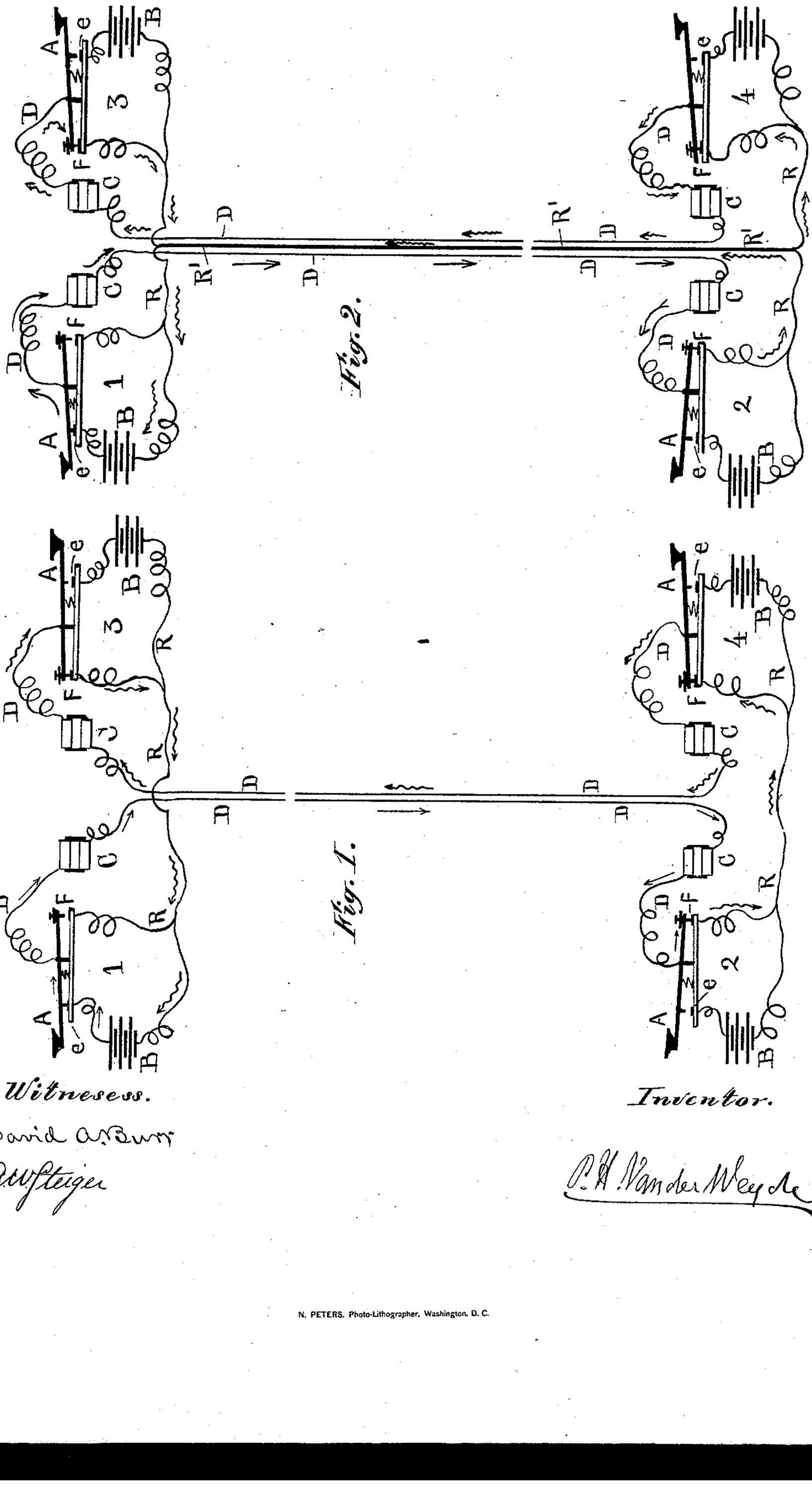
(No Model.) 2 Sheets—Sheet 1.

P. H. VANDER WEYDE.

COMPOUND TELEGRAPH CABLE.

No. 300,034. Patented June 10, 1884.



Witnesess.

