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HOT BOX DETECTORS

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Fig. 1.

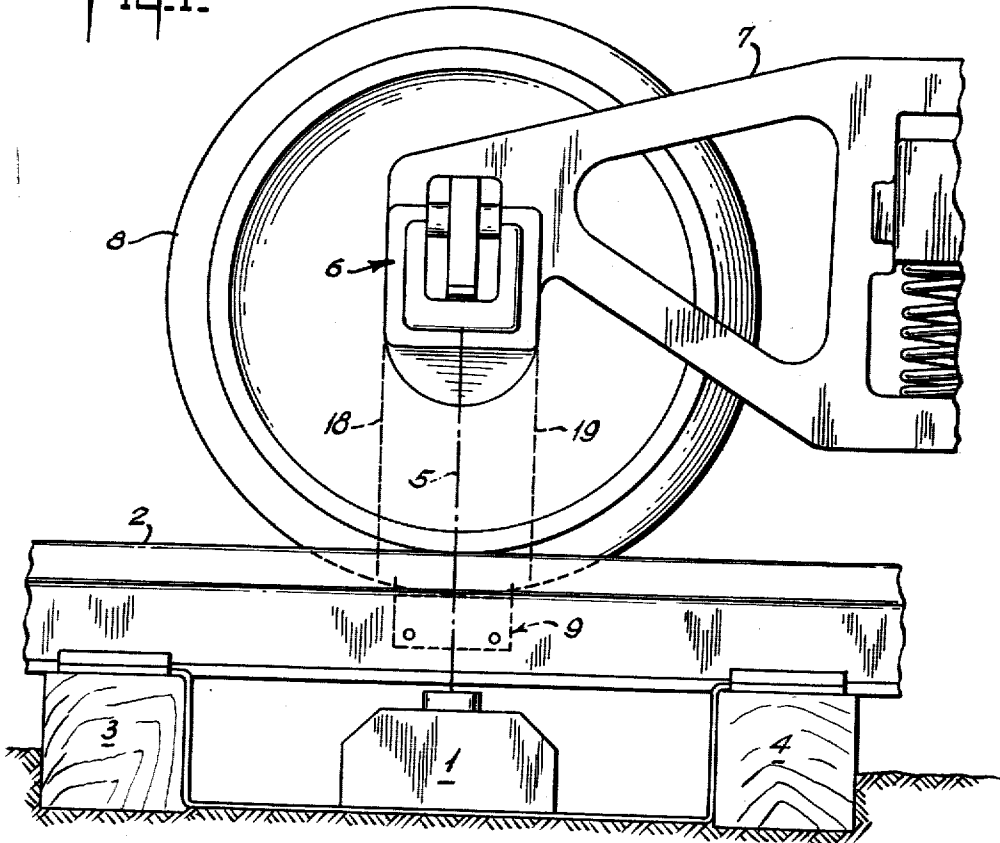


Fig. 2.

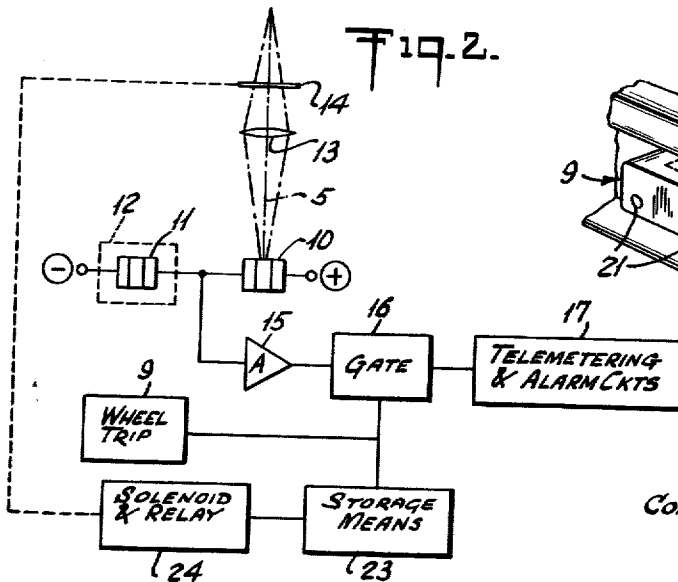
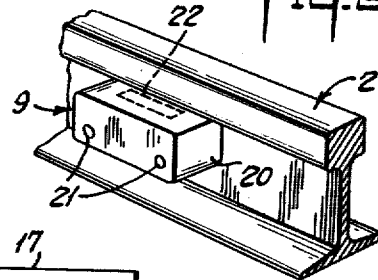


Fig. 3.



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1

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HOT BOX DETECTORS

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1 Claim. (Cl. 246-169)

In our copending application, Serial No. 747,553, filed June 30, 1958, now Patent 2,880,309, slant aspect viewing of journal boxes and wheel-axle junctions was described and claimed. This application is limited to the vertical-plane aspect of viewing journal boxes, wheel-axle junctions, or other areas which carry heat information of the journal boxes.

