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2,138,675

SHUNT BALANCING NETWORK FOR TELEGRAPH CIRCUITS

Filed Nov. 5, 1935

3 Sheets-Sheet 1

Fig. 1.

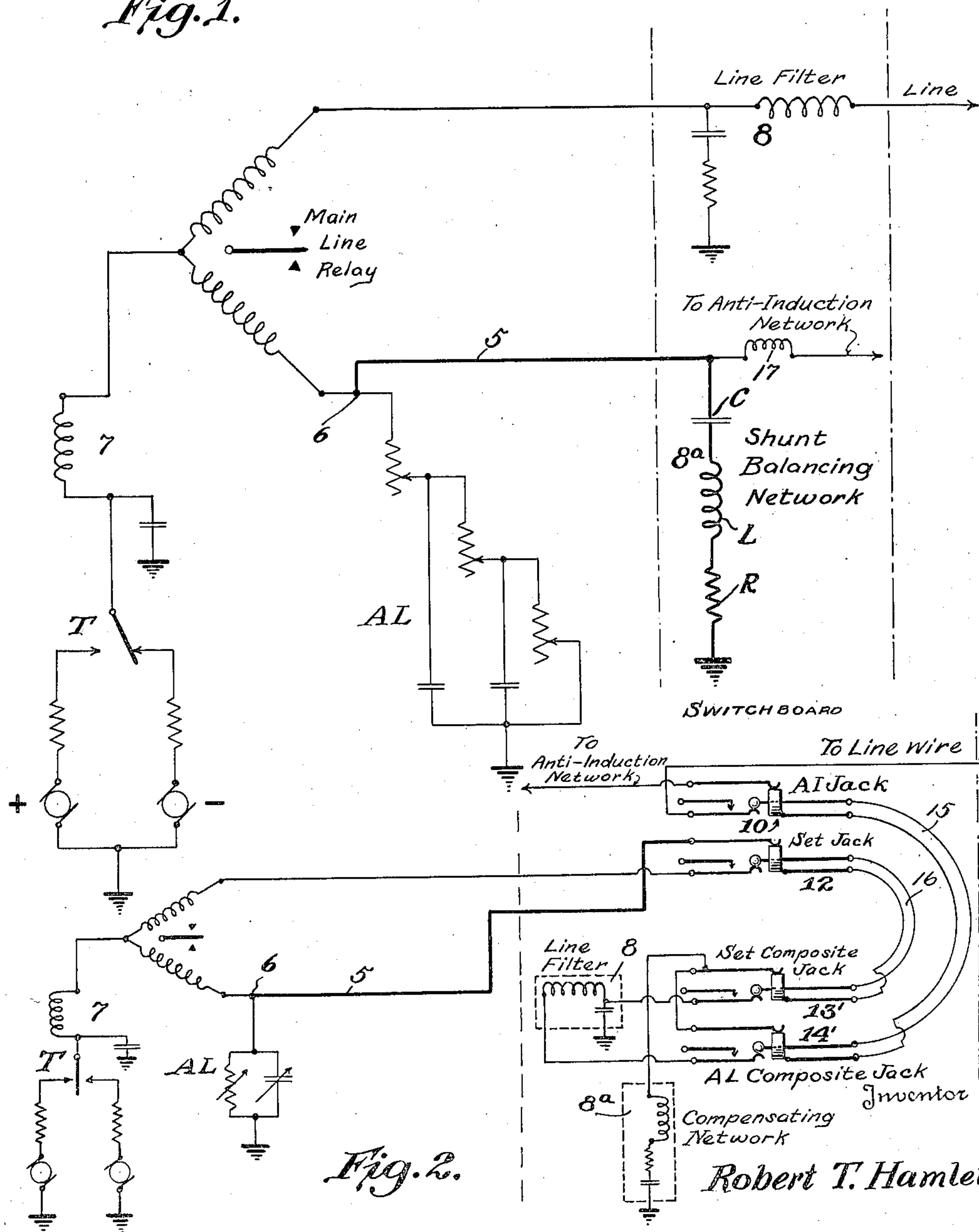


Fig. 2.

