

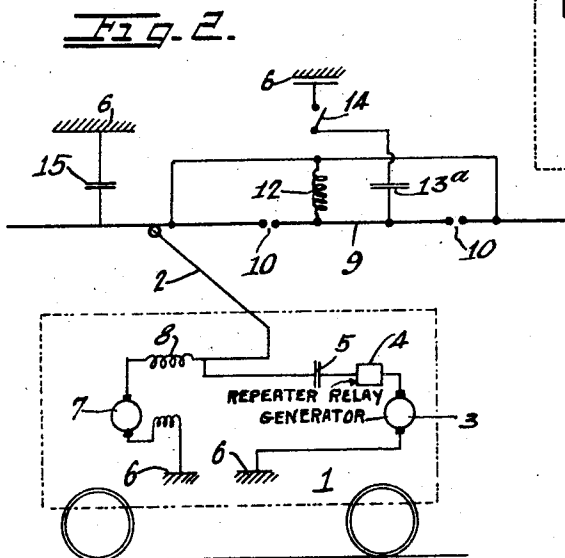
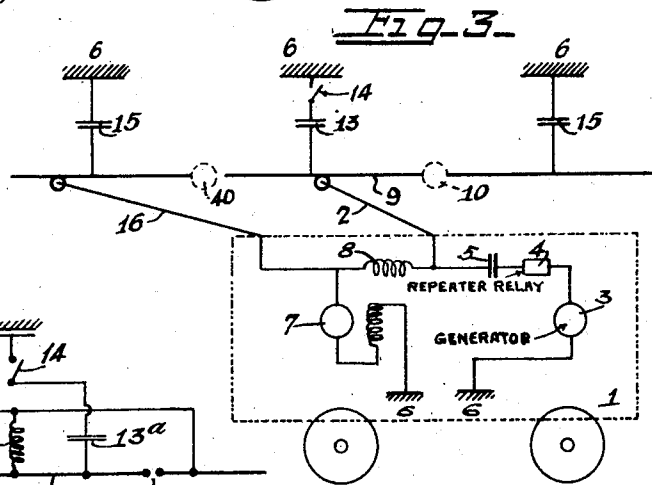
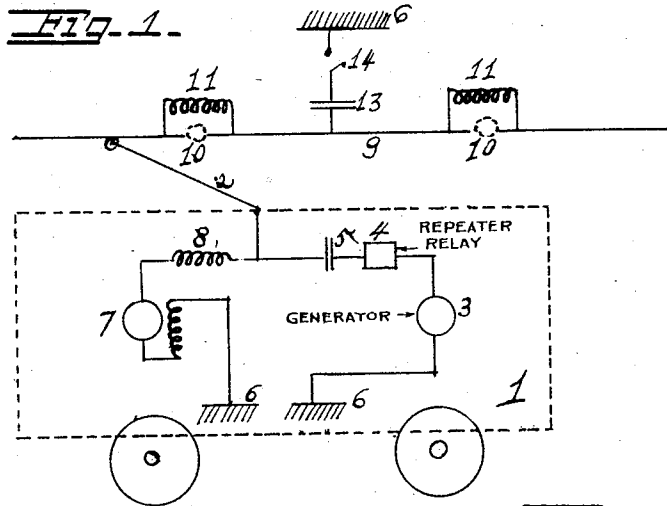
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J. BETHENOD

ELECTRIC RAILWAY SIGNAL REPEATING SYSTEM

Filed March 30, 1921



INVENTOR.

BY

Joseph Bethenod
Lehigh Valley
ATTORNEY.

UNITED STATES PATENT OFFICE.

JOSEPH BETHENOD, OF PARIS, FRANCE.

ELECTRIC-RAILWAY SIGNAL-REPEATING SYSTEM.

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(GRANTED UNDER THE PROVISIONS OF THE ACT OF MARCH 3, 1921, 41 STAT. L., 1313.)

