J. N. WALLACE.

TELEPHONE SYSTEM.

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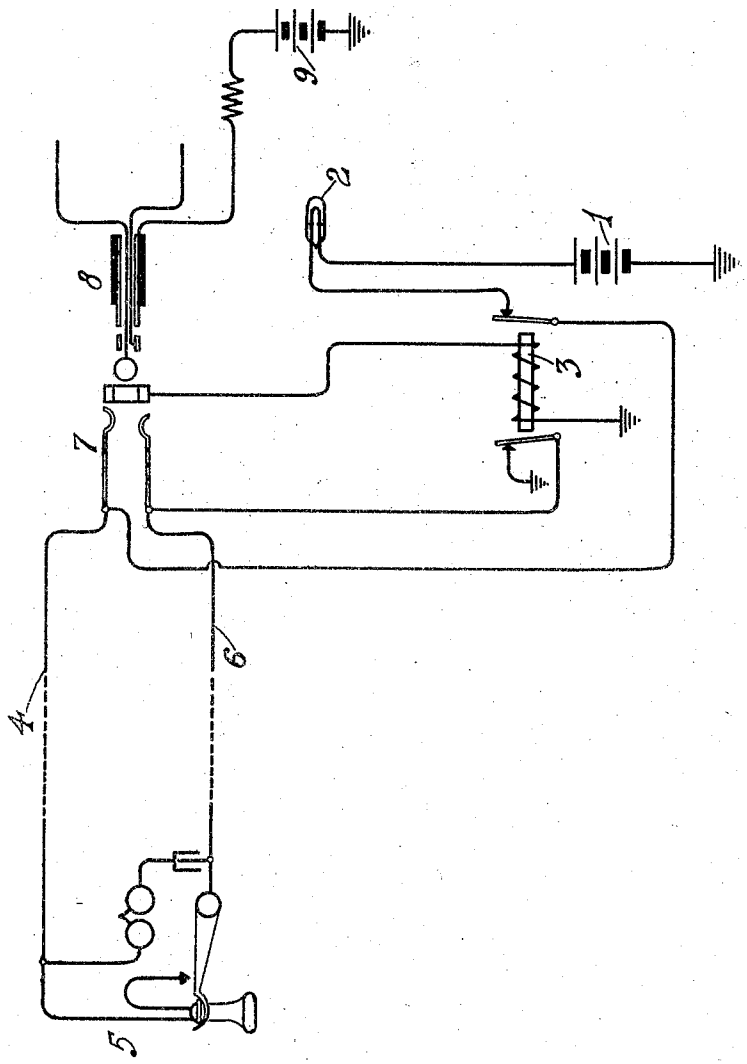
940,994. Patented Nov. 23, 1909.



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UNITED STATES PATENT OFFICE.

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TELEPHONE SYSTEM.

940,994. Specification of Letters Patent. Patented Nov. 23, 1909.

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To all whom it may concern:

Be it known that I, JOHN N. WALLACE, a subject of the King of England, and a resident of La Crosse, county of La Crosse, and State of Wisconsin, have invented a new and useful Improvement in Telephone Systems, of which the following is a specification.

My invention pertains to telephone systems using visual signals of the lamp type, as used in telephone switch boards, and it comprises an improvement in such systems, whereby in my improved system the signal is adapted in itself to respond directly to variant conditions of control which heretofore have required auxiliary or additional parts of apparatus, or such modification of the signaling means as would constitute substantially such additional parts.

When the incandescent lamp was introduced at first into the telephone switchboard as a visual signal for the operator, it was applied by including the helix of a relay in the controlling circuit and relaying the control by means of contacts controlled by the helix, whereby the lamp and contacts and the source of current could be included in a circuit local to the central office, all such circuits being of like resistance and not variable in resistance (when closed) by the external conditions of the main circuit to which the signal pertained, and of which its controlling helix formed a component part. This method of controlling the lamp filament was necessary because the lamps were not adapted to operate successfully when included directly in circuits which might be closed through widely varying series resistances.

The carbon incandescent filament requires for its proper illumination a current which shall fall within rather narrow limits. This current may be produced only by potentials which fall within still narrower limits, since the carbon filament itself manifests the characteristic of a decreasing resistance when subjected to an increasing electromotive force. Furthermore, the variation of the illumination is greater than the variation of the current, and has a still higher ratio to the impressed potential; the carbon filament incandescent lamp included directly in circuits with variable series resistance having widely variable values therefore became an inadvisable application of the device. Particularly was this limitation felt in connection with the carbon filament lamp for use as a line signal where lines approached considerable resistances, because of the possible accidental short-circuiting of the lines within or near the central office, which action would reduce the external line resistance to zero and give to the carbon filament of the lamp substantially the entire potential of the central office source of energy. This resulted in reducing the life of lamps so subjected, very frequently destroying them on the first occasion. In connection with the use of the carbon filament incandescent lamp for signaling purposes in such circuits, so called ballasting in two ways has been resorted to. The first method of ballasting is the inclusion in the circuit with the lamp and adjacent to the lamp, or between the source of potential and the lamp, of a dead resistance so high that the resistance of the external and variable portion of the circuit would become negligible, or would produce at most a maximum current variation in the circuit which would fall within the limitations of the current-carrying capacity of the lamp filament. The objection to this method of ballasting resistance. From 75% to 90% of the total energy used for signaling purposes is required as a ballasting loss in such an arrangement.

