

Hot box detector indirectly controls signal 4R to STOP and T-179 to APPROACH aspects when overheated journal is "spotted."

Hot Box Detector Sets Signals

Pennsylvania installs detector which automatically sets a signal to the Stop aspect when a hot box is detected on a passing freight train. Red indication lamp is lighted and alarm buzzer is sounded in a block station when the detector "picks up" an overheated journal.

ON THE TRENTON CUT-OFF, 25 miles west of Morrisville yard, the Pennsylvania installed a Servo Corporation hot box detector on the westbound track to view the journals of freight trains. This heavy traffic freight line handles 12 scheduled westbound freight trains daily, which with extras, may total 20 trains. Maximum speed in the territory is 40 mph.

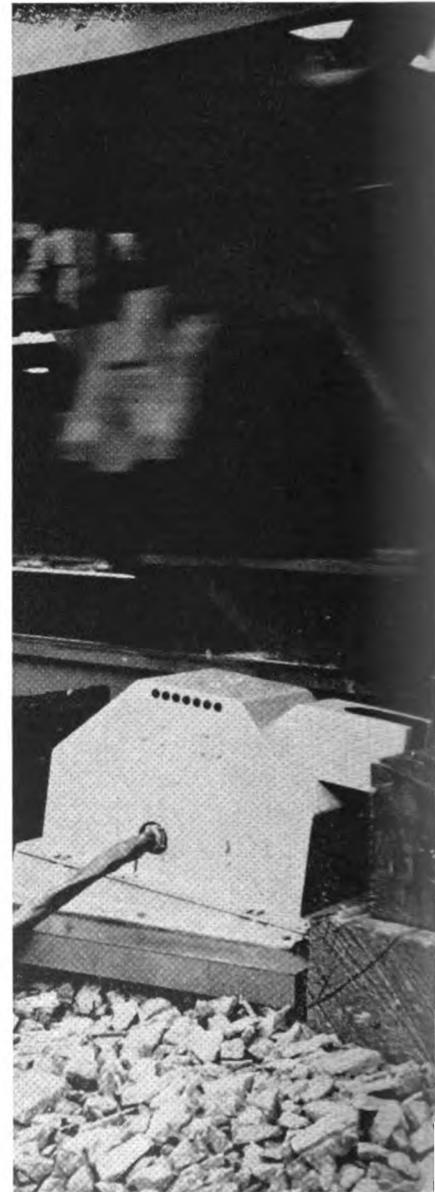
This installation was located in a territory where incipient hot boxes develop. The location of the detector fulfilled the other three requirements recognized by other railroads as ideal for hot box detector location, namely: (1) a signal to stop the train, either automatically or manually; (2) a siding to set cars off; and (3) where car inspectors are available for inspecting and servicing the set off cars.

The detector is located about 25 miles west of Morrisville Yard and, as shown in the diagram, is approximately 3.5 miles in approach to the home signal for Nest block station. A small yard at Nest may be used for setting off cars with abnormally hot journals and car inspectors are available for inspecting and servicing cars set off.

When the front end of the train

passes over the detector, the recording equipment at Nest block station starts to operate and the heat record of each journal is recorded graphically on a vertically moving chart, 5 in. wide. There is a stylus pen for each side of the car. These pens are opposite and are $2\frac{1}{2}$ in. apart. The pens move in parallel lines and are deflected to the right in proportion to the heat from the journal. The zig-zag record is burned into the special chart paper, which is divided into millimeters. When the difference in readings between opposite journals is 13 mm or more, relays are actuated to place the signal at Stop. It is the difference in reading between opposite journals, rather than the individual reading of a journal that decides whether the signal will go to Stop automatically.

When a freight car with an abnormally hot journal passes the detector it causes the detector equipment to actuate controls that set signal 4R to display the Stop aspect (three amber lights in a horizontal row, on the PRR position-light signals). Signal T-179, 8,975 ft in approach to 4R, displays the approach aspect (three amber lights in a row inclined 45 deg in the upper quadrant). Simultaneous with the setting



1 Westbound freight trains pass hot box detector 25 miles out of Morrisville

of 4R to the Stop aspect, a red indication lamp is lighted and a warning buzzer sounds in Nest block station. Acknowledging that a hot box has been detected, the operator turns a key switch shutting off the buzzer. The red warning lamp remains lighted as a reminder. In addition the graph is available for visible observance by the operator.

