CONSTRUCTION OF THE AMERICAN LINES.

CHAPTER XLVII.

Organization for Digging the Holes—Erection of the Poles—Suspension of the Wire—Insulating the Poles.

ORGANIZATION FOR DIGGING THE HOLES.

In organizing men for the construction of a telegraph line, much consideration must be given to the proper distribution of labor, to effect the most certain and rapid consummation of the ends in view. In the classification, a proper force must be placed at the digging of the holes, the getting and putting up of the poles, the suspension of the wire, and the necessary auxiliaries in the premises. I propose to notice each corps respectively.

The detachment of men engaged in digging telegraph holes is generally called a "squad," "gang," or "party." In my practice, I have usually termed them a "squad." The necessary implements are the shovel, fig. 1, the digger, a wrought-iron rod, about six feet long, with steel cutter at end, and the auger, with blades about twelve inches diameter, fig. 2. The use of these tools I will shortly describe. A digging squad should not exceed nine men, one of whom will act as "boss," or director. The duty of the boss is to step off the places for the holes, locating the spot of each by a stone, removing a little of the earth, or by driving a stick into the earth to serve as a mark to the diggers. The boss must be capable, and understand the whole process of construction. He establishes the range or line of the poles, so as to distribute the strain of the wire on as many of them as possible. Much expense has been thrown upon the subsequent working of lines by injudicious location of the poles; for example, suppose poles A B C are erected, the first on a hill, the second in a valley, and the third on a hill. The wire will pull off the cap of the insulator used on the southwestern lines, and will pull off the insulator employed on the eastern line, as most insulators are constructed with a view to the weight of the wire hanging, instead of its strength applied to an upward force. Again, angles are to be avoided as much as possible, establishing curves in their stead. From these few remarks, it will be seen that the duties of the boss are responsible, otherwise than in a proper management of his men. The squad of eight men are divided into four pairs, each pair having a digger, shovel, and an auger. In ordinary earth, two men can dig forty holes per day. To have more than two men to a hole is a waste of time, and no acceleration. I have thoroughly experimented upon this subject, and there can be no doubt of the correctness of these conclusions. Only one man can work at a time at the same hole. Now, it may be supposed that it would be better to have one man only to a hole, but such is not the case. Man is companionable, and, when alone, will not labor as fast as when associated. In a month, a squad divided into pairs will dig at least twenty per cent. more than when arranged in divisions of three, and much more than when placed one to each hole. When in pairs, each brings into action increased vigor after a little rest. The labor in digging a telegraph hole is severe on the back, and no man can toil the whole day without either an occasional rest or slowness in his work. When in pairs, the necessary rest is given, and each renews work strengthened for quick action. But this rest is not half the time, nor need it be more than ten per cent. of the time, as will be seen by the process of work.

Fig. 1

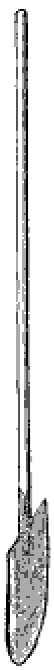
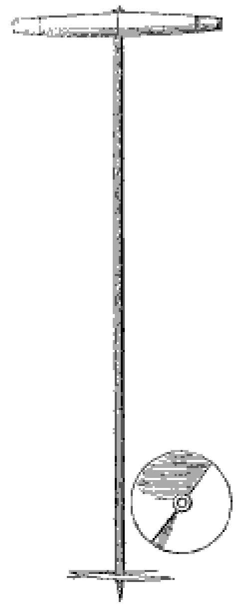


Fig. 2.



After the hole has been located, the men commence by cutting the earth with the digger to the extent of the size of the hole at the top, usually about fifteen inches diameter. The earth being loosened about a foot deep, the other man with the shovel removes it from the hole. The digger is again applied, and the shovel again removes the earth, and so on, until the hole is about three feet deep. One of the men then takes the auger represented in fig. 2, the blade or flange of which is constructed as seen by the side and top views, and bores the hole to the proper depth, which usually is about five feet. When the earth is very compact, four and a half feet will answer. In gravel, three and a half or four feet is found to be sufficient.

