Aug. 13, 1940. H. A. THOMPSON 2,211,181

APPARATUS FOR DECREASING RAIL CONTACT RESISTANCE

Original Filed Aug. 16, 1932

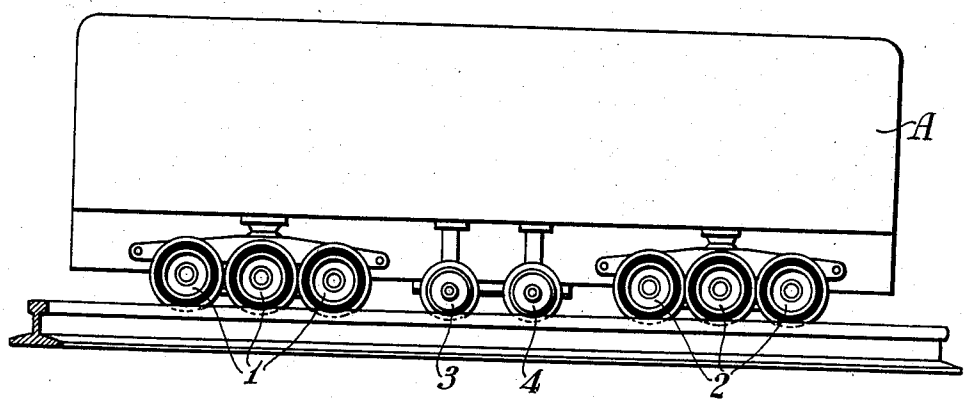


Fig. 1

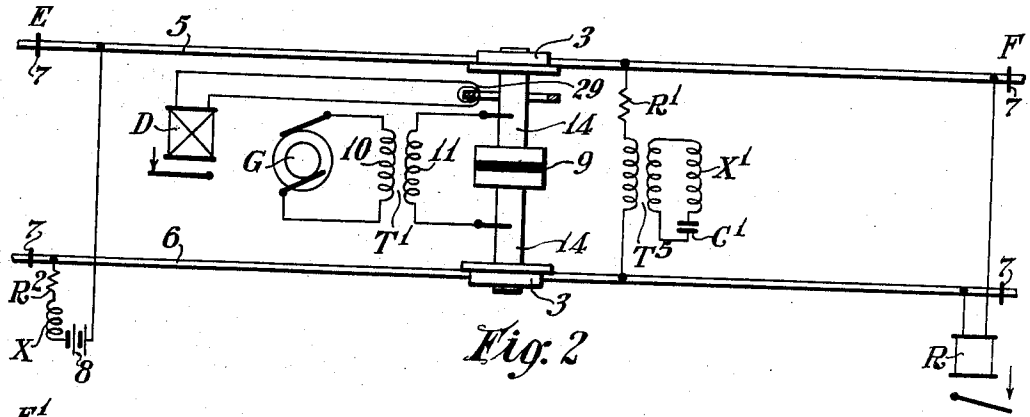


Fig. 2

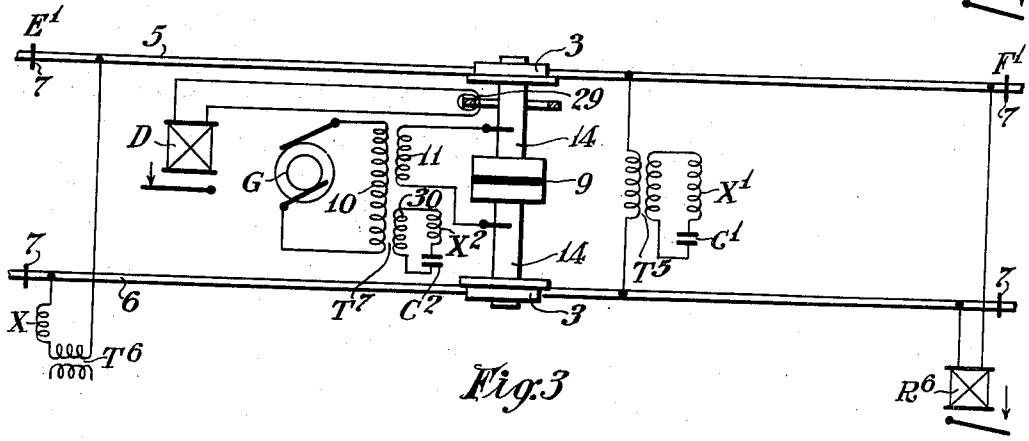


Fig. 3

INVENTOR
Howard A. Thompson.
BY
His ATTORNEY

Patented Aug. 13, 1940 2,211,181

UNITED STATES PATENT OFFICE

2,211,181

APPARATUS FOR DECREASING RAIL CONTACT RESISTANCE

Howard A. Thompson, Edgewood, Pa., assignor to The Union Switch & Signal Company, Swissvale, Pa., a corporation of Pennsylvania

Original application August 16, 1932, Serial No. 629,030. Divided and this application May 17, 1939, Serial No. 274,281

11 Claims. (Cl. 246—34)

My invention relates to apparatus for decreasing rail contact resistance, and more specifically to apparatus for improving track circuit shunting by light weight rail vehicles.

