Nov. 10, 1942. L. J. BOWNE 2,301,189

TELEPHONE SET CORD

Filed Nov. 27, 1941

FIG. 1

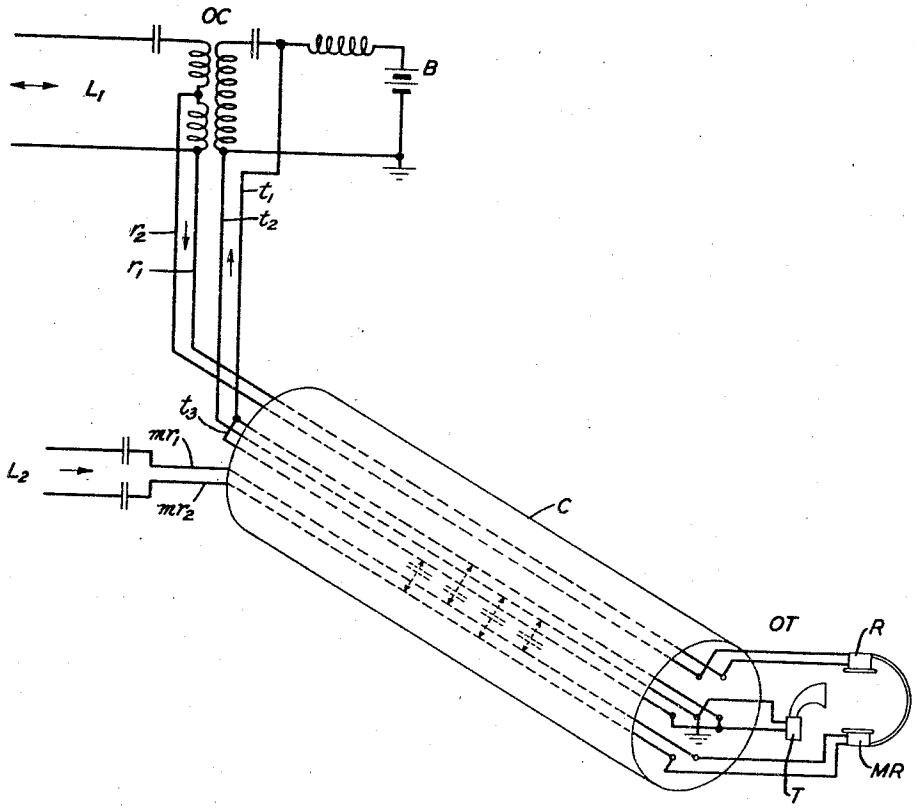
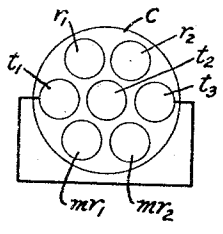


FIG. 2



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TELEPHONE SET CORD

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4 Claims. (Cl. 179—79)

This invention relates to telephone transmission systems and, more particularly, to flexible cables or cords for so-called operators' telephone sets comprising a transmitter and a pair of receiver units attached to a headband. Such cords usually consist of four conductors, two for the transmiter and two for the receivers, which latter conductors are connected in multiple to the two receiver units.

In certain cases it has been found desirable to employ only one of the receiver units for use with the transmitter for regular two-way transmission and to connect the other unit, by means of an additional pair of conductors, to a separate transmission circuit for the purpose of monitoring thereon, that is to say, enable the operator to converse in the usual way on one line by means of the transmitter and one of the receiver units and at the same time monitor, i. e., listen, on another line.

When this additional pair of conductors for the monitoring receiver, is included in the telephone set cord, thereby increasing the number of conductors to six, it has been found that under certain degrees of atmospheric humidity undesirable cross-talk between the two pairs of receiver conductors and between the transmitter pair and the pair connected to the monitoring receiver is experienced due to an unavoidable capacity unbalance between the conductors within the cord.

An object of the present invention is to reduce cross-talk in flexible cords of the character described.

While the above object might be attained by carrying the monitoring pair of conductors in a separate cord or cable, a single cord is considered more desirable and to obtain the desired reduction in cross-talk by electrostatically shielding the receiver pairs from each other and reducing the capacity unbalance between the transmitter conductors and the monitoring conductors.

A feature of the invention, whereby the desired result is obtained, resides in the addition of an additional or seventh conductor within the cord which is connected at both ends to one of the transmitter conductors and in so arranging the several conductors within the cord that the three transmitter conductors lie in a plane between the two receiver pairs to act as an electrostatic shield therebetween, and that a substantially uniform capacity exists between each receiver conductor and the transmitter conductors.

