

April 10, 1928.

1,665,683

T. ZUSCHLAG

TELEPHONE SYSTEM

Filed Oct. 6, 1924

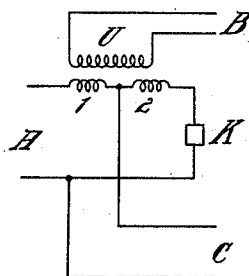


Fig. 1

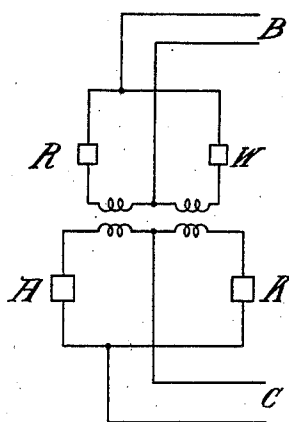


Fig. 2

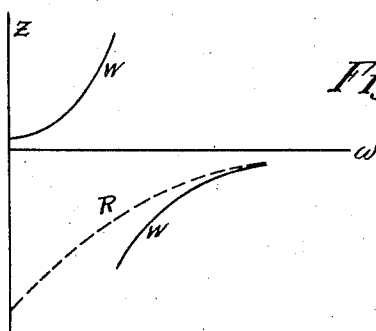


Fig. 3

Inventor:
Theodor Zuschlag
by *Heigler*
his atty.

UNITED STATES PATENT OFFICE.

THEODOR ZUSCHLAG, OF NEW YORK, N. Y., ASSIGNOR TO SIEMENS & HALSKE, AKTIEN-GESELLSCHAFT, OF SIEMENSSTADT, NEAR BERLIN, GERMANY, A CORPORATION OF GERMANY.

TELEPHONE SYSTEM.

Application filed October 6, 1924, Serial No. 742,038, and in Germany October 6, 1923.

This invention relates to telephone systems and more particularly to balancing networks which are employed in connection with such systems.

In balancing networks such as are commonly employed in connection with hybrid coils at repeater stations, and junction points between two-wire and four-wire lines, it is frequently found that at certain frequencies, the impedance of the artificial line or balancing network differs from the impedance of the transmission line, and consequently current may flow in the bridge circuit at these frequencies.

It is an object of this invention to eliminate the flow of current in the bridge circuit of a system such as described above at these frequencies as well as at other frequencies.

The above object and others which will be apparent as the nature of the invention is disclosed are accomplished by connecting one of the branch transmission lines associated with the bridge circuit to a second bridge circuit consisting of impedances so designed that at frequencies for which the original bridge circuit is unbalanced the second bridge circuit is balanced and will prevent current flow.

Although the novel features which are believed to be characteristic of this invention will be pointed out with particularity in the claims appended hereto, the invention itself, as to its objects and advantages, the mode of its operation and the manner of its organization will be better understood by referring to the following description taken in connection with the accompanying drawing forming a part thereof in which;

Fig. 1 shows diagrammatically a common type of bridge circuit such as is used in telephone repeater stations;

Fig. 2 illustrates a double bridge circuit constructed in accordance with this invention and

Fig. 3 shows a series of curves to be used in explanation of the operation of the system shown in Fig. 2.

Referring more particularly to Fig. 1, an incoming transmission line A is connected to local lines B and C in conjugate relationship by means of hybrid coil U and balancing network K. In such a system transmission may occur from line A to line B and from line C to line A but, for all frequencies at which

the impedance of balancing network K equals the impedance of line A, transmission will not take place between lines B and C. If, however, the impedances of line A and network K are not exactly balanced, a differential effect is produced by means of which signals may be transmitted between lines B and C.

This undesired transmission between lines C and B is prevented in the system illustrated in Fig. 2 in which portions similar to those shown in Fig. 1 are given the same reference characters. In this circuit a second bridge connection is obtained by impedances R and W which are connected to line B in series with the secondary of the hybrid coil, the balanced bridge comprising the two halves of the secondary of the hybrid coils and impedances R and W. These impedances must be so chosen that for those frequencies for which the impedances of the line A and artificial line K show small or no differences at all, the difference of the impedances R and W is large, and vice versa. It is assumed that the particular frequencies, the transmission of which between C and B is prevented by the second bridge connection mentioned above, are not necessary to insure good speech transmission between A and B, as this bridge connection also prevents transmission of these frequencies from A to B.

Impedances R and W may consist of any suitable combination of capacities, condensers and ohmic resistances. If, for example, line A should represent a loaded line, an artificial line K may be designed which will simulate the impedance of line A for the frequency range below the natural frequency of the line but which deviates therefrom at higher frequencies. In this case it is preferable to choose for impedance R a condenser, and for impedance W a parallel connection of inductance and capacity of suitable magnitudes.

In Fig. 3 curves W represent the impedance of network W plotted as a function of the frequency and curve R represents the impedance of the network R plotted to the same coordinates. In the condition illustrated by these curves, impedances R and W are equal at high frequencies which means that at those frequencies at which signals would tend to be transmitted between

lines B and C such transmission is prevented by the balanced condition of the second bridge including impedances R and W.

If the line A and the artificial line K show impedance deviations at frequencies below the speech frequency region, the impedance R should consist of an inductance and impedance W should consist of an inductance and a capacity connected in parallel. By connecting resistances in series or in parallel with the impedances a further balance at any desired frequency may be obtained.

Although this invention has been shown and described as applied to a particular system operating in a specific manner, it is not to be limited thereto but only in accordance with the scope of the invention as defined by the following claims:

What is claimed is:

1. In a communication system, a two-way transmission line, a pair of one-way transmission lines, means interconnecting said lines so that transmission is permitted between said two-way line and each one-way line, but transmission is prevented between said one-way lines at certain frequencies, in combination with a balanced bridge circuit connected in one of said one-way lines and at all times operative to prevent transmission between said one-way lines at other frequencies.

2. A combination in accordance with claim 1 in which the arms of said bridge circuit include elements the impedance of which differs at different frequencies to produce a balance in said bridge circuit at frequencies at which said means is ineffective to prevent transmission between said one-way lines.

3. In a communication system, a two-way transmission line, a pair of one-way transmission lines, means for connecting said two-way transmission line to said one

way lines including a hybrid coil having windings and a balancing network for said two-way transmission line whereby transmission between said one-way lines is prevented at certain frequencies, and means comprising a pair of additional balancing networks connected to one of said lines and to one of said windings for preventing transmission between said one-way lines at other frequencies.

4. In a communication system, a two-way transmission line, a pair of one-way transmission lines, means for connecting all of said lines comprising a hybrid coil and a balancing network, said network being designed to simulate the impedance of said two-way transmission line at certain frequencies whereby at those frequencies transmission between said one-way lines is prevented, and additional means for preventing transmission between said one-way lines at other frequencies comprising a bridge circuit consisting of a pair of impedance networks, said last networks being of equal impedance at those frequencies at which the two-way transmission line and the first mentioned network are of unequal impedance.

5. In a communication system, a transmission line and a balancing artificial line therefor, a pair of local lines associated with said first line in balanced relationship including a transformer having split primary and secondary windings, a pair of impedances connected in series with said secondary windings, said impedances being so designed that they are equal at frequencies at which the impedance of the transmission line and artificial line differ, and that they are unequal at other frequencies.

In testimony whereof I affix my signature.

THEO. ZUSCHLAG.