

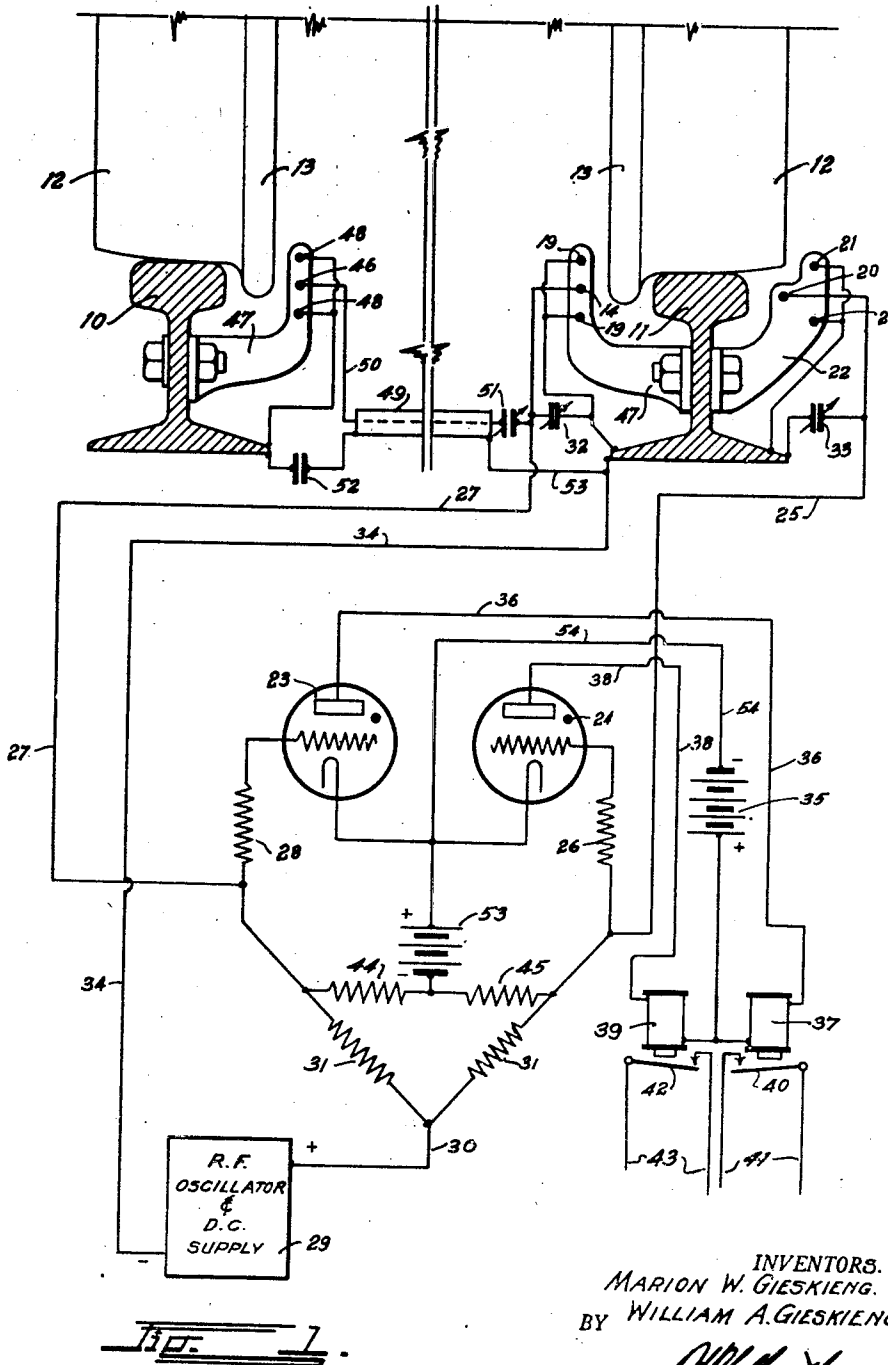
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M. W. GIESKIENG ET AL
RAILWAY WHEEL CHECKING DEVICE

