldered. Such, too, was the opinion among practical telegraphers fifteen years ago, in regard to the ordinary wire not galvanized.

Complaints are made against soldered connections on galvanized lines, because the wires break oftener at the splicings than elsewhere. Such was the case with the egg joint, and telegraphers objected to soldered connections at that time for the same reason. Some lines were then built without soldering any of them. In a few years they worked better during and after a rain than they did on dry days. This resulted from the water resting in the cavities of the wire joints, serving as auxiliary conductors. When they were dry, the rust was an inferior conductor, and hence the difficulty of getting a sufficient flow of the voltaic current from station to station. Even the dews of heaven that fell during the shades of night, served as rich blessings to the wearied operators, and as an amelioration to the struggling messenger destined for other climes! It seemed to me as though the finger of the Creator benignly aided in the perfection of the means for the transmission of that mysterious imponderable agent, which conceals itself, and nestles in the gorgeous drapery of his throne—a power in nature so transcendent in sublimity, that it can have no twin!