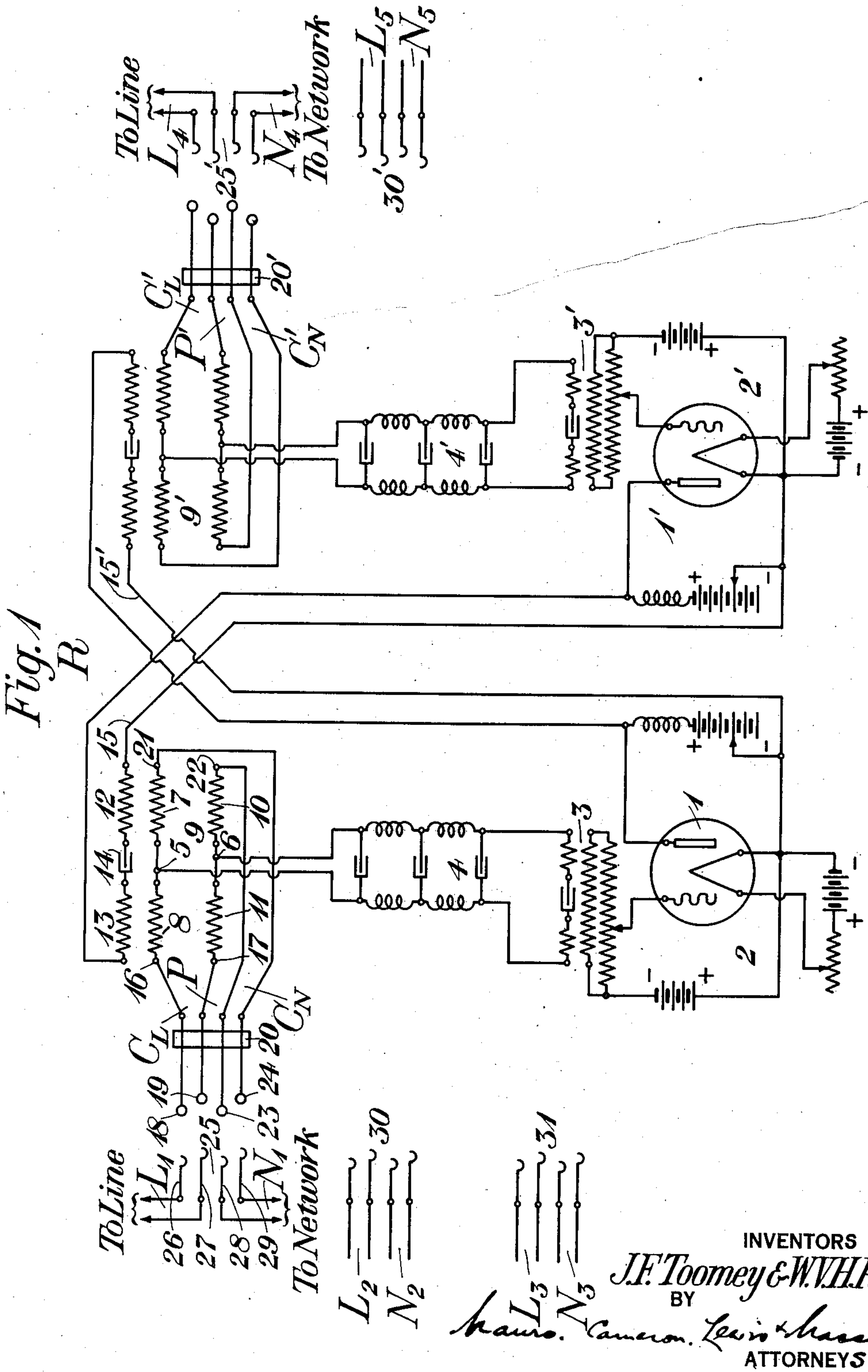


J. F. TOOMEY & W. V. H. READ.
ARTIFICIAL LINE SELECTING SYSTEM.
APPLICATION FILED MAR. 31, 1917.

1,277,274.

Patented Aug. 27, 1918.