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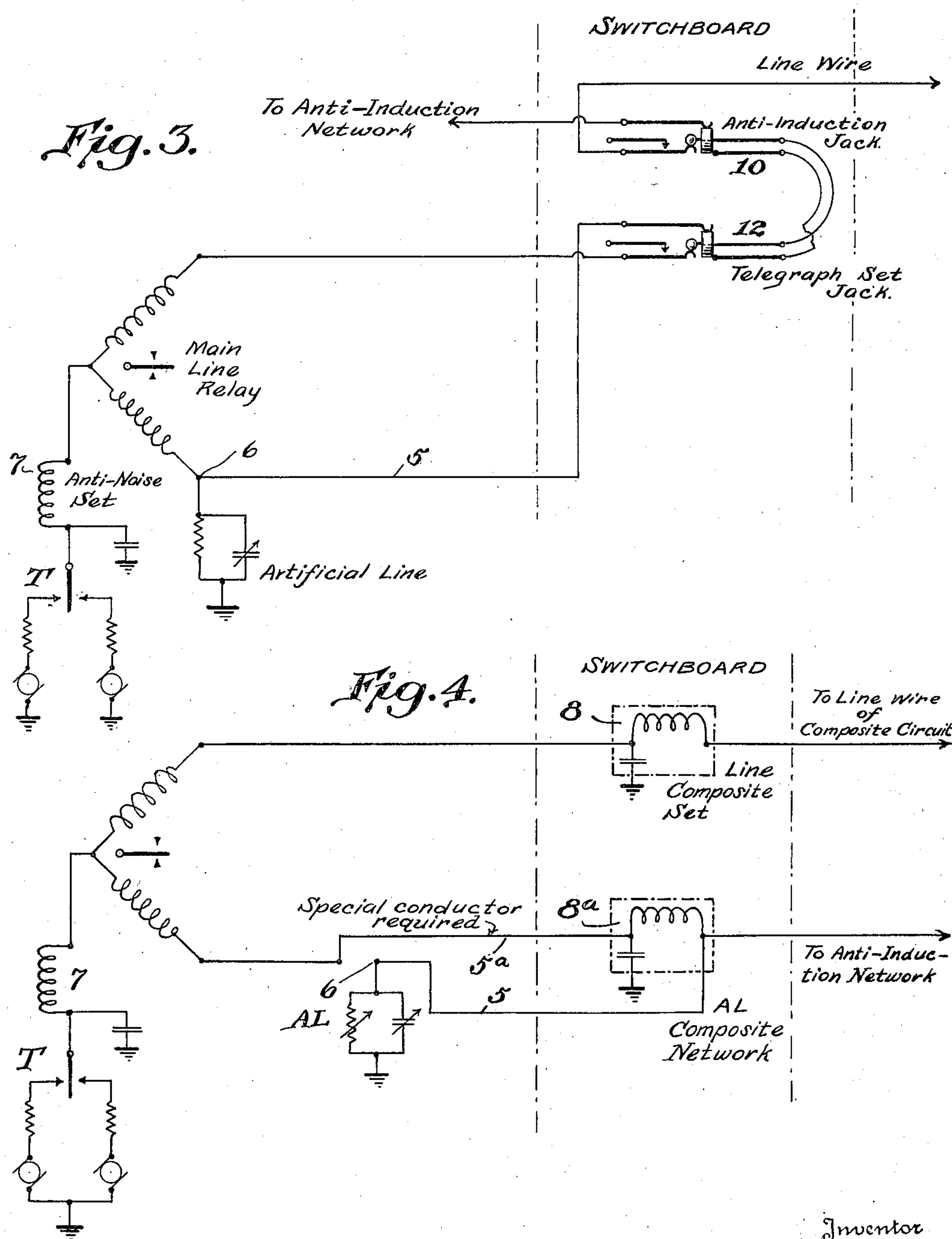
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3 Sheets-Sheet 2