Also, as soon as the hot box is detected indication lamps on the hot box detector alarm panel are lighted to show that the abnormal journal is on a wheel on the north or south rail. The pengraph recorder in the block station, which has been charting the detector recordings of the train, indicates the hot box by a "tall" pip. This pip will stand out

well above the other on the opposite end of the axle and is thus readily recognizable.

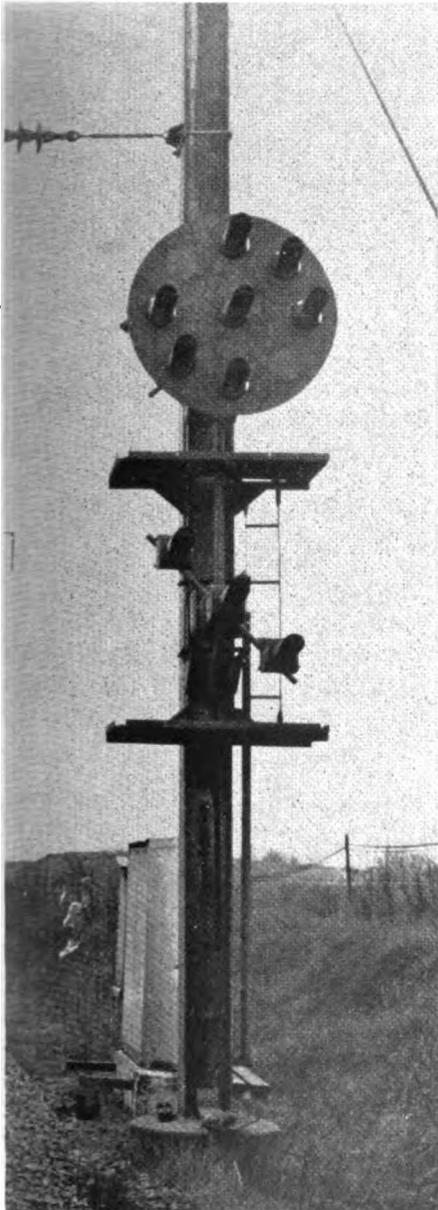
When the engineer has brought the train to a stop at signal 4R, a member of the train crew calls the Nest block operator and the operator tells the train crew the location of the hot box. For example: "You have a hot one on the rear journal of the front truck on the north side of the 14th car back." Counting four pips per car from the engine, the operator counts cars from the head end. If the hot journal is close to the rear of the train, he may count cars from the caboose.

After the crew inspects the journal they inform the block operator as to its condition, so he may line the

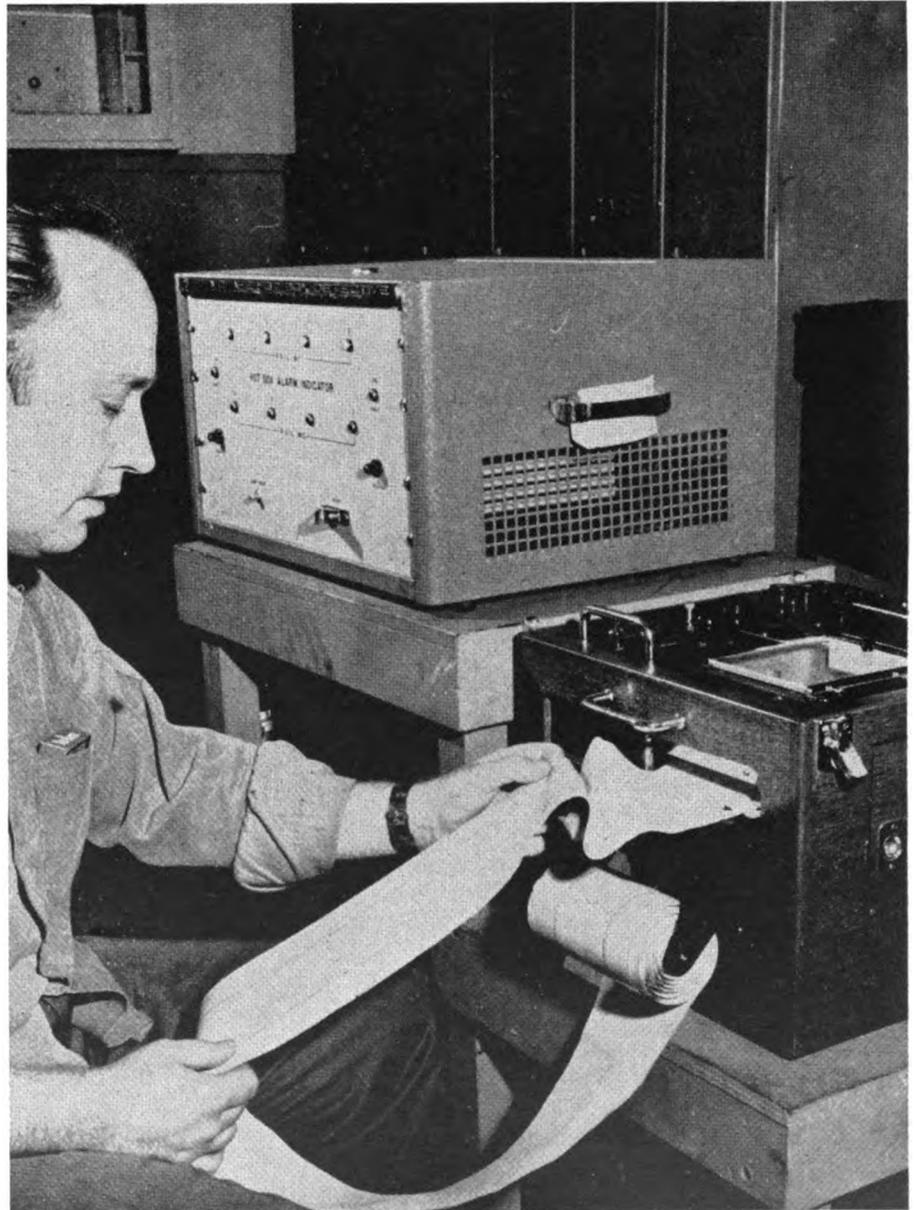
route for either setting off car or letting the train proceed. The operator presses a pushbutton that resets the home signal controls and thus clears signal 4R, allowing the train to proceed.