In the slant aspect viewing arrangement, an infra-red detection device is mounted alongside a track rail and projects an image of the heat-responsive means along an axis generally inclined to the horizontal plane and longitudinally of the track. The image is focussed on a side of a passing journal box. Ordinarily, for bi-directional detection, two infra-red detectors are required. In addition, a circuit arrangement for selectively gating only pertinent heat information to telemetering devices is employed. This circuit rejects influences which are not relevant to a determination of the journal box heat condition. The gating circuit is generally operated by a wheel-trip device of a type which produces an electrical impulse in response to a wheel rolling thereover.

In the slant aspect arrangement the journal box, at the instant of viewing, is at a position somewhat removed from the location of the infra-red detector. The wheel-trip device is located for operation by a wheel corresponding to the journal box to be viewed. Since the axes of viewing are widely divergent for traffic moving in opposite directions, two sets of wheel-trip devices are required if the same side of the journal box is to be viewed for either direction.

Experimental studies have shown that the forward side of a moving journal box is generally cooler than the trailing side and, further, the temperature differential between the upper and lower portions of the trailing side is considerably greater than the corresponding portions of the trailing side. Thus, when viewing the opposite sides of the box for the different directions of traffic, signal analysis is more troublesome because of these different temperatures and temperature gradients which exist on the forward and trailing sides of the box.

Accordingly, it is a primary object of this invention to provide a hot box detection system comprising only a single detector for consistently viewing the same area indicative of temperature conditions of journal boxes on rolling stock moving in either direction.

It is a further object of the invention to provide a hot box detection system wherein the infra-red detector is mounted alongside a track rail for vertical-plane viewing of bi-directional traffic, and utilizing only a single wheel-trip device; stated in other words, the wheel-trip means utilized for gating for one direction of traffic flow on a given track is also used for gating for the opposite direction of traffic flow on the same track.

In accordance with a feature of the invention, the heat-responsive means is coupled to a normally blocked gating circuit which is controlled by a wheel-trip device. The wheel-trip device is mounted alongside a track rail within an area defined by planes passing through the vertical sides of the journal box, whereby when the wheel-trip device is operated by a wheel passing thereover, the heat indicating area is in position to be observed by the heat-responsive device, irrespective of the direction in which the rolling stock is traveling.

2

The above-mentioned and other features and objects of this invention and the manner of attaining them will be best understood by reference to the following description of an embodiment of the invention taken in conjunction with the accompanying drawing, wherein:

FIGURE 1 is a side view of a length of track including the infra-red detector, journal box and a portion of rolling stock;

FIGURE 2 is a block diagram of a signalling circuit, including a schematic showing of the detector, for applying radiant energy signals to a telemetering circuit; and FIGURE 3 is a diagrammatic illustration of a wheel-trip device.

The general orientation of the detector and journal box is illustrated in FIGURE 1. The infra-red detector 1 is mounted alongside a track rail 2 supported on railroad ties 3, 4 and is disposed so as to project an image of a heat-sensitive cell along an axis 5 directed generally vertically upwardly; that is, in the vertical plane which is at a right angle to the longitudinal direction of the track 2. In the illustrated embodiment, a journal box 6 is viewed by the detector 1. However, it is now recognized that the heat condition of a bearing can be determined by detecting the heat energy at an adjacent wheel-axle junction. For viewing the wheel-axle junctions, the detector is mounted between the rails, and FIGURE 1 may be construed accordingly with the axis 5 being directed at the junctions. The journal box 6 is shown as part of the truck structure 7 and is mounted at the end of an axle which supports a pair of wheels, one of which, 8, is shown. A wheel-trip device 9 is shown schematically by dotted lines, and in accordance with the invention, is located so that when the wheel 8 rolls thereover, from either direction, the journal box 6, or wheel-axle junction, is in a position to be viewed by the detector 1. That is, the detector and the wheel-trip device are located in an area defined by planes passing through the vertical sides of the journal box 6.

Referring to FIGURE 2, the hot box detector comprises generally a pair of heat-responsive cells, such as thermistor flakes 10, 11, connected in a polarized bridge circuit. One of the cells, for example 10, is positioned to intercept the incident radiant energy from the journal box or wheel-axle junction and the other thermistor flake 11 is preferably shielded, as indicated by dotted lines 12, so as to provide an ambient or reference response against which the transient response of cell 10 may be compared.

The cell 10 is imaged on the heat-indicating area (journal box or wheel-axle junction) by optics including a lens 13 and a shutter 14. Usually, the detector 1 is provided in duplicate for any single installation, there being another unit on the opposite side of the other track rail to detect simultaneously journal bearing temperatures at both ends of the same axle.

