July 25, 1967 W. A. JAMISON ETAL 3,333,097

LOOSE WHEEL DETECTORS

Filed July 14, 1965 2 Sheets-Sheet 1

Fig. 1.

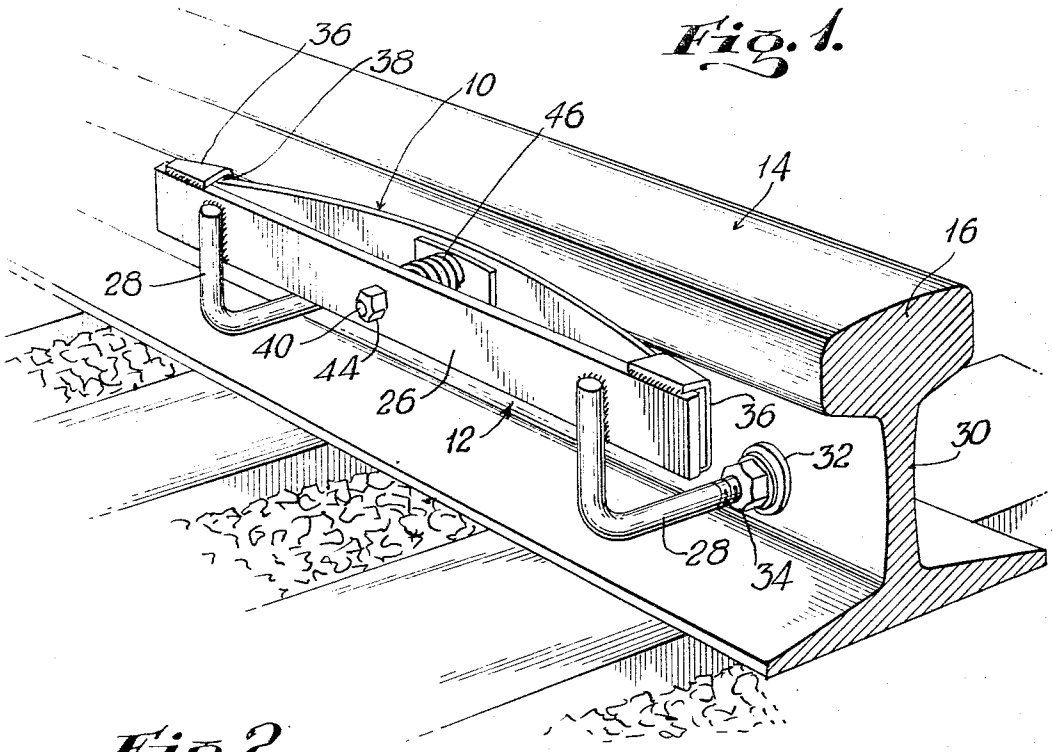
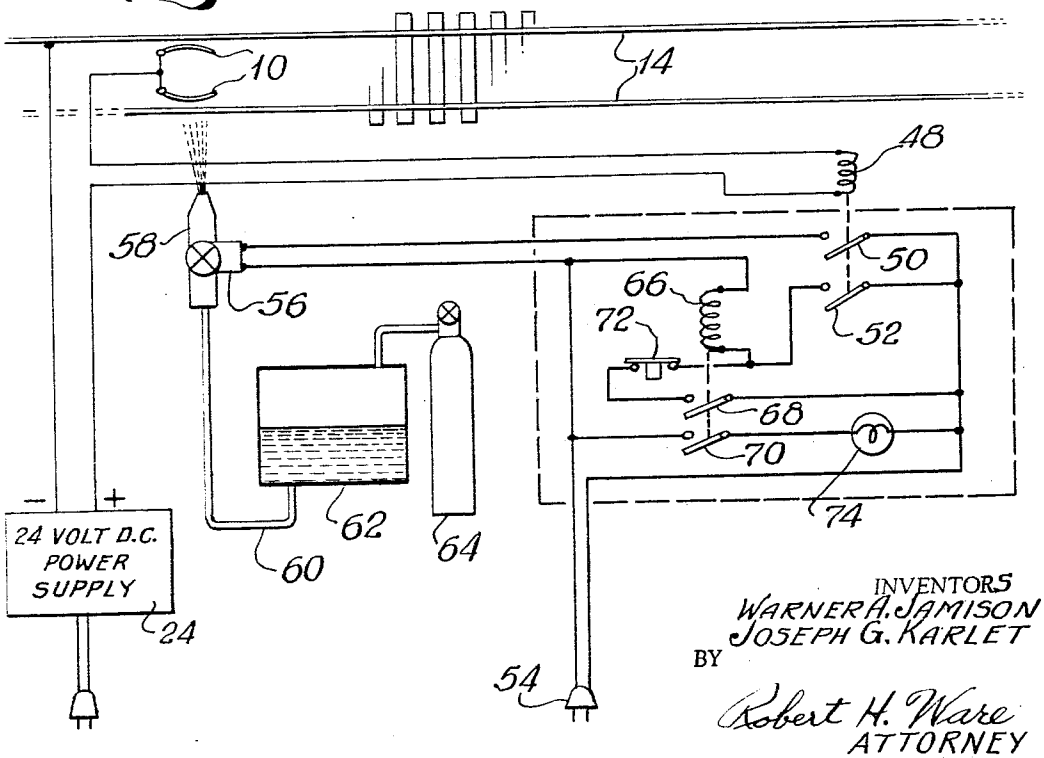