At the time one of the men commences with the auger to finish the hole, the other man proceeds to the next hole in course, with shovel and digger, and commences a new hole. He here works alone, alternately with the shovel and digger, until his companion arrives from the former hole, which has been finished by the auger; he joins in digging the hole number two, as had been done at number one. In this way, the holes are dug and left ready for the pole.

During this operation, the boss is busy locating the holes, and occasionally assisting in digging a hole; for example, when one of a pair is left to finish a hole with the auger, the other is alone at the next hole in the use of the digger and the shovel. Here the boss has an opportunity to aid with either of these tools, and in thus assisting, he becomes acquainted with the efficiency of his men; and, after a few days' service, he can readily determine how many holes his squad ought to dig per day.

In rocky earth, the auger cannot be used, and the entire hole has to be dug with the digger. In such cases, the average holes per day often do not exceed from twelve to twenty per pair of men. But in ordinary earth, a squad of nine men, with twenty-two holes per mile, can finish from six to ten miles per day.

I have never found it economical to have more than nine men in a squad, nor more than one boss for the same men. I have experimented on this fully, extending as high as forty men in the same squad, with a boss and two or more assistants. Whenever I exceeded nine men, I have found a loss, as a sure consequence. A gang of less than nine men will prove economical, but the speed will not be sufficient for the pole squad, soon to follow.

After the holes are dug, the poles should be erected as soon as possible, and at least within a few days, for the reason, that a rain may fall and fill the holes with water; and also to avoid damage to man and beast.

In regard to the first, I deem it proper to add, that after a hole has been filled with water, the pole cannot immediately be set solid. It is true the water may be taken out, as I have had done in thousands of cases, but the earth is left saturated with water, and, in fact, is a mere casing of mud. But, in the winter season, the water might freeze, and in that case the hole is filled with ice, which is as difficult to remove as to dig a new hole. In 1847, I had dug some forty miles of holes, and a rain fell, filling many of them with water; cold weather followed, and the water was solidly frozen in each hole. In that case, I found it less expensive to have new holes dug, and the old ones were abandoned. But the loss of the first holes was not all that was sustained; there was a more serious consequence. After warm weather had softened the ice, a traveller's horse stepped into one of the holes and broke his leg. The case was brought before a legal tribunal; the traveller demanding damages. The telegraph company pleaded that it was not responsible, as the digging of the holes was necessary in the construction of the line authorized by the act of the legislature; and, besides, the holes were within the limits belonging to the road company. The tribunal held that the company was not liable, as the digging of the holes and the erection of the poles had been given under contract to other parties. Action was then brought by the traveller against the road company, and the tribunal decided that the law required the company to keep in good order a travelling way of a given number of feet wide. The telegraph hole was not in that way, but was some feet from it, and as the traveller had departed from the proper and common highway, the road company was not at fault. From these facts, it will be seen that the law fully protects the telegraph and the road companies; but there may be abuses of this privilege, and abuses of all kinds should be most studiously avoided. Notwithstanding the law cannot give the traveller any damage for the loss of his horse, I have always found it best to soften the losses, by paying something, thereby voluntarily sharing in the misfortune. This amelioration begets friends, and tranquillizes even the most vicious and revengeful heart. The world must be taken and considered as it is, and not as it ought to be. Justice would not require the telegraph to pay for the loss of the horse; but man's depravity often impels him to deeds of wrong. In the dark hour of night, revenge might be satisfied by cutting the wire, and forcing upon the company a loss greater than the value of the horse. Providence, in the end, however, brings about a retribution, as an atonement for the offended law; this atonement, some telegraphers might say, reaches not the thing ponderable.

In America, it is too often the case, that when a man feels that the law has not sustained his imagined rights, commensurate with an excited conviction, he seeks revenge through a more clandestine course, by the execution of some personal infliction. In Europe, where society is taught to reverence the law, and yield in all cases to the decrees of fate, however unjust at the time, in order to attain the greatest good for the greatest number, the lines are not so much jeoparded, nor liable to malicious interruptions. A universal respect for the telegraph throughout the world, is a "consummation devoutly to be wished."