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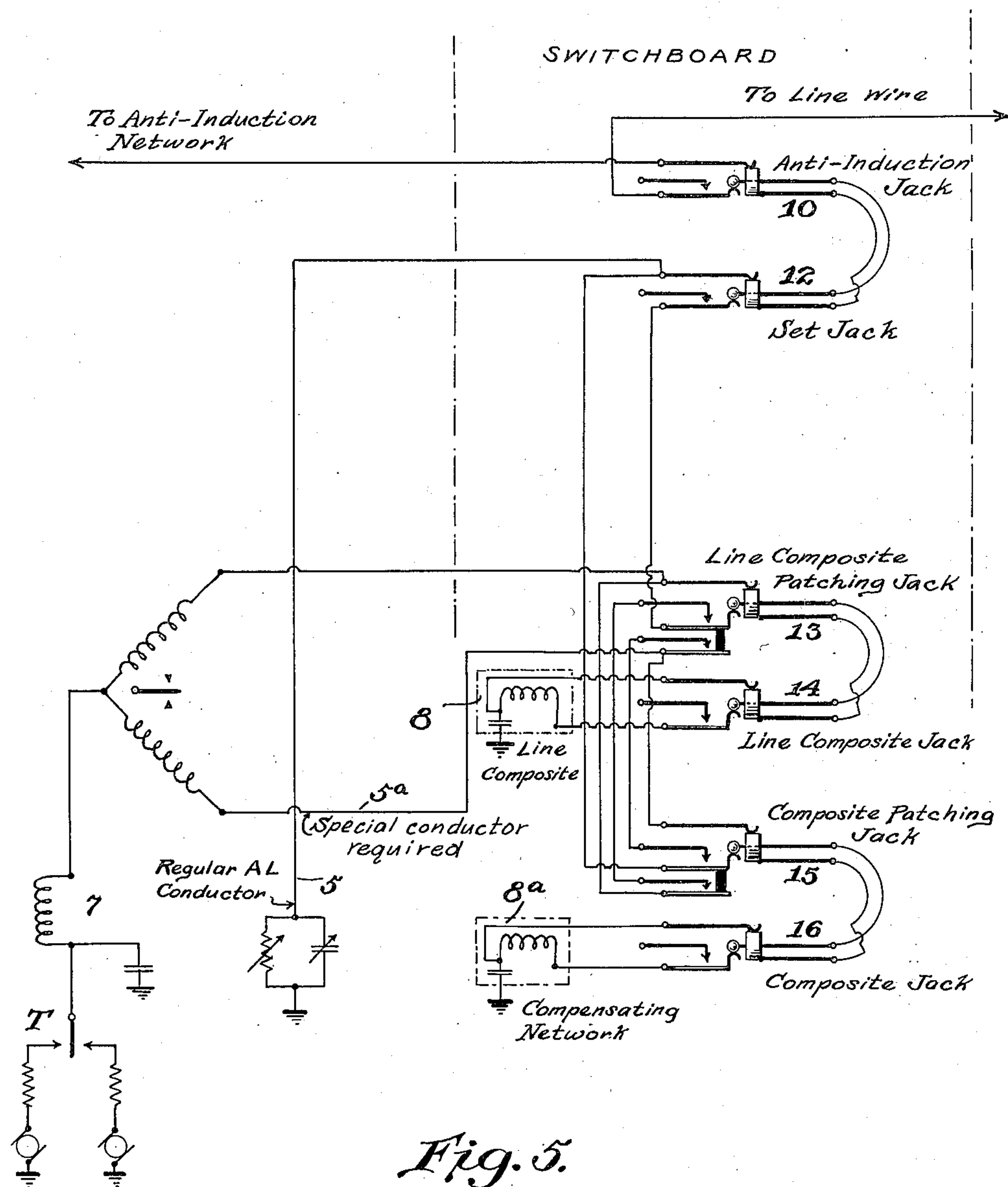


Fig. 5.

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UNITED STATES PATENT OFFICE

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SHUNT BALANCING NETWORK FOR TELEGRAPH CIRCUITS

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5 Claims. (Cl. 179—3)

This invention relates to signaling systems and more particularly to circuit arrangements for connecting duplex sets into composite telegraph and telephone circuits.

When telegraph circuits are operated over the same wires which are being used for telephone communication, it is necessary to insert filters in the line for the purpose of removing the interfering voice frequency currents which are generated in certain parts of the telegraph apparatus. One of these filters is usually connected in series with a conductor from the telegraph set to the line wire of the composited circuit.