Fig. 2.



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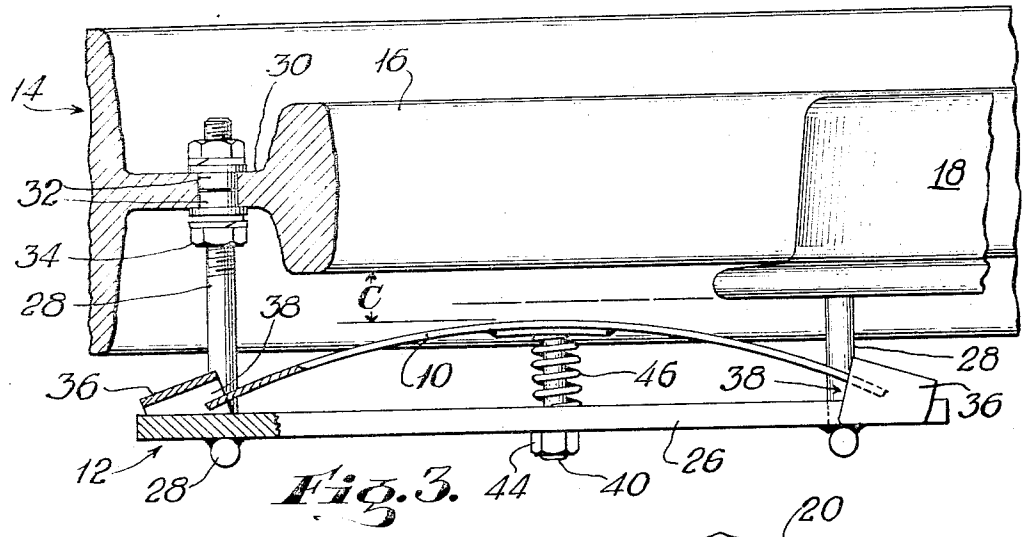


Fig. 3.

