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RETARDATION COIL FOR COMPOSITE SETS

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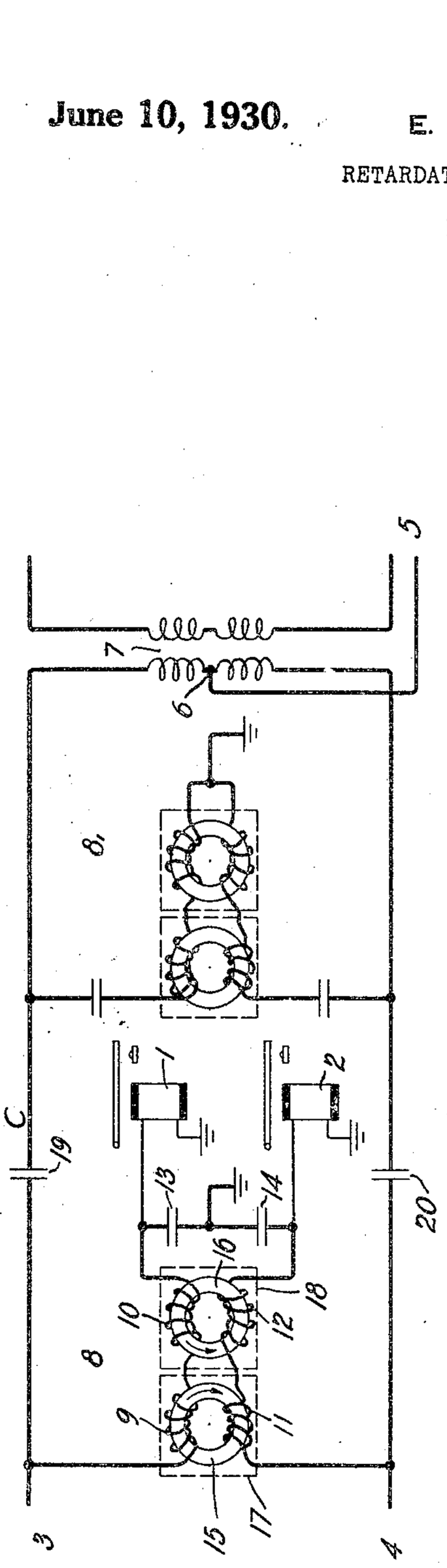

FIG. 1.

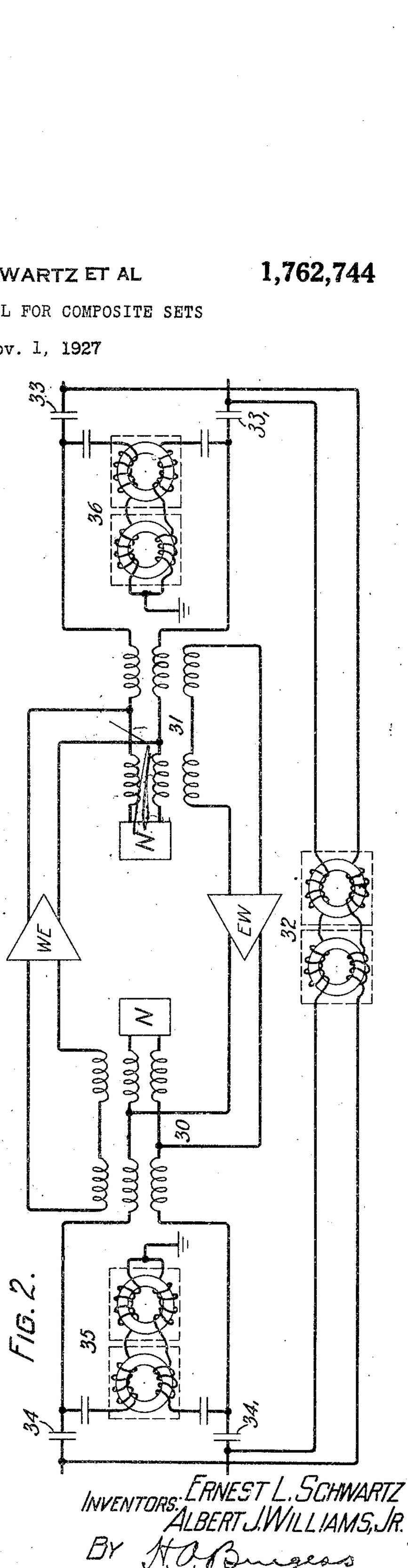

FIG. 2.

