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Remarks:
Amended claims in accordance with Rule 137(2) EPC.

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(54) **Railway tunnel of improved safety**

(57) The railway tunnel of improved safety is a tunnel of circular section (1) built with a tunnel boring machine, having a slab (3), placed slightly over the bottom of the tunnel, and a separating wall (2), disposed at the middle of the tunnel, forming two independent railway galleries completely isolated, and a service gallery (6), below.

On the slab (3), close to the circular wall (1), on both sides, fire devices of box type (10) are disposed, which are extended down, forming vertical access galleries (8), to allow for the safe passage of people to the service

gallery, in case of accident or fire inside the tunnel.

The separating wall (2) disposes of large openings (7), provided with fire doors, regularly spaced along the length of the tunnel, to allow for the passage of the trains from one line to the other, in the case one of the lines became out of service.

The service gallery (6) is provided with emergency vehicles of shuttle type (9), to allow for local access of personnel and the safe evacuation of people, in case of accident or fire inside the tunnel.

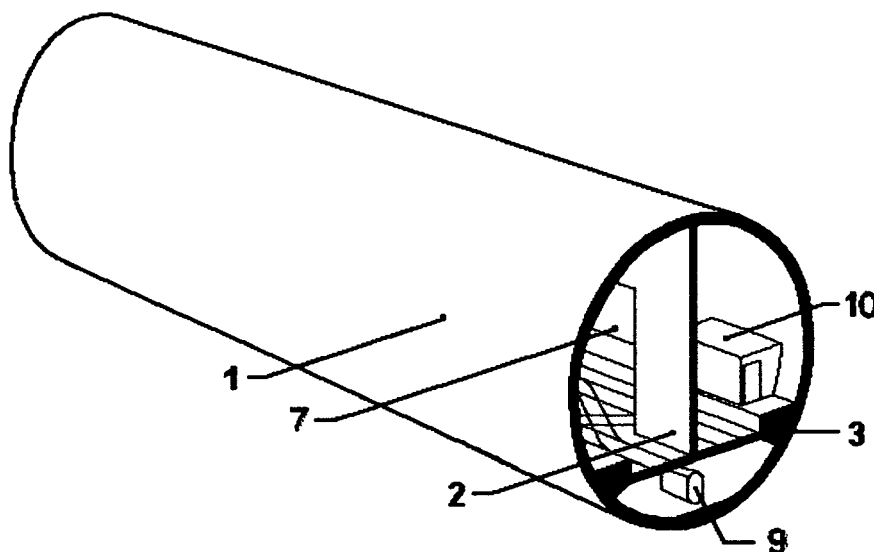


Figure 1

Description

Technical domain of the invention

[0001] The present invention relates to the construction of railway tunnels of circular section, with two lines, allowing for completely independent, but interconnected directions of traffic, and for easy local access and the safe evacuation of people, in the case of accident or fire inside the tunnel.

Background art

[0002] The construction of railway tunnels with tunnel boring machines is a solution increasingly used, for both economic and environmental reasons.

[0003] With the referred technique, the machine excavates the soil and places precast segments around the tunnel surface, in order to form the wall of the tunnel, which becomes circular shaped. Afterwards a filling on the bottom of the tunnel is executed, creating a platform for the circulation of the trains, with the two directions of traffic placed side by side.

[0004] In the case of long tunnels and high speed trains, due to the piston effect of the trains and to the requirements for fire safety, this solution is problematic, being necessary to build two separated tunnels, one for each direction of traffic. It is also necessary to build a complex system of galleries and shafts for local access and the evacuation of people, in case of accident or fire inside the tunnel. Alternatively, a third tunnel is built, between the other two. In both cases, the trains can not pass from one gallery to the other in case one of them became out of service.

[0005] Document EP1191186A1 discloses a tunnel with a separating wall at the middle, but it is a tunnel for road transport. Furthermore, the separating wall does not allow for the passage of the vehicles from one gallery to the other.

[0006] Document NL1013595C discloses a tunnel with a separating wall at the middle, but the wall is not continuous in high, not allowing for the isolation of the railway galleries.

[0007] Document JP2004270345 discloses a tunnel with a separating wall at the middle, but the wall exists only at the entrances of the tunnel, not allowing for the isolation of the railway galleries.

Description of the figures

[0008]

Figure 1 is a perspective of the tunnel.

Figure 2 is the current cross section of the tunnel.

Figure 3 is the cross section of the tunnel through a fire device localised inside the tunnel.

Figure 4 is the cross section of the tunnel through a fire device extending trough the wall of the tunnel.

Figure 5 is a plan of the tunnel.

Detailed description of the invention

[0009] The tunnel boring machine excavates the soil and places precast segments around the tunnel surface, which are clamped together, in order to form the external wall of the tunnel (1), which will be circular shaped.

