United States Patent

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[72] Inventors **David John Miller Dobbs; Derek Linder; Leslie John Giles, all of London, England**

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[73] Assignee **British Railways Board London, England**
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[54] **CLEANING OF RAILS**
5 Claims, 1 Drawing Fig.

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[51] **Int. Cl.** **B23k 9/00**
[50] **Field of Search** ..... 219/121, 121 P, 75; 104/279

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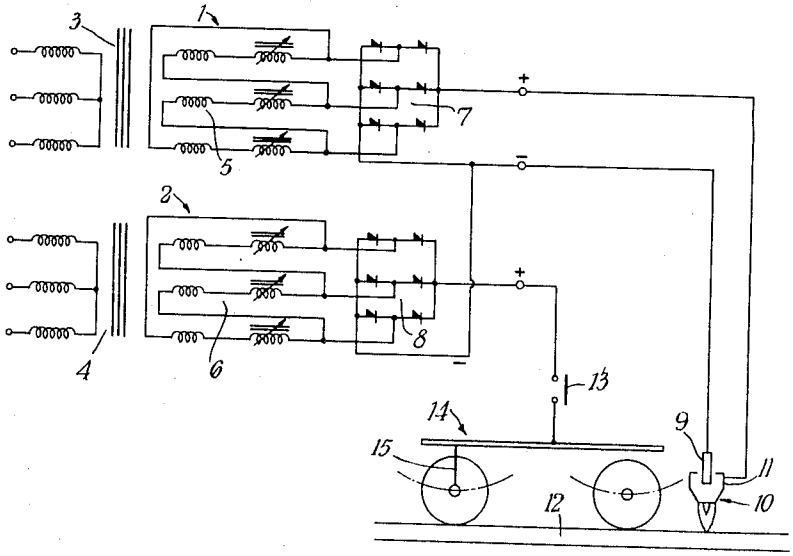
Primary Examiner—J. V. Truhe
Assistant Examiner—C. L. Albritton
Attorney—Sommers & Young

ABSTRACT: A method of cleaning a rail comprises subjecting the head of the rail to the gas jet from a plasma-arc torch operated in the nontransferred mode, but with an additional current passed between the torch and the head of the rail.



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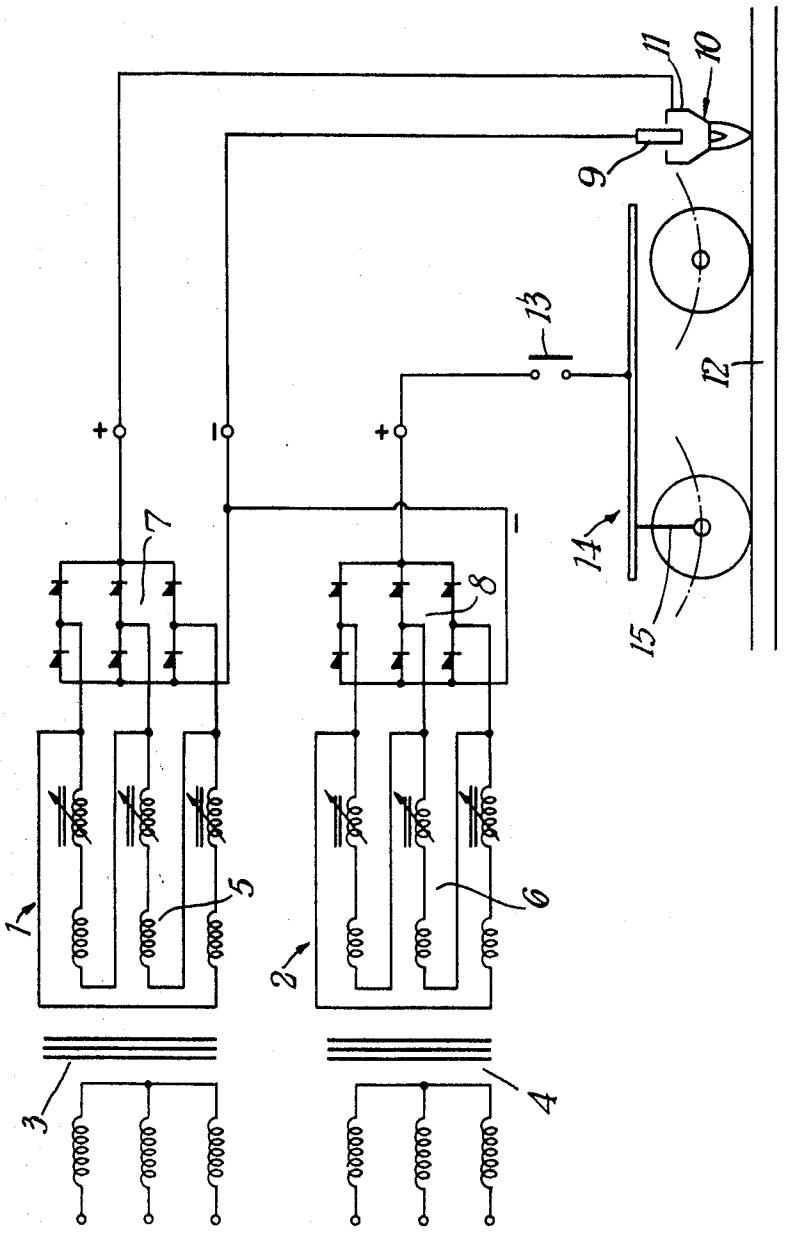

DAVID J.M. DOBBS
DEREK LINDER
LESLIE J. GILES

by Sommers & Young

CLEANING OF RAILS

This invention concerns improvements relating to the cleaning of rails, particularly for the purpose of improving wheel-rail adhesion of railway vehicles. It seeks to provide for more effective application of plasma-arc techniques for this purpose.

