

Emergency escape tunnel

The object of the invention is an emergency escape tunnel in a multi-storey building, especially in a building with a centrally situated staircase and useable rooms surrounding it, used to evacuate people in case of fire hazard.

From the description of a German utility model DE 20 2005 019 255 U1 there is known a self-supporting structure of a fixed emergency escape tunnel designed for installation in already existing buildings where it is necessary to provide additional emergency escape routes. In order to limit the loads of the building, the known tunnel with an outline of an upturned letter U has a rectangular skeleton of steel section bars which is anchored to the substrate by means of inclined corner supports. The surface wall and the side walls of the tunnel are formed by plates of sheet steel which are externally covered with layers of a fire-resistant material. Furthermore, there are known emergency escape corridors or tunnels being integral and fixed elements of buildings with a centrally situated staircase and useable rooms surrounding it. There are commonly known shiftable communication tunnels, colloquially called jet bridges, which are used at airports for transferring passengers between airport buildings and airplanes and in the opposite direction. These tunnels are

provided on mobile chassis units, have a skeleton type structure and are built of telescopically and also articulately interconnected segments with cuboidal outlines. Chassis units of airport tunnels are equipped with drives which enable them to move freely on the airport apron.

An emergency escape tunnel in a multi-storey building, especially in a building with a centrally situated staircase and useable rooms surrounding it, equipped with a load-bearing skeleton with an outline similar in shape to an upturned letter U, its surface wall and side walls being covered with layers of a fire-resistant material, characterised according to the invention in that it has a self-activating drive system and it is horizontally shiftable in the space between the staircase and the external wall of the building, the tunnel being located in the resting position within the staircase, and in its operating position its outlet section being situated within the exit door of the building while the exit opening of the tunnel being situated beyond the building. To make it possible to use the tunnel in relatively vast spaces, it consists of two or three telescopically overlapping segments, the ends of which are interlocked with their cover flanges. The load-bearing skeleton of each segment is built of spaced lateral frames with an outline similar in shape to an upturned letter U, the adjacent frames being permanently interconnected by means of slanted ties and traction wheels being provided on the lower edges of the skeleton. Over the segments of the tunnel there are horizontally spread two parallel and longitudinally shiftable rails. Each of the rails consists of a channel section guide bar and a drive toothed bar.

The front ends of the rails are mounted to the front edge of the internal segment of the tunnel. Inside the rails there are provided fixed roller supports

which are fastened to the walls of the staircase. The toothed bars of the rails mesh with the toothed wheels of the drive system which is situated within the staircase. Considering the possibility of an undesired contact with fire, the rear sections of the rails are surrounded by tubular shields made of a fire-resistant material and mounted on fixed roller supports. The drive system of the tunnel can have a form of a flexible tie rod without an end which is sunk in a channel formed in the floor of the building and spread parallel to the rails with the guide bars, the upper section of the tie rod being connected pointwise to the edge of the internal segment of the tunnel by means of a transversal driver. Preferably, the drive tie rod has a form of a leaf chain and the cross profile of the channel is narrowed upwards. In yet another embodiment, the drive system is a set of individual drives which are coupled to the traction wheels of the internal segment.

Thanks to the solution according to the invention, the emergency escape tunnel in its resting position is entirely hidden inside the staircase and therefore it does not block the space separating the staircase from the external walls of the building.

The object of the invention is visualised in the exemplary embodiment on the drawing where Fig.1 presents a vertical longitudinal section of a two-segment emergency escape tunnel in the resting position, Fig.2 – a vertical cross section of the tunnel according to Fig.1, Fig.3 – a vertical longitudinal section of the internal segment, Fig.4 – a vertical cross section of the internal segment, Fig.5 – a top view of the internal segment, Fig.6 – a vertical longitudinal section of the external segment, Fig.7 – a vertical cross section of the external segment, Fig.8 – a top view of the external segment, Fig.9 –

a horizontal longitudinal section of the two-segment tunnel in the resting position, Fig.10 – a horizontal longitudinal section of this tunnel in the operating position, Fig.11 – a perspective view of an extended two-segment tunnel, Fig.12 – a perspective view of an extended three-segment tunnel, Fig.13 – a perspective view of the front part of the tunnel in the resting position, Fig.14 – a perspective view of the drive of the tunnel, Fig.15 – a cross section of a rail with a roller support, Fig.16 – a cross section of interlocked cover flanges, Fig.17 – a longitudinal section of a tunnel with a tie rod drive, Fig.18 – an enlarged cross section of the tie rod drive, and Fig.19 – a perspective view of a tunnel with individual drives of traction wheels.

