H. B. STONE.

COMPOSITE SIGNALING SYSTEM.

APPLICATION FILED JULY 20, 1908.

922,206.

Patented May 18, 1909.

2 SHEETS—SHEET 1.

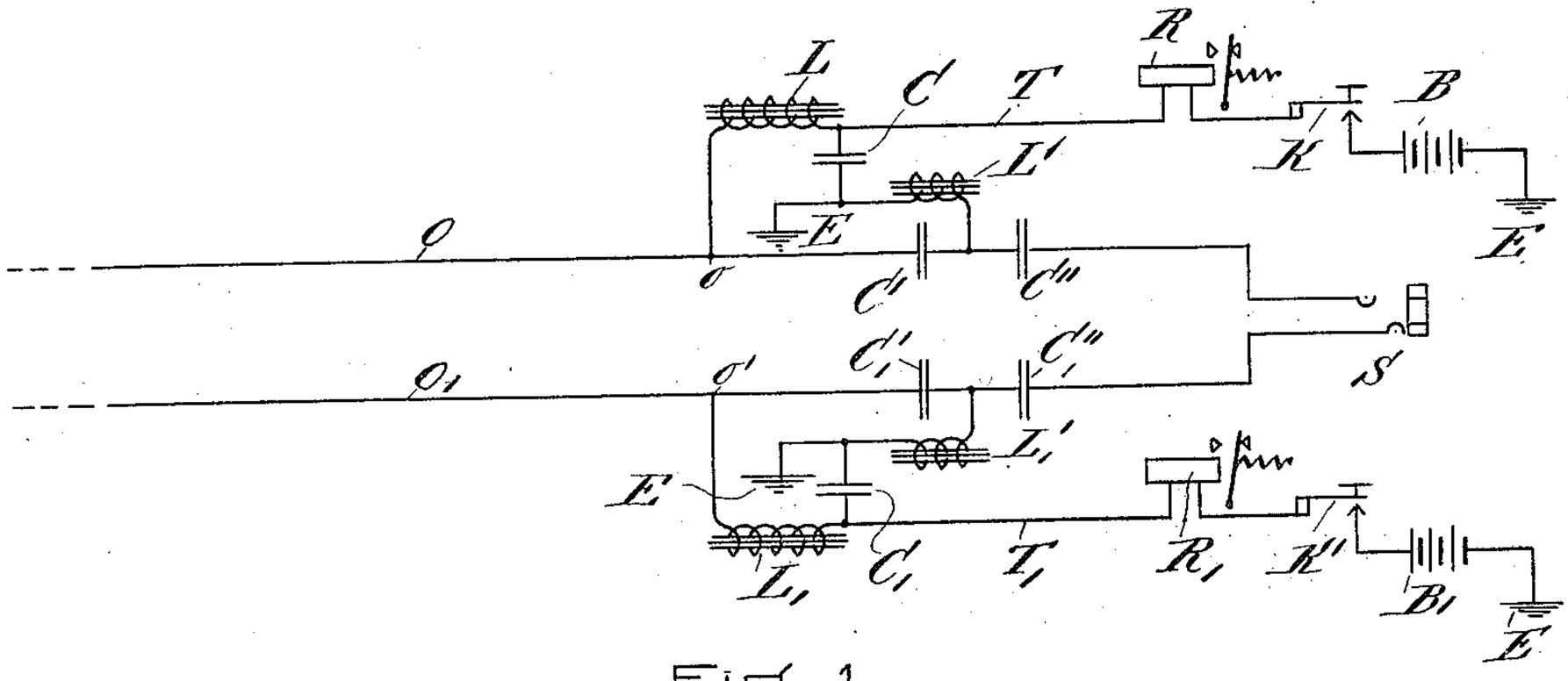

