W. McINTOSH & F. BAIN.

METHOD OF REPAIRING WIRE CABLE.

APPLICATION FILED SEPT. 3, 1909.

963,800. Patented July 12, 1910.

Fig. 1.

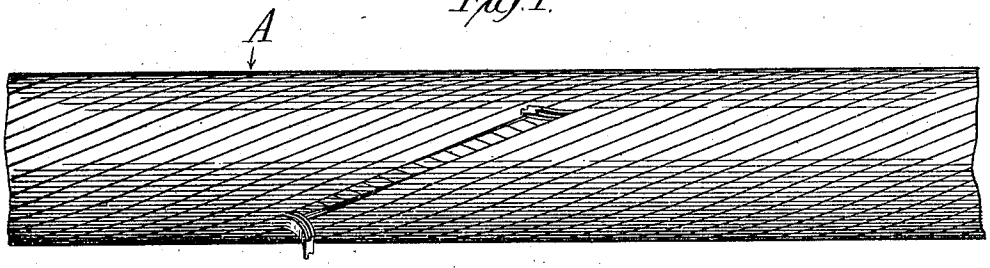


Fig. 2.

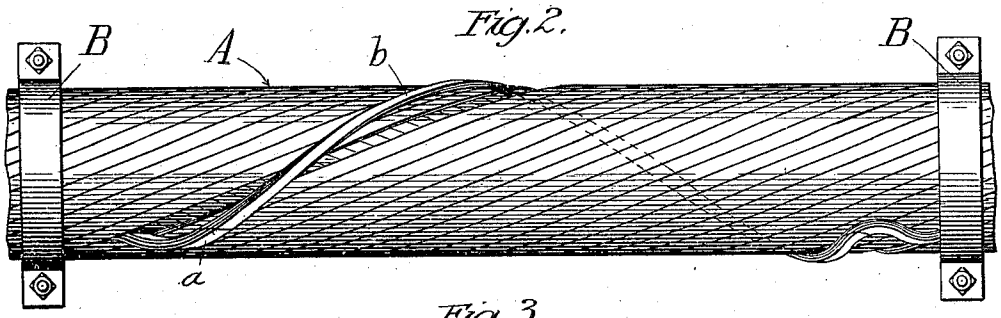


Fig. 3.

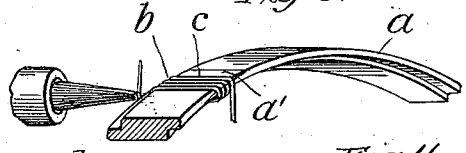


Fig. 4.

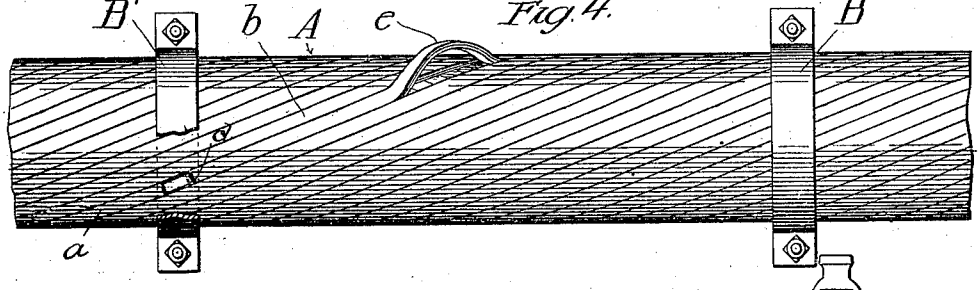


Fig. 5.

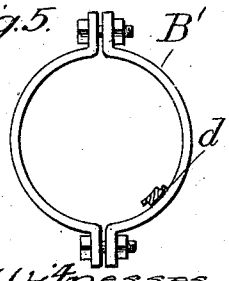


Fig. 6.

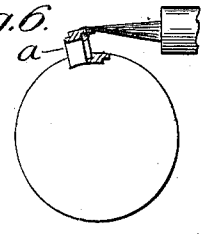
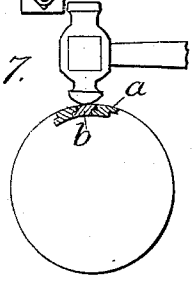


Fig. 7.



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UNITED STATES PATENT OFFICE.

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METHOD OF REPAIRING WIRE CABLE.

963,800. Specification of Letters Patent. Patented July 12, 1910.

Application filed September 3, 1909. Serial No. 516,082.

To all whom it may concern:

Be it known that we, WILLIAM McINTOSH and FORÉE BAIN, citizens of the United States, respectively residing at Grosse Ile, in the county of Wayne and State of Michigan, and at La Grange, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Methods of Repairing Wire Cable, of which the following is a specification.