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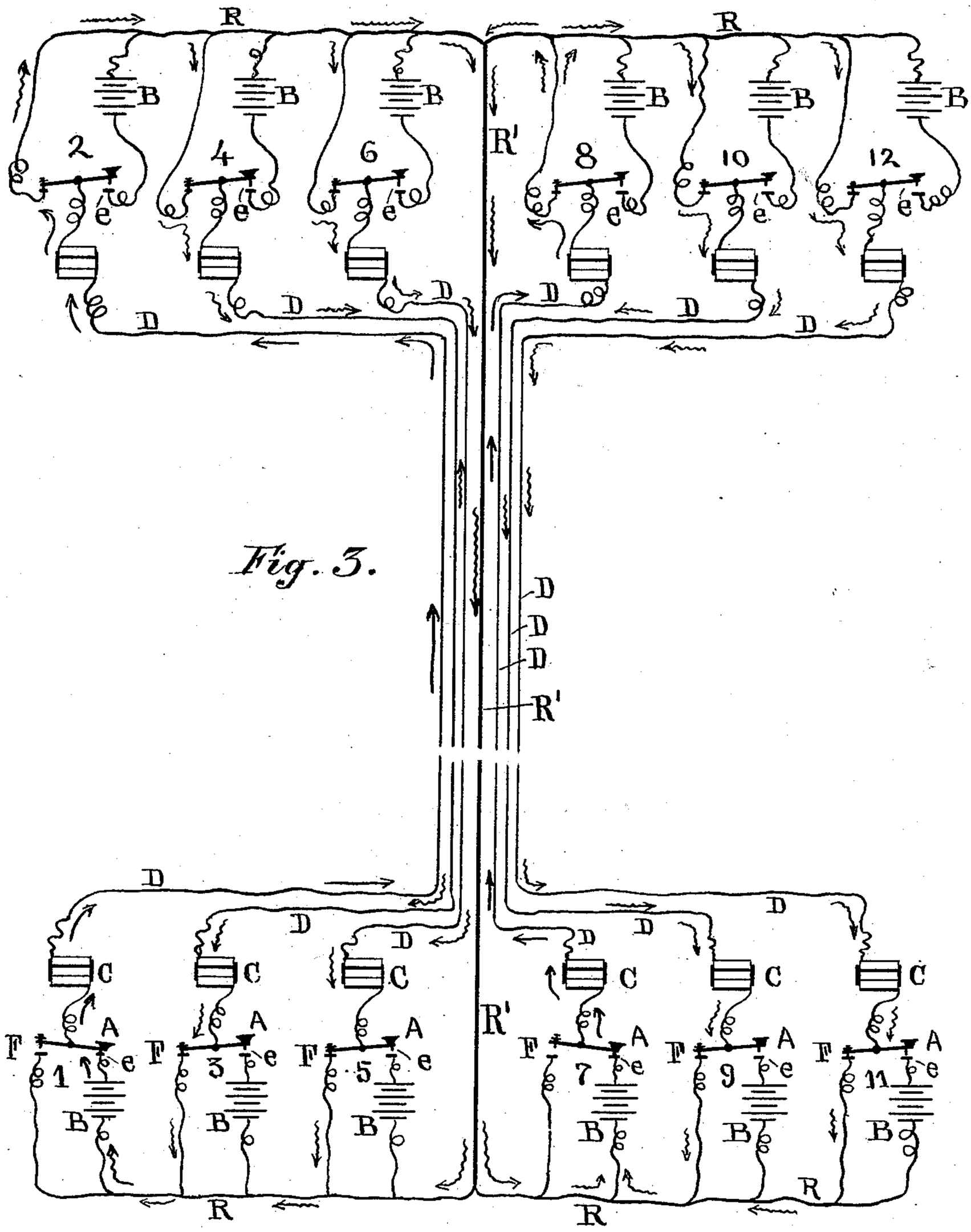

Fig. 3.

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PETER H. VANDER WEYDE, OF BROOKLYN, ASSIGNOR TO THE VANDER WEYDE ELECTRIC COMPANY, OF NEW YORK, N. Y.

COMPOUND TELEGRAPH-CABLE.

SPECIFICATION forming part of Letters Patent No. 300,034, dated June 10, 1884.

Application filed April 14, 1882. (No model.)

To all whom it may concern:

Be it known that I, PETER H. VANDER WEYDE, of the city of Brooklyn and county of Kings and State of New York, have invented a new and useful Improvement in Electric Conductors for Telegraphic and Telephonic Purposes; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, making a part of this specification.

My invention relates to the use of parallel wires or cables for telegraphs, telephones, and the transmission of electric currents generally, and has for its object the prevention of induction in the lines and of disturbances due to atmospheric electricity, the reduction of the static charge therein to a minimum, and the reduction to a minimum of resistance to the return-current in the working-circuits without the disadvantages attendant upon a ground-connection.

