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APPARATUS FOR REDUCING ELECTRICAL RESISTANCE TO SIGNAL SHUNT CURRENT

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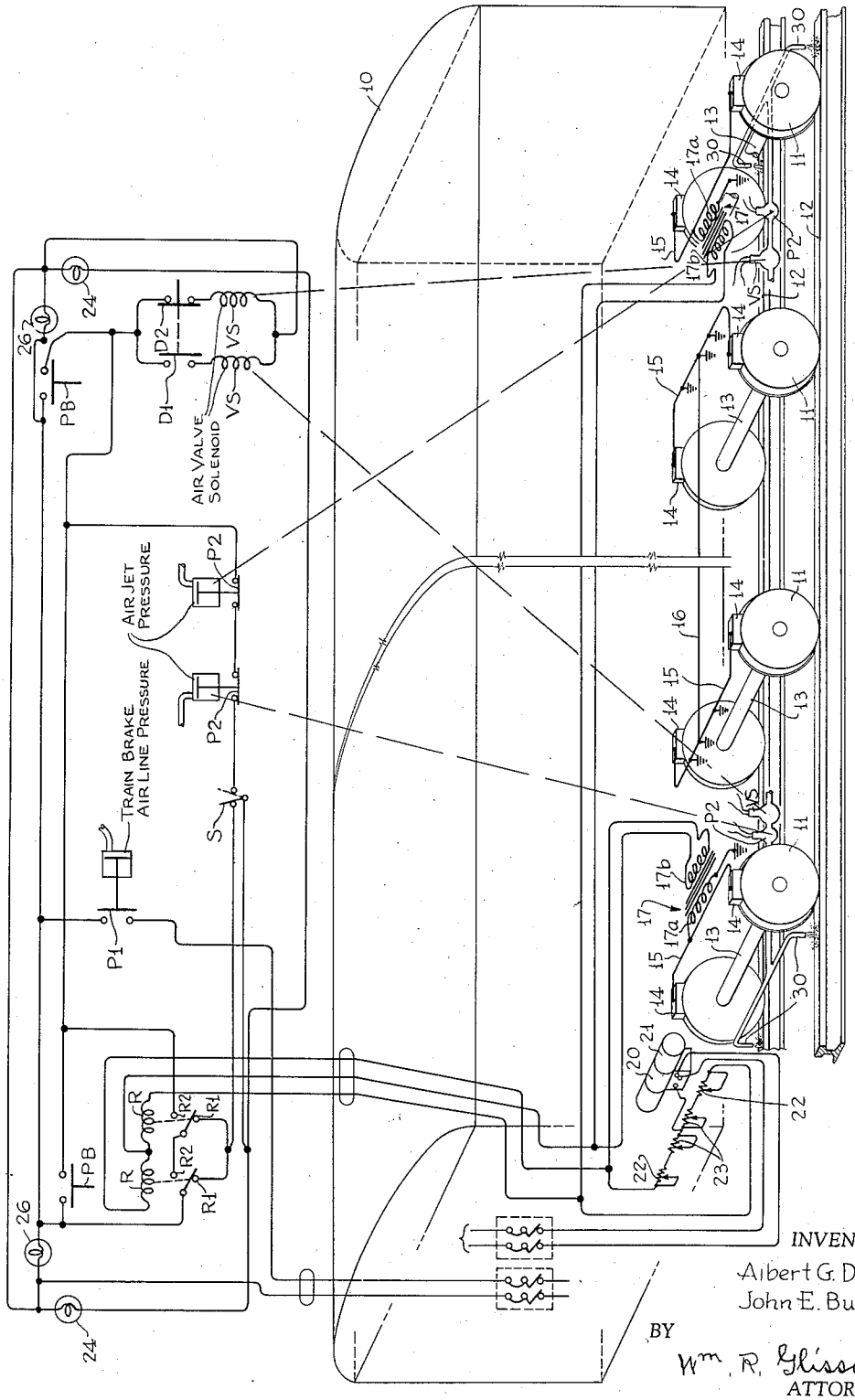