The normal plasma generator operated with a fully transferred arc is capable of producing an extremely high temperature on a surface. The heating effect is very localized and experience has shown that it is difficult to move the localized hot spot, or anode spot, uniformly at high speeds. The heating and cleaning effects upon rails to which the arc is applied tend not to be uniform and the arc is liable to be extinguished at discontinuities such as gaps between rails.

According to the present invention, the plasma generator is used for rail cleaning in the usual nontransferred mode, but an additional current is passed between the torch and the head of the rail. Return may be by way of the rail and a wheel in contact therewith.

This proposal has advantages over both the simple transferred mode and the simple nontransferred mode of operation. As compared with the former, the production of a localized anode spot is avoided. Basically the plasma gas emerging from the generator is utilized as a conductor which is further heated by the passage of a current between the generator and the rail surface. The heating effect of the gas jet in the rail, together with the comparatively low current flowing into the rail inhibits the formation of a constricted anode spot and permits of the attainment of uniform movement of the jet.

In common with the nontransferred mode of operation, the partially transferred mode in accordance with the present invention results in a hot stream of gas impinging on the rail surface and destroying or removing contaminants thereon. However, it avoids loss of effectiveness due to reduction in the temperature of the gas, by the time the latter strikes the rail, caused by mixture with ambient air. The present proposal ensures that the temperature of the gas is maintained down to the rail surface, thus enhancing the cleaning process both locally and away from the point of impact. Improved flow properties consequent upon the high temperature of the gas stream also contribute to this result.

The plasma gas jet may be enhanced either by the superimposition of a supply of direct current on the torch current or by the application of an alternating voltage between the anode of the torch and the rail. By the use of alternating current, the load on rectification equipment can be substantially reduced.

The proposal of the invention affords protection for rail end posts of insulating plastics material or composition. For the enhancement of the jet to be effective, the partially transferred plasma system relies upon the existence of a conducting path. Where insulated rail sections occur, no current will flow and the enhancement is reduced or eliminated, so that insulators are protected.

Examples of different gases which may be employed are indicated in the following table, together with suitable flow conditions and enhancement voltages:

Gas	Gas Flow liters/min.	Gas Velocity meters/sec.	Enhancement Voltage
A mixture of argon and H_2, the H_2 amounting to 10 % to 25% of the mixture.	10–100	200–1,500	25–100
A mixture of A and H_2, the H_2 amounting to 10% to 80% of the mixture.	10–100	200–1,500	25–120
Nitrogen	10–100	200–1,500	50–200
Compressed Air	10–100	200–1,500	50–300

An example of apparatus suitable for carrying the invention into effect is illustrated in the accompanying diagrammatic drawing.

Separate high-reactance power supplies **1** and **2** are provided for the current for the plasma torch itself and for the superimposed enhancement current respectively. The supplies **1** and **2** comprise three-phase transformers **3** and **4** respectively, variable series reactors **5** and **6** respectively and three-phase rectifiers **7** and **8** respectively. The outputs of these supplies are connected together on the negative side, which is connected to the cathode **9** of the plasma torch **10**. The torch **10** is carried upon a vehicle in a position above the rail **12**, for example from an axle-box of the vehicle. The anode **11** of the torch is connected to the positive side of the supply **1**. The positive side of the supply **2** is connected to the rail **12** by way of a contactor switch **13** to a wheel set running on the said rail. As diagrammatically shown, the supply **2** is so connected to the frame of a bogie **14** having a heavy-current bond **15** to a bogie axle. For use in accordance with the present invention, as compared with use simply in a normal nontransferred mode, the torch **10** itself does not essentially require any modification. If desired, more than one torch can be supplied from a common supply system.

With a supply system such as has been described, falling current/voltage characteristic supplies can be obtained by simple means.

In place of the enhancement supply **2**, use could be made of a DC generator with a series resistance arrangement. A falling current/voltage characteristic would again be provided.

The following table gives examples of specific operating conditions for a torch using a mixture of hydrogen and argon in which the hydrogen amounts to 10 percent of the mixture, the torch-to-rail spacing being 1 inch and a gas velocity in the region of 600 meters per sec. being employed.

Torch volts (anode-cathode) volts	Enhancement voltage (anode-rail) volts	Torch current, amps.	Enhancement current amps.	Gas flow (in litres per minute)
47	−7	120	12	30
68	−1	140	25	75
41	+3	188	30	30
41	+9	140	40	30

I claim:

1. A method of cleaning a track rail to improve wheel-rail adhesion which comprises,

subjecting the head of the rail to the effluent from a plasma-arc torch operated in the transferred mode, simultaneously passing an additional electric current between the torch and the head of the rail.

2. A method as claimed in claim **1**, wherein the plasma gas jet is enhanced by the application of a DC voltage between the anode of the torch and the rail.

3. A method claimed in claim **1**, wherein the plasma gas jet is enhanced by the application of an AC voltage between the torch and the rail.

4. A method as claimed in claim **1**, wherein the supply to the torch and the supply for the additional current have falling voltage/current characteristics.

5. A method as claimed in claim **1**, wherein the torch is supplied from two separate sources having common negative side to which the cathode of the torch is connected, the positive sides of the said supplies being connected to the anode of the torch and by way of wheel contact to the rail respectively.

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