I will describe two forms of apparatus for decreasing rail contact resistance embodying my invention, and will then point out the novel features thereof in claims.

The present application is a division of my copending application Serial No. 629,030 filed on August 16, 1932, for Apparatus for decreasing rail contact resistance.

In the accompanying drawing, Fig. 1 shows in elevation a rail vehicle equipped with apparatus embodying my invention. Fig. 2 is a diagrammatic view showing one form of apparatus for decreasing rail contact resistance embodying my invention and applicable to either direct or alternating current track circuits. Fig. 3 is a diagrammatic view showing a modified form of the apparatus of Fig. 2, also embodying my invention.

Similar reference characters refer to similar parts in each of the several views.

It is well known that a bright rail surface having low contact resistance initially, if exposed to atmospheric conditions for a period of time will usually have a film of appreciable resistance formed thereon. Where heavy rolling stock of the usual type is used, the weight effective upon the wheels of a rail vehicle is ordinarily sufficient to crush or destroy this high resistance film thereby making it possible to shunt the track circuit through the medium of the wheels and axles of the vehicle. If, however, a light weight rail vehicle such, for example, as the gas electric car used upon some railroads, is employed, some difficulty is frequently experienced in obtaining satisfactory shunting because of the inability of the wheels of such a car to penetrate through the insulating film upon the rail surface. Furthermore, if the wheels of a car are equipped with pneumatic tires, special means must be provided for shunting the track circuit. My invention is of particular utility in the provision of shunting protection by a car having wheels which do not make electrical contact with the rail surface and can be applied as well to a steel-wheeled car of insufficient weight for satisfactory shunting, or to a heavy car of the ordinary type operating over track circuits the rails of which have abnormally high contact resistance.

Referring to Fig. 1 of the drawing, the reference character A designates a rail vehicle in which the sets of wheels 1 and 2 have rubber tires, therefore making no electrical contact with the rails. One way in which I accomplish the purpose of my invention is by adding a pair of wheels such as 3 or 4 in a manner which will be more clearly understood in connection with the description of Figs. 2 and 3. Only one such pair of wheels is required for carrying out the purpose of my invention.

In Fig. 2 of the drawing, I have shown a stretch of railway track divided into block sections by means of insulated joints 7, one such section E—F being illustrated. Connected across the rails at one end of the section E—F is a battery 8 which supplies energy to a track relay R connected across the rails at the other end of the section, in the usual manner. Connected in series with the battery 8 is the usual current limiting resistor R^2, as well as a reactor X, the purpose of which will be explained hereinafter. Insulated from the body of the car A is a pair of auxiliary wheels 3 which make electrical contact with the rails 5 and 6, the wheels of this pair being insulated from one another by an insulating block 9.

The reference character G designates an alternating current generator arranged to be carried upon car A, the output of this generator being connected across one winding 10 of a transformer T^1. The secondary winding 11 of transformer T^1 is connected by suitable contacts to each half of the axle 14, whereby a potential from generator G may be impressed across the rails 5 and 6. Transformer T^1 is designed to have a high leakage reactance so that a comparatively high voltage will be applied to the wheels 3 until a flow of current is established through the rail path.

In order to provide a low impedance return path for the film breakdown current from winding 11, a resonant shunt is connected across the rails 5 and 6. This resonant shunt is of the usual type and comprises a transformer T^5 the secondary winding of which is closed through a reactor X^1 and condenser C^1 in series, the parts being so proportioned as to provide a low impedance path through the primary winding at the frequency of generator G. The purpose of resistor R^1 is to limit the current drain on battery 8 when section E—F is unoccupied. As shown, the resonant shunt is part of the wayside equipment; it can, however, be carried by the rail vehicle, connection to the rails being made by movable contacts. In the latter case, resistor R^1 may be omitted.

Assuming that the car occupies section E—F, a portion of the current delivered by winding 11 will flow through the ballast resistance, battery 8, and relay R, the remainder flowing through the resonant shunt. However, all of this current will flow between wheels 3 and the rails, breaking down the rail contact resistance to provide effective shunting of relay R. The detecting relay D is energized from a winding 29 of the axle transformer type and provides an indication that the rail contact resistance has been broken down.