FIG. 1

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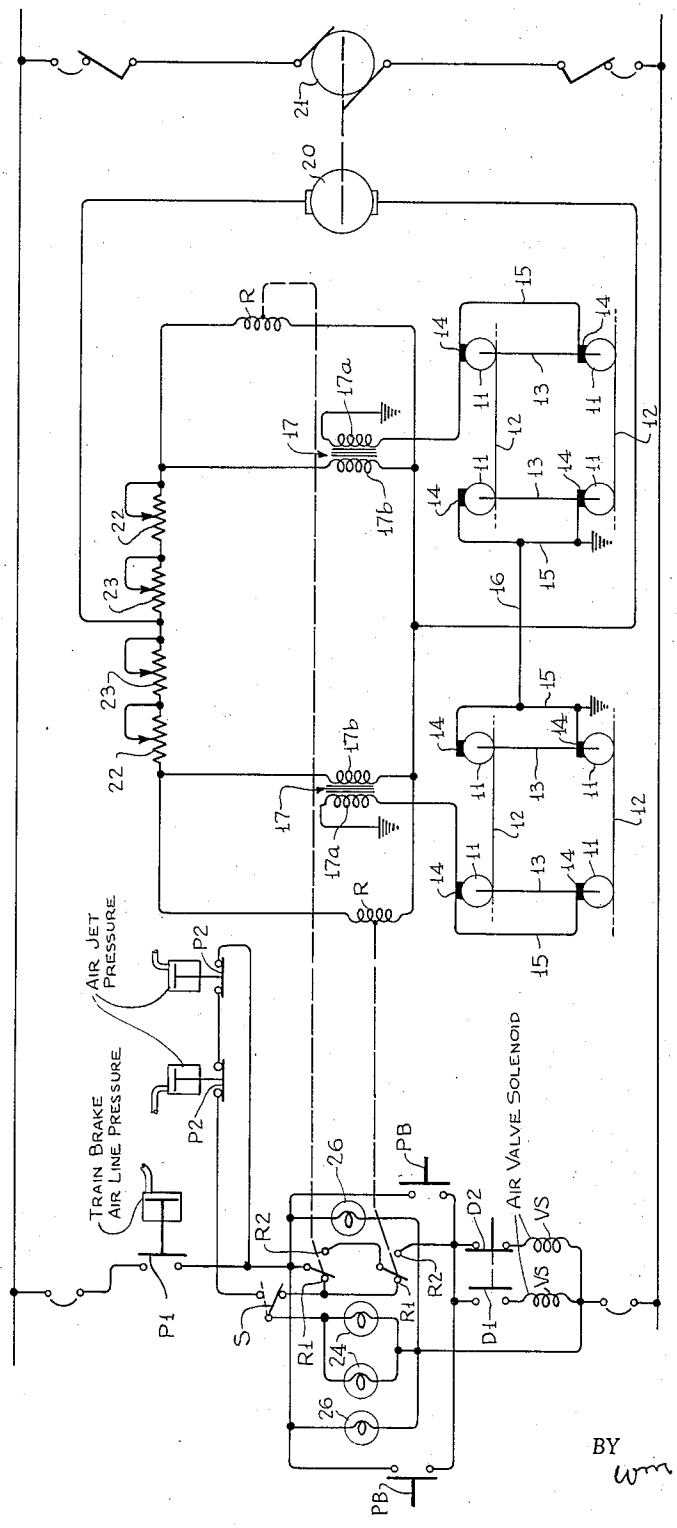


FIG. 2

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APPARATUS FOR REDUCING ELECTRICAL RESISTANCE TO SIGNAL SHUNT CURRENT

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4 Claims. (Cl. 104—279)

This invention relates to apparatus for reducing electrical resistance to signal shunt current and for indicating the condition for maintenance of a satisfactory level of shunt current, and has for an object the provision of improvements in this art.

In the operation of vehicles over track rails a shunt is made to carry signal current between rails through the vehicle, as through the wheel-axle units, through wheels and frame, or through other conductive means, to operate a signal which indicates the presence of the vehicle in the block.

For reasons of safety and other considerations the signal current and voltage are kept at a low value, hence the passage of shunt current is seriously affected by dirty contact zones between rails and rail-engaging means on the vehicle. The term dirt includes track scale, sand, oil, moisture or other deleterious matter which tends to increase the rail-to-vehicle resistance. Since the rail-engaging means are usually the vehicle wheels the present description will be simplified by referring only to rail-to-wheel resistance.

When a train of many vehicle units is operated there are many shunt paths and moreover the likelihood of encountering dirty contact zones at a great many shunt paths at the same time is not great. Consequently no special effort is needed to insure the likelihood of maintaining satisfactory shunting conditions.

However, when a single vehicle is operated the number of shunt paths is not as great and the chance of encountring local high-resistance conditions at all the shunt paths at once is greatly increased. Some relief has been provided by keeping wiper shoe blocks pressed against the wheel treads and improving the shunt paths by connecting electrical conductors to the contact shoes.

Nevertheless there are still conditions where further measures are needed to improve the shunting effect by reducing the rail-to-wheel resistance and to indicate to the operator whether good shunting conditions are being maintained.

According to the present invention a superimposed current is passed through a plurality of rail-to-wheel contact zones to aid in reducing the rail-to-wheel resistance and, coupled with this, means are provided for assisting in obtaining cleaner rail-to-wheel contact conditions. The latter means may take various forms, such as means to reduce sanding on the vehicle, means to scrape dirt off the wheels, means to scrape dirt off the rails, means to apply cleaning liquid or detergent to the rails, means to direct air or steam jets on the rails to remove dirt, and so on. Herein the use of air jets will be described, this form of rail cleaning means having been found to be very effective in use.