2,442,491

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2 Sheets-Sheet 1



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2 Sheets-Sheet 2

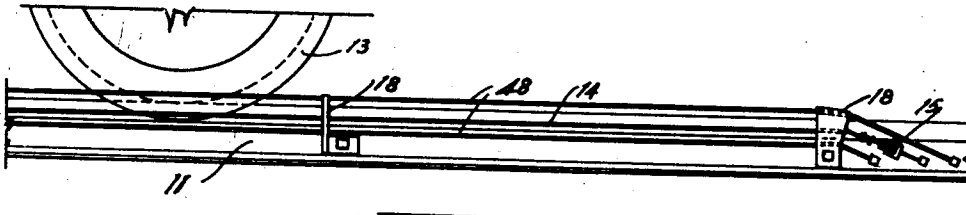


Fig. 2

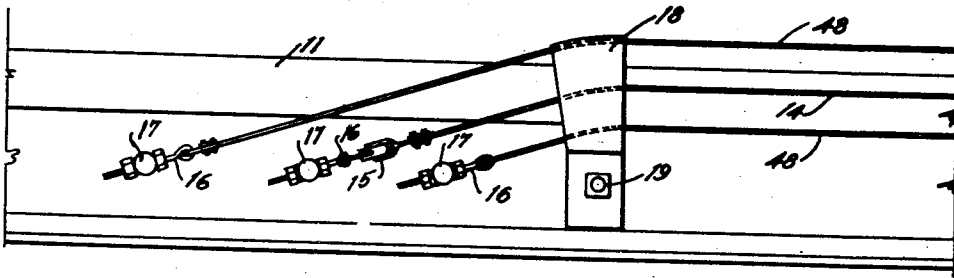
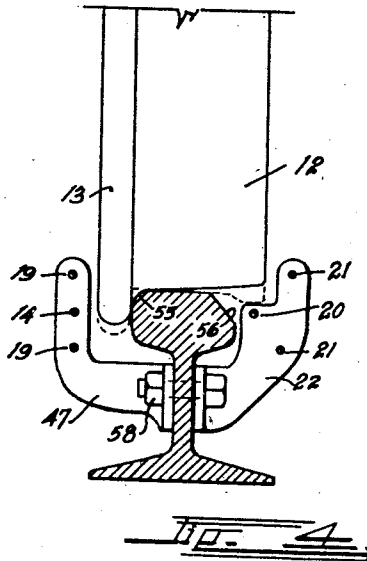
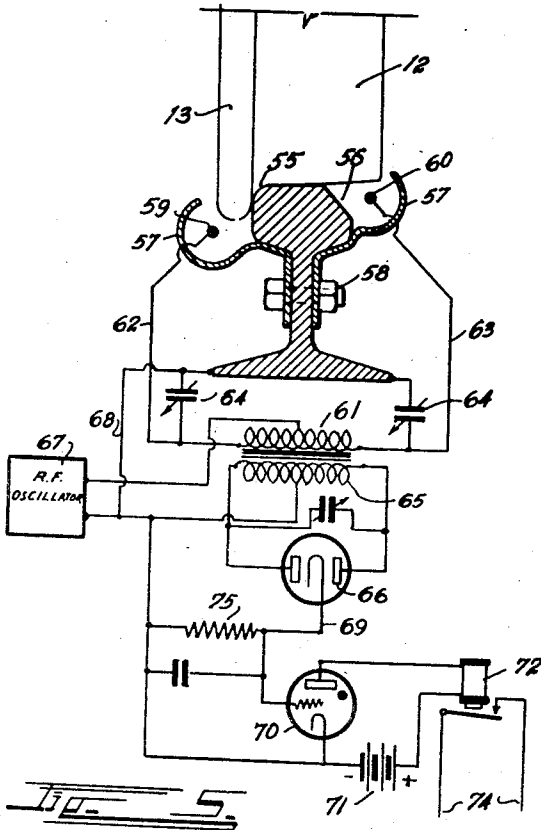


Fig. 3



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RAILWAY WHEEL CHECKING DEVICE

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6 Claims. (Cl. 246-169)

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This invention relates to a device for detecting flaws, defects, and breaks in railway car wheels, and has for its principal object the provision of a simple and highly efficient electronic device by means of which defects in wheels, such as broken flanges, broken treads, bent axles, etc., can be accurately located while the cars are in transit along the rails.

Other objects and advantages reside in the detail construction of the invention, which is designed for simplicity, economy, and efficiency. These will become more apparent from the following description.