ERECTION OF TELEGRAPH POLES.

The implements necessary for the erection of a telegraph pole are, the pike-pole, fig. 3, made of an ordinary pole, about ten feet long, with a sharp-pointed iron fastened in one end;

Fig 3.

around this end of the pole is placed an iron band, to prevent splitting; the rest-board, fig. 4, being a plank about six or eight feet long, ten inches wide, one inch thick, and concaved

Fig. 4.

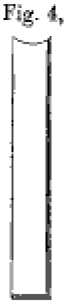
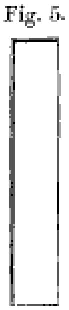


Fig. 5.



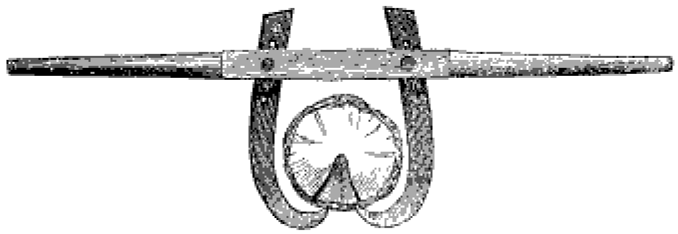
at one end, to allow the pole to lay in it; the foot-board, fig. 5, about five feet long, ten inches wide, and two inches thick, on one side a little hollowed; the cant-hook, fig. 6, made of timber, five feet long and about three inches square at the largest end, with handle end round; and about ten inches from the larger end a flat iron hook is fastened with a bolt. This iron hook can be moved, as will be seen, by the holes in it; the bolt is held firm by a screw nut, at one end, and a flat head at the other end. The pole-lifter, fig. 7, made as a double cant-hook, excepting that the hooks are placed near the centre of the lever. This wooden rod or lever is about six feet long. The rammer is made of a

Fig. 6.

round piece of wood about six feet long, about two and a half inches in diameter at the little end, and about four inches in diameter at the larger end. Around the larger end is placed a heavy iron band. Besides these tools, an ordinary farmer's shovel and pick are required.

The pole-squad should consist of ten men, one of whom acts as boss, six as pike-pole-men, one as foot-board-man, and two as pole-setters.

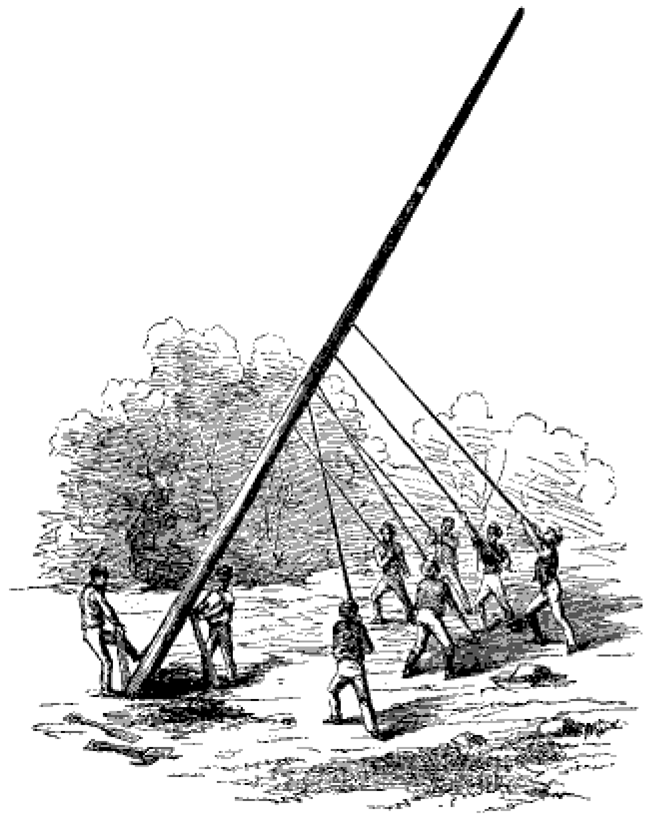
Fig. 7.



