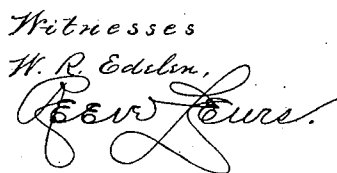


A. H. McCULLOCH.
ELECTRICAL CONNECTION CORD.

Patented July 17, 1894.



Inventor.

Alexander M Gullock
by J. L. Dumas
his attorney.

UNITED STATES PATENT OFFICE.

ALFRED H. McCULLOCH, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO THE
AMERICAN BELL TELEPHONE COMPANY, OF MASSACHUSETTS.

ELECTRICAL-CONNECTION CORD.

SPECIFICATION forming part of Letters Patent No. 522,999, dated July 17, 1894.

Application filed February 6, 1894. Serial No. 499,264. (No model.)

To all whom it may concern:

Be it known that I, ALFRED H. McCULLOCH, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain Improvements in Electrical-Connection Cords, of which the following is a specification.

The present invention relates to insulated electrical conductors and especially to such conductors as are frequently handled and require to be very flexible and yielding throughout their length.

An example of the kind of conductors to which the present invention is applicable is the looping or linking connecting cord which forms a part of the table outfit of a telephone central station operator and which is used for the purpose of connecting subscribers' lines with the operators' instruments and with one another. Such a connecting cord as is well known has attached to one of its ends a switch plug which is the terminal of the one or two conductors in the cord and at its other end a flexible metal terminal, or in some cases both ends may be fitted with similar terminals. The conducting part of such flexible cords has heretofore been made of wire, chain, or tinsel, which conducting portion is, for protection and insulation inclosed in a stout braided covering. With the strongest and most pliable conductors that have been devised and employed up to the present time, the frequent bendings and twistings which the cord undergoes in the service of a telephone exchange, cause in time the fracture of the metallic conductor within its braided covering, giving rise to serious annoyance and loss of service to subscribers. Such occurrences constitute one of the chief difficulties incident to the operation of a telephone switch-board.

The object of this invention is to avoid difficulties of this nature by furnishing an electrical connecting cord in which the conducting portion has pliability in the highest degree, so that it can be bent in any direction and to any extent without fracture or rupture, and to this end the invention consists in the employment of a column or thread of mercury, or other fluid conducting material con-

finied in a suitable containing tube, and in providing suitable devices at each terminal whereby the mercury is brought into electrical contact with binding posts or with electrical apparatus or conductors of any kind. 55

In the drawings which are attached hereto, Figure 1 is a view of a double conductor telephone switch cord embodying my invention. Fig. 2 is a sectional view of one terminal of the cord, and Fig. 3 is a section of a single conductor detached. Fig. 4 is a cross section of the cord and Figs. 5 and 6 are sectional views of the other or plug terminal of the cord. 60

In the drawings A represents the connecting cord as a whole; and being a double conductor cord, it carries two threads of mercury each in a flexible tube *a a*. The tubes *a a* are of soft vulcanized rubber having a diameter of about three thirty-seconds of an inch and an orifice of about one thirty second of an inch in diameter. Each tube is provided with a light braided covering of cotton thread. At each end of the cord means are provided whereby the mercury within is brought into connection first with the tip or sleeve side of the plug P; and second, with the external metal terminal 1; and primarily the means are the same, and consist of wires 4 and 9 which are inserted into the orifice at each end of the rubber tube *a*; at the plug end the wire 9 extends in but a short distance, while at the opposite end the wire 4 extends in a considerable distance for a reason to be explained farther on. 75

After the insertion of the wire, the outer surface 2 of the conductor is tightly wound or whipped with thread or cord 3 for a little distance to compress the rubber walls of the tubing upon the wire and make a tight joint. At the plug end, the externally projecting wires 9 are soldered to the connecting eyes which are secured respectively to the tip and sleeve of the plug P; at the other end of the cord A the wires 4 are soldered to flexible metal terminals 1. The mercury is poured into the rubber tubes *a* in any suitable manner. 85

In order to provide for the contingency of a rubber tube, *a*, bursting and permitting the mercury to run out, I inclose the said tube or 90 100

tubes, as the case may be, whether a single or double conductor cord, in another vulcanized soft rubber tube 5, the ends 8 of which are brought well over the whipped ends of the tubes *a* and are in turn whipped over them with thread or cord; so that if a tube *a* should burst, the mercury would run into the outer tube 5. The fact of such a burst would become known soon, as the cord would become inoperative by reason of the circuit becoming open.