3 SHEETS—SHEET 1.



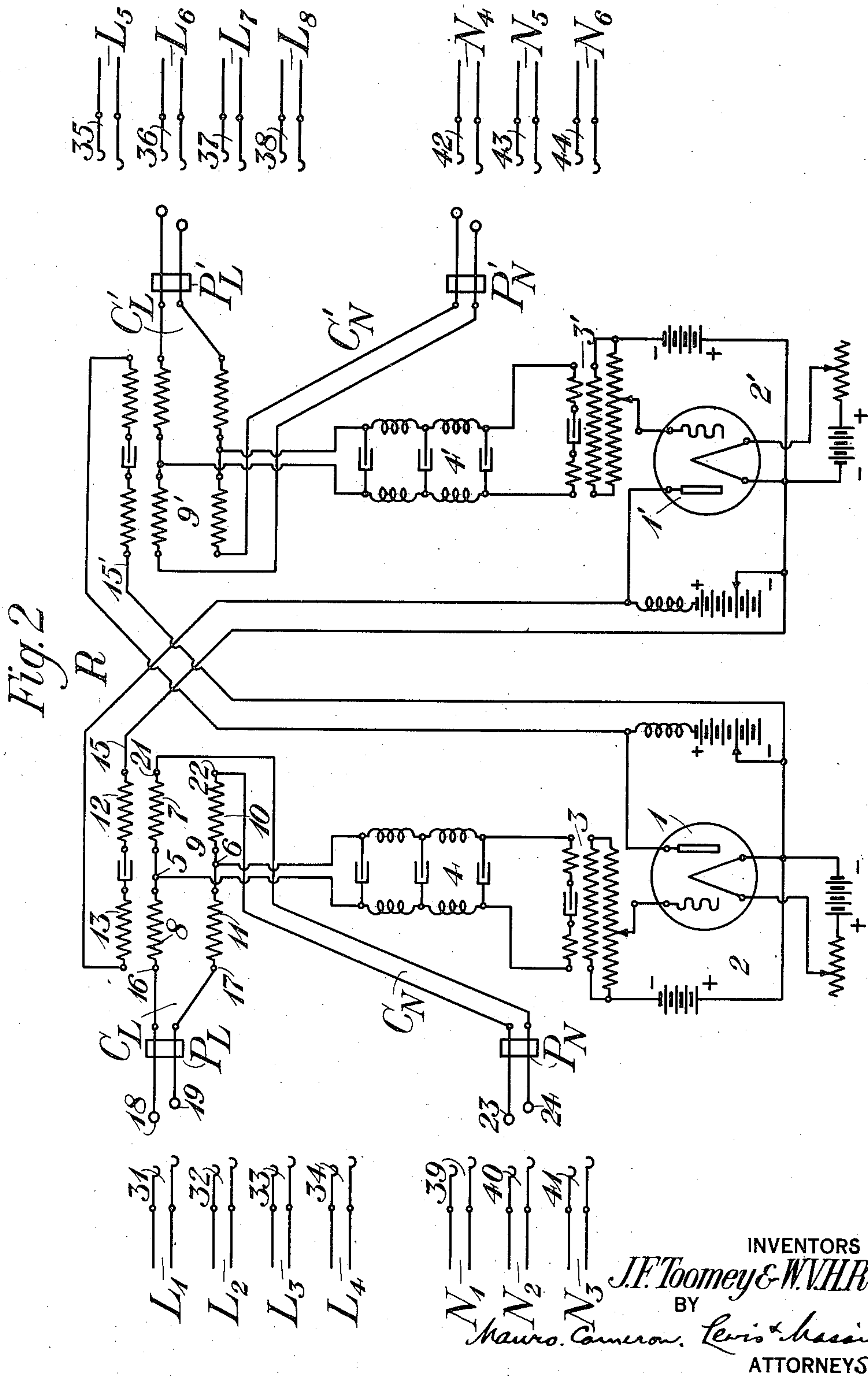
INVENTORS
J. F. Toomey & W. V. H. Read
BY
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3 SHEETS—SHEET 3.



ATTORNEYS

UNITED STATES PATENT OFFICE

JOHN F. TOOMEY, OF NEW YORK, N. Y., AND WALTER V. H. READ, OF NEWARK, NEW JERSEY, ASSIGNORS TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

ARTIFICIAL-LINE-SELECTING SYSTEM.

1,277,274.

Specification of Letters Patent.

Patented Aug. 27, 1918.

Application filed March 31, 1917. Serial No. 158,899.

To all whom it may concern:

Be it known that we, JOHN F. TOOMEY and WALTER V. H. READ, residing at New York city and Newark, in the counties of New York and Essex and States of New York and New Jersey, respectively, have invented certain Improvements in Artificial-Line-Selecting Systems, of which the following is a specification.

This invention relates to telephone repeater stations and more particularly it relates to repeater stations of the so-called two-way two-repeater type wherein each transmission line section is balanced by an artificial line. Its object is to provide a system such that any repeater may be associated with any transmission line and further that the appropriate artificial line may be always associated with the transmission line with which it is adapted to cooperate.

