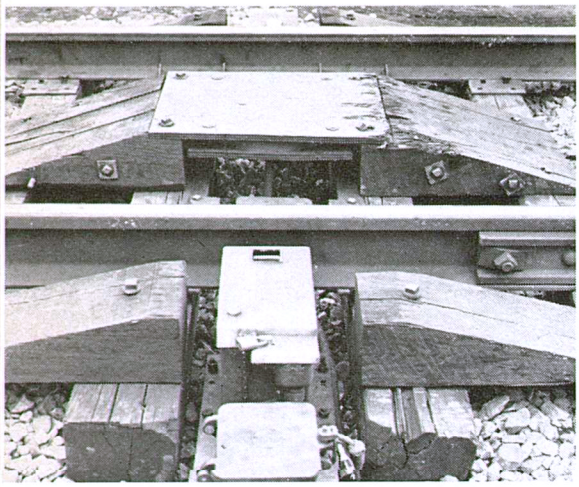
Hotbox detectors cut out journal losses on B&O

Installation of hotbox detectors on the Akron, Ohio division of the Baltimore & Ohio has reduced burned-off journals and derailments to the vanishing point. According to division superintendent C. E. Heck, the detectors have found a number of potentially dangerous hot journals, but detection has been early enough so preventive measures measures could be taken.

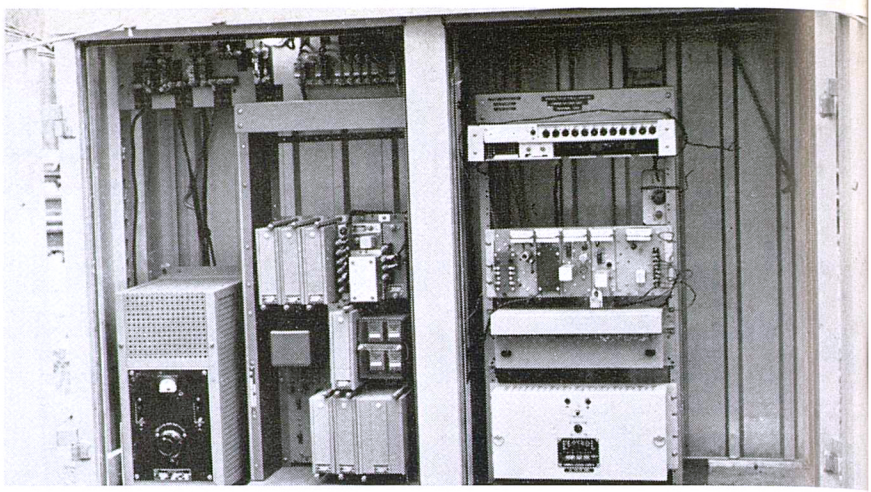
"There is no question that significant overall savings are resulting from the use of the hot journal detectors. And they spread over many areas of the railroad's interests. If the system has to date prevented just one derailment, it has more than paid for itself. Additionally, it is definitely benefitting shippers through minimizing train delays and eliminating the cargo damage that so often accompanies serious train derailments. In the passenger area, human safety and the maintenance of running schedules have been definitely enhanced," says Heck.

On the Akron division, B&O has installed six Wheel Thermo-Scanner units, made by General Railway Signal Co. Every individual wheel journal in a train is scanned for excessive hub heat each time it passes a scanner unit. Data is then transmitted to the dispatcher's office in downtown Akron. There it is read out on graphs by an analog recorder. Whenever a 15 mm deflection at 80 deg. above ambient

Recorders (left) and wheel counters (right) are in the dispatcher's office at Akron, Ohio. Readout includes train direction, time of day, and journal data.



Radiometers are outside of rails, proximity detector between rails.



Instrument case houses hotbox detector system's relays, timing circuits, amplifier, gate unit, etc., in left case; carrier equipment at right.

temperature occurs in a graphic readout, a hot journal is indicated.

Actuation of the detector by a hot journal also causes a white rotating beacon to be lighted. Mounted on a signal mast near the hotbox detector location, the beacon alerts the train crew that a hot journal has been detected. The train is then stopped and the conductor telephones the dispatcher.