Fig-1-

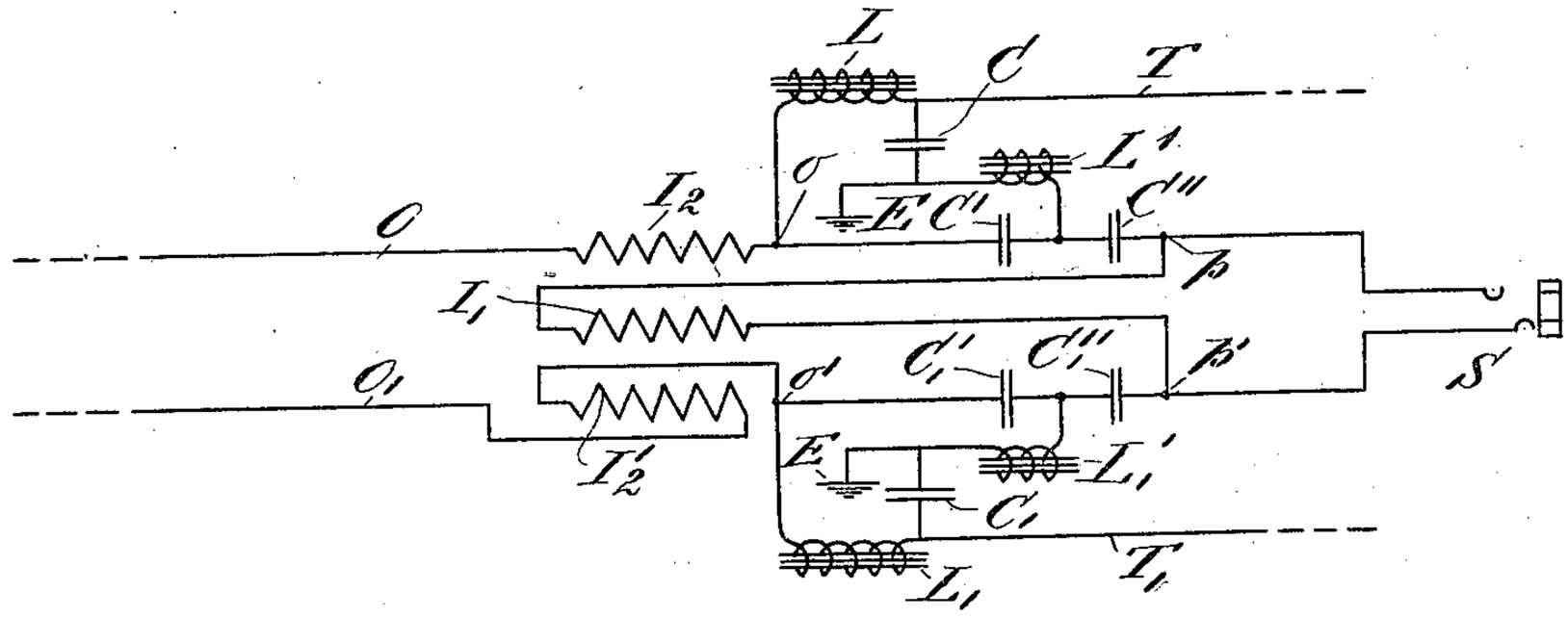

Fig-2-

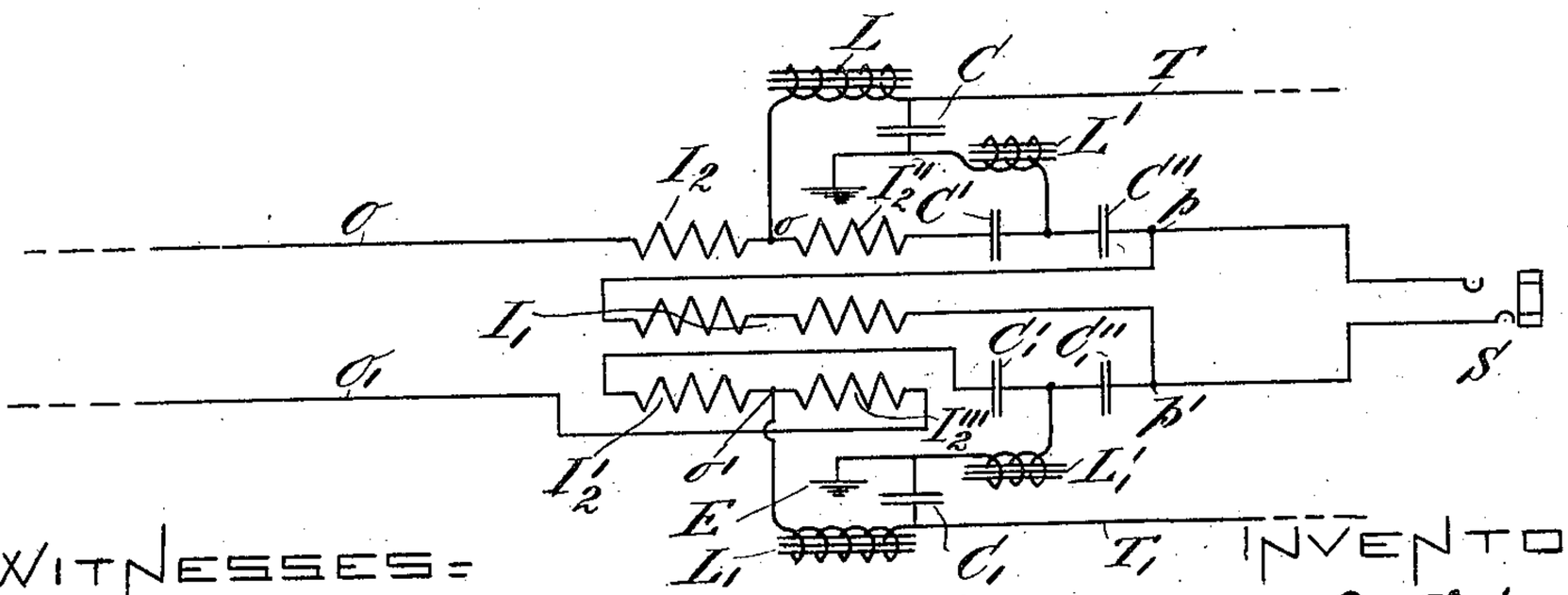

Fig-3-

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2 SHEETS—SHEET 2.