To all whom it may concern:

Be it known that I, JOSEPH BETHENOD, citizen of the Republic of France, residing at 79 Boulevard Haussmann, Paris, in the Republic of France, have invented certain new and useful Improvements in Electric-Railway Signal-Repeating System (for which I have filed application in France, Feb. 24, 1920, Patent No. 523,980; France, May 6, 1920, Patent No. 23,728; Germany, Feb. 23, 1921, Patent No. 346,713; Great Britain, Feb. 23, 1921, Patent No. 159,471; Italy, Feb. 15, 1921; Spain, Feb. 24, 1921, Patent No. 77,208; Sweden, Feb. 19, 1921, Patent No. 55,035; Switzerland, Feb. 13, 1921, Patent No. 96,284; and in Norway, Feb. 26, 1921, Patent No. 36,126), of which the following is a specification.

My invention relates to a system for the repetition of track signals on electrically equipped railways. The main feature of the invention is the absence, either of any additional fixed track contact, or of any equivalent inductive apparatus, for the purpose of insuring connection between the instruments situated along the track and those carried on the car or locomotive.

My invention is, for the purpose of clearness, disclosed in the accompanying drawings, in which:

Fig. 1 is a general schematic diagram of the invention, and

Figs. 2 and 3 are schematic diagrams of particular forms of the same invention.

The invention, see Fig. 1, consists essentially, for each place where a signal is to be repeated, in isolating, at two points 10, 10, a suitable portion 9 of the trolley wire, third rail, or other conductor, by means of two insulators of any suitable type, as indicated in the drawings. In order that the normal flow of current may not be interrupted by such insulation of a part of the conductor, each insulator may be shunted by a suitable choke-coil whose impedance must be negligible as far as the low frequency current used for propulsion is concerned. The insulated portion 9 can further, by means of a special switch 14, be connected to, or disconnected from, the ground or track rails through condenser 13, which offers only a negligible reactance for a given

frequency appreciably higher than that of the propulsion current, this being characteristic of the current employed for signalling. For the purpose of generating the higher frequency current there will be located on the railway car or locomotive an alternator (or magneto) of a suitable frequency whose terminals are connected, either directly or through a transformer, one end to the iron frame work and wheels of the car or locomotive, and the other end to a sliding or rolling contactor of any type, which serves also, in the case of an electrically propelled train or car to bring in the propulsion current. A special block condenser is inserted in this alternator circuit in order to prevent the propulsion current from flowing therethrough. As long as the contactor is on a non-insulated part of the conductor, the relatively high frequency alternator current cannot flow through the propulsion motors, lighting circuit etc., as every circuit not belonging to the signalling system is provided, where necessary, with choking coils, as indicated by 8, whose impedance is very high as far as the signalling frequency is concerned.

When, on the contrary, the contactor is passing over an insulated section, if at the same moment the corresponding switch 14 (which is controlled by the signalling arm) is closed, the alternator current will flow through condenser 13, and repeater relay 4, inserted in series with alternator 3, will come into action.

Another example of my invention is given in Fig. 2, where, as in the preceding case, the car or locomotive 1 derives current from the conductor by means of contactor 2, which may be of any type. The relatively high frequency signalling alternator 3 is inserted in series with relay 4 designed to work with a minimum amount of current, and one of the terminals of said system is connected to contactor 2, the other terminal being earthed on the car or locomotive frame-work 6.

Any appreciable diversion of the signalling current into the traction circuit is prevented by inserting choke coil 8 between contactor 2 and the traction circuit within the car or locomotive. At places where the

necessary signal is to be repeated on the car or locomotive a suitable section 9 of the conductor is insulated from the remaining portions of the conductor, the continuity of the circuit being effected through shunt 11, and said section 9 being connected to said circuit by choke coil 12, whose impedance is very high as regards the signalling frequency.

