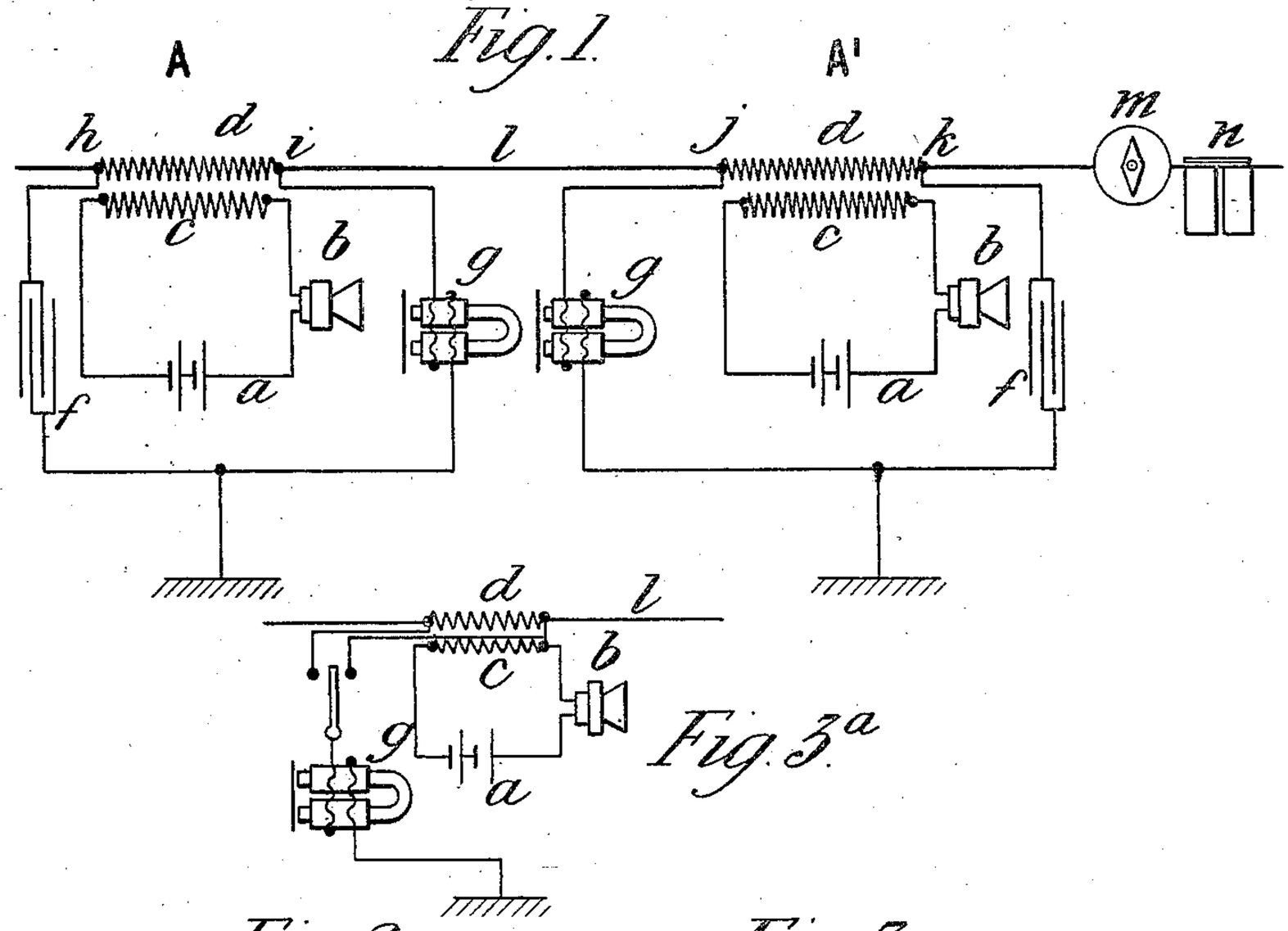
No. 879,643. PATENTED FEB. 18, 1908

C. M. JACOBS & W. J. THORROWGOOD.

# TELEPHONE CIRCUIT.

APPLICATION FILED OCT. 12, 1906.