The output from the thermistor bridge is applied to an amplifier 15 and the amplified signal is applied to a normally blocked gate 16. In certain installations the signals from amplifier 15 may be applied directly to telemetering and alarm circuits 17, where signal analysis is accomplished. The alarm circuits may be of the audible or visual type. In the preferred circuit the gate 16 is utilized to exclude heat signals not directly attributable to the journal box 6.

The gate 16 is unblocked, or opened, by the wheel-trip device 9, shown diagrammatically in FIGURE 3 and described and claimed in detail in copending application Serial No. 627,330, filed December 10, 1956, in the names of Gallagher et al. Briefly, the preferred wheel-trip device 9 comprises a polarized horseshoe-shaped magnet which is so disposed that the gap thereof is transiently closed by the flange of the wheel 8. An energized wind-

ing coupled to the magnet develops a trip signal in the form of an electrical impulse in response to the closing of the gap. As shown in FIGURE 3, the electromagnetic components are cast in a rugged plastic housing 20, which is secured to the side of the rail 2, preferably by bolts 21. One pole of the magnet is shown by dotted lines 22, and the other pole is in contiguous relation with the under-side of the head of the rail. Thus, when a wheel passes over the wheel-trip device, a magnetic circuit, including the rail head and wheel, is closed and produces a pulse in the energized winding which surrounds a portion of the magnet. The same pulse is produced regardless of the direction of train travel, and therefore the wheel-trip may be said to be bi-directionally responsive.

The gate 16 may be in the form of a single relay, which is closed in response to the pulse from the wheel-trip device 9. While the relay is closed, signals corresponding to the amplified signals from amplifier 15 are applied to the telemetering circuit 17. Alternatively, the gate 16 may be a multivibrator triggered into a first state of operation by the wheel-trip pulse and the output thereof being amplitude-modulated by the radiant energy signals from the amplifier 15.

In the illustration of FIGURE 1, the wheel-trip device 9 is shown located on the optic axis 5. If the magnetic gap is located on this axis, then one-half of the bottom of the box will be viewed by the detector. For example, if the journal box is moving from left to right in the sense of the drawing, the wheel-trip is operated approximately when the center of the journal box is aligned with the axis 5, as shown. The gate is then opened and remains open for a time sufficient to permit the detector to view a part, or all, of the bottom of the journal box surrounding the axis 5 and between lines 18 and 19.

In order to maintain the gate 16 in the open condition for a sufficient time for the thermistor flake to be activated by the radiations from the journal box, the wheel-trip preferably includes a storage circuit, as for example a monostable multivibrator or a time delay drop-out relay. The trip signal is pre-set to have a duration long enough to allow cell response along half of the bottom of the journal box 6 for a train moving at maximum speed, whereby for trains moving at slower speeds a smaller area is viewed.

In order to protect the internal parts of the housing 1 during periods when no trains are passing, shutter means 14 are operated to close and open a viewing aperture in the housing 1. The shutter means 14 remains open as long as a train is passing the detector. The wheel-trip 9 in conjunction with a relatively long time-constant storage circuit 23 provides the actuating signal for a shutter-opening solenoid 24. Thus, if the time constant provided by the storage means 23 is long enough to maintain a

shutter-opening signal of the solenoid 24 for the slower-speed trains, as for example down to five miles an hour, the shutter 14 will also remain open for all greater train speeds. When the train passes completely, the storage device 23 will fail to excite solenoid 24 and the shutter means 14 will close, as by spring or gravity-operated means, to await the next train.

It should now be apparent that by the unique orientation of the detector and wheel-trip device, it is possible to monitor the journal box radiations from rolling stock moving in either direction, using only a single detector and wheel-trip device. The invention, therefore, reduces the required number of detectors and wheel-trip devices by half.

While the foregoing description sets forth the principles of the invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation of the scope of the invention as set forth in the objects thereof and in the accompanying claim.

We claim:

A hot-box detector, comprising an infrared detection device mounted alongside a longitudinally extending length of railroad track, said device comprising heat-responsive means producing an electrical signal in response to incident radiant energy, optical means imaging said heat-responsive means along an axis directed upwardly in a vertical plane that is at a right angle to the longitudinal direction of the track and in a direction to view on passing journal boxes or axles an area indicative of heat in an adjacent journal bearing, a normally blocked gating circuit coupled to the output of said heat-responsive means, radiant-energy indicating means coupled to the output of said gating circuit, actuating means for said gating circuit including bi-directionally responsive wheel-operated trip means symmetrically disposed on opposite sides of said vertical plane and producing an electrical impulse for each passing wheel, the connection to said gating circuit being such as to open the same in response to said electrical impulse, whereby signals from said heat-responsive device are passed to said radiant-energy indicating means regardless of the direction of train movement on said length of track.

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