Having described the different tools and the number of men required for the erection of telegraph poles, I will now explain the proceeding in that formality.

On arriving at the hole, the first step to be taken is, to place the pole in the proper position for its elevation. The butt end must lie over the edge of the hole, and the pole must be placed so as to be easy to erect where the ground is uneven. Four men take the pole-lifter, fig. 7, and, grasping the butt end of the pole with the iron hooks, they lift the end of the pole to the proper position at the hole. Two of the men then proceed to adjust the other end of the pole with the lifter; the other two having prepared themselves with their pike-poles, fig. 3, to be ready for their use. When the pole is properly placed, the men with their hands elevate the little end about six or eight feet high. The rest-board, fig. 4, is then placed under it; the foot-board-man places his board, fig. 5, in the hole, about three feet deep, opposite the foot of the pole, as seen in fig. 8. The men then change their positions, placing their shoulders under the pole nearer the hole, when, from a stooping position, they come to a perpendicular; the rest-board is then brought nearer the hole. By this time the pole is at an angle of 45° The pike-poles are then taken and placed under the pole, as seen in fig 8, combining angular forces to elevate the pole to the perpendicular. When the pole is thus placed, the cant-hook, fig. 6, is applied to the pole, about ten inches above the surface of the ground, and one man can turn the pole in its upright position, so that the previously adjusted insulator at its top will be on a line as required for the wire. The instant the pole is brought to a perpendicular, three of the men with their pike-poles hold it upright for the application of the cant-hook, and for the pole-setters to fill the hole with the earth or stones sufficient to keep it in the proper position. The other men pass on to the next hole, and proceed to arrange the pole and elevate it preparatory to the application of the pike-poles. One of the

Fig. 8.

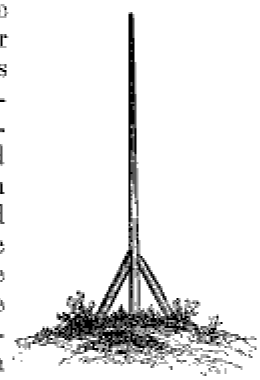


two pole-setters fills in the earth, and the other rams it to a solid state. The earth should be elevated a little around the pole at the surface of the ground, to allow for the earth to sink to a level, and to cause the water to run off, and not settle in a puddle around the foot of the pole. By the time the hole is filled, the next pole in course is ready, and so on.

By these facts, it will be seen that there will be no loss of time. Every man has to be on the active move, in order to maintain his position. The boss usually takes the foot-board, or the rest-board, which gives him an opportunity to see his men, and to give the commands from time to time. With expert men, properly organized, working ten hours per day, a corps of men thus described can erect a pole in four or five minutes. When the earth is frozen, an additional pole-setter is required. There is no position in the raising of the pole more responsible than the foot-board man; he must be careful not to allow the pole to slip either to the right or to the left from the board: because, if it does, the end is forced into the side of the hole, and the pole becomes difficult to raise, the pike-pole men lose their angular force, and the pole falls. By pressing his foot upon the pole, as in fig. 8, he can greatly facilitate its erection.

Unless the squad observe proper care an accident may happen in the raising of the pole, by its fall as above mentioned; though I never knew of but one case which was fatal. In 1847, Messrs. Tanner & Shaffner were in haste to erect some two hundred and eighty miles of line, through Kentucky and Tennessee, and a large number of men had to be employed. There were several squads for each department of the business. One of the pole squads was composed of men inexperienced in the business, and the third pole attempted to be raised, when between 45° and 90°—the pike-pole-men not applying their force properly—fell and killed one of the men. This melancholy accident caused the men to disperse and abandon the business.