Our invention consists in a method of repairing wire cable, such for example as the steel wire cables that are used in cable-ways employed in conveying heavy material, such as ore and stone, in mining and quarrying operations, and the like. Such cables are commonly made of a good grade of steel wire, laid in many superposed reversely-directed layers or courses, the outside course or layer of wire forming the sheathing whereon sheaves of moving conveyers run and being of specially heavy construction. It is upon the strands of this outside layer that wear directly takes place, and in practice these outer strands often break singly here and there long before the useful life of the cable as a whole has been exhausted. When such a rupture occurs, the sheaves of the traveling skips, buckets, and like conveyers, catch the broken strands and cause them to unwind from the main body and obstruct the conveyer passage and so rendering the cable unfit for use.

In practice, previous to the development of our invention, operators commonly continued to use their cables after strands had broken with the aid of various temporary expedients for relieving the difficulties occasioned by the broken strands, until conditions in the cable became so unsupportable that comprehensive repair was imperative; and then to effect such permanent repair, it was usual to remove the cable entirely from its supporting piers, ship it to the factory, and have the entire outside layer of wires removed and a new layer substituted therefor. This practice has always been objectionable in many particulars. The disadvantages of having to keep on hand a plurality of cables in order that the work might not stop while any cable was undergoing reshipment to the factory; the trouble and expense of taking down and erecting cables; the great freightage cost of shipping many tons of heavy cable to and from remote factories—often from difficultly-accessible fields of operation—and the expense of renewing an entire outside layer of the cable, are obvious. Furthermore, experience demonstrates a cable so repaired to be unsatisfactory for the reasons, among others, that while the initial use of the cable has stretched or "set" the inner windings, the newly applied exterior layer has no corresponding set and the travel of the sheaves thereover in subsequent use causes the lengthening of the outer strands and results in their "bunching up" at the termini of the path of sheave-travel; and further, the unequal conditions of strain upon the old and new layers of cable tend unduly to shorten the life of the repaired cable.

Our method of cable repair contemplates repairing the particular strand or strands broken—the "repair" strands we term them for convenient reference—to restore their effective continuity, without materially affecting the unbroken strands of the outer layer and without the necessity of the removal of the cable from the work. This effects enormous saving of cost in materials, time, and labor, enabling the repair work to be done on the job with minimum expenditure of labor and material, lessening the deterioration of the cable by enabling complete repair to be effected as frequently and as soon as breaks may occur, and obviating the many disadvantages arising from the superposition of a new covering layer upon old core layers.

Briefly considered, our method of cable repair contemplates clamping the cable, while in its working position, a suitable distance on each side of a break in a strand to hold the wires against relative displacement, lifting and scarfing the broken strand at two points suitably separated between the clamps, providing an insert of a little greater length than the wire vacancy, preferably of wire of the same character as the broken strand, effecting positive union between the ends of the insert and the severed ends of the strand to restore continuity to the repair strand, inlaying the joints and as much of the repair strand in the vacancy left by the original strand to leave only a projecting kink of so much of the surplus wire necessarily allowed to obtain slack for the joining operation,

and reducing, as by swaging, the slack-kink down into the contour of the cable.

In the drawings we have exaggeratively illustrated, for purposes of convenient disclosure, the practice of our invention upon a cable, and in said drawings—

Figure 1 is an elevation of a portion of a fragment of a cable with a cover strand broken; Fig. 2 shows the cable with the insert connected to the severed strand-ends; Fig. 3 shows a convenient method of making a brazed joint; Fig. 4 shows the cable with the joint and insert wire inlaid to leave only the slack bunch protruding; Fig. 5 shows a convenient manner of clamping the strand undergoing repair at the joints; and Figs. 6 and 7 indicate the swaging operation upon the slack kink to reduce the same to the cable contour.

In the drawings, we show the application of our invention to a cable having a covering layer of flat wire with overlapping edges forming half-lap joints; and it will be apparent to those skilled in the art that our invention is not limited to the repair of such wire, as it may be practiced with equal or greater ease upon round wire or pain flat wire.

When the repair strand, *a*, of the cable, A, is broken, as indicated in Fig. 1 of the drawings, we start the desired repair by preferably putting on clamps, B—B, unwinding the strand from the break a sufficient distance to give room for the operations to be performed and to reach an uninjured part of the strand. The distance is not especially material, but it is good practice to have six inches or more, lineal measurement of the strand, separate the two joints to be effected. Each end of the broken strand is then scarfed off, as at *a'*, Fig. 3, and an insert, *b*, of similar strand wire is scarfed off to appropriate length, slightly greater than the lineal distance of separation of the strand-ends or the length of the strand vacancy. The scarfed ends of the severed strand and the insert are then permanently and fixedly joined, preferably without material distortion or increase of the size or shape of the wire at the joints. Welding, hard-soldering, or brazing, are all applicable for effecting such joints, but we have found in practice that, working on suspended cables and therefore under somewhat adverse conditions, a simple method of brazing may most satisfactorily be practiced. In brazing the scarfed ends of the insert to the severed ends of the strand under such disadvantageous conditions, we employ in lieu of spelter a soft brass wire, *c*, wound firmly around the scarf joint, thereby acting to hold the parts together while being heated. Any suitable flux, such as a pinch of borax, is put upon the brass wire and a flame directed thereagainst sufficiently to heat the joint to be made and melt the brass, without materially affecting the cable as a whole adjacent the point of jointure.