In the following detailed description of the invention, reference is had to the accompanying drawings which form a part hereof. Like numerals refer to like parts in all views of the drawings and throughout the description.

In the drawings:

Fig. 1 is a circuit diagram illustrating the arrangement of the improved detecting device in relation to the rails and wheels of a typical railroad track, showing the preferred form of detecting circuit;

Fig. 2 is a side view of a portion of a typical railway rail, illustrating the application of the invention thereto;

Fig. 3 is an enlarged side view of the rail of Fig. 2, illustrating the terminal of the detecting device thereon;

Fig. 4 is an enlarged section through a modified rail section adapted to the uses of this invention; and

Fig. 5 is a circuit diagram illustrating an alternate form of circuit with which the objects of the invention may be accomplished.

Although it is the practice of all railroads to make continual inspection of the wheels, train wrecks still frequently occur due to defects in the flanges and treads of the wheels.

This invention is designed to be placed along the tracks at convenient points and intervals to automatically inspect the wheels of a passing train, to give a signal at any desired central station should there be defects in the treads and flanges of the wheels. In this improved defect-detecting device the wheels are not mechanically contacted in any way, so that the train may pass the device at any desired speed without interfering with the proper functioning thereof.

In the drawings, typical railway rails are indicated at 10 and 11. The tread of a typical wheel is indicated at 12 with its rail flange at 13.

In applying the improved detector, a wire or other metallic element, which will be herein des-

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ignated as the capacitor element 14, is placed along the inside of the rail 11. If a wire is used, it is tightly stretched between two strain insulators 15 by means of suitable terminal eye bolts 16, which are mounted in attachment lugs 17 on the web of the rail. The capacitor element 14 may be of any desired length, but must be at least sufficiently long to exceed the circumference of the largest expected railway car wheel.

Supporting bracket members 18 are attached to the web of the rail by means of suitable attachment bolts 19 at proper intervals to accurately position the element 14 inside of the path of the lower portion of the wheel flange 13 and in spaced relation to the latter.

The bracket members 18 also support two additional wires or other metallic elements, which will be herein designated the shielding elements 19, there being one of the elements 19 above and one below the capacitor element 14.

On the opposite side of the rail 11, a second capacitor element 20 is positioned so as to extend parallel to the head of the rail and immediately below the rim or outside portion of the wheel tread 12. Two additional shielding elements 21 are provided at this side of the rail, supported in suitable supporting brackets 22.

The electronic portion of the device employs two electron tubes 23 and 24 of the thyatron or gas-filled, quick-firing type. These tubes may be tetrodes, pentodes, or grid glow tubes, but in any event, the tubes should be such as to instantly pass a relatively large current when subjected to a slight input increase.

A conductor 25 extends from the second capacitor element 20 to the grid connection of the tube 24, a grid resistor 26 being interposed in series therewith. A second conductor 27 extends from the capacitor element 14 to the grid connection of the tube 23 through a second grid resistor 28. The resistors 26 and 28 serve to limit the current through the grid circuit to any desired value. The lengths of the capacitors 14 and 20 and the conductors 25 and 27 are respectively equal, and the values of the resistors 26 and 28 are equal so that the total capacities on the grids of both tubes are balanced.

Direct current modulated at radio frequency is supplied to the grid circuits from any suitable standard voltage supply unit 29. The positive terminal of the unit 29 is connected to a conductor 30. A resistor 31 is placed in circuit between the conductor 30 and each of the conductors 25 and 27, respectively. The negative ter-

terminal of the unit 29 is grounded to the rail 11 by means of a ground conductor 34.

The resistors 31 are of similar resistance so that between the positive conductor 30 and the rail 11 we have two balanced circuits. One circuit includes the conductor 27, the capacitor element 14, and the flange 13. The other circuit includes the conductor 25, the capacitor element 20, and the wheel rim or tread 12. The two circuits can be adjusted for perfect balance by means of trimming condensers 32 and 33 positioned between the rail 11 and the conductors 25 and 27, respectively.

Two resistors 44 and 45 are bridged between the conductors 25 and 27 and serve to polarize the signals, the polarity at the middle of the bridge being negative. The mid-bridge point is connected to the negative terminal of a "C" battery 53, which supplies the initial bias to the grids of both tubes. The positive terminal of the "C" battery 53 is connected to the cathodes of both tubes.