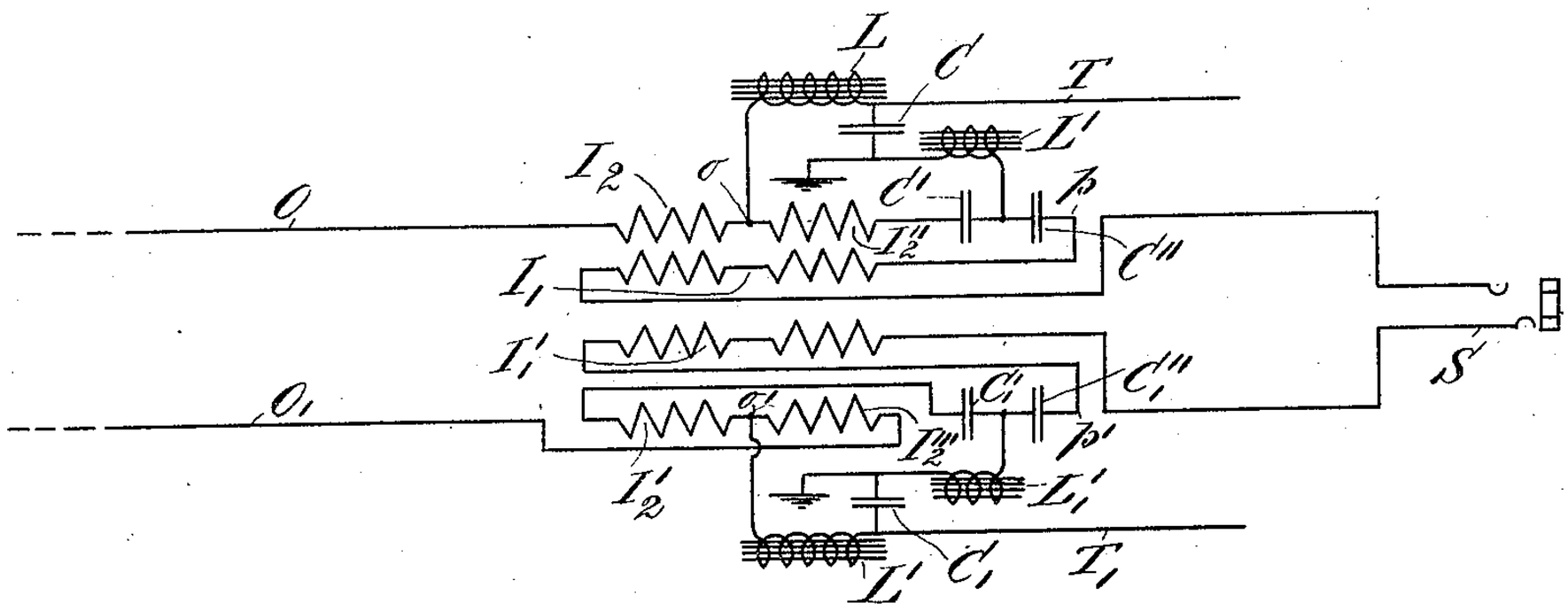

Fig. 4.