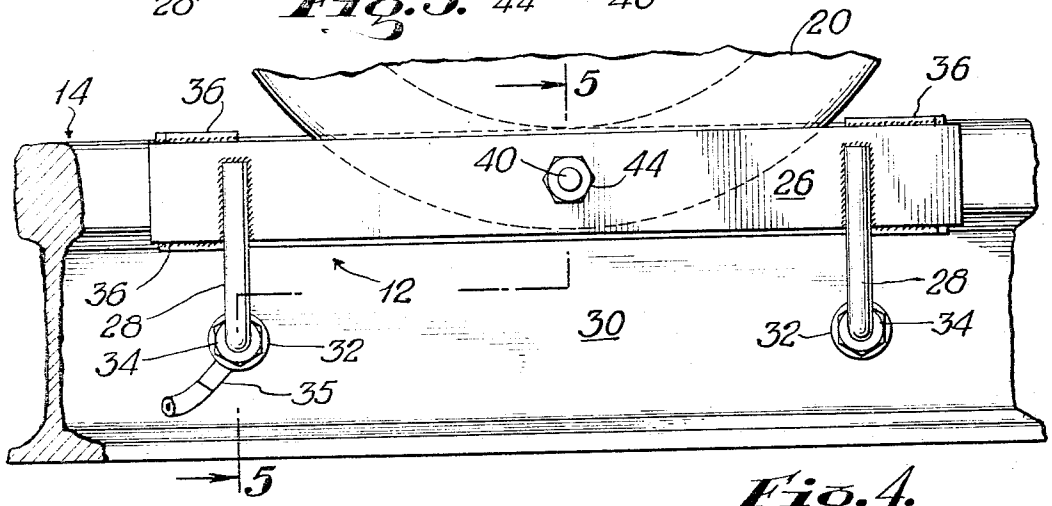


Fig. 4.

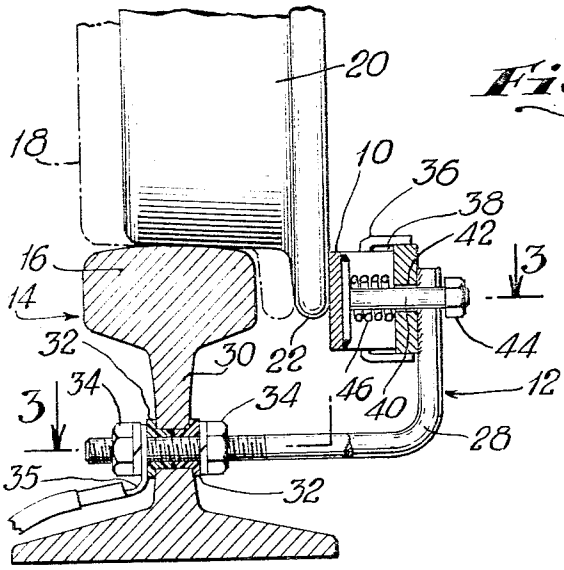


Fig. 5.

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LOOSE WHEEL DETECTORS

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11 Claims. (Cl. 246—255)

This invention relates to railway signalling and safety devices, and particularly to apparatus and systems for detecting and indicating the presence of a loose wheel on railway rolling stock.

The wheels of railway cars and locomotives are normally mounted on their axles with a tight press fit, and the two wheels and the connecting axle form an integral unit. If this original press fit should become loose, the wheel flanges, running on the inside of the pair of tracks, prevent such a wheel from slipping outward off the outer end of the axle, but often there is nothing to prevent substantial axial movement of a loosening wheel inwardly, toward its mating wheel. Loose wheels occur occasionally on railroads, and a single loose wheel moving inward and dropping off the track can derail a train.

Detection of loose wheels by sensing units mounted on every axle or every truck of every railway car would be impractically expensive. The loose wheel detectors of the present invention are installed on the railroad track, preferably in pairs and for convenience usually mounted near hot-box detectors, car counters, and other control devices; however, this is not a requirement for the effective operation of the detectors of this invention. The loose wheel detector systems of this invention are inexpensive and highly effective in operation.

A principal object of the present invention is to provide systems and apparatus for the detection of loose wheels on passing railway rolling stock.

Another object of the invention is to provide loose wheel detection systems and apparatus permanently mounted in conjunction with other control devices at selected locations on a railroad track.

A further object is to provide such systems and apparatus capable of automatically applying, directly upon a railway car, easily recognizable indications of the presence of a loose wheel thereon.