Fig. 9.

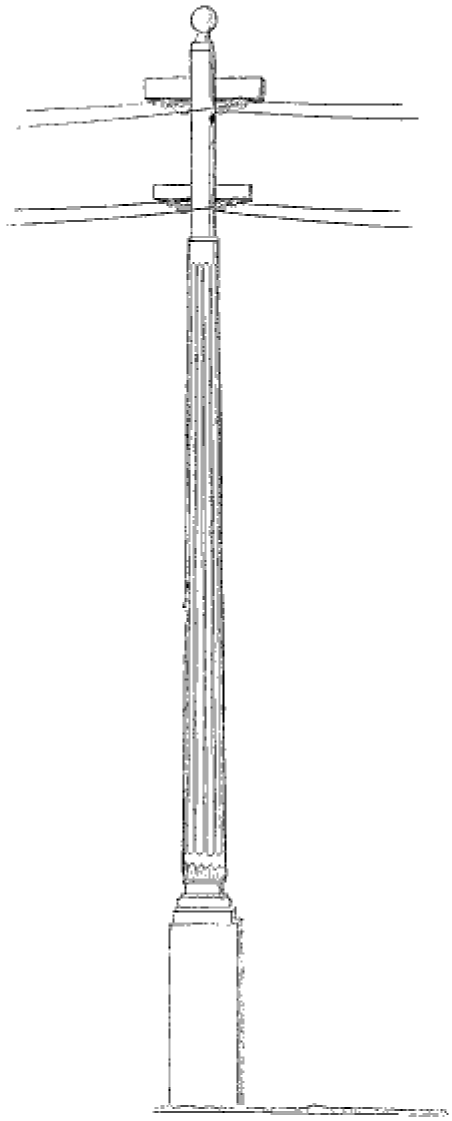


When the earth cannot be rammed compact around the pole, and it is not possible to get stones or gravel to aid in setting it solid, it is usual to use braces to prop the pole. One, two, three, or more braces are used, of indefinite lengths or sizes, as seen in fig. 9. Rough saplings, some four or more inches in diameter, are generally cut, and with one end set in the earth, and another in a notch cut in the pole, or nailed to it, or fastened with a wooden pin, the brace forming the hypotenuse of a right-angled triangle, are all that have been deemed necessary on the provincial highways in America. Sometimes sawed scantlings, four inches in diameter, are employed as braces, four to each pole, and the lower end nailed or fastened to log sills arranged around the pole, about four feet distant from the foot of the pole.

As a general practice, the bracing of posts is avoided, by changing the location of the pole, as experience has taught that it is more economical to make the line a little more circuitous than to have braced poles.

With a view to economize in labor on a line commenced by Mr. Tanner and myself, in 1847, I caused to be tried the erection of poles with a small pair of shears. This latter proved to be quite a success; but with the shears, nearly the same number of men were required, and not half the speed, as in the erection with the pike-poles.

Fig. 10.



The poles along the ordinary highways are very plain, but in some of the cities much effort has been made to ornament them, especially at the stations, so that they might serve as signs to distinguish the places. In former years, when there was much competition between companies, the spirit of rivalry extended to the poles erected in the cities. Fig. 10 represents the Louisville station pole. The base and fluted column were made of iron; the round shaft above and the cross-arms are of wood, and neatly painted. At St. Louis, one of the companies was still more extravagant, and had erected a massive ionic column, some twenty feet high, and upon it was placed a full-sized statue of Franklin, with the line wires passing through one of his hands! Another office had a large golden eagle, with outstretched wings, ready to soar off to some poetic region, the most distant from economy.

SUSPENSION OF THE TELEGRAPH WIRE.