*Fig. 1.*



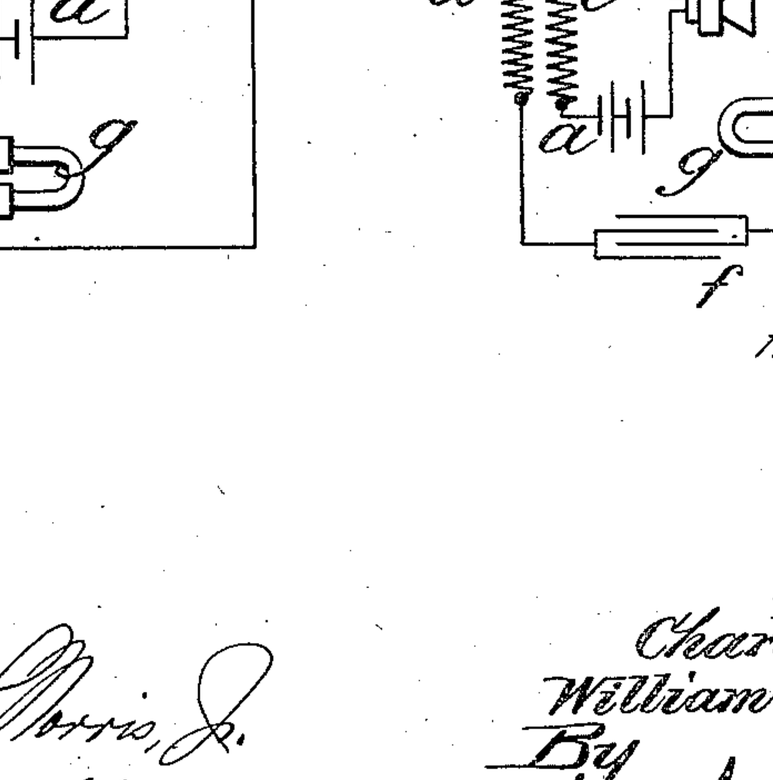




*Fig. 3ª*

*Fig. 2.*

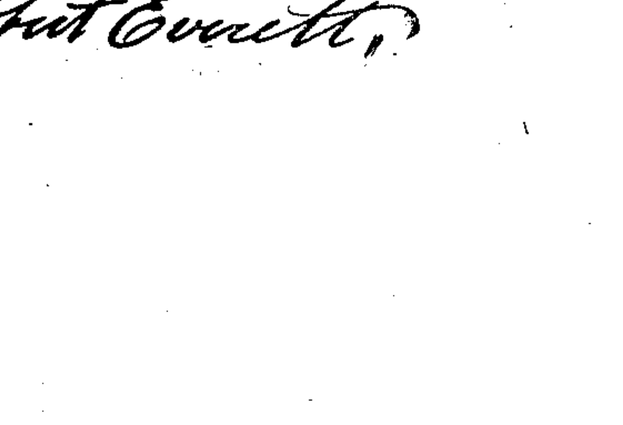
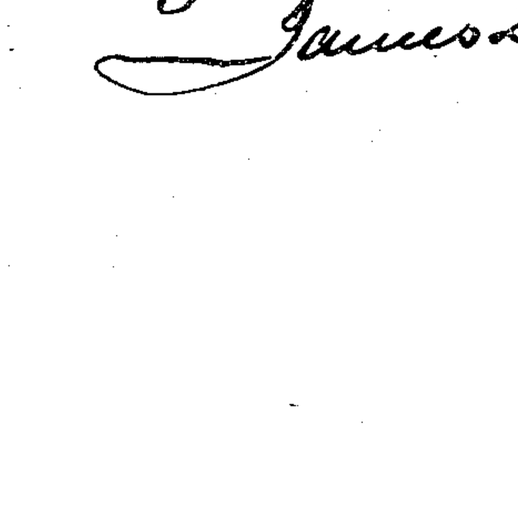



*Fig. 3.*




Witnesses.
James L. Morris, Jr.
Robt Everett,

Inventors.
Charles Mark Jacobs.
William John Thorrowgood.
By James L. Morris.
Atty.

# UNITED STATES PATENT OFFICE.

CHARLES MARKS JACOBS, OF READING, AND WILLIAM JOHN THORROWGOOD, OF WIMBLEDON PARK, ENGLAND.

## TELEPHONE-CIRCUIT.

No. 879,643. Specification of Letters Patent. Patented Feb. 18, 1908.

Application filed October 12, 1906. Serial No. 338,679.

*To all whom it may concern:*

Be it known that we, CHARLES MARK JACOBS, electrical engineer, and WILLIAM JOHN THORROWGOOD, telegraph engineer, both subjects of the King of Great Britain, residing, respectively, at St. Cuthberts, Alexandra Road, Reading, in the county of Berks, England, and 2 Waldemar road, Wimbledon Park, in the county of Surrey, England, have invented certain new and useful Improvements in Telephone-Circuits, of which the following is a specification, (for which we have applied for a patent in Great Britain, dated the 13th January, 1906, No. 997.)

In a known construction a telephone receiver is wound with a phonopore coil, which serves as a condenser of very small capacity, so that when the receiver is used on an unbalanced circuit, the disturbing effect of currents of low frequencies is not perceived in the telephone. In using this telephone receiver it has been connected with its phonopore coil in series with the secondary of the telephone transformer, an arrangement which is disadvantageous in that the resistance of the phonopore coils enfeebles the currents induced in the secondary.

