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POPULAR SCIENCE

From railroad inertia to the blocking system: understanding train safety

De la inercia del ferrocarril al sistema de bloqueo

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Abstract

What happened when a train experienced technical failure? Could the following train stop before reaching it? How were accidents avoided?These questions are central to the essay exploring the transition from railroad inertia to the blocking system.

The application of the blocking system began with communication devices used between operators of two stations, where the permission to circulate in the section was guaranteed only when the track was free, avoiding the frontal encounter between trains or one train catching up with another. Over the years, this system became "railway signaling" and in an evolutionary path reached the form of "automatic system of protection in the circulation". Today, it is possible to read the speed of a train and evaluate the running characteristics of the approaching train, in order to automatically apply the brakes or limit its speed to prevent the two trains from overtaking each other on the same track.

Resumen

A través de este proyecto, que tiene estado parlamentario, se busca dar una apoyatura técnica en un tema de gran trascendencia para la población por su impacto en la seguridad operacional y ambiental.

En el Senado de la Nación existe un proyecto de ley que plantea ampliar las competencias de la Junta de Seguridad en el Transporte (JST) a ductos y otros sistemas de traslado de energía en todas sus formas y fuentes. La propuesta, que ya tiene estado parlamentario, busca ampliar la Ley N.° 27514, que crea a la JST y delimita sus competencias en todos los modos de transporte de cargas y de pasajeros de Jurisdicción Nacional. Para el senador chaqueño Antonio José Rodas, el autor del proyecto de ley, los sucesos en el transporte de energía deben ser investigados por un organismo técnico multimodal como la JST, no solo por su impacto en la seguridad operacional, sino, sobre todo, en el medioambiente.

You may have experienced the discomfort that comes with pedaling on deflated wheels while riding a bicycle. Low air pressure can distort a wheel, creating "rolling resistance", which can happen in larger vehicles with rubber tires, similar to a bicycle. What about rail transportation? This land conveyance has one of the lowest rolling resistances due to the use of steel wheels on steel tracks. This is as a result of the wheels exhibiting extremely little deformation due to the stiffness of the steel surfaces.

Obviously, it is essential to make sure that no train touches another in order to achieve the circulation of enormous masses with a reasonable level of risk. This justification required years of practices that emphasized the significance of scheduling trains, restricting their movement on each section of track, and implementing blocking mechanisms".

Yet, it is important to remember that a railway vehicle must be suitably hefty in order to draw without slipping on steel. A tractive vehicle (of great weight) can tow a large number of cars without traction, as is most often understood. Nevertheless, this benefit of the train also carries a risk because it is exceedingly challenging to stop due to its mass and the inertia created throughout its circulation. Can the safety of a vehicle's circulation be correlated with its mass?

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Trains were initially dispatched based on intervals of time. But what would happen if a train was stopped because of a malfunction? Might the following train stop before joining it? Because of the aforementioned inertia, trains frequently collided, leading to catastrophic mishaps. As a result, in the first half of the nineteenth century, a method or process was put in place to lessen this risk. In other words, starting to think about safety before the idea became formalized.

In order to prevent frontal collisions between trains or the possibility that one train could reach into another, the blocking system was first applied to communication blocking devices used between station operators at two different locations.

After initially being referred to as the "signaling block system", this technology evolved into the "automatic traffic protection system" over time. Nowadays, it is feasible to read a train's speed and evaluate the features of an incoming train to automatically apply the brakes or reduce the speed of the approaching train in order to prevent a collision between the two vehicles on the same track.

Ultimately, three factors that are intimately associated to one another are the mass of the train, its inertia, and the safety management of its circulation. From the perspective of the systemic accident model, we could say that the blocking system, which was created more than 200 years ago as a practical method to manage the risks associated with the movement of trains in various sections even before safety was thought to be important today, serves as a crucial system defense barrier. Likewise, its ongoing evolution (manual blocking, Direct Traffic Control (DTC), automatic blocking with fixed and moving blocks) elevates it to the status of the primary determinant of the lines' ability to operate at full capacity.