Heretofore in the art it has usually been customary to make the artificial line a part of the repeater organization proper. As a consequence a particular repeater system was limited to use in cooperation with a particular line or a limited number of lines for which its particular artificial line was adapted. When it was desired to operate the repeater system with a line of different characteristics it was then necessary to remove the artificial line and substitute therefor another of appropriate characteristics. When the transmission system comprises a large number of lines it is highly desirable to provide a more flexible system which permits of the switching of any repeater organization into any transmission line. In accordance with this invention such a system has been secured by associating the artificial line with the transmission line or lines which it is to balance rather than making it a part of the repeater organization and by providing switching means whereby the appropriate artificial line is selected when a repeater organization is connected with any transmission line.

The invention is best understood by reference to the accompanying drawings, in which Figures 1 and 2 are diagrams illustrating two forms of circuit connections which embody the arrangement of this invention and Fig. 3 is a drawing showing a front view of a repeater switchboard.

Referring to Fig. 1, a two-way two-repeater organization is illustrated comprising two one-way vacuum tube repeaters 1 and 1'. The details of the repeaters themselves need not be described since they are well known to the art, and since further this invention is not limited in its use to any particular type of repeater. The input circuit 2 of repeater 1 is connected through a transformer 3 and an electric wave filter 4 to terminals 5 and 6. Terminal 5 is the common point of two windings 7 and 8 of a six coil transformer 9, terminal 6 is the common point of windings 10 and 11, while the remaining two coils 12 and 13 of said transformer are serially connected by condenser 14 in output circuit 15 of repeater 1'. Terminals 16 and 17 of coils 8 and 11 respectively are connected to tip 18 and ring 19 respectively of a "twin" plug 20. Terminals 21 and 22 of coils 7 and 10 respectively are connected to tip 23 and ring 24 of twin plug 20. Opposed to plug 20 is shown a twin jack 25, comprising a spring 26 adapted to engage tip 18, a spring 27 adapted to engage ring 19, a spring 28 adapted to engage tip 23 and a spring 29 adapted to engage ring 24, springs 26 and 27 forming the terminals of a transmission line L_1 while springs 28 and 29 form the terminals of an artificial line N_1 , adapted to be associated with line L_1 . Jacks 30, 31, 25' and 30' are similar to jack 25 each connecting with a transmission line and an artificial line. Furthermore plug 20' is precisely similar to plug 20, being associated with the windings of a transformer 9', similar and equal to transformer 9. The two halves of the repeater are similar and equal, corresponding elements of the two halves being designated by the same numerals, with and without primes respectively.

Assuming as an illustrative example that it is desired to connect the repeater system between lines L_1 and L_4 for two way transmission, plug 20 is plugged into jack 25 and plug 20' into jack 25', thereby connecting the two halves of the repeater system not only to the lines L_1 and L_4 but also to the appropriate artificial lines N_1 and N_4 . The transmission connections may equally well be made by plugging plug 20 into jack 25', and plug 20' into jack 25 since by the arrangements above described the proper arti-

ficial line is always associated with the transmission line. It will be evident further that any two of the lines may be connected by the repeater system.

5 In certain cases when a group of lines are uniform and have substantially the same impedance characteristics it may not be desirable to limit the use of a particular artificial line to a particular one of said group
10 since it may equally well coöperate with any other of said group of lines. In such case the arrangements of this invention are preferably those illustrated in Fig. 2. Referring to Fig. 2, the repeater organiza-
15 tion there shown is identical with that illustrated in Fig. 1, except for the fact that cords C_L and C_N do not terminate in a common twin plug P but in separate plugs P_L and P_N respectively, an analogous state-
20 ment applying also the cords C_N' and C_L' . Jacks 31, 32, 33, 34, 35, 36, 37 and 38 form the switchboard terminals of a group of lines $L_1, L_2, L_3, L_4, L_5, L_6, L_7$ and L_8 respectively which have substantially the
25 same impedance characteristics while jacks 39, 40, 41, 42, 43 and 44 constitute the terminals of artificial lines N_1, N_2, N_3, N_4, N_5 and N_6 respectively, each of said artificial lines being adapted to coöperate with any
30 one of the group of transmission lines. The artificial lines may be less in number than the lines proper when traffic conditions permit. If now it is desired to connect lines L_1 and L_6 , for example, through repeater
35 R for two-way transmission, plug P_L is inserted in jack 31, and plug P_L' in jack 36. Plug P_N may then be inserted in any one of the six artificial line jacks while plug P_N' may then be inserted in any other of
40 the six artificial line jacks. An advantage of this arrangement resides in the fact that in practice when it is extremely unlikely that all the transmission lines shall simultaneously be connected to repeaters it is un-
45 necessary to provide as many artificial lines as there are transmission lines.

