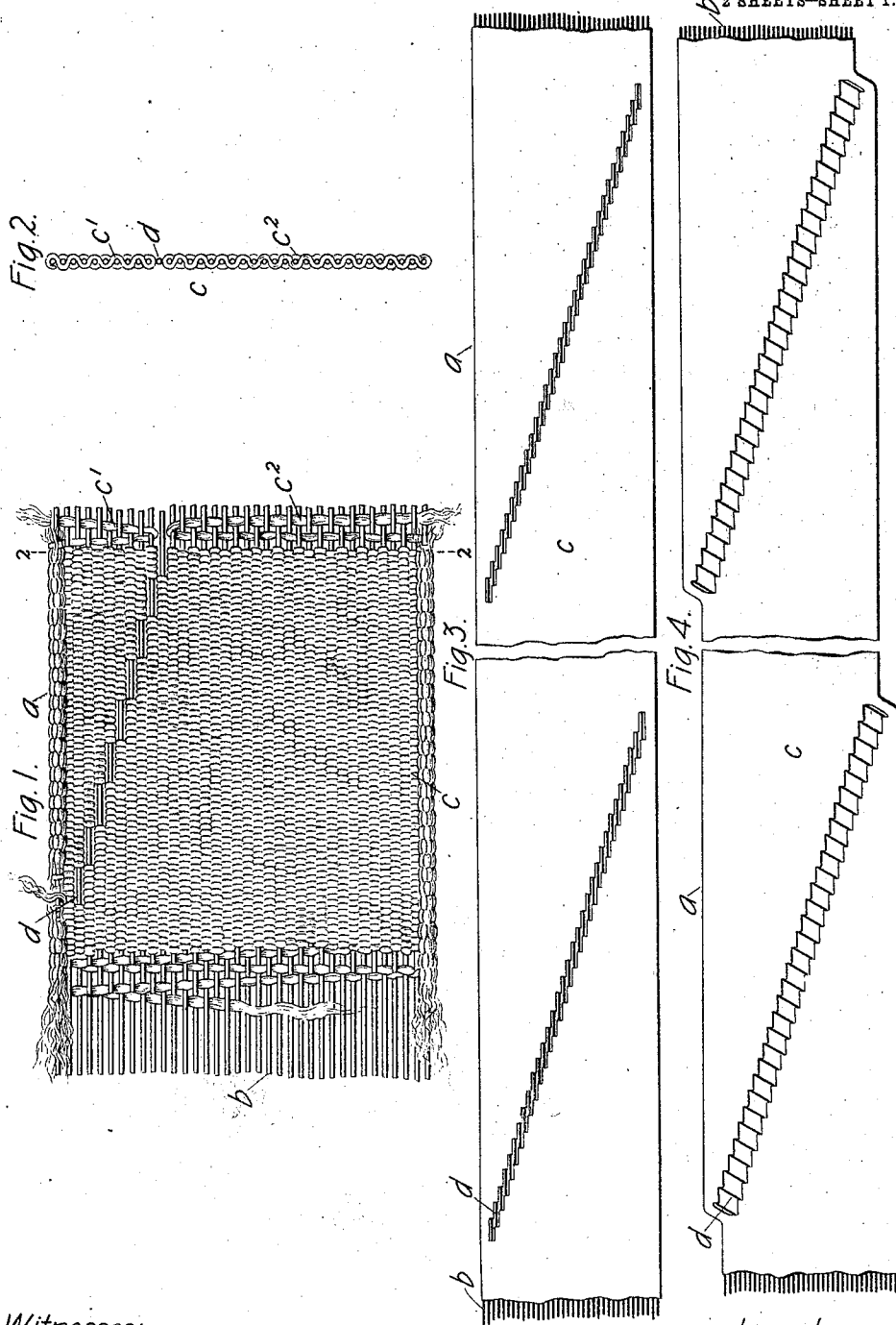


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METHOD OF FORMING CABLE.
APPLICATION FILED AUG. 9, 1909.

