

AUTOMATED UNDERGROUND CARGO FREIGHT SYSTEM

1. FIELD OF INVENTION

This invention relates to a new logistics concept using traffic segregation with tunnel systems in urban environments, which comprises tunnels and shafts and ramps at starting and ending points built of tubbing rings, where adjacent rings are adapted to be connected by coupling means, which is to be used as a tunnel lining and comprises of end face lying in respective planes and in between such structures embedded in respective grounds and comprises a number of uni- or bi-directional used lanes within the tunnels where self guided vehicles are driving autonomously with inducted energy supply using electronic or mechanical lane guidance, carrying micro containers (pallets) or containers of various sizes and weights within these tunnels from one access point to another and vice versa.

2. BACKGROUND OF INVENTION

In the past tunnels have been built to contain various infrastructures for transport, whereas the most known infrastructures are for railways, subways and roads. Inner urban tunnels to transport freight have been known approximately hundred years ago as well, in particular for transport of coal (Chicago) and for the transport of mail (London). Implementation and use of mentioned tunnels has been time consuming and difficult.

Another example of unmanned underground freight transport through tunnels was the Tunnel Tirol Project in early 1990 to transport cargo freight between the north of the European Alps along the base of the Alps to the south of Europe. This project was ultimately designed to move entire cargo trains through the tunnel, by having engines at the beginning and at the end of the train.

The Ruhr University in Bochum Germany has picked up the idea of providing cargo capsules to transport small palettes of cargo through unmanned tunnels and connect centers of industrial gravity in Germany with tunnels using Pipe Jacking Technology, whereas such tunnels should act as tubes for the autonomous vehicles. The principal difference to the applied patent is the size of such capsules which size does not match with logistic needs while using only mechanical track guidance.

In Switzerland there was launched an effort to provide underground transport for standardized Euro-Palettes which is deviated from the original idea of CargoCap. Similar to the German System it is planned, to establish a network of underground cargo tubes located in the area of ware house centers and cities across the country to serve the logistic needs of the cities. The principal difference to the applied patent is that it is designed for palettes only, the conventional structural outfit of the Swiss tunnel tubes which has no special provision to minimize the vibration impact to the underground and no coating to prevent fire and accidents eg, due to electromagnetic

smog.

Global urbanization started in between 1920 and 1940. The mix of individual vehicular mobility with the supply of goods using commercial vehicles was generally easier with lower urban population density than today, but growing cities suffered from increased supply disruptions caused by traffic jams.

Tunnelling has not yet become attractive at the early days of the last century, it has been far behind the tunnelling technology of today.

Since then, over the past half of a century, cities have massively invested in road construction to provide transport conditions on surface for the mixed traffic of personal and commercial transportation. Nowadays it became obvious, that mixed traffic conditions have reached a dead end.

To provide sustainable conditions in particular in an urban environment, the tipping point of traffic saturation has been reached. As cited in the report of the ITA working Group on Urban Problems, in 2007 for the first time in history our planet became predominantly urban with more than half of the world's population living in cities. In order to follow principles of intelligent traffic systems, sustainability will only be reached with traffic segregation, whereas cargo freight shall be diverted to underground tunnels which are connected with the surface via shafts respectively ramps, and personal transportation shall remain on the surface.

So far all known underground cargo freight systems are closed circuit systems, such being optimized for only one type of container, while the invention is designed to provide an open system in using underground space, whereas the first grade tunnels will service vehicles of different sizes, and secondary grade tunnels will service small vehicles for palettes only.

3. SUMMARY OF THE INVENTION

It is the object of the invention to provide a logistics concept based on traffic segregation by means of a tunnel system in high density urban agglomerations, which is capable to provide sufficient, fully automated transportation capacity for the cargo movement needed within an urban coastal or land locked environment.

In case of using tunnels in densely populated areas such tunnel systems shall include access points to connect with the surface and shall consist of one or two individual tunnels which are in general parallel and which are equipped with embedded energy system to provide energy over induction to the vehicles, an electronic or mechanical guidance system and a system for communication between vehicles and control center.

The surface access points shall be designed for climbing and diving tunnels and for tunnels remaining below ground, and shall be either open or covered ramps, vertical shafts equipped with one or several elevators or vertical shafts containing a spiral track

or two counter- rotating spiral tracks with one or several lanes.

These tracks shall contain an energy system to transmit energy over induction to the vehicles. These tracks might contain additional traction systems to support the vehicles on a steep slope.

The tunnel linings are made of reinforced precast concrete segments which are fully mechanically interconnected with mechanical connectors providing the invert structure for unmanned vehicles carrying containers or micro-containers equivalent to well wrapped palettes and continuously transported at low speed to allow for minimized impact to the underground and the environment and for reliable and predictable transport of cargo freight, whereas vehicles of different sizes can use the same lane.

4. BRIEF DESCRIPTION OF THE DRAWINGS

Figures 1, 2 and 3 show a schematic sketch of the options of the various tunnel cross section diameters.

Figure 4 shows the schematic sketch of the cross sections of access points (intake and outtake).

Figures 5, 6 and 7 are schematic sketches of the vertical section of the tunnel access point with shaft and ramp systems.

Figure 8 shows an access point with the tunnel climbing up to the surface and diving down.

CLAIMS

WHAT IS CLAIMED:

1. In a tunnel which consists of segmental lined rings for transport of underground cargo, using autonomously operated vehicles carrying standardized sea freight containers or one or several micro containers (palettes) on and off the transport system, containing the procedures and equipment for vertical, horizontal or inclined underground transport as well as underground storage of cargo vehicles.
2. The improvement set forth in claim 1, wherein said tunnel system of underground tubes, shafts and ramps are constructed predominantly using prefabricated reinforced concrete elements e.g. lining segments.
3. The improvement set forth in claim 1, wherein said system of underground tubes, shafts and ramps are arranged following the logistic of an underground network based on timely supply.
4. The improvement set forth in claim 1, wherein said surfaces and joints of the reinforced concrete are covered with special fire resistant and accident preventing layers of coatings.
5. The improvement set forth in claim 1, wherein the precast concrete invert segments are structured to contain energy supply, electrical and mechanical guidance system for vehicles.

6. The improvement set forth in claim 1, wherein the structured tunnel contains an information system to control the autonomous vehicles.

7. The improvement set forth in claim 1, wherein the vehicles are designed in order to follow the requirement of least air resistance.

8. The improvement set forth in claim 1, wherein the cross section of the tunnel tube contains a minimum of one and a maximum of four lanes.

9. The improvement set forth in claim 1, wherein vehicles with autonomous energy supply are only using the guidance system.

10. The improvement set forth in claim 1, wherein special provisions are provided at the invert level for control and minimization of the impact to the underground and to the above ground environment caused by vibrations from transport vehicles.