

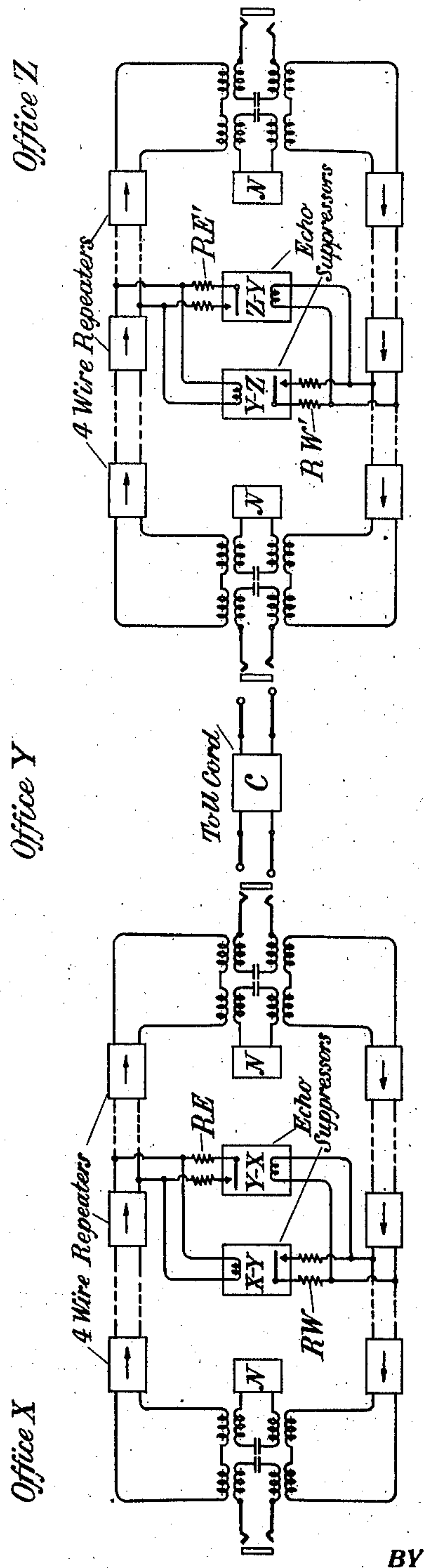
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TANDEM OPERATED ECHO SUPPRESSOR

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TANDEM-OPERATED ECHO SUPPRESSOR.

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To all whom it may concern:

Be it known that I, BRADLEY L. CHILD, residing at Brooklyn, in the county of Kings and State of New York, have invented certain Improvements in Tandem-Operated Echo Suppressors, of which the following is a specification.

This invention relates to transmission circuits, and more particularly to transmission circuits employing echo suppressors.

One of the objects of the invention is to provide an arrangement whereby two or more circuits, each equipped with echo suppressors, may be operated in tandem. The problem presented when two or more circuits, each having an echo suppressor, are switched together, is to prevent the circuits getting into such a condition that, when two subscribers at the ends begin to talk at about the same time, neither subscriber will be able to hear the other.

The nature of the trouble will be evident if we imagine that two circuits, each containing an echo suppressor, are connected together. If the subscriber at end A begins to talk, the voice currents generated will cause the suppressor near his end to operate in such a way as to short-circuit the transmission path coming from the subscriber at the end B. If, before the voice currents from the subscriber at end A reach the second suppressor near the end B, the subscriber at end B has already started to talk and the voice currents generated at his station have caused the suppressor near his end to operate, it will be evident that the voice of the subscriber at A will be blocked by the suppressor near end B while the voice of the subscriber at B will be blocked by the suppressor near the A end. Talking under these conditions would be difficult because part of the time both subscribers might be talking with neither one hearing the other.

In accordance with the present invention, it is proposed to overcome this difficulty by arranging the echo suppressors so that they do not absolutely disable the path transmitting in the opposite direction but merely increase the loss in such path. The loss introduced by the operation of the echo suppressor will reduce the echo effect and enable the circuit to be operated at a higher gain than if the echo suppressor were not present, and at the same time it will permit each

subscriber to hear the other when both echo suppressors are operated, although in each case the other subscriber will be heard at a very much reduced volume.

The invention may now be understood from the following detailed description, when read in connection with the accompanying drawing, the figure of which illustrates a preferred embodiment of the invention.

