

L. F. HOWARD.

ALTERNATING CURRENT TRANSLATING DEVICE.

APPLICATION FILED APR. 25, 1907. RENEWED NOV. 24, 1909.

960,553.

Patented June 7, 1910.

2 SHEETS—SHEET 1.

Fig. 2

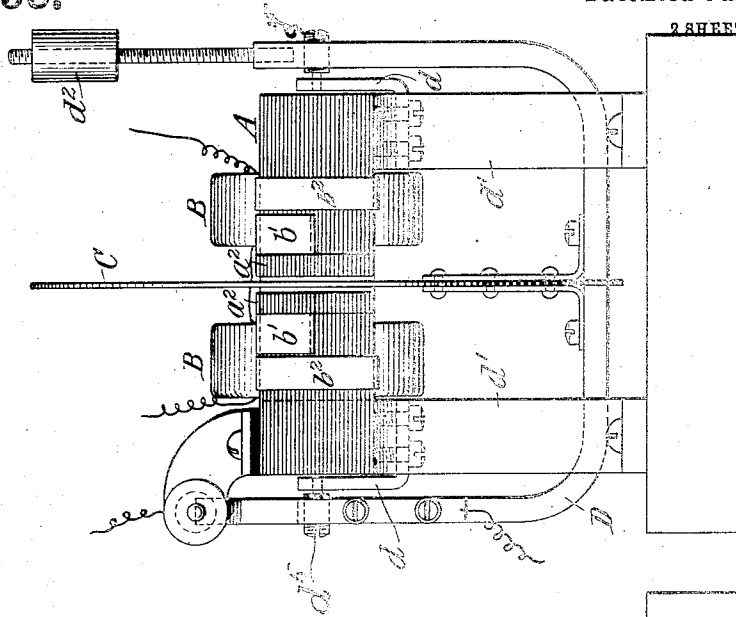
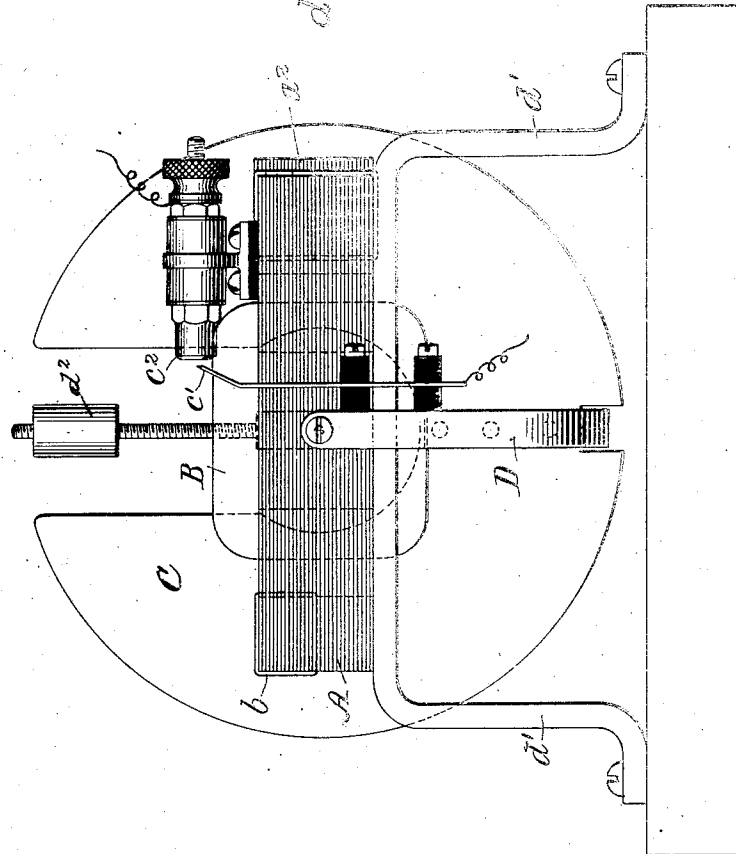


Fig. 1



Witnesses:
Raphael Ketter
R. H. Alderson

Inventor
Lemuel F. Howard
By his Attorney J. E. Egan

L. F. HOWARD.

ALTERNATING CURRENT TRANSLATING DEVICE.