The second method of ballasting is to include in series with the carbon lamp a ballasting resistance manifesting to a high degree the characteristic of an increasing resistance when subjected to an increasing electromotive force. Such a ballast offers a reasonably low resistance when in series with its lamp and a high external variable resistance, but offers a higher resistance when the external variable resistance is low, by reason of the higher drop of potential across the ballast under such a condition.

An arrangement of this second method of ballasting comprises merely an iron filament in series with the carbon filament, both preferably in vacuum, in order that the iron filament may attain incandescence without combustion.

In my improved signaling system for telephone exchanges, I provide, in connection with the signaling and switching circuits of the telephone system, an incandescent lamp filament manifesting within itself the characteristic of presenting an increasing resistance to an increasing electromotive force, thereby manifesting within itself the characteristics heretofore obtained only by the conjunction of an incandescent filament and a ballast resistance of the second class, above described. Such an incandescent filament may be formed of tantalum or tungsten, or metals manifesting similar characteristics. The resistance of the lamp in my system of signaling preferably is high, in order that the total variation by control of the external circuit may be a minimum, thereby attaining also the advantages of the first mentioned method of ballasting but without the objectionable loss of energy, since all energy is consumed in the signal lamp.

I illustrate the circuits of my invention in the figure accompanying, showing therein the simplest typical circuits in which my invention may be embodied. It is obvious, that in addition to the line circuit shown, my invention may be applicable to many signaling circuits throughout the exchange installation.

In the figure, a circuit extends from earth through the battery 1 and the metallic filament of lamp 2, thence through contact of relay 3, and through line conductor 4, substation 5, line conductor 6, and remaining contact of relay 3 to earth. It will be seen that the filament of lamp 2 is subjected to currents of minimum strength when the line is in good condition and the receiver at 5 is lifted, and that it is subjected to currents of maximum strength when for any reason the conductors 4 and 6 are connected at a point near the jack 7. The filament of the lamp 2 being a metallic filament, with a positive heat co-efficient, will compensate to some degree by the variation of its own resistance for any variation of the resistance in the conductors of the line.

By insertion of the plug 8 in the jack 7, the battery 9 will find circuit through relay 3, and open the circuit of lamp 2. It will be obvious that a simplification of telephone signal circuits in many instances will be possible by the use of the combination of controlling resistances and a lamp having a positive heat co-efficient in instances other than the one specific case here shown for illustration.

Having thus described my invention, what I claim as new and desire to secure by United States Letters Patent is:

1. In a telephone system, a line circuit containing a metallic filament lamp, and means for opening and closing said line circuit, substantially as described.

2. In a telephone system, a circuit containing a metallic filament lamp and means for opening and closing the circuit, said circuit having variant resistance values when closed, substantially as described.

3. In a telephone system, a battery; a metallic filament lamp; and a telephone line circuit in series therewith, substantially as described.

4. In a telephone system, a line signal comprising a metallic filament lamp connected directly between a source of potential and the switching devices of a line equipment, and included in a circuit with the line conductors, substantially as described.

5. In a telephone system, a line signal comprising a metallic filament lamp included directly in circuit with the line and sub-station equipment, substantially as described.

6. In a telephone system, a circuit containing a lamp having a positive heat coefficient of resistance and means for opening and closing the circuit, said circuit having variant resistance values when closed, substantially as described.

7. In a telephone system, a battery; a signal lamp having a positive coefficient of resistance; and a telephone line; said elements in series, substantially as described.

8. In a telephone system, a line signal comprising a lamp having a positive heat coefficient of resistance and connected directly between a source of potential and the switching devices of a line equipment and included in series in a circuit with the line conductors and substation bridge, substantially as described.

9. In a telephone system, a line signal comprising a signal lamp having a positive heat coefficient of resistance and included directly in circuit with the line and substation equipment, substantially as described.

10. In a telephone system, a plurality of signal lamps, all alike, and having a positive heat coefficient of resistance; a battery; and a plurality of telephone lines to any one of which any one of said lamps may be connected in series with the line and the battery, substantially as described.

11. In a telephone system, a plurality of telephone lines of variant resistances; a plu-

rality of lamps of uniform electrical characteristics and having a positive heat coefficient of resistance; and a battery; said lamps being severally in series with said lines, substantially as described.

12. In a telephone system, a plurality of telephone lines of variant resistances; a plurality of lamps, all similar, and having metallic filaments; and a source of current; each of said lines being in series with one of said lamps and said source, substantially as described.

Signed by me at La Crosse, county of La Crosse and State of Wisconsin, in the presence of the two witnesses.

JOHN N. WALLACE.

Witnesses:
GUST. I. LUNDGREN,
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