When both joints have been effected, the repair strand is of restored continuity and with little if any diminution of its strength, but some slack has necessarily been left in effecting the operation, and this must be obviated in restoring the repair strand to position in the cable. We find that this may best be done by inlaying all of the loose wire except one or more small slack-kinks thereof, which may be conveniently concentrated at any point or points along the cable, and then reducing the kink or kinks by swaging. In practice, it is of course preferable to confine the kinking and swaging to the area of the insert between the joints and therefore, in practice, we generally inlay the ends and joints of the original strand and as much of the insert as possible, by simply driving them into the strand-vacancy, effecting such inlaying, in a cable of the construction shown, by the use of a cape chisel and hammer, or other suitable tools. As soon as the joints are inlaid, we preferably clamp the repair wire at the joints, by the clamps B', laying especial pressure upon the repair strand by the use of small pressure-localizing blocks or "dutchmans," *d*, as indicated in Fig. 5. The slack we localize in a kink, *e*, as shown in Fig. 4, and the kink is treated with heat, as shown in Fig. 6, preferably until the wire reaches a cherry-red and then, as indicated in Fig. 7, the softened wire is swaged down into and along the vacancy in the outer layer to conform to the contour of the cable, the wire of the kink expanding somewhat, but the normal interstices of the cable taking up such expansion. The clamps B' are removed, and the repair is complete.

We have found by prolonged practical experiment and subsequent commercial experience that the endurance or life of a cable thus repaired is superior to that of a repaired cable with an entirely new covering as heretofore described, and that a cable may be repaired by our method in many places from time to time, as may be required, without any interference with its serviceability or the production of any deleterious effects upon the cable as a whole. The local section of the repair strand operated upon is, of course, affected by the heating of the wire incident to the joining operation and to the reduction of the resultant slack, but such effect is purely local to a small area of one strand for each break and practice has demonstrated that joints effected in a wire in the manner above suggested show no signs of weakness and that, when a repaired strand is properly replaced in the cable as above described, the presence of the joints and swaged area may hardly be detected and it will hold

its surface alinement with the general contour of the exterior layer and offer no impediment to the full performance by the cable of its sheave-guiding or weight-carrying functions.

While we have herein described in some detail a particular practice of our invention, which we deem most generally advantageous, variations might be made in the particular details of the practice of our invention without departure from its spirit and scope and within the scope of the appended claims.

What we claim is:

1. The method of repairing a broken cable strand which consists in applying a slack insert to bridge the severed ends, permanently uniting said insert with said ends, partly inlaying the repair strand to localize the slack into a kink, and reducing the kink to the cable contour.

2. The method of repairing a broken strand of the exterior layer of a multiple-layer wire cable which consists in applying a slack insert to bridge the severed strand ends, permanently uniting said insert with said ends, partly inlaying the repair strand, and shortening the repaired strand to eliminate the slack.

3. The method of repairing a broken strand of the exterior layer of a multiple-layer wire cable which consists in applying a slack insert to bridge the severed strand ends, permanently uniting said insert with said ends, partly inlaying the repair strand to localize the slack into a kink, securing the strand on opposite sides of the kink, and swaging the kinked strand to the cable contour.

4. The method of repairing a broken strand of the exterior layer of a multiple layer wire cable which consists in applying a slack insert to bridge the severed strand-ends, brazing the insert to the said ends without materially increasing its cross section, inlaying the joints and insert sufficiently to localize the slack into a kink remote from the joints, and swaging the kinked portion of the strand to the cable contour.

5. The method of repairing the broken strand of the exterior layer of a multiple layer wire cable which consists in scarfing the ends of the broken strand at separated points, applying a scarfed similar insert to bridge the strand-ends, wrapping the scarfed joints with a fluxing metal wire, heating the wire-wrapped joints to effect union of the scarfed ends by the fluxing wire, inlaying the joints into the strand vacancy and localizing the slack into a kink, securing the repair strand on opposite sides of the kink, and swaging down the kinked portion of the strand into the strand vacancy.

In testimony whereof we hereunto set our hands.

WILLIAM McINTOSH.
FORÉE BAIN.

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