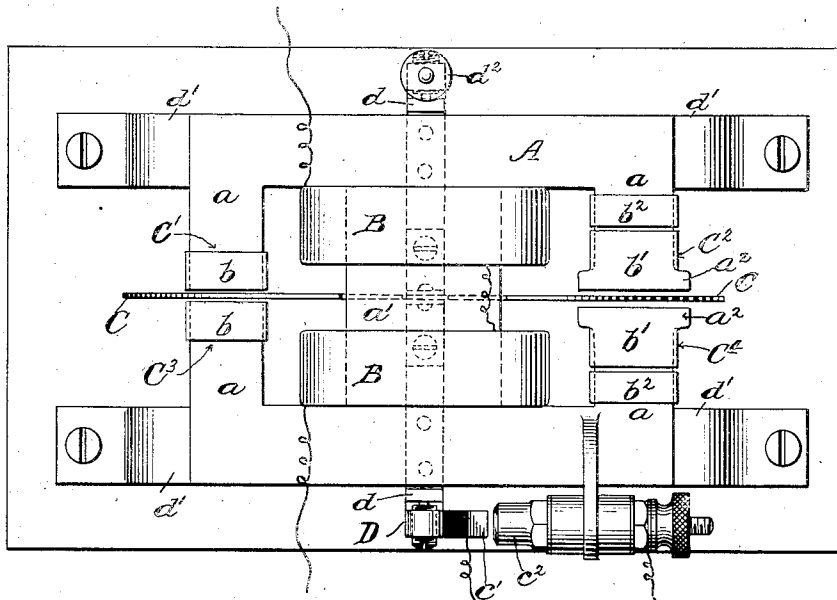
APPLICATION FILED APR. 25, 1907. RENEWED NOV. 24, 1909.

960,553.

Patented June 7, 1910.

2 SHEETS—SHEET 2.

Fig. 3



Witnesses:
Raphael Ketter
R. A. Balderson

Inventor
Lemuel F. Howard
By his Attorney
R. E. Lunn

UNITED STATES PATENT OFFICE.

LEMUEL FREDERIC HOWARD, OF EDGEWOOD PARK, PENNSYLVANIA, ASSIGNOR TO
THE UNION SWITCH AND SIGNAL COMPANY, OF SWISSVALE, PENNSYLVANIA, A
CORPORATION OF PENNSYLVANIA.

ALTERNATING-CURRENT-TRANSLATING DEVICE.

960,553.

Specification of Letters Patent.

Patented June 7, 1910.

Application filed April 25, 1907, Serial No. 370,151. Renewed November 24, 1909. Serial No. 529,813.

To all whom it may concern:

Be it known that I, LEMUEL FREDERIC HOWARD, a citizen of the United States, residing at Edgewood Park, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Alternating - Current - Translating Devices, of which the following is a specification.

My invention relates to alternating current translating devices, for example, relays for use in railway signaling systems, and especially to signaling systems employing alternating signaling current track circuits applied to electric railways wherein the track rails thereof are included in and form part of the return path or circuit for the car propulsion current.

My invention is particularly adapted for electric railways the motor cars of which are propelled by alternating current.

I will describe an alternating current translating device in the form of a relay embodying my invention, and then point out the novel features thereof in claims.

In the accompanying drawings, Figure 1 is a view in side elevation of a relay embodying my invention. Fig. 2 is a top view of the relay of Fig. 1. Fig. 3 is a side elevation of the relay of Fig. 1, but in a different vertical plane.

Similar letters of reference designate corresponding parts in all of the figures.

My invention comprises in an alternating current translating device, (for example a relay) a core having a winding or windings and two sets of poles which act upon a vane by induction to produce opposite or reverse movements of the vane. One set of poles has associated with it suitable means, which when an alternating current of one frequency is traversing the coil produces a turning movement of the vane in one direction. The other set of poles has associated with it suitable means, which when an alternating current of another frequency is traversing the coil, produces a turning movement of the vane in an opposite or reverse direction. When alternating currents of both frequencies are traversing the coil simultaneously the direction of turning movement of the vane is dependent upon which alternating current is dominant in the coil. The vane in its movements is made

to perform any desired work. For example, in a relay the opposite or reverse movements of the vane are availed of to open and close contacts in one or more circuits. The vane is so mounted or has associated with it suitable means to return it to a position to open the contacts when neither of the alternating currents is traversing the coil.