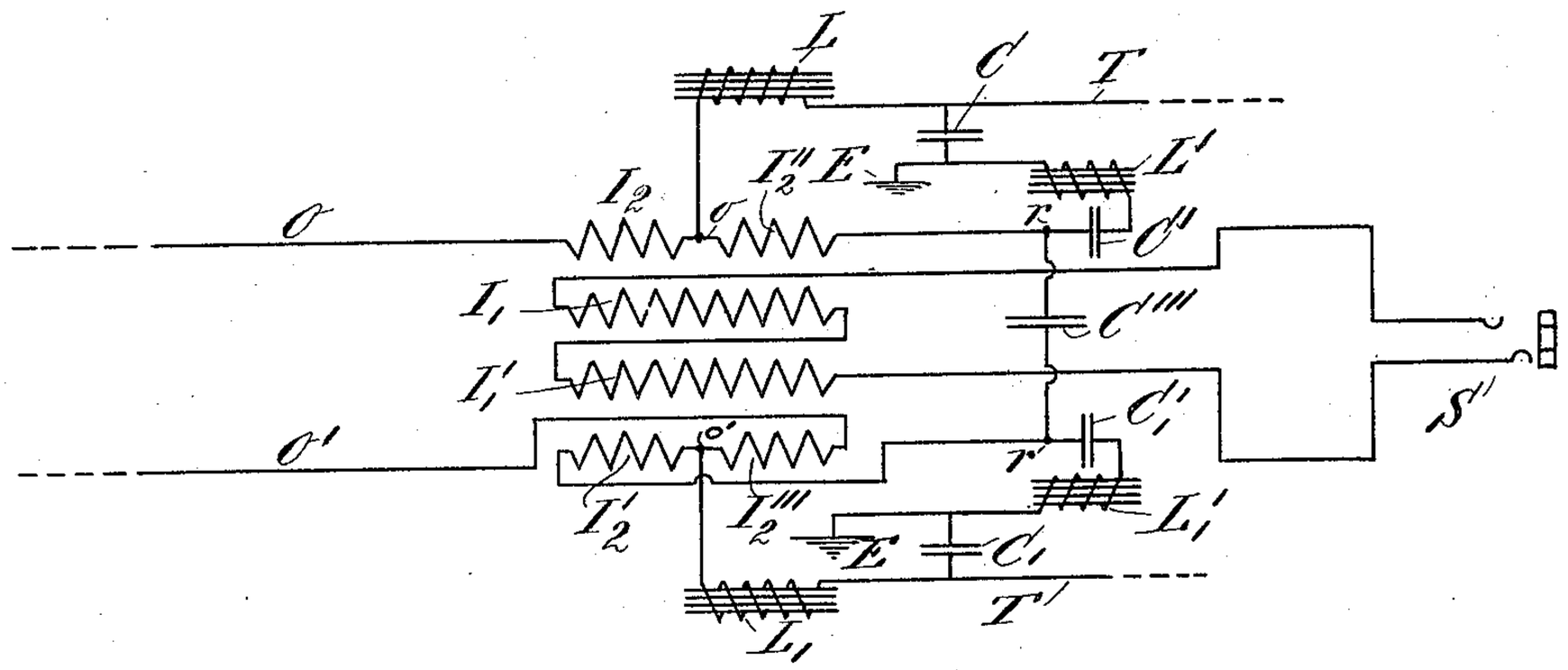

Fig. 5.

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UNITED STATES PATENT OFFICE.

HENRY B. STONE, OF PROVIDENCE, RHODE ISLAND.

COMPOSITE SIGNALING SYSTEM.

No. 922,206. Specification of Letters Patent. Patented May 18, 1909.

Application filed July 20, 1908. Serial No. 444,324.

To all whom it may concern:

Be it known that I, HENRY B. STONE, a citizen of the United States, and a resident of Providence, in the county of Providence and State of Rhode Island, have invented a new and useful Improvement in Composite Signaling Systems, of which the following is a specification.

My invention relates to composite signaling systems in which a line circuit may be used for simultaneous telegraphic and telephonic communication.

In composite signaling systems it is customary to connect one or more telegraph branches to the main line through the interposition of impedance coils whereby the rapidly varying telephone currents are prevented from affecting the telegraph apparatus, and to connect the telephone branch with the line circuit through the interposition of condensers whereby the more slowly varying telegraph currents are prevented from affecting the telephone system. It has been found however that the efficiency of the telephone system is greatly diminished by the necessity of passing the signaling or ringing currents through the condensers which connect the telephone branch with the line circuit. It has been proposed to remedy this defect by employing high-frequency ringing currents such as those produced by means of vibrators but the use of such high-frequency ringing current is objectionable and has developed a number of difficulties and limitations in practice.

It is the object of the present invention to provide a composite signaling system wherein the ordinary low-frequency ringing current may be employed by impressing the same on the line circuit on the line side of the aforesaid condensers, if the latter be retained, and it contemplates in one of its aspects the elimination of the condensers or inductostatic connection of the telephone branch of the line circuit.