The circuits are adjusted, and the capacitor elements 14 and 20 are so positioned that they will be in perfect balance when no wheel is in place on the rail. The balance of the two circuits or the equal capacity of both thereafter, depends on the maintaining of the air gap between the capacitor element 14 and the lower edge of the wheel flange 13 equal to the air gap between the second capacitor element 20 and the wheel tread 12. It can be readily seen that if the circuits are balanced with a perfect wheel in place on the rail 11 between the capacitors 14 and 20, they will remain in balance with all perfect wheels.

If, however, a wheel passes along the rail 11 with a broken flange 13, the break in the flange will increase the air gap between the capacitor 14 and the wheel, when the break comes into position therebetween. This causes a lowering of the bias on the grid of the tube 23 to allow that tube to discharge or "fire"—in other words, it will allow the passage of a heavy current from the tube cathode to the plate thereof. This current can be used in any desired manner to give an indication of a broken flange.

On the other hand, should a broken tread be present, it will vary the air gap between the second capacitor element 20 and the tread 12, causing a drop in the grid bias in the tube 24 so that the latter will "fire" the plate circuit thereof, allowing a heavy passage of current to flow to any desired indicating device.

The shielding elements 19 and 21 serve to prevent interference and variations in capacity due to brake shoes, rods, and other underhanging parts on the cars, or from conducting surfaces on the ground or ties of the track.

In Fig. 5, an alternate form of shielding element is shown, consisting of sheet metal shields 57 secured to the rail by means of suitable attachment bolts 58 and extending along and partially around the capacitor elements.

One method of supplying and employing the tube discharge current is illustrated in Fig. 1. In this method the "firing" current is supplied to the plate circuits of the tubes from a suitable source 35, the negative terminal of which leads to the cathodes of the tubes through a conductor 54. The plate terminal of the tube 23 is connected by means of a conductor 36 with a first relay magnet 37. The plate connection of the tube 24 is similarly connected by means of a conductor 38 with a second relay magnet 39. The magnet 37 controls an armature 40 in a circuit

41 connected to any desired type of broken flange indicator. The magnet 39 controls an armature 42 controlling a circuit 43 to a similar indicator for indicating broken treads. The construction of the indicators forms no part of the present invention and may be any type, such as a galvanometer, a tape perforator, an audible or visible signal, a graphic pen, an electrically controlled paint spray, a photographic camera, or other suitable means for giving a signal or an indication.

The above-described circuit will operate satisfactorily provided that every wheel passing along the rail 11 maintains substantially the same relative lateral position so as to maintain a uniform space between the capacitor element 14 and the flange 13. Should some of the wheels hug the rail 10 and others hug the rail 11, there will be a variation in capacity between the different wheels. Some means must be provided for preventing this variation from unbalancing the circuit.

One method for accommodating side movement is illustrated in Fig. 1, in which a third capacitor element 46 is positioned along the inside of the rail 10 in substantially the same relation thereto as the element 14 is to the rail 11. The element 46 is supported on suitable brackets 47 which also support shielding elements 48 above and below the capacitor element 46. The elements 48 serve a similar purpose to the elements 19 and 21, previously described, and are grounded to the rail 10 and to a shielding tube 49 passing between the rails. A cross-conductor 50 extends from the capacitor element 46 through the tube 49 to the conductor 27. A trimming condenser 51 is placed in the circuit of the conductor 50, and a fixed condenser 52 is placed in circuit between the rail 10 and the rail 11 so as to offer impedance to any block signal currents or other direct or low frequency currents which the rails may carry.

This arrangement places two air gaps in the circuit, including the grid of tube 23, one between the third capacitor element 46 and the flange 13 of the left-hand wheel, and one between the capacitor element 14 and the flange 13 of the right-hand wheel. Thus, between the two, a uniform gap will be provided regardless of whether the wheels hug rail 10 or rail 11, for the width of one gap will increase simultaneously and in proportion to the decrease of the width of the other.