If the telegraph circuit is to be operated as a duplex line, it then becomes necessary to insert a compensating filter network in the artificial line to balance the characteristics of the line filter. This has been accomplished heretofore by inserting identical filter networks in series with the line and in series with the artificial line of the duplex set. In case a duplex line was to be composited with another line, it necessitated the disconnection of the artificial line from the telegraph set and the employment of an additional conductor from the head end of the artificial line to the switch board.

The object of my invention is to provide an arrangement for eliminating the additional conductor heretofore required between the artificial line and the terminal switchboard in order to introduce a compensating filter network when connecting a duplex set into a composite circuit; to make such change without disturbing the regular switchboard termination of the duplex set, the switchboard jacks for terminating the composite apparatus being entirely independent of the duplex set; and to increase the flexibility of the entire composite arrangement so that it may be used on any duplex set and line wires which are regularly terminated in the switchboard.

My invention will be more clearly comprehended from the following detailed description in connection with the accompanying drawings, in which—

Figure 1 is a diagrammatic view showing the manner of connecting the compensating filter network in accordance with my invention;

Figure 2 illustrates the manner of introducing the voice frequency eliminating filters in the line circuit and the compensating filter network in the artificial line at the switchboard in accordance with my invention;

Figure 3 shows the ordinary switchboard termination of a duplex telegraph set;

Figure 4 illustrates diagrammatically the manner in which the circuit connections must be changed to insert the compensating filter network into the artificial line and which requires an additional conductor between the head end of the artificial line and the terminal switchboard; and

Figure 5 shows the switchboard connections required when said additional conductor is employed.

I have indicated in Fig. 3 the usual connections at the terminal switchboard of a duplex set. The telegraph set is connected to the main line through the tip contacts of the two jacks, 10 and 12, while the conductor 5 from the head end of the artificial line is connected through the sleeve contacts of the jacks to the usual anti-induction network which connects the head end of the artificial lines of the various duplex systems at a terminal station for the purpose of eliminating cross-fire between the lines. Such anti-induction networks are shown in U. S. Patent No. 1,560,540 and are described in an article in the Bell System Technical Journal, July, 1926, beginning on page 418.

Now when a duplex set is to be embodied as a part of a composite telegraph and telephone circuit it is necessary to eliminate the voice frequency disturbing currents which are generated in certain parts of the telegraph apparatus. The anti-noise set or apex filter 7, shunts out most of the disturbing frequencies due to the transmitter T. To eliminate the voice frequency current components generated in the main line relay by the vibratory movements of the armature, it is necessary to insert a line filter or line composite set 8 in the line. This necessitates the introduction of a corresponding compensating network 8^a in the artificial line to balance the characteristics of the low pass filter 8 in the line. This has heretofore necessitated the disconnection of the terminal telegraph set from the head end of the artificial line at the point 6 and the laying of a special conductor 5^a from the terminal switchboard to the head end of the artificial line which is usually a considerable distance. Another method which has been employed necessitated the introduction of a compensating network in series with the artificial line at each telegraph set and switching means for removing the network from the circuit. I have indicated diagrammatically in Fig. 4, the changes which were necessitated when a duplex line shown in Fig. 3 was connected into a composited circuit. The composited circuit arrangement in which two duplex telegraph lines comprise the two legs of

the composite with the telephone circuit connected across the two telegraph lines is familiar to every communication engineer and hence it is not necessary to include a complete diagram for purposes of illustration herein.

The switch connections at the terminal switchboard which were required in order to change the duplex line shown in Fig. 3, into the composited circuit of Fig. 4, were quite complicated, as indicated in Fig. 5. In addition to the two jack switches 10 and 12, four additional jack switches 13, 14, 15 and 16, together with their interconnecting conductors were required. Moreover, it was necessary to alter the connections of the main line and artificial line with the jack switches 10 and 12 in order to introduce the filter network 8 into the line and the compensating network 8^a into the balancing artificial line by means of patching jacks and cords as will be observed by referring to Fig. 5.