[0010] Inside the tunnel thus formed, a slab (3), placed slightly over the bottom of the tunnel and at all its width, and a separating wall (2), disposed at the middle of the tunnel and at all high, resistant to fire and to the pressure due to the piston effect of the trains, are built, forming two independent railway galleries (4) (5), completely isolated, disposed side by side, one for each line, and a service gallery (6) below, with one or two cellules.

[0011] On the slab (3), on both sides, and regularly spaced, fire devices of box type (10), provided with escape doors, are arranged, which are extended down through vertical access galleries (8), provided with interior stairs, to allow for safe passage of people from the railway galleries to the service gallery, in case of accident or fire inside the tunnel. The fire devices of box type (10) and the vertical access galleries (8) may go through the external wall of the tunnel (1), by locally dismantling the precast segments.

[0012] In the separating wall (2) large openings are arranged (7), provided with fire doors, regularly spaced along the length of the tunnel, in order to allow for the passage of the trains from one line to the other, in the case one of the lines became out of service.

[0013] Inside the service gallery (6) emergency vehicles of shuttle type (9) are installed, which may circulate suspended from the slab (3), to allow for local access of personnel and the safe evacuation of people, in case of accident or fire inside the tunnel.

Claims

1. Railway tunnel of circular wall (1) with two lines, **characterized by** to have a slab (3), placed slightly over the bottom of the tunnel and at its all width, and a separating wall (2), disposed at the middle of the tunnel and at all high, forming two independent railway galleries (4) (5), placed side by side, completely isolated, which are connected to a service gallery (6) below, through vertical access galleries (8), placed close to the circular wall of the tunnel (1), on both sides.
2. Railway tunnel according to claim 1, **characterized by** the vertical access galleries (8) to be protected with fire devices of box type (10), provided with escape doors, for the evacuation of people from the

railway galleries (4) (5).

3. Railway tunnel according to claims 1 and 2, **characterized by** the vertical access galleries to be provided with interior stairs, allowing for safe passage of people between the railway galleries (4) (5) and the service gallery (6). 5
4. Railway tunnel according to claim 1, **characterised by** the separating wall (2) to be provided with large openings (7), regularly spaced along the length of the tunnel, equipped with fire doors, allowing for the passage of the trains from one line to the other. 10
5. Railway tunnel according to claims 1, 2 and 3, **characterized by** the service gallery (6) to be provided with emergency vehicles of shuttle type (9), allowing for local access and the evacuation of people. 15

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Amended claims in accordance with Rule 137(2) EPC.

1. Railway tunnel of circular exterior wall (1), comprising a slab (3), placed slightly over the bottom of the tunnel and along the entire width, and a flat separating wall (2), disposed at the middle of the tunnel and the entire height, forming two independent and isolated railway galleries (4) (5) and a service gallery (6), **characterized in that** the separating wall (2) be provided with fire box devices (10), regularly spaced, equipped with escape doors (7) on both sides. 25 30
2. The railway tunnel according to claim 1, **characterized in that** the fire box devices (10) be extended down, forming vertical access galleries (8). 35
3. The railway tunnel according to claims 1 and 2, **characterized in that** the vertical access galleries (8) be provided with interior stairs (11), to allow for safe passage of people between the railway galleries (4) (5) and the service gallery (6). 40
4. The railway tunnel according to claims 1, 2 and 3, **characterized in that** the service gallery (6) be provided with emergency shuttle vehicles (9), to allow for local access and the evacuation of people. 45

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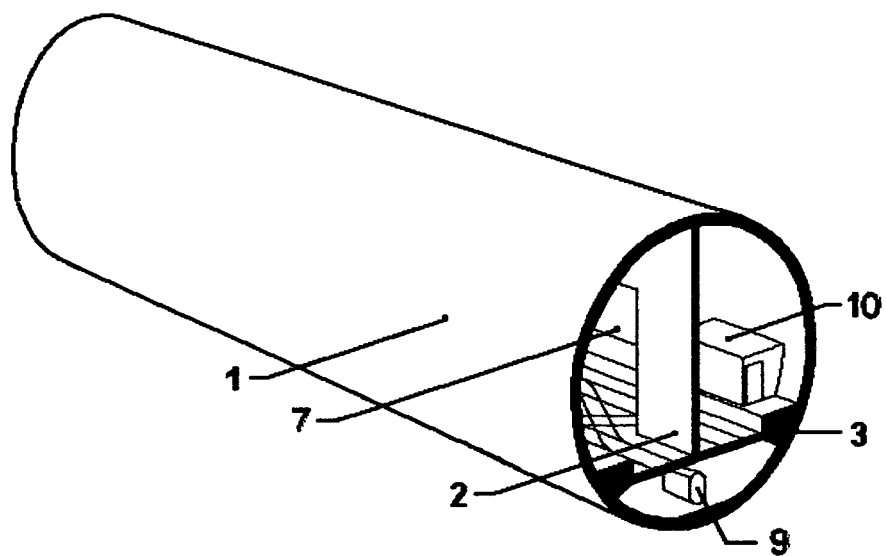