In Fig. 4, the outline of a new standard wheel is illustrated in solid line, and the position of a worn wheel is indicated in broken line. In a new wheel the rounded fillet of the flange 13 rides the inner corner of the rail and holds the flange away therefrom. As the wheels wear, the fillet wears away, so that the flange can approach closer to the rail. In order to obtain a uniform spacing between the flange 13 and the capacitor element with new as well as old wheels, it has been found advantageous to deform the head of the rail, as shown at 55, by rounding the inner corner to an exact fit with the flange fillet of a new wheel so that the flange thereof can lie snugly against the side of the rail head. Worn wheels will also lie in the same relative position, as shown in broken line. It has also been found advantageous to cut back the outside corner, as indicated at 46, Fig. 4, to allow the capacitor element 20 to underlie the wheel tread without too close an approach to the rail.

It has been found that, if the capacitor elements are covered with any suitable dielectric insulation, the sensitivity is reduced and the effect of lateral wheel spacing is minimized.

It will be noted that the arrangement of Fig.

1 is checking only the right-hand wheels. By placing the reverse of this construction further along the track, however, the left-hand wheels can be similarly checked.

The basic principle of the invention resides in having the flange of the wheel or the tread thereof, or both, included in a radio frequency bridge circuit as capacity so that any variations in the contour of the flange or tread cause variations in capacity in the circuits to create an unbalanced condition, which is employed to give a suitable signal. Many different circuits may be employed to carry out the above principle. One has been illustrated and described in Fig. 1 of the drawing; another is illustrated in Fig. 5.

In the circuit of Fig. 5 a flange capacitor element 59 and a tread capacitor element 60 are employed, corresponding to the elements 14 and 20 previously described. The elements 59 and 60 are connected to the terminals of a primary inductance 61 by means of suitable conductors 62 and 63. Trimming condensers 64 are placed between conductors 62 and 63 and the rail to balance the capacities of the two terminal circuits.

A secondary inductance 65 is placed in inductive relation to the inductance 61. The two outer terminals of the inductance 65 are connected to the two plate terminals of a full-wave rectifier tube 66. The inductances 61 and 65 form a balanced transformer. Current is fed to the mid-point of the primary inductance 61 from a radio frequency oscillator 67. The mid-point of the secondary inductance 65 and the rail are grounded to the other terminal of the oscillator through a ground conductor 68. The current flow through the opposite ends of the primary inductance 61 is in opposite directions and, as long as the capacities of the two opposite circuits are equal, the two currents will be equal and no current will be induced in the secondary 65. Should the capacity of either circuit be reduced by a defective tread or flange, however, a current will be induced in the secondary inductance 65. This current will be rectified in the tube 66 and supplied by means of a conductor 69 to the grid of a thyratron tube 70, causing it to "fire" and allowing a heavy current to flow from a battery 71 or other source to the plate of the tube 70 and through an electro-relay magnet 72 in circuit therewith. The magnet 72 controls an armature 73 in a signal control circuit 74 operating any desired signal.

Although a full-wave rectifier has been shown at 66, a half-wave rectifier could be used, or this tube may be eliminated, depending upon the circuit requirements, and the voltage from the secondary inductance 65 fed directly to the grid of the tube 70 so as to operate the relay circuit. A grid coupling resistor 75 is employed between the grid circuit of the tube 70 and the cathode thereof.

The device may be used in connection with any type of counting mechanism so as to register the number of wheels passing a given point so that the position of the defective wheel will be known. If the bridge circuit is slightly unbalanced, every wheel will give an indication of its passing on the indicating device, which would operate as a counter, or a wheel counter such as illustrated in U. S. Patent No. 1,835,234 may be employed.

It will be noted in Figs. 2 and 3 that the capacitor elements incline upwardly to their positions at a very gradual angle. This is necessary to prevent a too-rapid approach of the wheels to the element from firing the device.

While the two opposed, balanced capacity circuits have been herein applied to a wheel inspection device, they could be used in any application where it would be desirable to check the size, shape, or perfection of passing articles against each other or against a pre-set standard.

While a specific form of the improvement has been described and illustrated herein, it is desired to be understood that the same may be varied, within the scope of the appended claims, without departing from the spirit of the invention.

Having thus described the invention, what is claimed and desired secured by Letters Patent is:

1. A device for detecting flaws in railway car wheels as they pass along a rail comprising: a first capacitor element extending parallel to the path of said wheel in spaced relation to the lower portion of the flanges thereof; a second capacitor element on the opposite side of said rail in spaced relation to the tread of said wheel; a first circuit including the first capacitor element and said rail and the air gap between the two; a second circuit including the second capacitor element and said rail and the air gap between the two, the capacities of said two circuits being balanced with no wheel on the rail and throughout the passage of a satisfactory wheel over the rail and being adapted to be unbalanced upon passage of a broken wheel over the rail; and means operable in consequence of the unbalancing of the capacities between said circuits for operating an indicating device.