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UNITED STATES PATENT OFFICE

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RETARDATION COIL FOR COMPOSITE SETS

Application filed November 1, 1927. Serial No. 230,219.

This invention relates to composite sets used in conjunction with superposing telegraph channels and telephone channels upon the same line circuits and especially to retardation coils utilized in connection with composite sets.

Some means must be provided in a composite set for directing telephone and telegraph signals into their respective channels. Such means may comprise a condenser in the telephone circuit for separating the telegraph signals from the telephone lines while an impedance which is high to voice frequencies and which readily passes the telegraph signals may be provided in the telegraph circuits to prevent the voice currents from reaching the telegraph instrument. In the prior art the impedance thus provided is known as a retardation coil. Where composite sets are used in connection with phantom circuits and where a telegraph instrument is associated with each side of a telephone line, it is essential, in order to prevent cross-talk to maintain the impedance of both sides of the line in exact balance. Furthermore, there should be no coupling between the coils associated with each telegraph instrument since this would produce cross-fire, or operation of one telegraph sounder when a message is being received by the other.

One object of this invention is to maintain the impedance of both sides of the telephone line forming one branch of the phantom circuit balanced, when telegraph instruments are associated with both sides of the line through composite sets.

A related object of the invention is to eliminate cross-fire between two telegraph instruments which are connected to a telegraph line through the same composite set.

Another object is to eliminate the coupling between coils having a common core and still maintain the ratio which the impedances of the coils bear to each other constant for different frequency and current.

A feature of the invention resides in a retardation coil system comprising two coils which have the same flux paths and in which the windings of the coils are arranged so that a voltage individual to either of the coils will not induce any voltage in its associated coil, but wherein an inductance change in one will create a corresponding change in the inductance of the other.

A better understanding of the invention may be had from the following description in conjunction with the accompanying drawing, in which:

Fig. 1 shows one half of a phantom circuit having telegraph sounders associated therewith which are connected to a telephone circuit by the means of the invention.

Fig. 2 shows the invention used to bypass telegraph signals around a voice frequency repeater.

In Fig. 1 a composite set C is shown associating two telegraph instruments 1 and 2 which may either be senders or receivers with different sides of telephone lines 3 and 4 forming one branch of a phantom circuit. In order not to complicate the drawing a complete phantom circuit is not shown since circuits of this type are well known in the art. Such a circuit is shown in the U. S. patent to J. Mills, No. 1,351,863, granted September 7, 1920, if it be considered that the repeater therein shown be replaced by telephone terminal sets. The other side of the phantom circuit may be identical with that shown. The lead 5 from the phantom repeating coil (not shown) is connected at the midpoint 6 of one winding of the repeating coil 7. This connection must always be at the electrical midpoint of the line comprising wires 3 and 4 to prevent cross-talk.

The telegraph instruments 1 and 2 are connected to the line wires 3 and 4 through the coils comprising the windings 9 and 10 in series and windings 11 and 12 in series respectively, which together form the retardation coil system 8. The condensers 13 and 14 and the coils 9, 10 and 11, 12 in series therewith, provide a high impedance to the passage of voice frequency currents while each coil readily permits the passage of the telegraph signaling current to the sounders 1 and 2.

If there were any mutual coupling be-

tween the coil comprising the windings 9 and 10 and the coil comprising windings 11 and 12 it can readily be seen that one sounder would tend to be operated by the current induced in the coil connected thereto when a signal is being transmitted to the other sounder. Thus both sounders would respond when a signal is being transmitted over one of the lines, or if both lines were being used simultaneously, an unintelligent jumble of signals would be received at both sounders.

At the same time it is evident that a signal common to but one side of the line would create a change in the inductance of the coil associated therewith so that it is quite essential that means be provided for causing a similar change in the other coil or else the impedance of both sides of the line to voice frequencies would vary resulting in improper operation of the phantom circuit.

The retardation coil provides negligible mutual coupling between the coils and at the same time maintains the inductance of both coils equal in the following manner.

Two cores 15 and 16, identical in size and physical structure are each wound with equal portions of each coil. The three windings 9, 11, and 12 are poled in the same direction while the winding 10 is poled in the opposite direction.

Suppose now a telegraph signal is being transmitted to the sounder 1, the current will be such as to cause the flux in the core 15 to be in the direction of the arrow while the same current will cause the flux in the other core 16 to be in the opposite direction by virtue of the polarity of the winding 10. The flux in each core will be of the same density, but in opposite directions and the voltages induced in the windings 11 and 12 which are similarly wound will be opposite and balance each other.