Figure 1

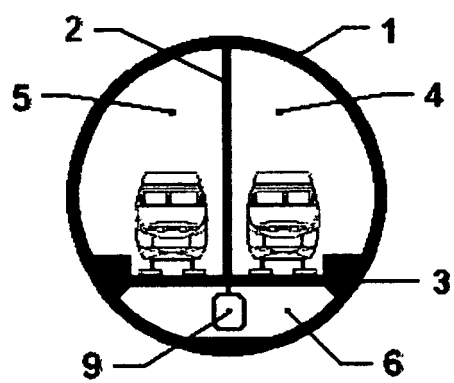


Figure 2

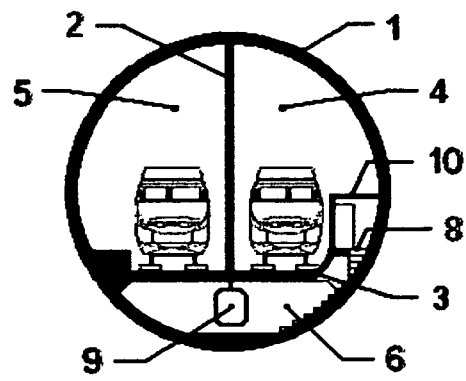


Figure 3

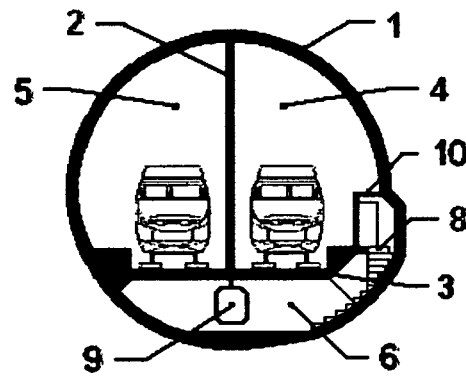


Figure 4

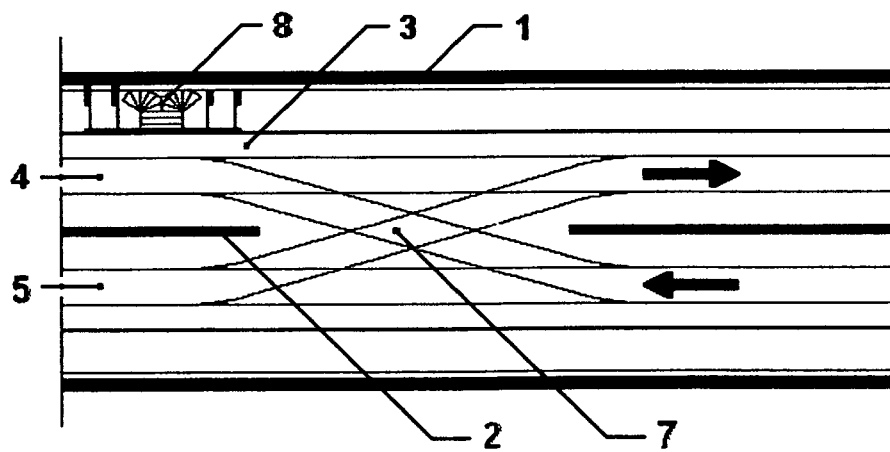


Figure 5



EUROPEAN SEARCH REPORT

Application Number
EP 11 00 2769

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2010/098496 A1 (SANTOS SILVINO POMPEU [PT]) 22 April 2010 (2010-04-22) * paragraphs [0011] - [0013] *	1-5	INV. E21D9/14
A	CN 201 412 160 Y (CHINA RAILWAY NO 4 SURVEY AND DESIGN GROUP CO LTD) 24 February 2010 (2010-02-24) * figure 2 *	1-5	
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A	DE 102 49 267 A1 (RICHTER HERBERT [DE]; MIETKE JUERGEN [DE]) 13 May 2004 (2004-05-13) * figure 1 *	1	
A	JP 2005 245683 A (OHBAYASHI CORP) 15 September 2005 (2005-09-15) * abstract *	1	
			TECHNICAL FIELDS SEARCHED (IPC)
			E21D
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 25 August 2011	Examiner Garrido Garcia, M
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			

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EPO FORM 1503 03 82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 11 00 2769

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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25-08-2011

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REFERENCES CITED IN THE DESCRIPTION

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- NL 1013595 C [0006]
- JP 2004270345 B [0007]