2. A device for detecting flaws in railway car wheels as they pass along a rail comprising: a first capacitor element extending parallel to the path of said wheels in spaced relation to the lower portion of the flanges thereof; a second capacitor element on the opposite side of said rail in spaced relation to the tread of said wheel; a first circuit including the first capacitor element and said rail and the air gap between the two; a second circuit including the second capacitor element and said rail and the air gap between the two; the capacities of said two circuits being balanced with no wheel on the rail and throughout the passage of a satisfactory wheel over the rail and being adapted to be unbalanced upon passage of a broken wheel over the rail; means for supplying radio frequency current to said circuits; and a relay interposed between the circuits so that variations in capacity between the latter will cause said relay to operate.

3. Means for detecting defects in a railroad car wheel passing along a rail comprising: a first capacitor element extending parallel to said rail in spaced relation to the path of the flange of a wheel thereon; a second capacitor element on the opposite side of said rail parallel to the path of the tread of said wheel; a first thyratron tube; a second thyratron tube, said first capacitor element being in the grid circuit of the first tube, said second capacitor element being in the grid circuit of the second tube; means for supplying a D. C. current modulated at radio frequency to both grid circuits through balanced resistors; means for supplying a bias current to said grid circuits through balanced resistors; an independent plate circuit for each tube; means for supplying operating current to both plate circuits; and a relay in each plate circuit for operating an indicating device, the capacities of said two grid circuits being balanced when no wheel is on the rail and also throughout the passage of an unbroken wheel so that they will be unbalanced by the passage of a broken wheel over the rail, said

plate circuits being energized through said tubes in consequence of unbalance in capacity between said grid circuits.

4. A flange inspecting device for inspecting the flange of a railroad car wheel passing along a rail comprising: a capacitor element extending along said rail parallel to the path of the lower portion of the flange of said wheel; a second capacitor element extending parallel to said rail and in uniform spaced relation to the path of the tread of said wheel; a capacity bridge acting to balance the capacity of said first capacitor element with the second capacitor element when no wheel is present on the rail and when a satisfactory wheel is passing along said rail and being adapted to be unbalanced upon passage of a broken wheel; means for rectifying and amplifying the bridge output; and means operable by said output for giving a signal.

5. A flange inspecting device for inspecting the flange of a railroad car wheel passing along a rail comprising: a capacitor element extending along said rail parallel to the path of the lower portion of the flange of said wheel; a second capacitor element extending parallel to said rail and in uniform spaced relation to the path of the tread of said wheel; a capacity bridge acting to balance the capacity of said first capacitor element with the second capacitor element when no wheel is present on the rail and when a satisfactory wheel is passing along said rail and being adapted to be unbalanced upon passage of a broken wheel; means for rectifying and amplifying the bridge output; means operable by said output for giving a signal; and a third capacitor element extending along a parallel opposite rail in parallel spaced relation to the path of the wheel flange therealong, said third capacitor element being connected to the first capacitor element so that variations in spacing between the first capacitor element and its wheel flange will be compensated for by variations in spacing between the third capacitor element and its flange.

6. Means for detecting flaws in the treads and flanges of railway car wheels as they pass along a conventional railway comprising: a first elongated

capacitor element; a second elongated capacitor element; electrically insulated means supporting the first capacitor element in spaced horizontal alignment with the inside face of the head of the rail so that the flange of a passing wheel will pass between the element and said head in spaced relation to the element; other electrically insulated means supporting said second capacitor element in spaced horizontal alignment with outside face of the head of the rail so that the rim of a passing wheel will pass along said latter element in vertically spaced relation therewith; a first circuit including the first capacitor element and said rail and the air gap between the two; a second circuit including the second capacitor element and said rail and the air gap between the two, the capacities of said two circuits being balanced with no wheel on the rail and throughout the passage of an unbroken wheel along the rail and being adapted to be unbalanced upon passage of a broken wheel along the rail; and means operable in consequence of the unbalancing of the capacities between said circuits for operating an indicating device.

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