I shall now explain the manner in which the above apparatus functions to provide improved shunting protection. The potential applied to wheels 3 by winding 11 of transformer T^1 is adjusted to a value sufficient to break down the insulating film which may exist upon the rail surface. When this film is broken down, a low value of rail contact resistance will become established between wheels 3 and the rails, so that relay R will become released through the medium of the shunt formed by wheels 3 and winding 11, as aided by the resonant shunt T^5. Winding 11 of transformer T^1 is constructed of heavy wire for the purpose of providing low shunting resistance from rail 5 to rail 6. Reactor X and resistor R^2 in series with battery 8 are useful in preventing an appreciable portion of the current supplied by winding 11 from being by-passed through the path formed by battery 8 and its track connections.

As long as the system is functioning properly, relay D will remain energized to provide an indication that the rail film has been broken down. Relay D may also be used to perform any other desired function such as applying the brakes on the car in case the apparatus ceases to function, or applying any other auxiliary shunt to the track circuit.

Where direct current track circuits are used, the generator G should be of the alternating current type in order that false energization of relay R may not result. If alternating current track circuits are used, the frequency of the current supplied by generator G should be sufficiently different from the track circuit frequency to prevent false operation of the track relay.

The wheels 3 may rest on the rails due to their own weight or, if desired, the weight may be increased in any suitable manner, or they may be held against the rails by auxiliary springs or by air pressure. Although I have shown the current from winding 11 conducted to rails 5 and 6 by means of the wheels 3, it will be understood that my invention is not limited to this particular arrangement, as any method for conducting the current into rails 5 and 6 such, for example, as by means of contact shoes or brushes can be used to produce a similar result. Also, in certain cases such, for example, as where alternating current track circuits are used, direct current from a suitable car carried generator can be applied to the two halves of axle 14 for breaking down the rail film.

If preferred, relay D may be connected in series with winding 11 of transformer T^1 rather than to an axle transformer winding. Furthermore, if it is desired to eliminate the contact resistance of the brushes which conduct current from the secondary winding 11 of transformer T^1 into the axle 14, transformer T^1 can be rigidly fastened to axle 14 for rotation therewith, slip rings being used to admit current from generator G into the primary winding 10. By applying a sufficiently high value of potential to the rail surface, the apparatus can also be used for breaking down an insulating film of appreciable thickness, such as an ice layer for example.

Referring to Fig. 3, the apparatus shown therein is particularly applicable to alternating current track circuits, and is similar to the apparatus of Fig. 2, except for the use of a third winding 30 on transformer T^7. Winding 30 is connected for consonance with winding 11, through a reactor X^2 and condenser C^2, the constants of which are so chosen that resonance is produced in winding 11 at the frequency of the track circuit current supplied by track transformer T^6. It will now be apparent that when the car enters section E^1—F^1, a maximum value of the auxiliary film break-down current will flow through transformer T^5 which is resonated to the frequency of generator G, and a minimum impedance of winding 11 for shunting the track relay will result because transformer T^7 is resonated to the track circuit frequency.

Where it is desired to obtain fouling protection, the rail contact apparatus may be duplicated at each end of the car being placed as near to the end of the car as practicable, for greatest protection, in order that the track circuit will be shunted when any portion of the car stands thereon.

It will be understood that the apparatus embodying my invention is not necessarily limited to the provision of decreased contact resistance in track shunting circuits, as this apparatus can be used equally well for breaking down the resistance film between a pair of contact members which may be included in any one of a large number of circuits having insufficient voltage or current to cause a break-down of the contact surface resistance film.

Although I have herein shown and described only two forms of apparatus for decreasing rail contact resistance embodying my invention, it is understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

1. In combination with a rail vehicle and a stretch of railway track, a source of alternating current on the vehicle, an impedance connected between the rails of said track and comprising a reactor and a condenser adjusted for series resonance at the frequency of said source, a pair of rail contacts one for each rail and carried by the vehicle, and means for applying a sufficient potential from said source across said rail contacts whereby a current will flow over a path which includes a portion of each rail and said impedance thereby breaking down the resistance of the rail surface to improve shunting of said track by said rail contacts.

2. In combination with a rail vehicle and a stretch of railway track, a source of alternating current on the vehicle, a transformer having the primary winding connected between the rails of said track and having the circuit of the secondary winding adjusted for consonance with said primary winding at the frequency of said source, a pair of rail contacts one for each rail and carried by the vehicle, and means for applying a sufficient potential from said source across said rail contacts whereby a current will flow over a path which includes a portion of each rail and said primary winding thereby breaking down the

resistance of the rail surface to improve shunting of said track by said rail contacts.