The telegraph wire is prepared at the manufactories in any required lengths. For some lines, it is prepared in half mile and mile hanks. The greater number of lines have had it wound on prepared reels. These reels have a drum about eight inches in diameter, with × ends, made of oak scantlings, four inches in diameter, as represented in fig. 11. The reels are about three feet long, and upon them is wound from three to eight miles, the average about five miles. Each joint is well soldered, and a whole strand of the quantity on the reel is continuous. Fig. 12 represents one of these reels, mounted on a wagon. The reels are distributed along the line at proper distances. Often they have laid upon the ground along the open highways, and in the forests, for many days, without any covering. To prevent the wire from oxidation, it was my practice to have the wire well covered with linseed oil, at the manufactory, and again before distributing the reels on the route, cover the outer layers of the wire with the same kind of oil. When this precaution was taken, the wire was always found free from rust; and, besides, it preserved it from decay when stretched. This was the case with wire not galvanized. In later years, many of the lines have been putting up galvanized wire. The "wire-squad" requires a wagon, drawn by two horses. On the wagon is mounted a frame work for the suspension of the reel, as seen in fig. 12. An iron rod, one and a half inches in diameter, runs through the centre of the reel, which serves as an axle. Through the hole in the cross, fig. 11, is run the axle. This axle rests and turns in metallic boxes fitted in the upright beams of the framework in the wagon, as seen in fig. 12. The arrangement is the same as the old-fashioned windlass. The whole mechanism for the suspension of the reel is rude, plain, and cheap, costing

Fig. 11.

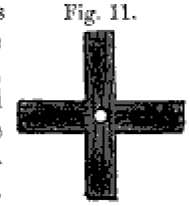
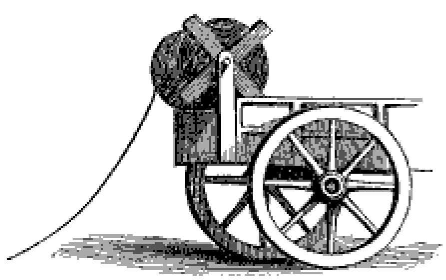


Fig. 12.



not more than some ten dollars. Fig. 12 represents a section of the wagon.

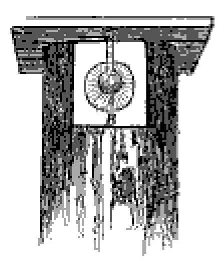
Another wagon is required for carrying insulators and divers tools necessary in the business. Two ladders, two axes, four hatchets, vices, pincers, soldering apparatus, nails, and a few spare tools are necessary. These articles embrace all that have been required on the provincial routes, especially through forest countries.

The wire corps is composed of at least thirteen men, viz.: one boss, two principal ladder-men, two assistant ladder-men, two trimmers, two teamsters, and four wire-pullers. The boss has the direction of the squad; the principal ladder-men arrange the wire and the insulators on the poles; the assistant ladder-men help in carrying the ladder and holding it firm, when the principal is mounted upon it: the trimmers cut off the branches of the trees on the line of the wire, and cut down all the undergrowth beneath the wire; the teamsters have the charge of their wagons, and, besides, aid in other work, as directed by the boss; and the wire-pullers transfer the wire from the reel, as it unwinds, to the poles, and, after being placed in the insulators, it is drawn by them taut, so that occasionally the principal wire-men may key the wire at any given pole.

Now this process contemplates the use of insulators, such as fig. 13, which are fitted in the pole as in fig. 14. This class of

Fig. 13.

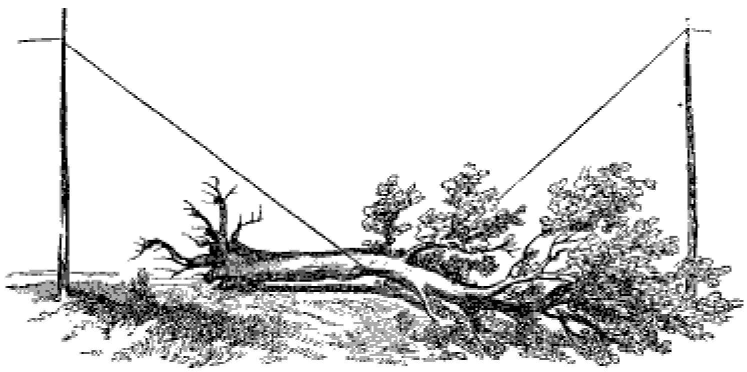
Fig. 14.



insulators has been principally used on the lines traversing forest regions, so that when a tree falls upon the wire as in fig. 15, it can slide through and not break. If tied to the insulator the wire would break under the weight, at the post.