A further object of my invention is to connect the telegraph branch or branches of a composite system to the line circuit at a point or points the potential of which is not affected by the development of the telephone signaling current so that such current will not affect the telegraph apparatus.

The drawings which accompany and form a part of this application represent in diagrammatic form various arrangements of circuits and apparatus whereby the foregoing objects may be accomplished.

In the drawings, Figure 1 is an explanatory diagram illustrating a well known composite system in common use today. Fig. 2 represents one embodiment of my invention in which a simple repeating coil, having its primary bridged across the telephone side of the composite set is employed for associating the telephone branch with the line circuit. Fig. 3 represents an extension of the principle shown in Fig. 2, in which the repeating coil has two sets of secondaries each set consisting of two coils connected in series with one side of the line circuit. Fig. 4 shows a modification in which the repeating coil has two primary windings connected in series with the telephone branch and the line circuit. Fig. 5 represents a further modification in which the primaries of the repeating coil are connected in series with the telephone and are inductively related to the line circuit, the condensers on the drop side having been discarded.

In the figures O O_1 represent the sides of an all-metallic line circuit.

T T_1 represent the telegraph branches of the composite signaling system, said sets including, respectively, the batteries B B_1, the keys K K_1 and the relays R R_1. The telegraph branches are connected to the line circuit at the points *o o'* respectively, and each is earthed at E. The impedance coils L L_1 are interposed between the telegraph branches and the line circuit, and the usual shunts including the condensers C C_1 and the impedances L′ L_1' may be connected to earth as shown.

