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Multi-Directional Cable-Free Elevator for High-Rise Buildings

To quote my October 2013 column, which described a vertical transportation advance, "Without a major breakthrough, elevators have reached their height limits because longer cables will break under their own weight." (You will find that column online at http://www.technologytoday.us/columnPDF/A_Vertical_Transportation_Breakthrough.pdf.)

In 2003, ThyssenKrupp installed its first twin elevator system. They named the system TWIN because it allowed two elevator cars to travel independently up and down in the same shaft. The elevator cars can travel independently because each one has a fully independent cable system. The computer system that drives the TWIN elevators makes certain that the cars never get too close to each other while traveling up and down in the shaft. (See Fig. 1.) This was a major elevator design advancement that increased the number of people who could be served by one elevator shaft.

Illustrations courtesy ThyssenKrupp

Fig. 1—The TWIN elevator system has two elevator cars running independently in the same elevator shaft.

To move beyond a system that has two elevator cars in one shaft, ThyssenKrupp engineers decided to get rid of the cable that lifts and lowers an elevator. To accomplish this, they adapted the magnetic levitation (maglev) system that they had designed to levitate their Transrapid high-speed maglev monorail trains. They repurposed the maglev system so it could work in an elevator shaft. They have named their new elevator system MULTI.

The ThyssenKrupp maglev system allows many elevator cars to run independently in the same shaft. The system is very radical because the MULTI calls for a twin-shaft elevator system where one shaft has elevator cars going only up and the parallel shaft, only a few feet away, has these same elevator cars only going down. The cars move up independently and, when they reach the top of the shaft, they switch to the parallel shaft to go back down.

If you look carefully at the top of Fig. 2, you will notice this two-shaft system is connected by a horizontal shaft at the top. The two shafts of the MULTI system will also be connected by a horizontal shaft at the bottom. At these two locations, the elevator cars switch from one elevator shaft to the other. For a visual of how this will work, see www.youtube.com/watch?v=53aIQszaHiw.

Fig. 2—The MULTI system has one shaft for elevator cars going up and another for the same cars going down.

The ThyssenKrupp MULTI system for vertical transportation is a safe

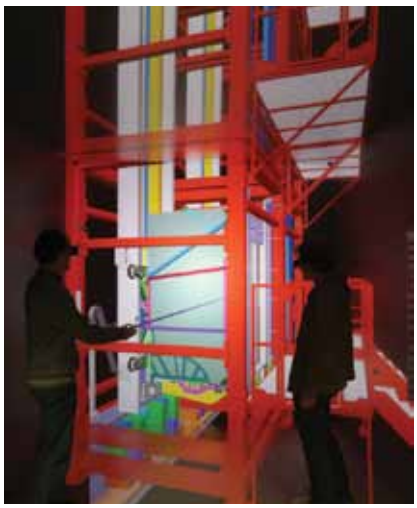

Fig. 3—Before they build a full-size system, ThyssenKrupp needs to model it to make certain all the structural, mechanical, and computer components function flawlessly.

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Fig. 4—The ThyssenKrupp vision calls for MULTI to develop into a vertical and horizontal transportation system.

technology with all the proper safety features that will prevent a car from falling in case of a power failure or other kind of disruption. It will not propel passengers up and down the elevator shaft at maglev train speeds, so it won't pop their ears or cause them to feel extra heavy or momentarily weightless. ThyssenKrupp is now modeling the system so a full prototype can be built by the end of 2016. (See Fig. 3.)

The MULTI elevator design has no height limitations. The world's tallest building is the Burj Khalifa in Dubai. It measures a few feet over one-half mile in height. When much taller buildings are built, the MULTI elevator system design could give individual elevator cars the needed distance to accelerate and decelerate to greater speeds without making the occupants in the car uncomfortable. When buildings grow to be one-mile high, this elevator system could carry passengers comfortably at much higher speeds.

When ThyssenKrupp redesigned their train system for elevator travel, they realized that magnetic levitation of the elevator car could allow the car to physically move in any direction that an elevator shaft system allowed. (See Fig. 4.) Therefore, if the elevator shaft was constructed in the same design as a vertical subway tunnel system, the elevator car could become a multi-directional transportation system in a new building. In this scenario, the elevator shaft would allow the elevator car to move in any direction and this could lead to radically new building designs.

ThyssenKrupp is now building a new elevator-testing tower in Rottweil, Germany. (See FIg. 5.) The tower will be completed in 2016 and ThyssenKrupp hopes to certify the safety of their MULTI elevator system quickly, since it basically repurposes an already proven transportation system.

Recalling the Facts

1. Research: How does a maglev train use magnetism to drive, stop, and lift the train when it is not physically in contact with the rail system?
2. How does ThyssenKrupp's TWIN elevator system differ from their MULTI elevator system?
3. Do you think it would be possible to operate this MULTI elevator system with many cars independently going up and down in one shaft? Why? TD

Fig. 5—ThyssenKrupp is building this tower to test their MULTI elevator system. Before MULTI can carry people, it will have to pass many kinds of tests.