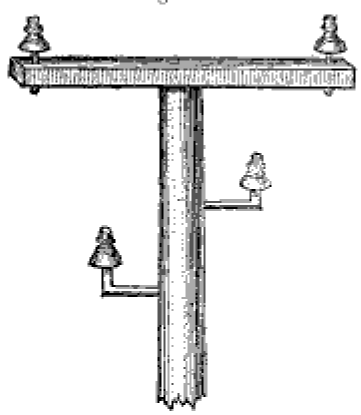
When the wire is stretched upon the poles from hanks there must be additional assistance for the handling of the small coils, and when the wire is tied to every insulator there would be economy in the employment of more ladder-men. On lines where the wire is fastened at each pole, the routes are more free from forest limbs and undergrowth. Along the railways there is not much trimming required, so that there need be no especial men engaged for that particular service.

Fig. 15.



I have stated that there will be required four wire-pullers on open insulator lines, but practically, nearly the whole force assist. The wire is first placed in the insulator and it hangs loosely between the poles. After a half mile is thus arranged, nearly the whole force assist in drawing it taut. The wire runs through the insulator in the case of fig, 13, and over the arm, as represented in fig. 16. When the wire is drawn nearly

Fig. 16.



straight, it is " made fast " to a stump, a tree, or something else. The wire-men again proceed in arranging another section upon the poles, assisted by one of the ladders. The other ladder is at the same time engaged in tying the wire to the insulator in the one case, or in keying it in the other place to the last insulator next to the place where the wire is " made fast " to the stump or otherwise. This key is a small iron in the shape of a button, with a groove through the flange from the side to the centre. The wire passes into this groove and a small piece of iron is driven into it, which binds the wire. Another mode is, simply tying upon the wire two or more nails, with a small wire, which will prevent the line wire from passing through the insulator farther than the nails.

On some routes the wire-men can be dispensed with, by boring holes in the arms of the × ends (fig. 11) of the reels. By placing an iron rod into these holes, the rod serves as a lever, so that, with a catch wheel attached, the teamster alone can rewind the wire on the reel, arranging the wire as taut as required. On railways a reel of this kind can be fixed upon a hand-car, and employed for the purposes above described. Ordinarily, however, to avoid accident, the common wagon is the best to be used on any kind of road.

Such is the organization of a wire squad, and the mode of putting up the wire, on most of the lines that have been constructed in America. Such an organization can put up from six to ten miles of wire per day, a speed little faster than the speed of the digging of the holes and the erection of the poles. It has been usual to allow the poles to be put up some miles in advance, so that the whole line will be finished at about the same time. The speed of putting up of the wire can be reduced by dispensing with a part of the force.

FIXING THE INSULATORS ON THE POLES.

In consequence of there being no uniform insulator employed on the telegraph lines, a description of the adjustment of the pole for insulation can not be other than but general. I will therefore refer briefly to the manner of arranging the two different classes of insulators, viz., 1st, the open groove insulator, and 2d, the tie insulator.

The open groove insulators are put upon lines where it is desired that the wire shall not be made fast or tied at each pole. In the use of this class the pole must be adjusted for the glass before erection. In the case of fig. 13, a square groove is morticed through the top of the pole. This is done by boring an auger hole, the size of the glass to be used; with a saw a block is cut out from the end of the pole to the auger hole, so that the glass can rest in the groove, with its upper side even with the top of the pole, as seen in fig. 14. When the pole is thus prepared it is ready for erection. The adjustment of the pole for the glass is usually done after they are distributed at the holes.