In connection with the resistance break-through current and the rail cleaning means, both being forms of resistance reducing means, the present invention provides means for indicating to the operator when the rail cleaning means is energized for action and when the rail cleaning means is in operation.

The invention will be described in connection with a specific embodiment which is illustrated in the accompanying drawings, wherein:

Fig. 1 is an isometric phantom schematic elevational view of a railway car equipped in accordance with the present invention; and

Fig. 2 is a wiring diagram of the equipment shown in Fig. 1.

As shown in the drawings, a railway car **10** is provided with wheels **11** which operate upon track rails **12**, the wheels being rigidly connected in pairs by axles **13**. An axle and its two wheels may be referred to as a wheel-axle unit. The car illustrated has two four-wheel trucks, one truck at each end of the car.

It will be assumed that the wheels and axles are electrically connected together so as to conduct current from rail to rail. If insulated wheels are used the cross flow of current will be provided for through other paths across the car. Herein the cross flow of current or shunting effect is improved by providing spring-biased wheel-cleaning and current conducting block shoes or brushes **14** which are connected to conductors **15** which are grounded to the car frame. Some of the wheel-axle units may simply be grounded and group-connected as by a conductor **16**, while others are provided with means for passing a resistance-reducing current to the wheels and from them to the rails.

As a matter of convenience for the particular car which is here taken for illustration, a self-propelled car with power drive to the inboard axles, these inboard wheel-axle units are grounded and the outboard wheel-axle units are connected to an electrical circuit, as through a transformer secondary **17*a*** of a transformer **17** having a primary **17*b***.

Current may be passed to the wheels in various ways, depending on conditions and the circuits which are provided to meet the requirements of the conditions; in the arrangement illustrated current passes in parallel on each side from a wheel through the rails and back across the inboard wheels and frame. Under other conditions the current may be passed across the car in a loop through wheels and axles and both rails—which is known as a series connection. The particular car-rail connection is not material for present purposes so long as good wheel to rail resistance-reducing effect is provided.

The primary coils **17*b*** of the transformers are in the circuit of an A. C. generator or alternator **20** which is driven by a motor **21**. The characteristics of the alternator current will be so chosen that there will be no conflict with the shunting current system or the car supply systems and will not endanger other equipment and personnel. Current of a frequency of 400 C. P. S. at normal 115 volts has been used satisfactorily where other equipment present used currents of 60 C. P. S. and with simple filters this gives no difficulty. Equipment employing relatively high frequency current is also fairly small and light.

Adjustable resistances or impedances **22**, **23** are provided for regulating the current supply from the alternator. The inherent limiting effect on the secondary current by the use of resistances or impedances here in series with the primary winding provides for high no-load ionizing potential through the rail-wheel contact zones and limits the short circuit current to a predetermined level conducive to maintaining effective ionization current flow.

Means are provided for indicating the characteristics of the current flowing through the transformers **17** and thus indicating the character of wheel-to-rail resistance which is being encountered at each truck. The means herein

shown comprises voltage-responsive relays R connected in the circuits of the primary coils 17*b* of the transformers 17. These relays are set to act at a predetermined voltage level to operate their switches between off contacts R1 and on contacts R2.

When the switch of the relay R of either truck is in engagement with the off contact R1 pilot lamps 24 (for example green) at the two operators' stations at the two ends of the car will be kept lighted to indicate that satisfactory shunting conditions are being maintained on the vehicle through at least one effective shunt path at one truck. If it should be desired the operation of either relay could initiate cleaning action as well as give a pilot or monitoring signal. In the illustrated form it will be assumed that a signal from both trucks is required before cleaning is initiated.

As illustrated, when the switches of both relays R are in engagement with the on contacts R2 the coil of a solenoid VS will be energized to supply jets of air from nozzles 30 to the rails ahead of the leading wheels of the vehicle. There are nozzles 30 and relays VS controlling the valves of the air lines thereto for each end of the car for each direction of travel and the selection of the one to be used will be made automatically by the actuation of switches D1, D2 by the operator when he reverses his controls. The switches D1, D2 are normally present on a car to control sanding according to direction of car travel and the coils of solenoids VS for air jet selection are cut into the circuit which is already present. The circuit arrangement is shown at the upper part of Fig. 1 and in Fig. 2 and at the lower part of Fig. 1 the physical location of the solenoids VS in relation to the piping and air nozzles 30 is shown.