The invention will be understood from the following description and the accompanying drawing, Fig. 1 of which shows, schematically, an operator's telephone set, and its associated cord arranged in accordance with the present invention whereby crosstalk between the two receiver pairs of the cord is substantially eliminated when the operator is talking on one line and monitoring on another line at the same time; and Fig. 2 shows a cross section of the telephone set cord.

Referring to the drawing, Fig. 1, an operator's telephone set OT comprising a transmitter T and receiver R is shown connected by conductors *t1*, *t2* and *r1*, *r2*, contained in a flexible cable or cord C, to an operator's telephone circuit OC terminating a line L1 whereby two-way conversation between the operator's transmitter T and the receiver R and the line L1 may be carried on.

A second line, L2, is also shown connected to another receiver unit MR of the operator's set OT by means of a third pair of conductors *mr1* and *mr2* contained in the cord or cable C whereby the operator, by means of receiver unit MR, may monitor, i. e., listen on the line L2 while talking on line L1.

In addition to the conductors *t1*, *t2* and *r1*, *r2* and *mr1* and *mr2*, an extra conductor *t3* is also included in the cord C which conductor is shown as terminating at the two ends of the cord and connected at each end to the transmitter conductor *t2*.

By referring to Fig. 2 it will be noted that the above conductors are closely and uniformly arranged within the cord so that they lie in three parallel planes, one consisting of conductors *r1* and *r2*, another consisting of conductors *mr1* and *mr2* and the third or intermediate plane including the conductors *t1*, *t2* and *t3*.

From the foregoing it will be noted from the drawing that the three closely positioned conductors *t1*, *t2* and *t3* lying in a plane between conductors *r1*, *r2* and *mr1* and *mr2* from an effective non-magnetic shield between the two receiver circuits thereby substantially eliminating the possibility of crosstalk interference between them.

Further, if the transmitter conductors *t1*, *t2* and *t3* and the monitoring receiver conductors *mr1* and *mr2* are all uniformly spaced with respect to each other, the capacity unbalance between either side of the transmitter circuit and the monitoring receiver circuit will be zero due to the fact that transmitter-conductor *t1* is connected in parallel with conductor *t3* which par-

allel conductors neutralize and balance out the capacity unbalance effect of *t2* on either of the conductors *mr1* or *mr2*. For example, if we assume at any instant a positive potential on conductor *t2* an equal negative potential will be present on both conductors *t1* and *t3* which obviously will neutralize the effect on either conductor *mr1* or *mr2* of the positive potential of *t2*.

In normal practice, the positive side of the operator's telephone circuit battery B, Fig. 1 is grounded and therefore conductor *t2* is grounded at one end and a more effective and stable shield between the two receiver circuits is therefore provided if the same conductor, *t2*, is also grounded at the other end of the cord, as shown in the drawing.

What is claimed is:

1. In a telephone transmission system comprising a cable including two sets of two conductors each for separate transmission in the same direction and a third set for transmission in the opposite direction, means for reducing crosstalk between said first two sets and between said third set and either of the other two sets characterized in this that said individual sets of conductors lie in parallel equidistant planes with the third set intermediate the other two, said third set having three conductors the outer two of which are connected together, and all of said seven conductors being so spaced with respect to each other that a substantially uniform capacity exists between each conductor of the first two sets and its two adjacent conductors of the third set.

2. In a telephone transmission system comprising a cable including two sets of conductors each for separate transmission in the same direction and a third set for transmission in the opposite direction, means for reducing crosstalk between said first two sets and between said third set and either of the other two sets characterized in this that the conductors of said individual sets lie closely adjacent each other in different parallel planes closely adjacent and equidistant from each other, with the third set intermediate the other two and having three conductors the outer two of which are connected together at each end of the cable.

3. In a telephone transmission system comprising a cable including seven conductors arranged in three separate groups for providing three independent transmission circuits, means for reducing crosstalk between said independent circuits characterized in this that the conductors of each circuit group lie closely adjacent to each other in closely adjacent parallel planes, two of said circuits comprising two conductors each and the third circuit comprising three conductors whose plane is intermediate the other two, and having its outer two conductors connected together to form one conductor of a circuit pair.

4. In a telephone transmission system comprising a cable including seven conductors arranged in three separate groups for providing three independent transmission circuits, means for reducing crosstalk between said independent circuits characterized in this that the conductors of each circuit group lie closely adjacent to each other in closely adjacent, parallel planes, two of said circuits comprising two conductors each and the third circuit comprising three conductors whose plane is intermediate the other two, the outer two of said three conductors being connected together at each end of the cable, the third conductor of said three-conductor group being equidistant from the other six conductors and each conductor of the two outer groups being equidistant two of the conductors of the third group.

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