Other and more specific objects will be apparent from the features, elements, combinations and operating procedures disclosed in the following detailed description and shown in the drawings, in which:

FIGURE 1 is a perspective view of a portion of railroad track incorporating a detector assembly of the present invention;

FIGURE 2 is a schematic circuit diagram showing a detector system of the present invention incorporating the assembly shown in FIGURE 1;

FIGURE 3 is a top plan view of a segment of a railroad rail having a detector like the one shown in FIGURE 1 mounted thereon, showing an approaching wheel;

FIGURE 4 is a fragmentary side elevation view of the structure shown in FIGURE 3, showing a passing wheel; and

FIGURE 5 is a cross sectional end elevation view of the structure of FIGURES 3 and 4 taken along the line 5—5 in FIGURE 4, and showing a passing loose wheel actuating the detector assembly.

In the loose wheel detector systems of this invention, a resilient, insulated bowed leaf spring **10** is supported by a detector assembly **12** near the inside of a railroad rail **14** on a level with the ball **16** of the rail **14**. The bowed leaf spring is insulated from the railroad rail, and forms a part of detector circuits and systems.

This insulated spring **10** is spaced inwardly away from the ball of the rail sufficiently to allow each normal wheel **18** on passing railway rolling stock to travel along the rail past the bowed leaf spring **10** without contacting the spring, as shown in FIGURE 3. The spring steel bows **10** are correctly adjusted when the distance from the convex face of spring bow **10** is 53⅞" from the inside "gage" surface of the opposite rail. This method will always result in a correct adjustment even though the standard rail gage spacing is slightly off.

A loose wheel **20** which has moved inwardly on its axle, bringing its flange **22** inward toward the opposite rail, will engage and depress the bowed leaf spring **10** as it passes by, as indicated in FIGURE 5. The loose wheel **20** thus becomes a bridging element forming an electrical connection between the rail **14** and the bowed leaf spring **10**, which is otherwise insulated from the rail.

The normal railway track signal voltage employed in the signal block in which the rail **14** is incorporated may be utilized with the bowed leaf spring detectors of this invention to provide signal indications of the presence of a loose wheel. However, it is preferable to use an independent power source, such as a storage battery or an A.C. to D.C. converter **24** (FIGURE 2), having one terminal connected to the rail **14** and the opposite terminal connected to the bowed leaf spring **10** of the detector **12**. As indicated in FIGURE 2, a pair of such detectors are preferably mounted across from each other on the facing inner sides of a pair of rails **14** forming a track. The leaf springs **10** of both detector units may be connected to a single terminal of D.C. power source **24**, and the opposite terminal may be connected only to a single rail of the track pair, since the integral wheel and axle units of the train will conduct the signal voltage from one rail to the other, but the loose wheel detector signal circuit will not be closed until a loose wheel engages the bowed leaf spring detector as shown in FIGURE 5.

The detector systems of the present invention may include pen recorders, signal lamps, buzzers or other indicators to indicate defects at local or remote locations. A preferred embodiment of the invention incorporating an automatic car marking system is illustrated in FIGURE 2; this system sprays a jet of paint or bright-colored dye directly on the car carrying the loose wheel. Thus the buzzer or light indicator permits the train to be halted promptly, while the dye marking on the car allows the loose wheel to be identified immediately.

Loose wheel sensing assembly

The loose wheel detector sensing assembly **12** shown in the figures incorporates a spring supporting plate **26**, to the ends of which are attached downwardly extending rods **28** bent in an L-shaped configuration extending beneath the plate **26** toward the web **30** of rail **14**. The rods **28** are secured to but insulated from the rail **14**. Thus, as shown in the drawings, the horizontally extending legs of rods **28** are preferably threaded and inserted through suitably spaced apertures passing through the web **30** of the rail. Rods **28** are insulated from the web by flanged plastic bushings **32** of nylon or other suitable weatherproof insulating material. The bushings are anchored in their installed position by lock washers and nuts **34**, and the terminal of the D.C. power supply **24** is preferably connected to detector assembly **12** by a terminal eye **35** anchored under one of these nuts **34**, as shown in FIGURE 5. An alternate preferred method of connecting the power to the insulated loose wheel detector is to use a screw type clamp similar to a ground rod clamp to secure the current carrying wire to L-shaped rod **28** shown in FIGURE 1.