It is usual to connect the two pairs of condensers C′ C″ and C_1' C_1'' in the two sides of the line circuit between the points of connection therewith of the telegraph branch and the telephone branch. Inasmuch as the ringing current must pass through the condensers C′ C″ and C_1' C_1'', which are usually condensers of from two to four microfarads capacity, and as a certain portion of said current necessarily passes through the shunts including the coils L′ L_1', which are coils of relatively low impedance, it will be clear that the arrangement shown in Fig. 1 is quite inefficient for transmitting low-frequency ringing currents. The attempt to improve the efficiency of the system shown in Fig. 1 by

the use of relatively high-frequency ringing currents has not proven successful, partly because of the disturbances induced by such currents in neighboring lines, and partly because of the complexity of the apparatus required for their production and the difficulty experienced in maintaining the same in proper adjustment.

The simplest form of my invention is shown in Fig. 2, in which as well as in the remaining figures, the reference characters have the same significance as in Fig. 1. In Fig. 2, I_1 represents the primary winding of a repeating coil, said primary being bridged across the telephone branch of the composite system between the points p p', and, as shown, connected in series with the spring-jack S of a telephone switch-board. I_2 I_2' are the secondaries of said repeating coil and each is connected in series with one of the sides of the line circuit O O_1. The ringing current from the telephone branch will be transmitted to line partly through the condensers C' C'' C_1' C_1'' but principally by way of the repeating coil which inductively translates the energy of said currents to the line to reinforce that portion of the energy of said currents received from said condensers. While the efficiency of transmission is greatly increased by the arrangement shown in Fig. 2, it has been found that variations in potential at the points o o' due to the development of the ringing currents affects the telegraph branches and also that the telegraph current is often heard in the telephone instruments.

In Fig. 3 I have shown a system whereby the efficiency of transmission of the ringing current may be still further improved and at the same time the mutual action of the telegraph and telephone branches greatly reduced or entirely eliminated. In Fig. 3 the telegraph branches T T_1 are connected to the line circuit at the points o o' which are midway between the serially connected secondary windings I_2 I_2'' and I_2' I_2''', respectively, of the repeating coil. The primary I_1 of said repeating coil, as before, is shunted across the drop side of the composite system between the points p p'. It will be obvious that the points o o' in Fig. 3, which are respectively between the outer ends of the two coils of each of the two sets of secondaries of the repeating coil, are points having their potential unaffected by the development of varying current such as ringing current in the primary of said coil, so that the telegraph instruments are not affected by said current. It will be seen conversely that the telegraph currents impressed on the system at the points o and o' divide and induce approximately equal and opposite effects in the primary I_1 so that the harmful effects of such currents upon the telephone receiver will be reduced to a minimum or entirely avoided. A suitable adjustment of the condensers C' C'' and C_1' C_1'', whereby the amplitudes and phases of the currents flowing in opposite directions from the points o o' may be regulated, will aid in accomplishing this result.

An extension of the principles shown in Fig. 3 is represented in Fig. 4, which shows an arrangement whereby the efficiency of transmission of the ringing currents is still further increased by connecting the primaries I_1 I_1' of the repeating coil in series with the telephone branch, so that the ringing currents will pass through said primaries before reaching the shunts which include the coils L' L_1'.

In the system shown in Fig. 5 the condensers C' C_1' may be employed as before between the secondaries of the repeating coil and the shunts which include the impedances L' L_1', but the condensers C'' C_1'' can be eliminated and the primaries I_1 and I_1' connected metallically in series. These condensers being discarded, the addition of a condenser C''', as shown, between the inner terminals of the secondaries assists in the elimination of the effect of the telegraph currents in the telephone instruments and increases the efficiency of the repeating coil. In Fig. 5 the telegraph branches are connected at points o o', between which there is developed a practically zero difference of potential by the ringing currents of the telephone system, so that the operation of the telephone system will not appreciably affect the telegraph receiver. Conversely, the currents impressed on the system by the telegraph branches divide and induce approximately equal and opposite effects in the primary windings I_1 I_1' of the repeating coil so that the telephone receivers will not be injuriously affected by said currents. This may be accomplished by suitable adjustment of the condensers C' and C_1' or the coils L' L_1', or by the adjustment of both sets of coils and condensers.