Referring to the drawing, three offices, X, Y and Z, are shown with a four-wire repeater circuit extending from office X to office Y, and a similar four-wire repeater circuit extending from office Y to office Z. The four-wire circuit extending from office X to office Y is provided at some intermediate point with an echo suppressor, schematically indicated at X—Y and Y—X. Similarly, the four-wire circuit extending from office Y to office Z is provided at an intermediate point with a similar echo suppressor, schematically indicated at Y—Z and Z—Y.

These echo suppressors are of a type well-known in the art and comprise some relay arrangement responsive to voice currents transmitted over one line of the four-wire circuit to operate a contact which disables the line transmitting in the opposite direction. In echo suppressors, as heretofore operated, it has usually been customary to arrange the contact to short-circuit the transmission path. In accordance with the present invention, however, the echo suppressor X—Y, associated with the path transmitting from X to Y between office X and office Y, is arranged so that its contact bridges a resistance element RW across the line transmitting from Y to X. Likewise, the echo suppressor Y—X, associated with the line transmitting from Y to X, is arranged so that in response to voice currents it shunts a resistance RE across the line transmitting from X to Y. Similarly, the echo suppressors associated with the four-wire circuit between office Y and office Z are arranged to bridge shunt resistances RE' or RW', as the case may be, across the lines transmitting in the opposite directions, respectively.

Suppose the two four-wire circuits are connected through the usual toll cord C at office Y in order to establish a transmission circuit between office X and office Z. If the

echo suppressors were arranged to directly short-circuit the lines, and the subscriber at office X commenced to talk, the echo suppressor X—Y would short-circuit the line transmitting from Y to X in the four-wire circuit between X and Y. Then, after the voice currents had travelled to the echo suppressor Y—Z, the latter echo suppressor would operate to short-circuit the line transmitting from Z to Y between office Y and office Z. Suppose, however, before the voice currents transmitted from office X arrived at the echo suppressor Y—Z, waves from the subscriber at office Z should arrive at the echo suppressor Z—Y. The latter would operate to short-circuit the line transmitting from Y to Z between office Y and office Z. This would prevent the voice currents originating at office X from being transmitted beyond the echo suppressor Z—Y to the subscriber at office Z. In the meantime, the voice currents originating at office Z would be transmitted through the toll cord to the point at which the echo suppressor X—Y is located, but would there be blocked by means of the short-circuit so that they could not be transmitted on to the subscriber at office X. Neither subscriber would be able to hear the other.

If, however, resistances are shunted across the lines by the echo suppressors, the transmission in each direction will not be entirely blocked but a transmission loss will be introduced in the line transmitting in the opposite direction by the operation of the echo suppressor. Obviously, if both subscribers should begin talking at once under these conditions, each subscriber would be able to hear the other, although at a considerable reduction in volume, so that one subscriber would cease talking, thereby restoring the path in the opposite direction to normal. At the same time, considerable advantage in the operation of the circuit would arise by means of the loss introduced by the echo suppressor since the volume of the echoes would be cut down by the amount of the loss inserted. It will, therefore, be evident that a circuit having echo suppressors arranged as indicated in the drawing could be worked at a much better transmission equivalent than a

circuit without an echo suppressor for equal echo effects in both cases.

It will be obvious that the general principles herein disclosed may be embodied in many other organizations widely different from those illustrated without departing from the spirit of the invention as defined in the following claims.

What is claimed is:

1. In a transmission system, a plurality of transmission circuits adapted to be connected in tandem, a pair of echo suppressor units associated with each circuit, each echo suppressor being responsive to currents transmitted in one direction only, and means controlled by the echo suppressor unit in response to currents in one direction to introduce a loss in the path transmitting in the opposite direction, the loss being so proportioned as to prevent the transmission of harmful echo currents while at the same time permitting direct transmission over the paths with sufficient volume to be heard at the distant end.

2. In a transmission system, a plurality of four-wire circuits arranged to be connected in tandem, each four-wire circuit comprising a pair of lines for transmitting in opposite directions, an echo suppressor unit associated with each line and responsive to voice currents transmitted over the line with which it is associated, an impedance element associated with the opposite line of each four-wire circuit, and means controlled by the echo suppressor unit associated with one line of a four-wire circuit to shunt said impedance element across the opposite line of the four-wire circuit, said impedance element being so proportioned as to introduce a transmission loss in the line transmitting in the opposite direction sufficiently great to prevent the transmission of harmful echo currents while permitting the direct transmission of voice currents with sufficient volume to enable them to be heard at the distant station.

In testimony whereof, I have signed my name to this specification this 1st day of July, 1924.

BRADLEY L. CHILD.