1,062,347.

Patented May 20, 1913.

2 SHEETS—SHEET 1.



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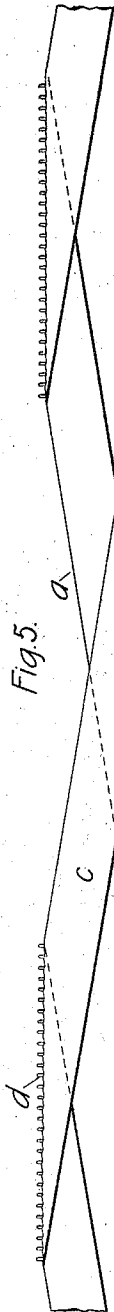


Fig. 5.

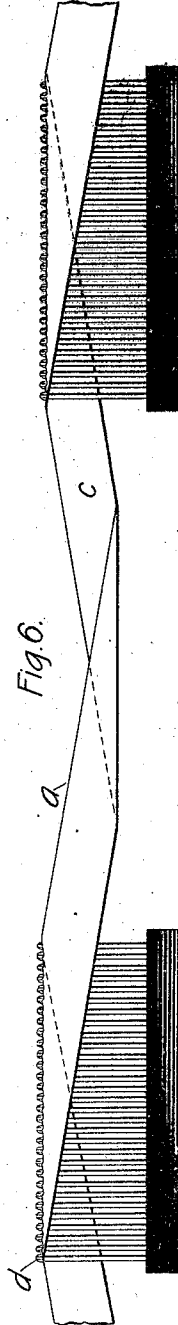


Fig. 6.

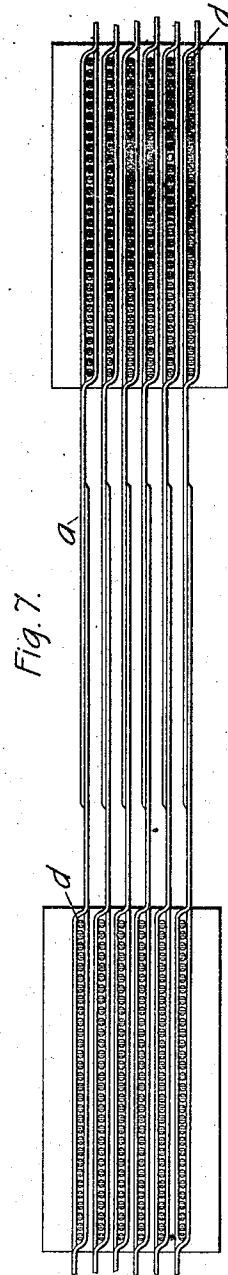


Fig. 7.

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UNITED STATES PATENT OFFICE.

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METHOD OF FORMING CABLE.

1,062,347.

Specification of Letters Patent.

Patented May 20, 1913.

Application filed August 9, 1909. Serial No. 511,984.

To all whom it may concern:

Be it known that I, FRANK R. McBERTY, a citizen of the United States, residing at New Rochelle, in the county of Westchester and State of New York, have invented a certain new and useful Improvement in Methods of Forming Cables, of which the following is a full, clear, concise, and exact description.

10 This invention relates to a method of forming cable of the type which is described and claimed in my application Serial No. 418,121, filed February 27, 1908. This cable is in the form of a flat woven ribbon, 15 which comprises a warp of bare wires and a woof of insulating thread, the wires being exposed at intervals to allow electrical connections to be made therewith.

The particular object of the present invention is to provide a simple method of weaving a ribbon of this nature in such a manner that the warp wires will be left exposed on both sides at intervals in a definite pattern or row, so as to permit the wires to 25 be soldered directly to corresponding terminals of a selector or other device to be connected. The "bare spots" or places where a wire is exposed preferably extend in a row diagonally across the cable, making the different wires successively available for connection, the cable being preferably folded along the diagonal row to fit over a row of terminals.