My invention consists in the combination of suitable keys or commutators and conductors, substantially in manner as is hereinafter fully described, with any desired number of parallel insulated telegraph or telephone wires, either bound together in a cable or otherwise carried in the same direction side by side, so that while each wire may serve independently as the conductor for a direct electric current in the customary manner, all the remaining wires in the system not at the moment transmitting a direct current shall serve conjointly and independently of any ground-connection as conductors for the return-current, either alone or in combination with an extra auxiliary wire reserved exclusively for the return-current.

My invention consists, likewise, in the combination, with suitable keys or commutators and conductors, and with a system of insulated telegraph or telephone wires, either bound together in a cable or otherwise carried in the same direction side by side, and adapted and arranged to serve as conductors for direct currents, of an auxiliary wire or cable reserved exclusively for the return current or currents, so that while each primary wire may serve independently as the conductor for a direct electric current in the customary manner, the auxiliary wire or wires shall serve independently of any ground-connection, and either alone or conjointly with the remaining wires in the system not at the moment transmitting a direct current, as the conducting medium for the return-current.

In the accompanying drawings, Figure 1 is a diagram illustrating the use and application of my improved telegraphic keys and devices in combination with two independent telegraph-lines, whereby either may be made to serve as a conductor for the return-current from the other independently of the ground. Fig. 2 is a similar diagram illustrating my invention in connection with two independent lines and a single separate return-wire without ground-connections; and Fig. 3 illustrates the more comprehensive application of my invention in connection with a cable of many wires, including an auxiliary return-wire.

A A represent the telegraph-keys, B B the batteries, C C the sounders, and D D the main wires, in use upon the telegraph-lines included in my improved system. The bar of each key A is connected with its line D and sounder C, and its anvil *e* is connected with one pole of the local battery B. An extra contact, F, is provided at the back end of the key, which, when the key is "up" and at rest, connects it constantly with return-wire R. This return-wire R is connected with the opposite pole of the battery of the instrument, and with the return-wires and batteries of all other instruments at its end of the cable or system of parallel lines, and becomes a substitute for the ordinary ground-connections, which are entirely dispensed with.

In the accompanying drawings, which illustrate the working of lines thus connected, the instruments at one end of the cable or system of parallel lines are numbered 1, 3, 5, 7, 9, and 11, and the instruments at the opposite end are designated by the numbers 2, 4, 6, 8, 10, and 12. When the keys are all up in the position in which they automatically assume when not in use, (see the instruments 2, 3, and 4,) a general return-circuit is closed over all the wires, while the batteries B B are all cut out of circuit. If, now, the key A of one of the instruments (see No. 1 or No. 7) is depressed,

the particular line to which it is attached is thereby disconnected from the general return-circuit, while, as the key is brought into contact with its anvil *e*, to which a battery, B, is connected, the line-circuit is closed, and the current from the battery is transmitted through the key to the line and over it to the sounder C of the opposite receiving-instrument 2, (or 8.) The return-current from this sounder will pass through the key-bar 2, and through its back connect at F to the return-wire R, and over said wire to the general circuit, by which it will be transmitted back to the battery at 1 (or 7,) as is indicated by the wavy arrows in the drawings.

It will be seen by reference to said drawings that the return-current will pass from the anvil F of the receiving-instrument 2 through the return-wire R and its connections to the anvil F of each and every key which is up and in back contact with its said anvil, and thence through the key-bar and the accompanying sounder over the line-wire to the sounder and key of the instrument at the other end of the line, and by means of the contact of that key with its anvil, through the same to the return-wire at that end of the line, and so back to the battery of the transmitting-instrument No. 1, to complete its working-circuit. The return-current will thus be conducted back through all the lines not cut out of the general return-circuit by the depression of the key-bar in either of the instruments connected therewith, and hence the greater the number of lines thus connected in one general return system the less will be the resistance to the return-current. Although, for the sake of illustration, two lines are illustrated in the diagram, Fig. 1, as thus connected my invention in this simple form is designed to be used in connection with a comparatively large number of lines, of which but few are likely to be used at the same time, so as to leave always a larger number of lines open to the return-current than of lines in use, and thereby diminish the resistance. Hence the greater the number of lines included in the system the greater its advantages. Where but a small number of wires are included in the system, or where a number of the lines are liable to be brought simultaneously into use with direct currents, I combine therewith a larger auxiliary return-wire, R′, which, by preference, is placed in the center of the cable or system of parallel wires, and connects the same with the return-wires R R of the several instruments at either end of the lines, as shown in Figs. 2 and 3. Where such a direct return-wire is employed, the return-current is divided in its course between it and the remaining wires not in use, as indicated by the wavy arrows in Figs. 2 and 3, and the resistance to the return-current is correspondingly diminished, while the currents passing through the instruments are also to the same extent weakened. The use of the independent return-wire is especially advisable in all telephone systems, owing to the extreme sensitiveness of the telephone-instruments to the influence of even weak currents. It is to be understood from all this that the independent central wire for the return-current may only be omitted with advantage in cables embracing a large number of direct wires, over which no great amount of simultaneous business is likely to occur, as the moment a line is closed for a direct current it is cut out from the general return-circuit, and temporarily lost for use as a return-wire, and the resistance of the general return-circuit is correspondingly increased. If in cables of a small number of wires the return-wire proves at any time insufficient, (which will appear by an action of the return-current upon the instruments,) either one of the remaining wires may be temporarily joined thereto to double its capacity. This, however, will very rarely occur, especially when the cable is connected with intermediate stations which operate to increase the resistance in the direct wires without affecting the resistance in the special return-wire, the instruments being connected with the direct wires while the return-wire is not thus encumbered.

