

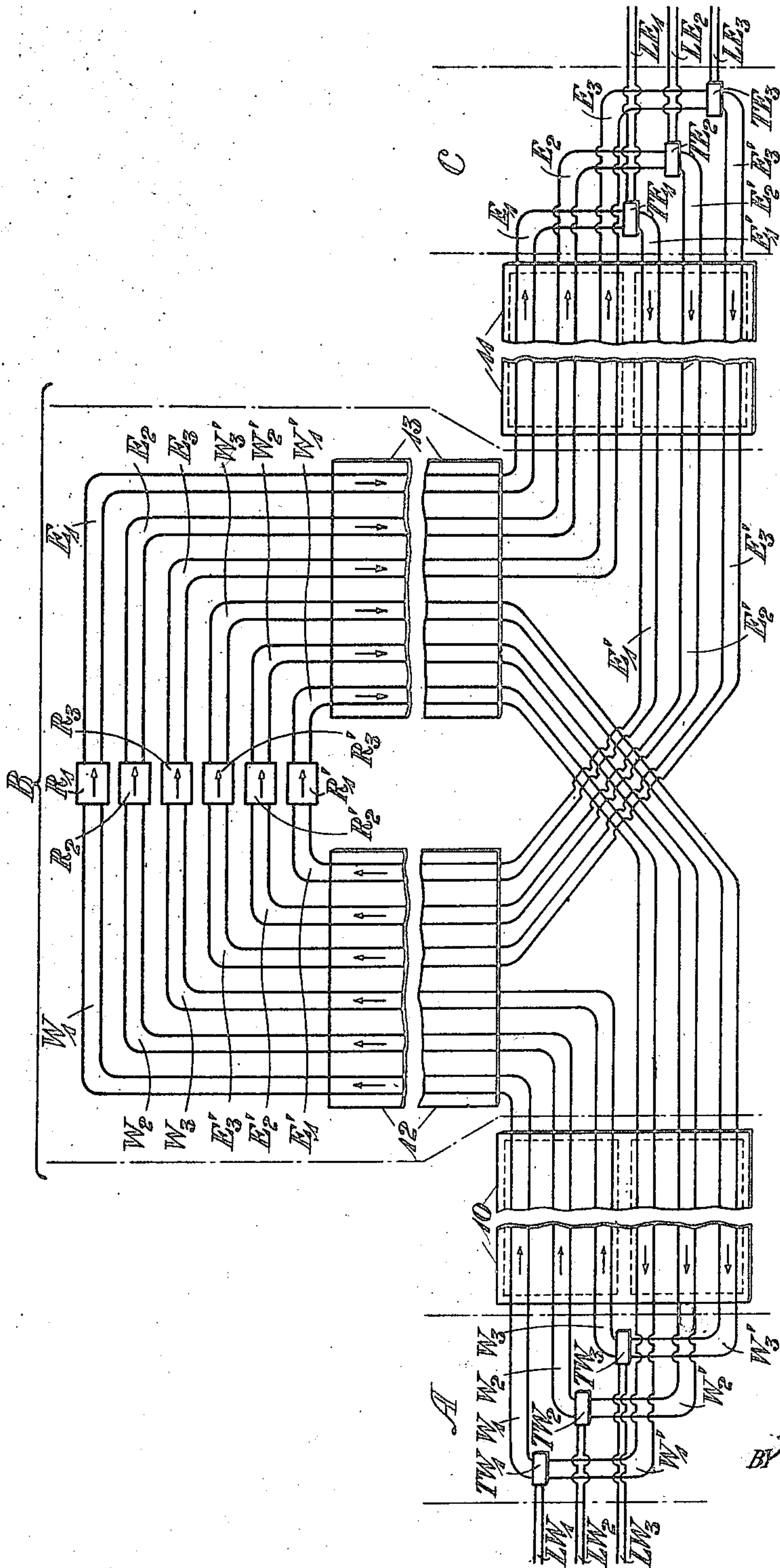
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MEANS FOR AND METHOD OF REDUCING CROSS TALK IN FOUR WIRE CIRCUITS.

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INVENTOR

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UNITED STATES PATENT OFFICE.

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MEANS FOR AND METHOD OF REDUCING CROSS TALK IN FOUR-WIRE CIRCUITS.

Application filed January 2, 1920. Serial No. 348,731.

To all whom it may concern:

Be it known that I, RICHARD A. RENSCHAW, residing at Woodhaven, in the county of Queens and State of New York, have invented certain Improvements in Means for and Methods of Reducing Cross Talk in Four-Wire Circuits, of which the following is a specification.

This invention relates to transmission systems and more particularly to transmission systems of the type known as four-wire repeater systems.

The present application is related to a patent to O. B. Blackwell on "Means for and method of reducing cross-talk in four wire circuits," No. 1,394,062, October 18, 1921.

In the said patent cross-talk interference between the circuits leading in one direction and those leading in the opposite direction is avoided by an electrical segregation of the conductors and repeaters of opposite directions, this being accomplished in the embodiment of the invention described therein, by placing the repeaters of one direction remotely from those of the other direction, and by providing four separate branch cables, one leading to the input sides of the repeaters transmitting in one direction, another leading from the output sides of the said repeaters, and the other two similarly leading to the input and output sides of the repeaters transmitting in the opposite direction.