The plate **26** is elongated in the longitudinal direction, parallel to the rail, and its length is the same order of magnitude as the diameter of the wheel **20** to be detected. The plate **26** is supported in a substantially vertical plane

parallel to the side of the ball or head **16** of rail **14** and inwardly spaced therefrom by the L-shaped rods **28** anchored to the web **30** of rail **14**, as shown in FIGURE 3. A pair of spring retainers **36** are mounted on the ends of plate **26** facing each other and forming concave cavities **38** shaped to receive loosely the movable free ends of the bowed leaf spring **10**. The ends of the spring **10** are positioned within these cavities **38** near the ends of plate **26**, and the central portion of the bowed leaf spring **10** protrudes in its normal bowed curve toward ball **16** of rail **14**, all as indicated in the figures.

The spring retainers **36** in the illustrated embodiment are formed as U-shaped flat strap members whose ends are welded to the upper and lower end edges of plate **26**, as shown in FIGURES 1, 3 and 5. The central portions of these spring retainers **36** are angularly displaced from the plane of plate **26**, and are substantially parallel to the ends of bowed leaf spring **10** accommodated therein. Anchored to the mid-portion of the bowed leaf spring **10** is a protruding alignment rod **40** extending inwardly toward and through a suitable aperture **42** passing through the plate **26**, and provided with an elastic stop nut **44** threaded thereon on the opposite side of plate **26**. A compression coil spring **46** is sandwiched between plate **26** and leaf spring **10** surrounding the alignment rod **40**. In the normal position of assembly **12**, the leaf spring **10** is bowed toward the rail **14** and urged in that direction by the compressed coil spring **46**.

By adjusting the two lock nuts **34** together along each threaded rod **28**, the plate **26** and leaf spring **10** may be moved toward or away from ball **16** of rail **14**, to leave ample clearance C (FIGURE 3) for the passage of normal wheels, making allowances for normal wear and conventional tolerances on the distances between pairs of wheels and rails. A final or fine adjustment of the bow **10** can be accomplished by turning elastic stop nut **44**.

When the inner face of flange **22** of a loose wheel **20** is too far from the central plane of the rail **14**, however, it contacts leaf spring **10** (FIGURE 5). By setting the assembly **12** at the desired clearance distance C from rail **14**, the safe operating limits of wheel separation are automatically employed to signal the presence of any pair of wheels closer together than such desired limit.

By employing two detectors **12** directly opposite each other, such a faulty pair of wheels will be detected no matter which wheel is riding normally and which is riding on the outer edge of its rim, like wheel **22** in FIGURE 5.

Car marking and signalling system

As shown in the schematic diagram of FIGURE 2, the D.C. power supply **24** has one terminal connected to one rail **14** of the pair, and its other terminal connected to each of the leaf springs **10** of a pair of loose wheel detector assemblies **12** secured to and insulated from each of the rails **14** in the manner illustrated in FIGURE 1.

Interposed between the leaf springs **10** and the power supply **24** is a D.C. relay **48** with suitable operating characteristics. When a loose wheel **20** bridges the gap between rail **14** and detector assembly **12**, as shown in FIGURE 5, this has the effect of closing the circuit and applying the voltage of the power supply via rail **14**, wheel **20**, spring **10**, assembly **12** and terminal eye **35** directly across the relay **48**, closing its contacts **50** and **52**.

The contacts **50** of relay **48** apply A.C. voltage from the A.C. line **54** directly to a solenoid-controlled valve **56** incorporated in a colored dye spray-head **58** positioned alongside the track **14** near the loose wheel detector assembly **12**.