The detector has been in service near Nest block station for over a year. It has been successful in its operation of automatically controlling signal 4R to the Stop aspect when an abnormally hot journal is detected.

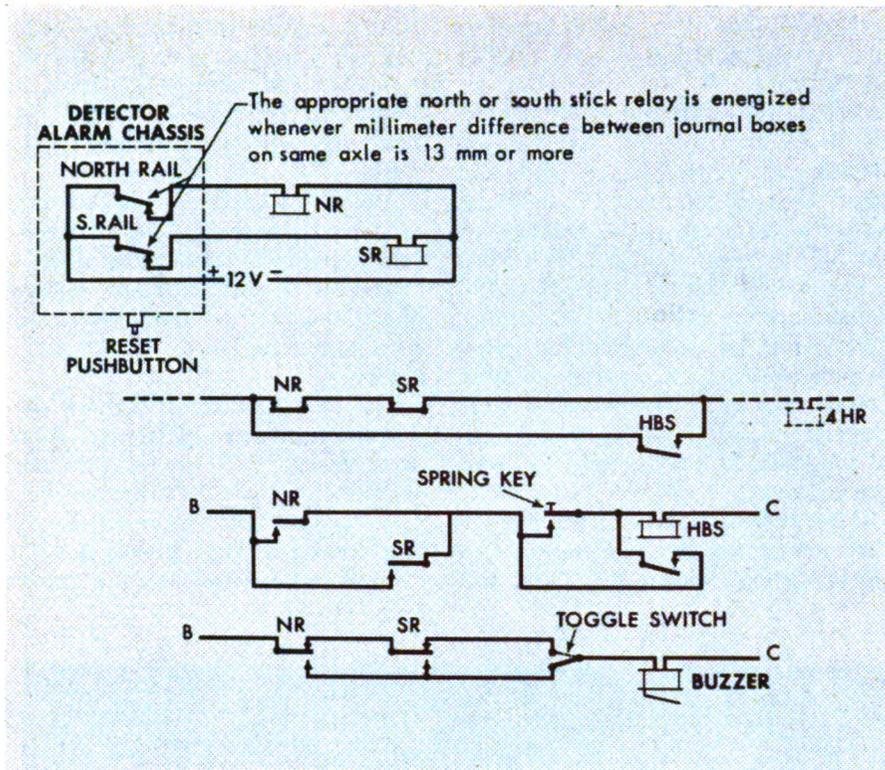
The PRR has found that for their purpose a 13-mm differential deflection between the journals at the ends of the same axle is a proper minimum amount for automatically setting the signal. This deflection is high enough to be more than the general