3. In combination with a rail vehicle and a stretch of railway track forming a track circuit section, a first source of alternating current track circuit energy and a track relay for said section, a second source of alternating current on the vehicle of a frequency substantially different from the frequency of said first source, a first resonant shunt connected between the rails of said section, said shunt being adjusted for minimum impedance at the frequency of said second source, a pair of rail contacts one for each rail and carried by the vehicle, a second resonant shunt carried by the vehicle and having its terminals connected across said rail contacts, said second shunt being adjusted for minimum impedance at the frequency of said first source, and means for applying a sufficient potential from said second source across the terminals of said second shunt whereby a current will flow over a path which includes a portion of each rail and said first shunt thereby breaking down the resistance of the rail surface to improve shunting of said track section by said second shunt.

4. In combination with a stretch of railway track and a rail vehicle thereon, a source of current on the vehicle, a circuit for applying a sufficient potential from said source across the two rails of said track for breaking down the resistance film on the rail surface, a source of periodic track circuit current connected across said rails, and means for causing an increased flow of current from said track circuit source through said potential applying circuit to thereby aid in maintaining the low resistance of said rail film as an aid to shunting of said track by said vehicle.

5. In combination with a stretch of railway track and a rail vehicle thereon, a source of current on the vehicle, a circuit for applying a sufficient potential from said source across the two rails of said track for breaking down the resistance film on the rail surface, a source of periodic track circuit current connected across said rails, and means including a tuned circuit for causing an increased flow of current from said track circuit source through said potential applying circuit to thereby aid in maintaining the low resistance of said rail film as an aid to shunting of said track by said vehicle.

6. In combination with a stretch of railway track and a rail vehicle thereon, a source of current on the vehicle, a circuit for applying a sufficient potential from said source across the two rails of said track for breaking down the resistance film on the rail surface, a source of periodic track circuit current connected across said rails, and means including a reactance device for causing an increased flow of current from said track circuit source through said potential applying circuit to thereby aid in maintaining the low resistance of said rail film as an aid to shunting of said track by said vehicle.

7. In combination with a stretch of railway track and a rail vehicle thereon, a source of periodic current on the vehicle, a circuit for applying a sufficient potential from said source across the two rails of said track for breaking down the resistance film on the rail surface, a source of track circuit current connected across said rails, a track relay energized from said track circuit source, and a circuit tuned to the frequency of said periodic source connected across the rails of said track for causing an increased flow of current from said periodic source through said potential applying circuit to thereby aid in maintaining the low resistance of said rail film as an aid to shunting of said track relay by said vehicle.

8. In combination with a stretch of railway track and a rail vehicle thereon, a source of periodic current on the vehicle, a circuit for applying a sufficient potential from said source across the two rails of said track for breaking down the resistance film on the rail surface, a source of track circuit current connected across said rails, a track relay energized from said track circuit source, a circuit tuned to the frequency of said periodic source connected across the rails of said track for causing an increased flow of current from said periodic source through said potential applying circuit to thereby aid in maintaining the low resistance of said rail film as an aid to shunting of said track relay by said vehicle, and an indicator responsive to said increased flow of current.

9. In combination with a stretch of railway track and a rail vehicle thereon, a source of current on the vehicle, a circuit for applying a sufficient potential from said source across the two rails of said track for breaking down the resistance film on the rail surface, a source of periodic track circuit current connected across said rails, and means for resonating said potential applying circuit at the frequency of said periodic current for causing an increased flow of current from said periodic source through said potential applying circuit to thereby aid in maintaining the low resistance of said rail film as an aid to shunting of said track by said vehicle.

10. In combination with a rail vehicle and a stretch of railway track, a source of varying current in the trackway, a resonant track shunt carried by the vehicle and connected across the rails of said track, a source of current on the vehicle, and means for applying a sufficient rail film break-down potential from said vehicle source to the rails of said track, whereby a track shunting path of relatively low impedance to the flow of current from said trackway source is established through said resonant track shunt.

11. In combination with a rail vehicle and a stretch of railway track, a source of alternating current in the trackway, a resonant track shunt on the vehicle connected across the rails of said track and adjusted for minimum impedance at the frequency of said source, a source of current on the vehicle, and means for applying a sufficient rail film break-down potential from said vehicle source to the rails of said track, whereby a track shunting path of relatively low impedance to the flow of current from said trackway source is established through said resonant track shunt.

HOWARD A. THOMPSON.