It will be obvious to those skilled in the art that a simple repeating coil, or one having a plurality of secondaries, or a plurality of primaries and a plurality of secondaries, may be employed in various ways to associate the telephone branch of a composite signaling system with the line circuit, and therefore I desire it to be understood that although I have described in detail several arrangements whereby the objects of the present invention may be effected, I do not wish to limit myself to the said specific arrangements, inasmuch as they have been selected from a number of equivalent systems merely for the purpose of more fully disclosing the present invention.

I claim:

1. In a composite signaling system, a line circuit, a telegraph branch, a telephone branch, a repeating coil having all of its secondaries connected in series with each other

and with the two sides of the line circuit, a connection from the primary of said repeating coil to said telephone branch, and a connection from the telegraph branch to the line circuit through one of said secondaries.

2. In a composite signaling system, a line circuit, two telegraph branches, a telephone branch, a repeating coil having all of its secondaries connected in series with each other and with the two sides of the line circuit, a connection from the primary of said repeating coil to said telephone branch, and connections from the telegraph branches to the two sides of the line circuit through said secondaries respectively.

3. In a composite signaling system, a line circuit, a telegraph branch, a telephone branch, a repeating coil operatively associating said telephone branch with said line circuit, said repeating coil having a plurality of secondaries in series with each other and with the line circuit, and a connection from said telegraph branch to the line circuit through one of said secondaries.

4. In a composite signaling system, a line circuit, two telegraph branches, a telephone branch, a repeating coil operatively associating said telephone branch with said line circuit, said repeating coil having a plurality of secondaries in series with each other and with the line circuit, and connections from the telegraph branches to the two sides of the line circuit through said secondaries respectively.

5. In a composite signaling system, a line circuit, a composite set including a telegraph branch and a telephone branch, a repeating coil operatively associating said telephone branch with said line circuit, said repeating coil having a plurality of secondaries in series with each other and with the line circuit, a connection from said telegraph branch to the line circuit through one of said secondaries and connections bridging the primary of said repeating coil across the telephone side of said composite set.

6. In a composite signaling system, a line circuit, a telegraph branch, a telephone branch, and means connecting said telegraph branch to the line circuit at a point having its potential unaffected by the development of varying current in the telephone branch.

7. In a composite signaling system, a line circuit, two telegraph branches, a telephone branch, and means connecting said telegraph branches respectively to the line circuit at two points, having their potential unaffected by the development of varying current in the telephone branch.

8. In a composite signaling system, a line circuit, a telegraph branch, a telephone branch, a repeating coil having two secondaries connected in series with each other and with one of the sides of the line circuit, a connection from said telegraph branch to a point between the outer ends of said secondaries, a primary winding inductively related to said secondaries, and a connection from said telephone branch to said primary winding.

9. In a composite signaling system, a line circuit, a telegraph branch, a telephone branch, a repeating coil having two sets of secondaries each set consisting of two coils connected in series with each other and with one of the sides of the line circuit, a connection from said telegraph branch to a point between the outer ends of the two coils of one of said sets of secondaries, a primary winding inductively related to said secondaries and a connection from said telephone branch to said primary winding.

10. In a composite signaling system, a line circuit, two telegraph branches, a telephone branch, a repeating coil having two sets of secondaries, each set consisting of two coils connected in series with each other and with one of the sides of the line circuit, connections from said telegraph branches to points between the outer ends of the two coils of each of said sets of secondaries, a primary winding inductively related to said secondaries and a connection from said telephone branch to said primary winding.

In testimony whereof, I have hereunto subscribed my name this 16th day of July 1908.

HENRY B. STONE.

Witnesses:

FREDERICK F. MANCHESTER,

WILLIAM C. KENDALL.