The spray-head **58** is operatively connected through a conduit **60** to a dye reservoir **62** containing a quantity of paint or brightly-colored dye, and pressurized by such means as a cylinder of compressed gas **64** connected to the top of reservoir **62**, as shown in FIGURE 2. For example, this may be a type "K" cylinder of dry nitrogen supplying a regulated gas pressure of 45 p.s.i. to the dye reservoir.

The solenoid valve **56** on spray-head **58** may be an Asco solenoid spray valve with a time delay relay producing a three second hold, for example, spraying a suitable jet of brightly-colored dye aimed at the side of the car directly above the loose wheel detected by the system as described above. The slight time delay of two or three seconds holding time for the relay can be obtained by connecting two suitable capacitors in parallel across the 24 volt D.C. relay as shown in FIGURE 2. This method would be in lieu of using a mechanical-type time delay relay.

The contact **52** of the relay **48** connects the A.C. line **54** directly across an A.C. relay coil **66**, energizing this relay **66** to close its contacts **68** and **70**. Relay contact **68** is a "holding" contact, bypassing the contact **52** of relay **48** to connect the A.C. line **54** directly across the relay coil **66**, and thus maintaining A.C. relay **66** energized until the reset button **72** is pushed, to de-energize relay **66**. Contact **70** of A.C. relay **66** is closed by this energizing of the relay, applying the A.C. line voltage across a signal lamp **74** or such other signal devices as recorders or audible alarms. For example, the third or "marker" pen of a pen recorder may be connected to record actuation of assembly **12** by a loose wheel.

Operation

Every normal wheel **18** rolling along rail **14** will bypass the leaf spring **10** of the detector assembly **12** without touching it, since its flange extends inward from the rail a distance less than predetermined permissible maximum clearance C, as shown in FIGURE 3. The detector thus draws no current and suffers no abrasion or wear with the passage of normal wheels.

A loose wheel slipping inwardly on its axle, such as wheel **20** shown in FIGURE 5, will touch and depress the leaf spring **10** momentarily as it passes the detector assembly **12** as indicated in FIGURE 5, thus briefly closing the circuit of D.C. power supply **24** and placing its entire D.C. potential across the D.C. relay **48**. As a result of the operation of relays **48** and **66**, as described above, the lamp **74** or other signal devices are energized, and if desired, as shown in FIGURE 2, the solenoid valve **56** is actuated to spray a jet of brightly-colored dye directly on the car to indicate the location of the loose wheel detected by the system.

One preferred method of determining the location of the loose wheel in the train is useful with a dual-pen recorder, such as those used with dual hot box detectors mounted alongside both rails of a track. A passing hot box is indicated on such recorders by a deflected peak on one recorded pen line. In this preferred method, the loose wheel detector is connected to cause both pens or stylii of the recorder to be deflected simultaneously. This can be accomplished as follows: When a loose wheel moves inwards on the axle and contacts the spring steel bow **10**, a circuit is completed which causes a relay to close momentarily while the flange of the wheel is rubbing against the bow. This momentary closing of contacts can be used to close another circuit and cause a voltage pulse to be delivered to the recorder in such a manner as to cause the pen or stylus for each rail to be deflected simultaneously. This simultaneously high deflection of both pens or stylii will indicate on the chart the exact location of the loose wheel in the train.

From FIGURES 3, 4 and 5 it may be seen that the arched leaf spring **10** forms a contact ramp facing the adjacent lateral surface of each passing wheel **18** or **20**. The ramp slants toward the plane of rotation of the flange-side of each approaching wheel, and each succeeding portion of the contact ramp from each end, held in spring retainer **36**, to the center of leaf spring **10** is successively closer to this plane, providing a double ramp accommodating wheels approaching in either direction.

The center of leaf spring **10** thus constitutes a final region of the contact ramp, spaced beyond the path of normally aligned wheels **18** (FIGURE 3) and in the path of misaligned wheels **20** (FIGURE 5) for contact with their facing lateral surfaces.

While the objects of the invention are efficiently achieved by the preferred forms of the invention described in the foregoing specification, the invention also includes changes and variations falling within and between the definitions of the following claims.