As long as contactor 2 is on a non-insulated portion of the conductor, relay 4 continues to be excited by alternator 3, under the necessary condition that the total impedance of the whole propulsion circuit, as measured across contactor 2 and the framework grounding 6, be negligible in comparison with that of the signalling unit 3, 4, 5. When, on the contrary, contactor 2 is passing along the insulated section 9 the current flowing through relay 4 is greatly reduced, if the impedance of choke coil 12 be sufficiently high, and relay 4 will then come into operation by reason of the reduction in the current supplied thereto, the relay being especially constructed to operate on this principle. In any case where the signal need not be repeated on passing a given section 9, a special condenser 13^a will serve as a connection between said section 9 and the common ground 6, by means of switch 14 controlled, for example, by the signalling arm (not shown). The signalling circuit will then be closed, the current following the path 4, 5, 2, 9, 13^a, 14, and 6, and relay 4 will remain excited even when passing over section 9. No signal will be repeated.

Special condensers 15 may be, if necessary, permanently connected across the non-insulated portions of the conductor and the track rails or ground, in order to lower the impedance of the traction circuit with regard to the signalling frequency. Condensers 5 and 13^a serve to prevent the propulsion current from flowing into the various signalling circuits. However, condenser 13^a can be dispensed with if switch 14 is connected, for example, to shunt 11, instead of being connected directly to the ground 6.

In cases where the propulsion current is conducted to the car or locomotive by means of two contactors, at a distance apart sufficient to prevent both contactors passing simultaneously over section 9, as shown on Fig. 3, the choke coil 12 may be omitted. Contactor 2 is then dead with regard to the propulsion current, during its passage over section 9. As to the signalling current, it will be either interrupted or not, according to whether switch 14 is open or closed. One of the advantages of this example is that choke coil 8 is never traversed by propulsion current when contactor 2 passes over section 9; consequently choke coil 8 is not subjected to any saturation effect from the propulsion current, during the time when

its presence is needed to prevent the alternating signalling current from being diverted through part 7 of the traction circuit. It is obvious that the second contactor 16 supplies current to 7 directly, that is without any current passing through choke coil 8. Particularly in cases where the propulsion current is furnished by means of a side third rail, with the above arrangement, the section of rail which constitutes section 9 can be located on the side of the track opposite to that occupied by said third rail. This implies, of course, that the car or locomotive is provided with four contactors, or shoes, (two on each side) so that, when a shoe leaves the third rail at the gap the corresponding shoe on the other side makes contact with the insulated rail section, etc. Moreover, these four contactors, or shoes, will insure, by means of an additional rail section located on the same side as section 9, the supply of propulsion current at all times, by two shoes at least, even during their passage across the gap.

It is evident that, in all cases, the structure of the choke coils is a matter of choice and determination and that means can be provided (magnetic core gap, combination of magnetic circuits, etc.) so as to limit the saturation resulting from the propulsion current, in cases where iron-cores are used. Besides, condenser 13 may be inserted in series with an inductance so as to lower the total impedance (resonating shunt) and also, across each choke coil, a condenser may be connected to increase the high frequency impedance (resonance stopper) etc. Finally, any alternating current source of a sufficiently high frequency can be substituted for the relatively high frequency alternator.

Having thus described my invention, I claim:

1. In a signal repeating system; a propulsion current conductor provided with insulated sections having grounded connections at signal repeating points; a repeater relay located on the vehicle; a source of alternating current of a relatively higher frequency than the propulsion current; and a branch circuit in which are included the said relay, the source of higher frequency current, and a condenser of high impedance for the propulsion current frequency between the said insulated sections and the ground.

2. In a signal repeating system; a propulsion current conductor provided with insulated sections having grounded connections at signal repeating points; a repeater relay located on the vehicle; a source of alternating current of a relatively higher frequency than the propulsion current; a branch circuit in which are included the said relay, the source of higher frequency

current and a condenser of high impedance for the propulsion current frequency; a contactor through which the branch circuit is connected with the propulsion current conductor; and choke coils with relatively greater impedance with regard to the signalling current frequency than with regard to the propulsion current frequency, and located between the said insulated sections and the other portions of the propulsion current conductor. 10

In testimony whereof I affix my signature.

JOSEPH BETHENOD.