A counter, working as part of the scanner sytem, provides information enabling the dispatcher to relay to the train conductor the exact car number and journal causing the trouble.

The Wheel Thermo-Scanner units use two radiometers mounted between ties and positioned to scan the underside of the hub of the wheel. The radiometers are built around Eastman Kodak Co.'s Ektron infrared detectors. The detector consists essentially of a film of photoconductive substance deposited on a glass or quartz base. Changes in irradiance alter the film's resistance and set up an electrical signal.

Ektron detectors are pure Ohm's Law resistors which, having no diode effect, are not subject to microphonics. Therefore they are largely impervious to change from such random fluctuations including noise, a factor which, if not compensated, could result in false readouts. Therefore, it is the Ektron detectors that efficiently sense excessive wheel hub heat and set up the hot journal signal so quickly translated into a graphic readout at the dispatcher's office.

Here is how the Wheel Thermo-Scanner unit operates:

As a train passes a scanner its wheel traverses a magnetic detector. A voltage pulse is generated as each wheel flange moves through the detector's magnetic field. Passage of the first wheel actuates relays controlling a recorder and the Ektron detector, causing the former to start and a shutter connected with the latter to open. Passage of successive wheels keeps the relays energized. A timing circuit releases the recorder relay about eight seconds after the last wheel of a train passes the detector.

Rotating white beacon below signal head lights to alert crews.

Passing wheels are accurately spotted above the magnetic wheel detector when they are optically centered within the Ektron detector's field of view. The infrared detector's sensitive area is about ⅛" square. It senses heat from the passing wheel journals and immediately responds to this infrared radiation. The output of the Ektron detectors is fed directly into a two-channel, high-gain amplifier housed in the wayside control rack in an instrument case. In its turn, output of the amplifier is fed into a gate unit.

Scanning is processed within the gate unit, allowing only infrared signals to be fed to the dispatcher's office analog pen recorder at the precise instant wheel hubs are being scanned.

In the wheel counting procedure, a proximity detector differentiates between locomotive and cars by sensing low-hanging metal masses on the former at the head of the train. Output of the magnetic wheel detectors is fed to a car detector unit which counts the wheels as they pass. The same number of wheels passing the magnetic wheel detectors defines the first truck of a car. Counting the same number of wheels for the second truck identifies the end of the car.

An analyzer unit in the wayside instrument case supplies the necessary logic to identify locomotive units and hot journals, and to encode

its own output for transmission via railroad carrier equipment to the dispatcher's office. Pulse height detectors in the analyzer are trigger circuits with operating points adjusted to correspond to the desired pen deflection and, therefore, to accurately describe wheel hub temperature rises.

Temperature information from the track is posted in the form of pen deflections through a printer control at the dispatcher's office. Resultant readouts provide a permanent record of the passage of trains, including their direction, time of day and, as previously noted, any abnormally hot journals, plus their exact location in the train.

The seven hotbox detectors on the Akron division are located at Newton Falls, Ohio, about 10 miles west of Youngstown; at Apco, about 19 miles west of Youngstown; at Monroe Falls, about 8 miles east of Akron; at Easton, about 15 miles west of Akron (scanners on both sides of double track viewing trains operating in either direction); and at Homer, about 37 miles west of Akron (two sets of detectors as at Easton).

The hotbox detectors on the Akron division, are but a part of a system-wide approach taken by the B&O with regards to detector installations. As of Jan. 1, 1966, B&O had 20 GRS detectors in service and 7 hotbox detectors in operation that are made by Servo Corp. of America.

Hotbox detector reliability has been exceptional, reports the Akron division superintendent. Out of five detections in a recent month, for example, four were of potentially troublesome hot journals—about an 80% level of accuracy as far as hotboxes are concerned.

The one discrepancy can be explained by the fact that the wheel Thermo-Scanner indicates such other troubles as (1) bad carrier bearings on diesels; (2) a direct coupling to an axle giving off heat; and (3) set up brakes.

But, notes Mr. Heck, detecting these other conditions is important, too. In case of set up brakes, it the condition persists long enough, flat wheels requiring otherwise unnecessary work will result. So, by early detection of troubles other than hot journals, savings in parts, components and labor costs are realized for the railroad. **RS&C**