When air jets are used for the rail dirt reduction or cleaning action and if the air supply is taken from the train line system which is used for braking, it is desirable to provide means for supplying air for the jets only when the pressure for braking is above a predetermined level. For this purpose a pressure actuated switch P1 is provided which is closed when the pressure is adequate, that is, above the selected predetermined pressure at which good brake operation is assured. Pilot lamps 26, one for each operator's station, are lighted when the switch P1 is closed to indicate to the operator that the air jet system is conditioned for automatic operation.

There may be times when the operator may wish to use the air jets even if the automatic controls do not call for air jet operation. For this purpose a pushbutton PB is provided at each operator's station.

At times or for certain installations or conditions the relays R may vibrate or close momentarily when there is no real need to use the air jets. This momentary relay action will not affect the solenoids VS because they have sufficient operational inertia to avoid it but it may cause the pilot lamps 24 to flicker annoyingly. To avoid this flicker means are provided for lighting the lamps 24 only when air has been supplied to one of the jet nozzles 30, the one supplied depending on the direction of travel, as stated. The means here shown for this purpose comprises pressure switches P2 operated by air pressure in the lines to the nozzles 30 which can be cut in to replace the action of the relays R on the pilot lamps 24. A switch S, or such switches at each operator's station, is used to switch from relay to jet pressure operation of the pilot lamps. The solenoid VS, whichever one is in circuit for direction of travel, is operated by the relays R.

It is thus seen that the invention provides control of means for reducing or tending to break down the rail-wheel resistance by passing through the contact zones a current which is considerably greater than the signal shunt current and which tends to provide ionized conducting paths for the signal shunt current; also that it provides in conjunction with the resistance reducing current means for cleaning the rails when the resistance to the imposed current reaches a predetermined level at which satisfactory shunting is not obtained. Furthermore it provides signal means for indicating to the operator when the track cleaning means are rendered effective for operation and for indicating when the track cleaning means are acting, the latter including means for selectively indicating when the cleaning means are cut into circuit or when it is actually applied. The inherent limiting of the secondary by means of the resistance or impedance in series with the primary winding provides for high no-load ionizing potential from wheel to wheel through the rail and limits the short circuit current to a predetermined level conducive to maintaining ionization current flow.

While one embodiment of the invention has been described in detail for purposes of illustration, it is to be understood that there may be various modifications and changes within the general scope of the invention.

What is claimed is:

1. Apparatus for reducing the rail-wheel resistance to signal shunt current on a railway vehicle, comprising in combination, means for applying to the rail-wheel contact zones an imposed alternating current having a resistance break-down potential greater than that of the signal shunt current and a frequency which is distinctive from that of the signal current and the other vehicle electrical systems, reactance means for providing a high no-load potential and for limiting the short-circuit current, means for each truck of a two-truck vehicle set to respond to a predetermined voltage level of the imposed current, means responsive to said last-mentioned means for applying a cleaning action on the rail-wheel contact zones, and means responsive to the action of the cleaning means for indicating when the cleaning action is started.

2. Apparatus as set forth in claim 1, wherein said means for applying a cleaning action to the rail-wheel contact zones comprises a pipe line for forcing a fluid out under pressure, a valve controlled in accordance with high contact resistance at the rail wheel contact zone for controlling the flow of fluid in said pipe, and said means for indicating the start of cleaning comprising a device operated in accordance with the pressure of fluid in said pipe controlled by said valve for giving an indication of the flow of cleaning fluid from said pipe.

3. Apparatus as set forth in claim 1, wherein said means for applying a cleaning action to the rail-wheel contact zones comprises a pressure fluid pipe, a valve controlled in accordance with voltage in said zones for controlling the flow of fluid in said pipe, signal means, means for operating said signal means by voltage change which operates said valve, means for operating said signal means by flow of fluid in said pipe as controlled by said valve, and means for selectively placing said signal means under the influence of either said voltage controlled means or said fluid flow controlled means.

4. Apparatus for reducing the rail-wheel resistance to signal shunt current on a railway vehicle having two trucks and being reversible in its direction of travel, comprising in combination, means for continuously applying to the rail-wheel contact zones of each truck an imposed alternating current having a rail-wheel resistance break-down potential greater than that of the signal shunt current and a frequency which is distinctive from that of the signal current, control means for each truck arranged to respond to a predetermined voltage of the break-down current, means responsive to the control means of both trucks for supplying air for one of said trucks to clean the rail-wheel contact zones, said air supply means including a connection to the brake air line, pressure responsive means in said connection for withholding air from said cleaning supply means when the brake air line pressure is below a predetermined point, means responsive to the control means of both trucks for operating a cab signal when the air supply means for one truck is energized, means responsive to the flow of cleaning air for operating the cab signal, and means for selectively placing the cab signal operation under actuation by either

said control-responsive means or said air flow controlled means.

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