By the present invention the secondary of the telephone transformer and the phonopore winding of the receiver are arranged in parallel, the object being to reduce considerably or to eliminate the effect in the telephone receiver of currents of low frequencies and to insure that the volume of the telephone currents through the telephone receiver shall be a maximum.

The fact that a phonoporically wound telephone receiver does not respond to currents of lower than telephonic frequency is probably due to the fact that such a telephone receiver acts practically as a condenser of small capacity, and on this account it becomes necessary in order to obtain a maximum effect in the receiver with telephonic currents that the terminals of the telephone receiver shall be connected with such points of the circuit as have a maximum difference of potential regarded from the point of view of telephone currents.

The accompanying diagrams illustrate the invention.

Figure 1 shows the arrangement of a two station telephone circuit superimposed on a wire used for telegraphic purposes. Figs. 2 and 3 show alternative arrangements of an intermediate telephone. Fig. 3[a] shows the arrangement of Fig. 1 applied to an intermediate station.

In each of these arrangements *a* is the battery, *b* the transmitter, *c* the primary of the telephone transformer and *d* the secondary of this transformer connected in the line *l*. Referring to Fig. 1 the phonoporically wound receivers of the telephones at stations A and A′ are connected in leak to earth E at the points *i* and *j* of the line *l*. Owing to the self-induction of the secondaries *d* the potential of the telephone currents impressed upon the circuit by means of the primaries *c* and secondaries *d* has an appreciable drop through the latter. The phonoporic receivers *g* being connected in leak to earth at the points *i* and *j* are therefore connected to points of maximum potential so far as concerns telephone currents impressed by means of the primaries *c* and secondaries *d*. The impedance offered to telephone currents by the secondaries *d* being appreciable, while the receivers *g* offer practically no impedance to telephone currents, more of the telephone currents impressed on the circuit at A or A′ will pass through the receivers *g* than through the secondary at A′ or A. The condensers *f*, which have considerable capacity, are connected in leak to earth at the terminals *h* and *k* of the secondaries *d* so that if the line *l* has considerable ohmic resistance or impedance to the left of *h* or the right of *k*, telephone currents can get to earth at the points *h* and *k* and not suffer attenuation through having to traverse the whole length of the telegraphic line *l*.

In the case of an intermediate telephone the receiver may be in leak on the side of the secondary of the telephone which is nearer to the station with which the user is speaking, for convenience, therefore, there may be a receiver on each side of the secondary or the receiver may be provided with a switch for connecting it with either side as shown in Fig. 3[a]. Fig. 2 shows an arrangement whereby one receiver only is sufficient at an intermediate station without a switch being necessary. In this case the terminals of the receiver *g* are connected in shunt across the terminals of the secondary *d*. The impedance to telephone currents being greater through the secondary *d* than through the re-

ceiver *g* more of the telephone currents impressed upon the circuit at other stations will pass through the receiver than through the secondary.

Fig. 3 shows an alternative method of connecting an intermediate telephone with the line; in this case the secondary *d* of the induction coil is not included directly in the line circuit but is connected in leak from line to earth through a condenser, the latter being necessary in order to prevent telegraphic currents from the instruments such as *m*, *n*, in Fig. 1 passing directly to earth at this point. The phonoporic telephone receiver is also connected in leak from line to earth, the two arrangements consequently being in shunt with each other. Although the secondary *d* and condenser *f* are in shunt with the phonoporic telephone receiver *g*, they do not materially affect the volume of the received telephone currents on account of the self induction of the secondary.

Having thus described the nature of this invention and the best means we know of carrying the same into practical effect we claim:

1. In a system for eliminating or reducing the influence of disturbing currents on telephone circuits, the combination of a telephone transformer and a phonoporically wound receiver, the latter being connected across the terminals of the secondary winding of the transformer, the said secondary winding being directly in the line.

2. In a system for eliminating or reducing the influence of disturbing currents on telephone circuits, the combination of a telephone transformer, a phonoporically wound receiver and a condenser, the said receiver and condenser being connected in series with each other across the terminals of the secondary winding of the transformer and having their intermediate point connected with earth.

3. In a system for eliminating or reducing the influence of disturbing currents on telephone circuits, the combination of a telephone transformer, a phonoporically wound receiver and a condenser, the said receiver and condenser being connected in series with each other across the terminals of the secondary winding of the transformer and having their intermediate point connected with earth, and the said secondary winding being connected directly in the line.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

CHARLES MARK JACOBS.
WILLIAM JOHN THORROWGOOD.

Witnesses:
JOSEPH MILLARD,
WALTER J. SKERTEN.