On either side of the tubes *a a*, I place a solid, flexible, braided cord 7 to round out the external tube 5; and braid over the whole a stout cotton covering 6.

Fig. 7 represents a section of a telephone switch-board provided with two flexible cords *A A* having mercury conductors. *C* is a bar provided with means for holding the cords at one end, and for connecting them electrically to the operator's table. The plugs *P P* are supported upon the said table, and the cords are kept straight by means of the weight *w* in their bights; *p s* are the plug sockets in the upright portion of the board. It is necessary that the ends of the cords *A* attached at *C* shall be as high as the upper row of plug sockets in order that a continuous thread of mercury may extend from one end to the other of the cord. To guard against a disconnection by any lateral swelling of the tube *a* and the consequent accumulation of mercury locally, I extend the wire 4 at the suspension end of the cord say eighteen inches into the tube *a*. In such a constructed cord, it is necessary that all possible strains be removed from the flexible tubes *a* and from the outer auxiliary tube 5, and to this end the whipping 8 put on over the braided covering 6, serves to seal the tube 5 and also to fasten the covering down, thus bringing all strain to bear upon the covering. At the plug end I show additional means of bringing the strain upon the outer covering. The lower end of the plug is made in two parts *b* and *d*, the former having a threaded part *c* which screws into the latter. A portion of this thread is cut away, and when the end of the cord is pushed into the part *b* to be connected to the plug, the braided covering 6 is turned over the end of *b* where the screw threads are cut away, and whipped on thereto with thread, and then the part *b* is screwed into the part *d*, as shown in Fig. 6, the braided covering thus taking the strain also at this end.

It will be understood that such a conductor as is herein described can be applied to all the uses for which an ordinary conductor is employed, when the proper connecting appliances are attached thereto; and that the invention is applicable to connecting cords having single or double conductors.

Having now fully described my invention, I claim—

1. A flexible insulated conductor, consisting of a non-conducting tube and a column of mercury contained therein.

2. An electrical conducting cord consisting of a flexible non conducting tube and a fluid conductor such as mercury filling the same from end to end.

3. An electrical conductor consisting of a flexible non conducting tube containing mercury and provided at each end with suitable means of connection with other conductors, as set forth.

4. An electrical conductor consisting of a flexible non-conducting tube containing mercury provided at each end with connecting appliances which consist at one end of a connecting plug and at the other of a solid metal terminal, as set forth.

5. In an electrical conductor consisting of a flexible non conducting tube containing mercury provided at each end with suitable means of connection, and an auxiliary flexible tube inclosing the said non-conducting tube, as set forth.

6. An electrical conductor consisting of a flexible non-conducting tube containing mercury, provided at each end with suitable means of connection, and an auxiliary flexible tube inclosing the said tube, provided with an outer braided covering, as set forth.

7. An electrical conductor consisting of one or more flexible non-conducting tubes containing mercury, provided at each end with suitable means of electrical connection, suitable flexible filling material between the said tubes, and an auxiliary flexible tube inclosing the said tubes and filling material, as set forth.

8. A flexible electrical connection cord comprising a plurality of columns of mercury; a non-conducting elastic tube inclosing each of the said columns; an exterior non-conducting elastic tube surrounding the said mercury inclosing tube; flexible fibrous filling contained together with the insulated mercury conductor in the said exterior tube; a fibrous envelope braided or woven over the said exterior tube; and electrical connection devices at both ends of the said mercury columns, substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 18th day of December, 1893.

ALFRED H. McCULLOCH.

Witnesses:

GEO. WILLIS PIERCE,
FRANK C. LOCKWOOD.