Referring now to Figs. 1 to 3, the relay comprises a core A, an energizing coil or coils B, and a vane or armature C. The core is made of a number of rectangular shaped laminations having what I term two outside legs a , a , and a middle leg a^1 on which the coil or coils B are placed. The outside legs are split to form air gaps and poles C^1 , C^3 and C^2 and C^4 . The end portions of the poles C^2 and C^4 are larger than the end portions of the poles C^1 and C^3 and this may be accomplished by providing lateral extensions a^2 on these poles. With this form of core two magnetic circuits are provided, one through the poles C^1 , C^3 and middle leg a^1 and the other through the poles C^2 , C^4 and middle leg a^1 .

The poles C^1 , C^3 , are split or bifurcated and inclosing the upper portion of the bifurcation of each pole is a closed conductor b , preferably a copper band. The poles C^2 , C^4 , are also split or bifurcated, and a closed conductor b^1 , preferably a copper band, incloses the upper portion of the bifurcation of each pole. A closed conductor b^2 , preferably of copper, also incloses each pole C^2 , C^4 . The coil B, or in the event of there being two coils B in series, are placed on the leg a^1 . This coil or coils are connected with two conductors upon which two alternating currents of different frequencies are impressed, for example, the track rails of a track circuit for a block section. The alternating signaling current is of a relatively high frequency, say 60 cycles, while the alternating propulsion current is of a relatively lower frequency, say 25 cycles.

The vane C as I shall hereinafter designate it, is of aluminum, and formed to extend between the two sets of poles C^1 , C^3 , C^2 , C^4 , and when the coil B is traversed by alternating currents of different frequencies, the vane C moves on its pivot or axis in opposite or reverse directions according to which set of poles produces the strongest turning movement to open and close the con-

tacts c^1 , c^2 . The action of the alternating current to move the vane is on the "shifting magnetic field" principle, which is well understood in the art. The vane C is riveted or otherwise secured in a stirrup D which is trunnioned at its end in non-magnetic brackets d suitably secured to the core A, the core in turn being suitably supported on non-magnetic supports d^1 . The trunnions d^2 constituting the axis or pivot of the vane, are located in a line passing through the axial center of the energizing coil, and preferably they are midway between the two sets of poles. An adjustable counterweight d^2 is provided for the vane, here shown as being secured to the stirrup D, which serves to return and hold the vane C (when no current is flowing in the coil B) in such position as to have the contacts c^1 , c^2 open.

The closed conductors b , b^1 are both on the upper sides or halves of the poles C^1 , C^3 , C^2 , C^4 and on opposite sides of the axis of the vane C, and it will thus be seen that these two sets of poles (C^1 , C^3 , and C^2 , C^4) tend to produce turning movements of the vane in opposite directions when alternating current is flowing in the coil B. I have found by experiment that the poles C^1 and C^3 are relatively more efficient at 60 cycles than at 25 cycles to producing a turning movement of the vane C than are the poles C^2 , C^4 , which are enlarged or have a greater end area than the poles C^1 , C^3 . The closed conductors b , b^1 , air gaps and areas of the poles may be so adjusted that when an alternating current of high frequency, for example, an alternating signaling current of 60 cycles is flowing in the coil B the magnetic leakage in the two magnetic circuits is such that the poles C^1 , C^3 produce the strongest turning movement on the vane C and consequently the vane C moves in one direction to close the contacts c^1 , c^2 , and when an alternating current of 25 cycles is flowing in the coil B, the magnetic leakage in the two circuits is such that the poles C^2 , C^4 , produce the strongest turning movement on the vane C, which is in the opposite or reverse direction of movement produced by the alternating current of 60 cycles, and thus open the contacts c^1 , c^2 . When both frequencies of alternating current are present in the coil B, the resultant action on the vane C will depend on whether one frequency is dominant over the other. The actions hereinbefore ascribed to the relay due to alternating current of different frequencies are independent of the voltage of the alternating currents provided such voltages are below the burning out point of the coil B.