It can readily be seen that a signal traversing the other coil comprising windings 11 and 12 will induce no voltage in its associated coil comprising windings 9 and 10 for the same reason as set forth above. In this manner any tendency to cross-fire between the two sounders is eliminated. In order that there be no flux leakage from windings on one core to those on the other, metallic shields 17 and 18 are provided.

It can further be seen that the magnetic path being wholly common to both coils, the inductance in both lines which may change due to telegraph signals will nevertheless be the same in one coil as in the other. In this manner the tap 6 where the lead from the phantom circuit joins the midpoint of the repeating coil secondary will always be at the electrical center of the two lines.

A similar retardation coil 8, is provided to drain the charges accumulated in the condensers 19 and 20 from the telegraph signals.

Fig. 2 shows the manner in which the telephone lines are maintained balanced where the telegraph circuits bridge the telephone repeater. A two-way repeater for amplifying telephone signals is shown comprising the west to east repeater WE, the east to west repeater EW and hybrid coils 30 and 31 of well known type for separating the oppositely directed speech signals.

A by-pass including the retardation coil system 32 is provided around the repeater for the telegraph signals which are excluded from the repeater circuit by the condensers 33, 33_1, 34 and 34_1 and the retardation coil systems 35 and 36, which furnish a path to ground for any of the telegraph charges which might collect on the aforementioned condensers. The retardation coil system 32 in turn precludes any possibility of the voice signals being shunted around the repeater. The coil 32 is in all respects similar to that described in Fig 1 and provides for balancing both sides of a telegraph line regardless of the telegraph signals in either side of the line.

Although this invention has been described in connection with specific embodiments, it is to be understood that the invention is to be limited only by the scope of the appended claims.

What is claimed is:

1. In a transmission circuit, a line circuit, means for simultaneously superposing voice signals and telegraph signals on said circuit, and means comprising a retardation coil system for separating said signals, said retardation coil system comprising two coils having common flux linkage and portions of their windings poled so as to practically eliminate mutual coupling between the coils.

2. In a transmission circuit, means for simultaneously superposing speech signals and telegraph signals on said circuit, and means for separating said signals, said means comprising a retardation coil system having a plurality of cores with a plurality of coils disposed thereon, one of said cores having a portion of each of said coils disposed thereon, said cores providing common flux paths for said coils, each of said coils being arranged so as to have negligible mutual coupling with any of the other coils.

3. In a transmission system, means for simultaneously superposing speech signals and telegraph signals on said system, and means for separating said signals, said means comprising a retardation coil system having two coils, each of said coils having equal portions of their windings disposed upon a pair of cores and having negligible mutual coupling therebetween.

4. In a transmission circuit, a line circuit, means for simultaneously superposing speech signals and telegraph signals upon said circuit, means for separating said signals com-

prising a retardation coil system having two coils and two cores, half of each of said coils being disposed on each of said cores, the windings of one of said cores being in the same direction, and the windings of the other of said cores being in opposite directions.

5. A combination in accordance with claim 4 in which the coils are enclosed in metallic shields.

6. In a signaling system adapted for the simultaneous transmission of telephone and telegraph signals, the combination with a line circuit of a terminal telephone circuit, and a plurality of telegraph circuits, a composite set for directing the signals into their respective channels, said composite set comprising a retardation coil system having a coil associated with each of said telegraph instruments, said coils having flux paths wholly in common and poled so as to prevent mutual coupling therebetween.

7. In a signaling system adapted for simultaneous transmission of telephone and telegraph signals, the combination with a line circuit of a terminal telephone circuit and a plurality of telegraph circuits, a composite set for directing the signals into their respective channels, said composite set comprising two coils serially bridged across said line circuit, each of said coils having windings disposed equally on a pair of cores such that the flux paths of the coils are common, said windings being poled so that the voltage induced in the windings of one coil due to a voltage impressed upon the other coil is negligible, said coils also being adapted so that a change in inductance of one coil results in a corresponding change in inductance of the other.

8. In a transmission circuit, a line circuit, means for simultaneously superposing voice signals and telegraph signals on said circuit, and means comprising a retardation coil system for separating said signals, said system comprising a plurality of coils having common flux linkage and portions of their windings poled so as to practically eliminate mutual coupling between any of the coils.

In witness whereof, we hereunto subscribe our names this 17th day of October A. D., 1927.

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