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DISADVANTAGES OF TRACK CIRCUITS

Abstract: in this article, the author discusses the shortcomings of track circuits, and describes ways to prevent them. Following is an example of negative consequences in case of untimely elimination of these disadvantages.

Key words: rail circuit, rail line, false employment, false lightsome, electronic systems, sensor control axes.

The main task of the systems of railway automation and telemechanics is to ensure the safety of train traffic during the operation of railway transport. Most railways use track chains to determine whether a section of a railroad track is occupied/vacant. These devices are fairly simple in design and have been in use from 1872 to the present day. Currently, there are more than 30 types (800 types of them) of track circuits.

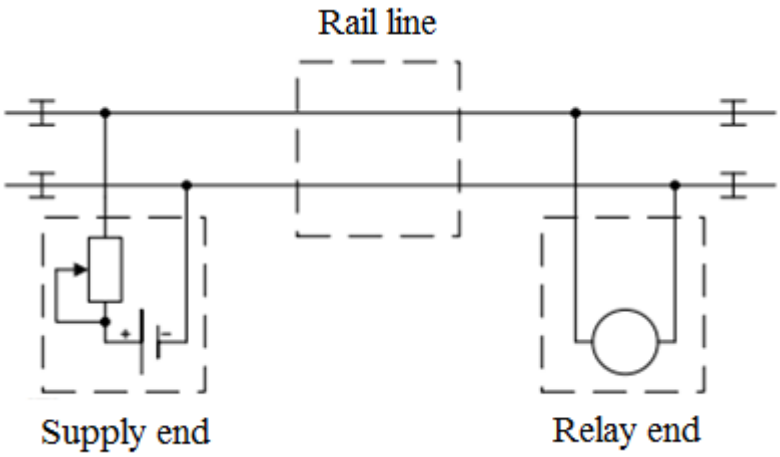
A rail circuit is an electrical circuit, the conductors of which are the rail lines of a railway track. The simplest diagram of a track circuit is shown in Pic.1.

It is customary to divide the track chain into 3 parts:

- supply end (integrates the equipment that serves to power the rail circuit);

- relay end (integrates equipment that serves to perceive signals from the rail line);

- rail line (includes rails, sleepers and ballast).



Pic.1. Track circuit diagram

When the track circuit is free, the power supply through the equipment of the supply end enters the rails and is removed from the rails through the equipment of the relay end and is fed to the travel relay. In this case, the track relay is energized, which indicates that the track circuit is free.

When the track chain is occupied by the wheel pair, the relay end is shunted, as a result of which the track relay is de-energized, thereby fixing the track chain being occupied.

Rail chains fulfill various critical functions:

1) automatic continuous monitoring of the state of track sections on the tracks and stations (employment / vacancy);

2) control of the integrity of the rail lines;

3) excluding the possibility of accepting a train on a busy track, moving the arrow under the train;

4) transfer of information about the indications of track traffic lights to the ALS system (automatic locomotive signaling).

But at present, due to objective reasons (unsatisfactory content of the ballast layer, limited length, lack of isolating rails from bridge structures, etc.), reliable operation of track circuits is impossible on many road sections.

A significant problem is the so-called false occupancy (when the travel relay is de-energized in the absence of rolling stock). In such cases, the station

attendant allows the movement of trains by invitation signal. Attempts to adjust the track circuit with false occupancy sometimes lead to a dangerous failure - "false vacancy" (when the track relay of the section occupied by the train does not turn off).

The reasons for the false occupancy of the track and switch isolated section: ballast pollution, malfunction of signaling devices, snow drifts or icing of the track, rust on the rails or wheels of the rolling stock.

The most dangerous failure in a track circuit is false freedom, as this can lead to an accident.

The reasons for the false freeness of tracks and switch sections may be: malfunction of rail circuits, signaling devices, contamination of the rail heads, rust on the rail heads, snowfall, ice, being on the tracks, isolated switch sections of lightweight mobile units and wagons with wheelsets, surfaces which skating is dirty, etc.

In the case of acceptance of rolling stock on a busy track, operating in the condition of false freedom, it is impossible to stop the train instantly, since the movement of the train occurs at a set high speed, as a result of which a collision and wreck of trains occurs with the ensuing severe consequences.

So, for example, on December 22, 1990 at the Yelnikovo station of the Southern Railway, three trains crashed at once. The reason for the crash was the false vacancy of the switch section 4-8 of the joint venture when it was actually occupied by the last three carriages of train No. 3062, which allowed the station attendant to move switch 8 under the base of the last car, as a result of which this car got off and untied from the freight train, which led in tragic consequences.

The control of the free state of the track sections can also be carried out on the principle of counting wheelsets entering and leaving the section. The axle counting system is an alternative to track circuits system for automatic control of

the occupancy / vacancy of railway track sections, based on microprocessor technologies.

Electronic systems for counting the axles of the rolling stock make it possible to automatically calculate the axes of the rolling stock passing through certain points of the station in any direction and for any period of time, as well as archive this information. This will allow you to have information about the number of cars that are at any time and on any sections of the track.

A critical element of the electronic axle counting system is the sensor for controlling the passage of the axles of the rolling stock. The sensors have found application not only in the system for monitoring the vacancy of track sections, but also as part of diagnostic systems for wheelsets of rolling stock and other systems.

The floor-standing equipment of the electronic axle counting system includes:

- electronic module;
- device for protection against lightning and impulse overvoltage;
- rail sensor;
- sensor mounting kit.

All the equipment of this system does not require seasonal adjustments, has small dimensions and is easy to install.

But axle counting devices do not control the integrity of the track lines, and in the absence of track circuits, as a rule, it is impossible to encode the paths with ALS codes. For this reason, the use of axle counters on the main tracks of stations, the tracks along which the movement of passenger trains is carried out, the tracks of non-stop pass, as well as on the tracks that are equipped with automatic blocking is impractical.

In such cases, loops with a length of no more than 250-300 m are laid next to the rails on the track sections. It is recommended to use several loops connected through separate code transformers, with a long section length.

The exclusion from operation of track circuits, which are the cause of 30-40% of all failures of signaling devices, will lead to a decrease in delays and downtime of rolling stock, an increase in the turnover of cars and locomotives, and an improvement in train traffic safety. At the same time, operating costs for trimming ballast, for replacing and maintaining insulation elements for rail lines and butt connectors are excluded, including the cost of operating railcars for welding butt connectors.

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