In certain cases occurring in practice certain lines terminating at a switchboard constitute a group having substantially the
50 same impedance characteristics while other lines must each be provided with its own appropriate artificial line. In this case cords C_L and C_N may terminate in a twin plug as shown in Fig. 1 while cords C_L'
55 and C_N' may terminate in separate plugs as shown in Fig. 2. The twin plug P is then adapted for insertion, in a twin jack while plugs P_L' and P_N' may be plugged into the separate line and artificial line jacks
60 of the group of lines. This compromise arrangement will be so clearly understood from the arrangements shown in Figs. 1 and 2 as not to require illustration.

The arrangement of jacks and repeater
65 cords at the switchboard is shown in Fig.

3 which is a drawing of the front view of a three-repeater switchboard. Referring to Fig. 3, a group of transmission lines terminate at the switchboard in line jacks 41 to 55 inclusive. Lines 41 to 45 inclusive
70 are dissimilar and each is therefore provided with its individual artificial line, said artificial lines terminating at the switchboard in jacks 56 to 60 inclusive. Jacks 41 to 45 inclusive are individually multiplied in a
75 row of jacks 61 to 65 inclusive, each of said first mentioned row of jacks being multiplied with the jack immediately below it. The rows of jacks 61 to 65 and 56 to 60 inclusive, constitute a row of twin jacks, and
80 it will be understood that the artificial line of each twin jack is adapted to coöperate with the transmission line of the same twin jack. The transmission lines terminating in jacks 46 to 55 inclusive, have substan-
85 tially the same impedance and each of said lines is adapted to coöperate with any one of a group of artificial lines terminating individually in a row of jacks 66 to 70 in-
90 clusive, said artificial lines being similar and equal. Three repeaters R_1, R_2 and R_3 terminate at the board in cords C_L, C_N, C_L' and C_N' . Cords C_L and C_N of repeater R_1 terminate in a twin plug P while cords
95 C_L' and C_N' of repeater R terminate in a twin plug P' . Cords C_L and C_N of repeater R_2 terminate also in a twin plug P but cords C_L' and C_N' of repeater R_2 terminate in separate plugs. The cords of repeater
100 R_3 all terminate in separate plugs.

As shown in Fig. 3 twin plug P of re-
peater R_1 is plugged into twin jack 56, 61 while plug P' is plugged into twin jack 58, 63. Repeater R_1 therefore connects the
105 lines terminating in line jacks 41 and 43. Plug P of repeater R_2 is plugged into twin jack 60, 65 while cords C_L' and C_N' of re-
peater R_2 are plugged into jacks 52 and 68 respectively. Repeater R_2 therefore connects the lines terminating in jacks
110 45 and 52. Repeater R_3 is shown as idle but it will be understood that it could be used to connect any two of the idle lines. It will be further understood that the
115 switchboard shown in Fig. 3 is simplified to clearly show the features of this invention, and that this invention is not limited to the particular arrangement herein shown, but may be embodied in various other arrange-
120 ments falling within the scope of the ap- pended claims.

What is claimed is:

1. A repeating system comprising a plu-
rality of transmission lines, a plurality of
balancing artificial lines, a repeater and
125 switching means to associate any one of the lines and a balancing artificial line of similar characteristics with the repeater.

2. A repeating system comprising a plu-
rality of transmission lines, a plurality of
130

balancing artificial lines, a plurality of repeaters, and switching means for associating any one of said repeaters with any one of the lines and an artificial line having characteristics similar to the line.

3. A repeating system comprising a plurality of transmission lines, a plurality of artificial lines less in number than the transmission lines, each of said artificial lines having characteristics similar to one or more transmission lines, a repeater and switching means for associating said repeater with a transmission line and an artificial line having similar characteristics.

4. A repeating system comprising a plurality of transmission lines, a plurality of artificial lines less in number than the transmission lines, each of said artificial lines having characteristics similar to one or more transmission lines, a plurality of repeaters, and switching means for associating any repeater with any one of said transmission lines and an artificial line having similar characteristics.

5. A repeater system comprising a plu-

rality of transmission lines, a plurality of balancing artificial lines, a repeater and switching means for simultaneously associating a transmission line and an artificial line of similar characteristics with said repeater.

6. In a repeater system, a transmission line and a balancing artificial line terminating in a twin jack, and a repeater having its line connection and balancing connection terminating in a twin plug, whereby upon inserting the twin plug in the twin jack, the transmission line and artificial line will be simultaneously connected to the repeater circuit.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses, this 27th day of March, 1917.

JOHN F. TOOMEY.
WALTER V. H. READ.

Witnesses:

SAMUEL RASUNSAN,
ALFRED KAUFMANN.