In my improved system, as above described, of connecting the conducting-wires included in a cable, or in a series of parallel wires, with each other and with the line instruments and batteries, whereby the return-current for each line is carried back in close proximity to its direct wire over one or more of the remaining wires in the system, the return-current is made to neutralize the inductive influences which would otherwise be exerted upon the neighboring wires by the direct current or currents running in one direction only, and the disturbing effects of induction which exist in cables and in proximate parallel telegraph and telephone lines as ordinarily constructed are thereby avoided. Moreover, as in this improved anti-induction system the cable is made to contain in itself perfectly-closed circuits, which run with balanced intensities and quantities in opposite directions and without ground-connections, it is evident that no outside inductive influence, however active, can overcome its passivity or neutrality, and the cable will be wholly relieved from the disturbing influences ordinarily arising in the presence of thunder storms or auroral displays, or from earth-currents, while it offers at the same time less resistance than any form of compensated cable heretofore constructed. The static charge in the lines, which, as is well known, is one of the most serious drawbacks to a rapid transmission of telegraphic signals, especially in underground and submarine cables, is greatly reduced in my system, and in fact may be reduced therein to a minimum by simply working one half of the direct wires with the positive and the other half with the negative currents.

The transmission by my invention of the

return-current through many wires, and especially in connection with a wire specially devoted to that purpose, and which may be made very large, affords all the advantages to be found in a ground-connection without its disadvantages. By increasing the number of wires the resistance of the return-current in the cable may be reduced to the minimum of a ground-connection, and in all cases my system, comprising three or more wires, will offer less resistance than will a double wire, whether straight or twisted, in which the resistance of the return-current is equal to that of the direct current, and it will be found even more advantageous when compared with the use of the so-called "solenoid" wires, in which the resistance to the return-current is increased many fold.

I am aware that by means of switches or commutators a return-circuit has heretofore been established for a direct current sent through any one of a series of wires in a telephone system back through the remaining wires of the system independently of the ground.

What I claim as my invention is—

1. The combination, in an electric telegraph or telephone system, with two or more main parallel conducting-wires severally adapted for transmitting direct electric currents, of an auxiliary parallel wire and suitable commutators and conductors adapted to establish from either main wire which may be transmitting a direct current a return-circuit through said auxiliary wire independent of any ground-connection, substantially in the manner and for the purpose herein set forth.

2. The combination, in an electric telegraph or telephone system, with two or more main parallel conducting-wires severally adapted for transmitting direct electric currents, of an auxiliary parallel wire and suitable commutators and conductors adapted to establish from either main wire which may be transmitting a direct current a return-circuit to battery conjointly through said auxiliary wire and the main wires not otherwise in use independently of any ground-connection, substantially in the manner and for the purpose herein set forth.

3. The combination, with an electric telegraph cable or system of parallel line-wires, and with the sounders and batteries for each line in said cable or system, of telegraph-keys, each having its anvil connected electrically with one pole of its appropriate battery and its bar connected in like manner directly with one end of its appropriate line-wire, and each of which is fitted with a back contact adapted to close, when the key is up and the connection with its battery thereby broken, an electrical connection between its bar and the opposite pole of each and every battery, and the back contact of each and every other key at its end of the cable or system, substantially in the manner and for the purpose herein set forth.

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Witnesses:
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GEO. F. RILEY.