For the purpose of greatly simplifying the circuit connections required to connect a duplex set into one leg of a composited circuit and to eliminate the additional conductor heretofore required, I have devised the arrangement disclosed in Figs. 1 and 2. Instead of inserting the compensating filter network in series with the artificial line, I connect the filter compensating network 8^a in shunt to the usual conductor 5 leading from the head of the artificial line to the anti-induction network. The constants of this compensating shunt filter 8^a viz: the values of the condenser C, the inductance L and the resistance R, are so chosen that they closely approximate the impedance (at telegraph frequencies) of the low pass filter network 8, introduced in series with the line connection of the telegraph set. A coil 17 may also be connected in series with the anti-induction lead in order to correct the anti-induction network when the shunt balancing network is connected.

Referring to the switchboard connections in Fig. 2, it will be observed that by eliminating the special conductor 5^a previously required, the terminal connections of both the line wire and the conductor 5 to the switches 10 and 12, remain unchanged when shifting an ordinary duplex set shown in Fig. 3, into a leg of a composite circuit as shown in Fig. 2. This makes it possible to use any duplex set (terminated as shown in Fig. 3) for composite service without making any changes on the set. The two jack switches 13' and 14' used for terminating the composite apparatus are entirely independent of the duplex set and the other jacks on the switchboard. The flexibility of the entire composite arrangement is thus greatly increased, since the composite apparatus may be used on any of the duplex sets and line wires which are regularly terminated in the switchboard.

The manner in which the telephone circuit is bridged across a pair of telegraph lines is well understood and requires no further illustrations.

I claim:—

1. In a signaling system employing a composite set comprising a pair of telegraph lines and a telephone circuit bridged across said lines, one of said lines being arranged for duplex operation, a low pass filter connected in said duplex line to eliminate interfering voice frequency components from the outgoing telegraph signals and means

for balancing the effect of said filter in the artificial line of said duplex line, comprising a network connected in shunt to the artificial line, said network having electrical constants closely approximating the constants of said filter, at telegraph frequencies.

2. In a signaling system having a duplex telegraph line forming one branch of a composite telegraph and telephone circuit, a filter network in said line operating to eliminate voice frequency current components from the outgoing telegraph signals and a filter compensating network connected in shunt to the artificial line of said duplex line.

3. In a signaling system having a duplex telegraph line forming one branch of a composite telegraph and telephone circuit, a filter network in said line operating to eliminate voice frequency current components from the outgoing telegraph signals, a conductor connecting the head of the artificial line with the usual anti-induction network and a filter compensating network connected between said conductor and ground.

4. In a signaling system having a terminal switchboard provided with the usual jack switches having socket and plug elements, a duplex telegraph line having a conductor from the telegraph set and a conductor from the head end of the grounded artificial line terminated in the spring contacts of one switch socket of a pair of jack switches and having the main line and conductor to the usual anti-induction network terminated respectively at the spring contacts of the other switch socket of said pair, a low pass voice frequency filter network having its terminals connected respectively to corresponding spring contacts of a second pair of switch sockets and a compensating filter network having one terminal grounded and the other terminal connected to the other spring contacts of said second pair of switch sockets, whereby said duplex line may form one branch of a composite set by inserting the plugs on the opposite ends of a pair of the usual connector cords into the corresponding sockets of said pairs of switches.

5. In a signaling system having a plurality of duplex telegraph sets provided with the usual grounded artificial line and having a conductor from the usual anti-induction network connected to the head end of the artificial line, a terminal switchboard provided with jack switches having socket and plug elements, the telegraph set and said conductor connected to the artificial line of the respective duplex lines terminating in the spring contacts of the socket elements of respective pairs of said switches and the corresponding telegraph lines and anti-induction conductors terminating in the spring contacts of the other socket elements of said pairs and a plurality of sets of low pass line filters and corresponding compensating filter networks terminating in pairs of socket elements of said switchboard switches with said compensating filter networks connected between the head of the artificial line and ground, whereby any duplex line may be readily adapted to form a leg of a composite set by inserting the plugs of the usual connector cords in the corresponding terminal sockets of a duplex line and the sockets of a filter set.

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