In the present invention I propose to group together the conductors leading to the input sides of the repeaters from both directions, and to group together also the conductors leading away from the output sides of all the repeaters, so that all the repeaters may be assembled in one group, without deleterious effect. Each group of conductors may be in separate cables or they may be in the same cable, one group being electrically separated from the other in any desired manner, for instance, in the way described in the above mentioned Blackwell application.

A good understanding of the invention may now be had from the following description thereof, reference being had to the accompanying drawing showing in diagrammatic view one specific form and arrangement of circuits embodying the invention.

In this drawing is shown a four-wire

transmission system extending between stations A and C, through an intermediate repeater station B. A cable 10 extends from station A to station B and a similar cable 11 extends from station B to station C. Each cable includes the conductors of a plurality of four-wire transmission circuits. For purposes of illustration three distinct four-wire transmission circuits are shown, but it will be understood that this number is merely illustrative and any desired number of circuits may be provided. Each of the four-wire circuits terminates in two-wire lines, such as LW_1 , LW_2 and LW_3 at station A and LE_1 , LE_2 and LE_3 at station C. The lines LW_1 and LE_1 are interconnected by means of a four-wire circuit comprising the two-wire line sections W_1 and E_1 connected at the repeater station B by means of a one-way repeater R_1 for transmission from west to east and the line section E_1' and W_1' connected by a repeater R_1' at station B for transmission from east to west. Three-winding transformers of the usual type, TW_1 and TE_1 , are provided to associate the conductors of the four-wire sections with the two-wire lines, these transformers being shown schematically in the drawing, it being readily understood that any other suitable devices may be used for this purpose. The remaining two four-wire circuits illustrated are similar in all respects to that just discussed and need not be further described.

Currents flowing to the repeater stations from stations A and C are considerably attenuated when they reach the repeaters whereas the currents leaving the repeater station are comparatively strong. Unless, therefore, the conductors carrying the repeater output currents are electrically separated from the repeater input currents, the said output currents may cause cross-talk interference in the input circuits, of appreciable magnitude relative to the said weak input currents. The electrical separation between the input and output conductors is effected in the present invention by grouping together the circuits leading from stations A and C to the input sides of the repeaters, i. e., W_1 , W_2 , W_3 , E_1' , E_2' , and E_3' , and similarly grouping together the circuits leading from the repeaters to stations A and C, i. e., E_1 , E_2 , E_3 , and W_1' , W_2' and W_3' , and electrically separating the two groups

from each other. In the drawing I have shown the input conductors in one cable 12 and the output conductors in another cable 13, but a like result may also be obtained if the two groups are placed into one cable and shielded from each other in the manner described in the above mentioned Blackwell patent for example. It will be observed that with this arrangement the eastbound and westbound repeaters need not be segregated from each other. Interference between the currents in the separate conductors of each group may be kept within permissible limits by transposition of the conductors, or by any of the other methods in common use. The manner in which cross-talk interference is prevented between the conductors in cables 10 and 11 is described in the said Blackwell patent.

Although I have herein shown and described only one form and arrangement of circuits embodying the invention, it is readily understood that various changes and modifications may be made therein within the scope of the following claims, without departing from the spirit and scope of the invention.

What I claim is:

1. The method of preventing interference between four wire circuits at a repeater installation, which consists in leading the wires carrying the weak input currents to the repeaters through one cable and leading the wires carrying the strong output currents away from the repeaters through another cable, the two groups of wires being electrically separated.

2. The method of preventing interference between the conductors carrying, respectively, the weak and the strong currents at a repeater installation, which consists in grouping together the conductors of both directions carrying the weak currents, similarly grouping the conductors of both directions carrying the strong currents, and electrically separating the said groups.

3. The method of reducing the interference at a repeater station between conductors of four wire circuits, which consists in grouping together the input conductors of opposite directions, similarly grouping together the output conductors of opposite directions, and shielding the groups from each other.

4. In combination, a plurality of repeaters, four wire circuits associated therewith and comprising in each direction input and output conductors, and a cable grouping together the input conductors of both directions, a second cable grouping together the output conductors of both directions said cables comprising means for shielding the conductors of one cable from those of the other cable.

5. In combination, a plurality of one-way repeaters associated in a group, four-wire circuits associated with said repeaters, said circuits comprising in each direction input and output conductors, a cable comprising the input conductors of both directions, a second cable comprising the output conductors of both directions, said cables comprising means for electrically separating the conductors in one cable from those in the other cable.

6. In combination, a plurality of repeaters, four-wire circuits associated therewith comprising a plurality of groups of electrically separated incoming and outgoing conductors, a cable grouping together all incoming conductors and a cable grouping together all outgoing conductors.

7. In combination, a plurality of repeaters, four-wire circuits associated therewith comprising a group of incoming and a group of outgoing conductors electrically separated and for a station in one direction and a group of incoming and a group of outgoing conductors electrically separated and for a station in another direction, a cable grouping together the incoming conductors from both directions and a cable grouping together the outgoing conductors from both directions.

8. In combination a plurality of repeaters, four-wire circuits associated therewith comprising a cable for a station in one direction with incoming and outgoing conductors therein electrically separated, a cable for a station in another direction with incoming and outgoing conductors therein electrically separated, a cable grouping together the incoming conductors from both directions, and a cable grouping together the outgoing conductors from both directions.

In testimony whereof, I have signed my name to this specification this 29th day of December, 1919.

RICHARD A. RENSHAW.