The method of weaving by which this structure is produced is as follows: The bare wires are assembled in parallel to form the warp of the ribbon, and an insulating thread is interwoven transversely therewith, forming a plain filling or woof, until 40 the wires are to be exposed, whereupon two threads are used, said threads being passed alternately from each side of the ribbon, each thread embracing in its loop only those warp wires between the edge of the ribbon and the particular point where a wire is to be exposed, each thread of course passing alternately over and under the warp wires embraced in its loop. At successive intervals the loops made by one of the threads 45 may be progressively increased to embrace a greater number of warp wires, while the loops made by the other thread from the opposite side of the ribbon are correspondingly decreased, so that each of the wires in turn 55 may be exposed.

The invention will be more readily understood by reference to the accompanying drawings, in which—

Figure 1 shows on an enlarged scale a portion of cable during the process of weaving. Fig. 2 is a cross-sectional view on line 2—2 of Fig. 1. Fig. 3 is a rear of a completed length of cable, on a smaller scale. Fig. 4 shows such a length of cable with the two portions laterally displaced or opened 65 out along the line of bare spots. Fig. 5 shows the cable folded upon itself along the lines of bare spots and at intermediate points to adapt it for connection to rows of terminals. Fig. 6 is a side view of two 70 groups of terminals connected by such folded woven cables, and Fig. 7 is a view taken at right angles to Fig. 6.

The same reference characters are used to indicate the same parts wherever they are 75 shown.

The cable *a* consists of a ribbon of wires or conductors *b* bound together and at the same time electrically insulated from each other and from other objects by means of insulating thread *c* woven about the conductors, the wires forming the warp and the insulating thread the woof of the fabric. The wires *b* may be of any suitable conducting material and dimensions, as, for example, No. 28 tinned copper wires; and the woof may be of any suitable insulating thread or yarn, as wool, silk or cotton, No. 40 mercerized cotton being suitable for insulating the No. 28 copper wire. In weaving 90 the cable, a double shuttle loom may be used, with a jacquard attachment by which the particular warp wires to be included in each "pick" or passage of the shuttle may be automatically determined. 95

In weaving the plain woof or filling, only a single shuttle need be employed to carry a single thread back and forth, across the whole group of warp wires; but when the "pattern" is to be woven, that is, when the 100 different wires are to be successively left bare for short distances, two shuttles are used, forming loops which embrace only the warp wires from the edge of the ribbon up to the particular point to be left bare, the 105 wires upon one side of this point being embraced by the thread *c* carried by one of the shuttles, while the wires upon the other side are embraced by the thread *c* carried by the other shuttle. Preferably the wire 110

to be left bare at a particular place d is not at that place embraced in the loops of either thread and is thus actually left bare in the weaving. To accomplish this, in the operation of the loom, the various wires forming the warp are one after another omitted from the path of the thread. In this manner the loops forming the woof are formed without embracing the wire to be left bare, until such wire is again placed in the path of the thread. If desired, however, the loom may be operated so that all the wires of the ribbon are at all times during the weaving included in the woof woven by one thread or the other. In this case, no portions of the wires are left bare in the fabric as it comes from the loom, but the wires may be bared thereafter, at the places where the two portions of the woof meet, by pushing back the woof on both sides of the dividing line between the portion woven by one shuttle and the portion woven by the other. Or, if desired, the fabric may be so woven that portions are left bare as described on one wire after another, while between the bare portion of one wire and the bare portion of the next, both shuttles carry their threads across the entire width of the ribbon, thus binding the two portions of the woof together and preventing the bare portions from being closed up by the spreading of the threads.