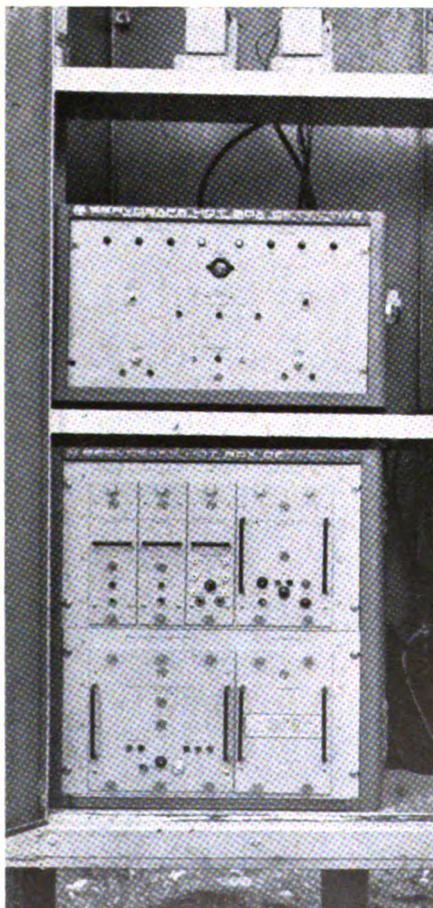
2 If an overheated journal is "spotted," this signal automatically goes to stop.



3 Nest block operator is alerted by buzzer and a red indication lamp that train has an overheated journal. He reads the graph to find the location so he can tell the train crew.



Circuit diagram showing connection between hot box detector system and signal controls.



Relay case at detector location contains: relays for traffic direction (top); alarm unit (center); power supply and amplifiers (below). This is about 3.5 miles in approach to Nest.

differential for roller bearing cars and locomotive journals, so that they do not knock down the home signal. This deflection is not so great that there is danger of a burned off journal before the train can be brought to a stop.

A four-wire circuit with a ground return is used between the detector location in the field and the pen-graph recorder with a detector alarm in Nest block station. One wire controls the north rail pen in the recorder, a second is for the south rail pen. A third wire is to turn the recorder on "on" and "off," and a fourth wire is for control of the alarm equipment.

Interconnection with the signal circuits is by normally closed front contacts of NR (north rail) and SR (south rail) relays. One of these relays is de-energized by a stick relay when the detector shows a differential deflection of 13 mm or more. The dropping of either the NR or SR (1000-ohm, DN-11) relay opens the HR circuit, setting signal 4R to Stop aspect. With NR or SR de-energized, the operator cannot clear 4R.

The signal circuit is restored to normal by pressing the Reset button on the Servo detector alarm panel, which cancels the stick circuit in the alarm panel and allows NR and SR

to energize. This must be done to restore the alarm circuit after each train on which a hot box is detected.

In case the operator wishes to place the signal back in operative condition and still retain the alarm indication on the alarm chassis, he presses on the spring return key, which picks up relay HBS (1000-ohm, DN-11), contacts of which bypass NR and SR contacts in control of 4HR.

Single Direction Detectors

Each detector is mounted outside the rail on a 12 by 12 by 36-in. concrete foundation between two ties. The detectors are in weatherproof housings, canted at an angle toward the rail. The detector viewing line sweeps across the bottom and up the side of the journal as it recedes from the detector.

Three transducers are mounted on the inside of the south rail. When a wheel passes over these transducers, the appropriate relays are activated. The relays control the starting of the recording chart and the opening and closing of detector shutter.

The shutter over the detector lens will stay open sufficiently long to accommodate a train passing at low speeds. After the caboose passes, the shutter will close in a few seconds. To prevent snow and ice from interfering with operation of the shutter, 300-watt heaters, automatically controlled, are located in each detector head.

The power supply and amplifiers in the field as well as the pen graph recorder and detector alarm equipment at the block station operate on 110 volts, 60-cycle a.c. Control circuits are fed 12 volts d.c. from a battery on trickle charge from a rectifier.

The Pennsylvania plans to install 20 more of these Servo hot box detectors in heavy density traffic lines on their system. Sixteen of these installations will provide for the automatic alarm features and place signals to Stop, similar to the Nest installation. The other four will be placed at entrances to strategic yards to facilitate yard inspection of cars.

This installation was made by the signal department of the Pennsylvania under the jurisdiction of J. I. Kirsch, System Engineer-Communications and Signals, working with the hot box detector manufacturer, Servo Corporation of America.