How Steel Hovers Maglev Trains Above the Right Track

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Magnetically levitated trains, known as maglev trains, are the fastest trains on Earth. Nevertheless, they took a very long time to arrive. The physics behind maglev trains was first touted at the beginning of the last century and a number of people have been associated with its development.

The French-born American inventor, Emile Bachelet, obtained a patent for a "levitating transmitting apparatus" in 1912. The Russian physician, Boris Petrovich Weinberg, built an experimental model of a vacuum train in 1913 using magnetic suspension technologies. And, the German engineer, Hermann Kemper, received a patent in 1934 for a "monorail vehicle with no wheels attached." They were all way ahead of their time.

It wasn't until 1984 that the first maglev trains entered commercial use.

How Do Maglev Trains Work?

Unlike trains driven by engines and wheel-on-steel electric trains, maglev trains are propelled by superconductive electromagnets, typically made of magnetic steel. Steel is between 98% and 99% iron and its iron atoms give steel its magnetic properties. The other 1% to 2% of steel is made from carbon, which gives it the strength and durability to support the infrastructure required for maglevs.

As with all magnets, when you place matching poles face to face with each other they repel each

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other. Maglev trains use electromagnetism. A magnetized coil is fixed along the length of the track, which, for maglev trains, is called a guideway. This repels the large magnets fixed underneath the train, which causes the train to levitate about 12 cm above the ground. The magnetic current running through the coils also creates a strong magnetic field that moves the train along the guideway.

What Are the Benefits of Maglev Trains?

The electromagnetic propulsion means that maglev trains can go much faster than conventional trains. They can cover hundreds of kilometers an hour. As they experience no friction, they have less wear and tear, fewer mechanical faults, and are less likely to be delayed by incremental weather. Plus, they provide a much smoother and quieter ride for their passengers.

Where Do Maglev Trains Operate?

Maglev trains operate on a commercial scale in South Korea, China and Japan. The fastest maglev train is currently being trialed in Qingdao, China; it can reach speeds of up to 600 km per hour. It's just waiting for its tracks to be built so it can enter commercial service.

As maglev trains can not currently run on standard train tracks, maglev track construction is often what holds up many maglev launches. Japan is now testing its latest maglev train; the Chuo Shinkansen hit 603 km an hour in test runs. It will eventually be guided between Tokyo and Nagoya by steel profiles made of hot-rolled steel and electromagnetic coils made from aluminium windings. To make its route earthquake-proof, pillars carrying elevated tracks are to be seismically reinforced with steel plates. Its commercial launch has now been delayed because particularly soft soil was found in one of the areas to be tunnelled.

Once completed, now forecast to be in 2034, the Chuo Shinkansen will do its route in just 40 minutes, cutting 45 minutes off the current 90-minute journey.

Adapting Existing Train Tracks Could Make Maglevs Go Mainstream

Now, Italian company IronLev has created a new technology that allows maglev trains to run on existing train tracks. It has carried out its magnetic levitation test on Italy's Adria-Mestre train route. Using passive ferromagnetic levitation, IronLev's prototype vehicle, weighing one ton, successfully covered the 2-km-long test track at a self-limited speed of 70 km/hour. Magnetic skids suspended the vehicle by interacting directly with the traditional railroad tracks.

"We proved that our prototype can be applied on a large scale, revolutionizing the rail transportation sector, thanks to its technical simplicity, versatility of use and lower cost than similar systems," said Adriano Girotto, president of IronLev.

The logistics of running superfast maglev trains on the same tracks as standard trains may be problematic, but once this has been overcome maglev trains could one day crisscross the world and give air travel a run for its money. ✦