After a predetermined number of loops have been formed from the edges of the ribbon to the point to be left bare, that is, after a predetermined length of ribbon has been woven by such loops from the opposite sides, respectively, of the ribbon up to the wire to be left bare, the warp wires are altered in position, as by the jacquard attachment on the loom, to bring a greater number of said wires within the loops formed by one thread and a less number of said wires within the loops formed by the other thread, and the weaving is continued on this basis for a predetermined number of picks, or until a sufficient length of cable has been woven with the bare spot located at the point so determined, whereupon the position of the warp wires is again altered. The weaving is thus continued, the loops made by one of the threads being progressively increased in scope at successive intervals to embrace a greater number of warp wires, while the loops made by the other thread from the opposite side of the ribbon are correspondingly decreased in scope to embrace a less number of warp wires, thus at regular intervals displacing the meeting line of the two portions toward one side a distance equal to the lateral distance from any wire to the next, until all the wires (or as many as are to be left bare) have been passed. After the length of cable has been woven in which the wires have successively been left

bare at spots which form a row diagonally across the ribbon, one of the shuttles is stopped and the weaving continued by the other shuttle, which embraces all the wires in its successive loops and so forms a complete plain filling until the pattern is again to be woven.

The angle at which the row of bared portions appears in the cable is determined by the number of "picks" which are taken at each stage of the weaving with loops of a given scope, and should be such that the bare spots on adjacent wires are spaced apart a distance corresponding to the spacing of the terminals to which the cable is to be connected.

In forming the woven cable for connection with a row of terminals, the two sections on opposite sides of the line of bare spots are preferably displaced laterally so as to bend the bared portions of all the wires angularly with respect to their normal direction and substantially at right angles to the row of bare spots, the cable then appearing as in Fig. 4. This operation not only opens out the cable for connection, but also forces back the insulating woof and holds it in place at the ends of the bare portions. The next operation in the forming process, which consists in folding the cable upon itself along the line of bare spots, as shown in Fig. 5, causes the bared portions of the wires to appear as projecting loops which may be laid over the corresponding terminals and soldered directly thereto, as shown in Figs. 6 and 7.

What is claimed is:

1. The process of making ribbon cable which consists in weaving two separate woof-portions upon a warp of parallel wires, and progressively increasing the width of one woof portion while correspondingly decreasing the width of the other woof portion, whereby the different wires one after another are accessible for electrical connections at points located along the diagonal line of meeting of the two woof-portions.

2. The process of making ribbon cable which consists in interweaving two threads across a warp of parallel wires, passing said threads alternately from each side of the ribbon over and under the warp wires up to a predetermined intermediate wire and back again, said intermediate wire not being embraced at this point by the loops of either of said threads, whereby it is left exposed for electrical connection therewith.

3. The process of making ribbon cable which consists in interweaving two threads across a warp of parallel wires, passing said threads alternately from each side of the ribbon to an intermediate point and back again, forming loops which embrace the warp wires between the sides of the ribbon,

respectively, and said intermediate point, and progressively increasing, at successive intervals, the scope of the loops from one side of the ribbon while correspondingly decreasing the scope of the loops from the other side thereof.

4. The process of making ribbon cable which consists in interweaving insulating thread with a warp of parallel bare wires, and varying the travel of the woof thread to progressively omit all of the wires one after another for short intervals, to leave portions of said wires exposed for electrical connections.

5. The process of making ribbon cable which consists in interweaving two separate woof portions upon a warp of parallel wires, progressively increasing the width of one woof portion while correspondingly decreasing the width of the other woof portion, and in such interweaving omitting the different wires one after another for short intervals

to leave portions of said wires exposed between the woof portions.

6. The process of making ribbon cable which consists in taking a warp of parallel bare wires, interweaving two woof threads therewith, by feeding the woof threads from opposite sides of the ribbon, increasing the throw of one woof thread, while correspondingly decreasing the throw of the other, the combined throw of both threads being less in length than the width of the ribbon, whereby each wire, in turn, will be exposed for a short distance, the exposed portions forming a line which extends diagonally across the face of the ribbon.

In witness whereof, I hereunto subscribe my name this sixth day of August A. D., 1909.

FRANK R. McBERTY.

Witnesses:

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