We claim:

1. A track-guided wheel detector positioned facing adjacent lateral surfaces of passing wheels for sensing and indicating the presence of any passing faulty wheel misaligned away from its intended track-guided position in a direction transverse to the plane of rotation of a normal wheel's adjacent lateral surface, comprising, in combination

(A) a contact ramp slanting toward said plane of rotation and having successive regions positioned progressively closer to said plane in the direction of travel of the track-guided wheels,

(B) with a final region being spaced transversely from said plane by a preselected maximum "clearance" distance placing the final portion beyond the path of normally aligned wheels and in the path of misaligned wheels for contact with the facing lateral surfaces thereof,

(C) and indicating means responsive to each contact of a misaligned wheel with the contact ramp.

2. The detector of claim **1** including means resiliently urging the contact ramp toward a predetermined position at the preselected maximum "clearance" distance from said plane to counteract deflection of the final portion of the contact ramp away from the predetermined position by a laterally-misaligned passing wheel.

3. A wheel detector mounted beside a wheel-carrying rail and positioned to detect the passing of a laterally misaligned wheel, comprising, in combination

(A) a contact member having a central surface portion arched convexly toward the head of the rail,

(B) support means adjustably positioning the central surface portion beside the head of the rail at a predetermined position spaced therefrom by a preselected maximum "clearance" distance placing the arched surface portion beyond normally aligned wheels and in the path of laterally misaligned wheels for contact therewith,

(C) and indicating means responsive to each contact of a misaligned wheel with the arched surface portion of the contact member.

4. The detector of claim **3** including means resiliently urging the arched surface portion toward the predetermined position to counteract deflection of the arched surface portion away from the predetermined position by a laterally-misaligned passing wheel.

5. The combination defined in claim **3** in which the contact member and the rail are electrically insulated from each other by the support means, and are electrically connected only by a passing misaligned wheel simultaneously contacting both the rail and the central surface portion, and in which the indicating means is connected to the rail and the contact member for actuation by each simultaneous contact of a misaligned wheel with both rail and contact member.

6. A loose railway wheel detector mounted beside a railroad rail and comprising, in combination

(A) a thin curved member having its central portion normally arched convexly toward the head of the rail,

(B) support means adjustably positioning the arched central portion beside the head of the rail at a predetermined position spaced therefrom and incorporating

(1) restraining means positioning the curved member for guided movement away from the rail

(2) and resilient means urging the curved member toward the predetermined position,

(C) and indicating means responsive to each contact of the curved member by a misaligned loose wheel protruding beyond the predetermined spaced position from the head of the rail.

7. The combination defined in claim **6** wherein the resilient means includes a compressed coil spring interposed between the curved member and the support means.

8. The combination defined in claim **6** wherein the thin curved member is a leaf spring positioned for flexing displacement by a misaligned wheel contacting the arched central portion thereof.

9. A loose wheel detector positioned facing the adjacent lateral surfaces of wheel flanges beside the inner side of the head of one of a pair of railroad rails and comprising, in combination

(A) thin elongated curved leaf spring having its central portion normally arched convexly toward the head of the rail,

(B) electrically insulated support means adjustably positioning the arched leaf spring convexly presented beside the rail's head at a preselected maximum "clearance" distance therefrom, and including retainers loosely confining the ends of the arched leaf spring, and an adjustable alignment rod guiding a central portion of the arched leaf spring for flexing movement toward and away from the rail's head,

(C) and indicating means activated by simultaneous contact of a misaligned wheel with both the rail and the leaf spring to indicate the presence of the misaligned wheel.

10. The combination defined in claim **9** including a second, separate curved leaf spring oppositely positioned by electrically insulated support means beside the inner side of the head of the opposite rail of a pair of rails and connected to the same indicating means.

11. The combination defined in claim **1** wherein the indicating means includes a dye-spraying system, actuated by a contact of a misaligned wheel with the contact ramp, and positioned to direct a jet of colored dye on the side of a railway car having the actuating misaligned wheel mounted thereon.

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