The action of the relay, assuming the different parts, that is, the closed conductors and air gaps are properly proportioned, specifically stated, is as follows: If an alter-

nating current of high frequency (say 60 cycles) should flow through the winding B, the flux produced by the alternating current in the winding has two paths through which it can flow and the greatest amount of flux will flow through the path of least reluctance. The conductors b^2 on the poles C^2 , C^4 , cause more leakage across the poles C^1 , C^3 , than would otherwise occur if they were not present. The electro-motive force induced in these bands with a given flux is proportional to the frequency, that is the higher the frequency the greater will be the electro-motive force. Consequently, a frequency of an alternating current at 60 cycles will produce more electro-motive force in the conductors b^2 than an alternating current of 25 cycles (the frequency generally employed for car propulsion current.) The electro-motive force produces a current which produces an opposing flux, and this opposing flux tends to increase the leakage between the poles C^1 , C^3 , leaving a comparatively smaller amount of flux to pass between the poles C^2 , C^4 . Consequently, at this frequency the poles C^1 , C^3 , will produce the strongest turning movement on the vane C. In the case of a low frequency current traversing the coil B, the opposing flux generated by the conductors b^2 is proportionately less than at the higher frequency, and this opposing flux has less proportional tendency to cause leakage across the poles C^1 , C^3 . Consequently, with this frequency and by reason of the enlargements on the poles C^2 , C^4 , the poles C^2 , C^4 , will produce the strongest turning movement on the vane C.

I have found that in practice the relays described operate substantially as stated and I have given my views as to the explanation of such operation, but I do not desire to be limited to any particular theory of the operation.

I do not make any broad claims herein for the broad invention herein described as such claims are in my co-pending application Serial No. 353,349, filed February 2, 1907.

What I claim as my invention is:

1. A relay comprising an energizing coil adapted at times to be traversed by alternating currents of different frequencies, a core having two magnetic paths each of which includes a set of poles and one set of poles has a larger end area than the other set, a vane within the influence of the flux traversing both of said magnetic paths, and means for causing the two fluxes to exert turning efforts on said vane in opposite directions.

2. A relay comprising a core having two sets of poles, an energizing coil wound on the core and adapted at times to be traversed by alternating currents of different frequencies, a magnetic path for each set of poles of which the core forms a part, a vane mounted on an axis located in a line passing

through the axial center of the energizing coil, said vane being within the influence of the flux traversing both of said magnetic paths, means in each path for causing the flux to exert a turning effort on said vane, and means for causing the flux in one path to predominate at one frequency and for causing the flux in the other path to predominate at a higher frequency, whereby the vane is caused to turn in one direction when alternating current of one frequency traverses said coil, and in the opposite direction when alternating current of a higher frequency traverses said coil.

3. A relay comprising an energizing coil adapted at times to be traversed by alternating currents of different frequencies; a core having two sets of poles; a magnetic path for each set of poles of which the core forms a part; a vane mounted on an axis located in a line passing through the axial center of the energizing coil, said vane being within the influence of the flux traversing both of said magnetic paths; means in each path for causing the flux to exert a turning effort on said vane, and means for causing the flux in one path to predominate at one frequency and for causing the flux in the other path to predominate at a higher frequency, whereby the vane is caused to turn in one direction, when alternating current of one frequency traverses said coil, and in the opposite direction when alternating current of a higher frequency traverses said coil, contacts opened and closed by said vane in its turning movement; and means carried by the vane to have it open the contacts when no current is flowing in the energizing coil.

4. A relay comprising a core having two sets of poles; an energizing coil wound on the core and adapted at times to be traversed

by alternating currents of different frequencies; a magnetic path for each set of poles of which the core forms a part; a vane mounted on an axis located in a line passing through the axial center of the energizing coil, said vane being within the influence of the flux traversing both of said magnetic paths; means for varying the magnetic fluxes in the two magnetic paths at different frequencies, whereby at one frequency the rotative effect on the vane of one set of pole pieces predominates, while at another frequency, the rotative effect on the vane of the other set of pole-pieces predominates.

5. A relay comprising an energizing coil adapted at times to be traversed by alternating currents of different frequencies; a core having two sets of poles; a magnetic path for each set of poles of which the core forms a part; a vane mounted on an axis located in a line passing through the axial center of the energizing coil, said vane being within the influence of the flux traversing both of said magnetic paths; means for varying the magnetic fluxes in the two magnetic paths at different frequencies, whereby at one frequency the rotative effect on the vane of one set of pole pieces predominates, while at another frequency the rotative effect on the vane of the other set of pole pieces predominates, contacts opened and closed by said vane in its turning movements and means carried by the vane to have it open the contacts when no current is flowing in the energizing coil.

In testimony whereof I have signed my name to this specification in the presence of two subscribed witnesses.

LEMUEL FREDERIC HOWARD.

Witnesses:

A. HERMAN WEGNER,
H. A. HAMILTON.