The emergency escape tunnel is formed in a multi-storey building with a centrally situated staircase **1** and an external wall **2** situated approximately 15 m away from it, the staircase **1** of the building being surrounded by useable rooms not shown on the drawing. In the solution presented on Fig.1, 2, 9, 10, 11, the tunnel consists of consists of two telescopically overlapping segments **3** and **4**, the ends of which are interlocked with their cover flanges **5**. In cases where the distance between the staircase **1** and the external wall **2** of the building is relatively small, the internal segment **4** alone can serve as the tunnel. If this distance definitely exceeds 15 m, then, according to Fig.12, a three-segment tunnel is employed in which between the external segment **3** and the internal segment **4** an intermediate segment **3a** is provided. Each segment **3**, **3a**, **4** of the tunnel has a load-bearing skeleton **6** with an outline similar in the shape to an upturned letter U which is built of steel section bars of a rectangular shape. The surface wall **7** and the side walls **8** of the tunnel are covered with layers **9** of a fire-resistant material providing the tunnel with

the required fire resistance. In turn, the skeleton **6** of each segment **3**, **3a**, **4** is built of lateral spaced frames **10** with an outline similar in shape to an upturned letter U. The adjacent frames **10** are permanently interconnected by means of slanted ties **11**. There are traction wheels **12** set on the lower edges of the skeleton **6** of each of the segments **3**, **3a**, **4**. The tunnel has a self-activating drive system **13** and it is horizontally shiftable in the space **14** formed between the staircase **1** and the external wall **2** of the building. In the resting position of the tunnel, the segments **3**, **3a**, **4** set one on another are situated within the staircase **1**. In the operating position, the outlet section **15** of the internal segment **4** of the tunnel is situated within the exit door **16** of the building, the exit opening **17** of this segment of the tunnel being situated beyond the building. The drive system **13** is provided within the staircase **1** and consists of a motor **18** and a transmission **19** with a two-part drive shaft **20** ended with a couple of toothed wheels **21**. Over the segments **3**, **3a**, **4** of the tunnel there are horizontally spread two parallel and longitudinally shiftable rails **22**. Each of them consists of a channel section guide bar **23** and a drive toothed bar **24**. The front ends **25** of the rails **22** are fixed to the front edge **26** of the internal segment **4** of the tunnel by means of vertical supports **27**. Inside the guide bars **23** there are immovably provided roller supports **28**, mounted on the ends of the horizontal extensions **29**, which are fixed by means of steel beams **30** to the walls of the staircase **1**. The supports **28** are provided with turning rolls **28a** on which the shifted rails **22** rest. The toothed bars **24** of the rails **22** mesh with the toothed wheels **21** of the drive system **13**. The rear sections of the rails **22** are surrounded by the tubular shields **31** made of a fire-resistant material, particularly of gypsum boards, which are mounted on

roller supports **28**. The tunnel according to the invention can also be equipped with different drive systems which do not require to be engaged with the toothed bars **24** of the rails **22**. One of the drive systems, presented on Fig.17 and 18, has a form of a flexible tie rod **32** without an end which is sunk in the channel **33** formed in the floor **34** of the building and spread parallel to the rails **22** having no toothed bars **24**. The upper section of the tie rod **32** is connected pointwise to the edge **26** of the internal segment **4** by means of the transversal driver **35**. Most preferably, the tie rod **32** has a form of a leaf chain whereas the cross section of the channel **33** is narrowed upwards so that the floor **34** has safe surface. In the solution according to Fig.19, the drive system is a set of individual drives **36** which are coupled separately to the traction wheels **12** of the internal segment **4**. Each individual drive **36** has its own electric motor, not shown on the drawing, which is powered by the current from the grid by means of a retractable cable. This motor can also be powered from batteries situated in the internal segment **4** of the tunnel. In another solution, not shown on the drawing, the particular traction wheels **12** of the segment **4** are coupled through chain transmissions to a common drive motor which is situated on the internal segment **4**. If the smoke detectors not shown on the drawing detect fire hazard within the building, then the signals emitted from them will cause the motor **18** in the drive system **13** to self-activate. While rotating, the toothed wheels **21** through the toothed bars **24** cause a longitudinal shift of the rails **22** and of the related internal segment **4** which extends from the external segment **3** or the intermediate segment **3a** and moves towards the wall **2** of the building. During this movement, the flange **5** of the internal segment **4** gets tightly interlocked with the flange **5** of the

intermediate segment **3a** or the external segment **3**, pulling it behind itself towards the wall **2**, the segments **3** and **4** or **3**, **3a**, **4** of the tunnel rolling on the floor **34** on their traction wheels **12**. In the final phase of the movement of the segments **3** and **4** or **3**, **3a**, **4**, the door **16** in the external wall **2** opens in the self-activation manner. The outlet section **15** of the internal segment **4** is introduced within the door **16** deeply enough to make the exit opening **17** of this segment go beyond the building. After the self-deactivation of the drive system, the rear section of the external segment **3** remains partly sunk in the staircase **1**. While being immobilised in such positions, the segments **3** and **4** or **3**, **3a**, **4** of the tunnel make it possible to safely cross the open space **14** of the building and evacuate people from the fire hazard zone.

Markings

- 1 – staircase
- 2 – building wall
- 3 – external segment
- 3a – intermediate segment
- 4 – internal segment
- 5 – collar
- 6 – skeleton
- 7 – surface wall
- 8 – side wall
- 9 – material layer
- 10 – skeleton frame
- 11 – frame tie
- 12 – traction wheel
- 13 – drive system
- 14 – building space
- 15 – outlet space
- 16 – building door
- 17 – exit opening
- 18 – motor
- 19 – transmission
- 20 – drive shaft
- 21 – toothed wheel
- 22 – rail
- 23 – guide bar
- 24 – toothed bar
- 25 – bar ending
- 26 – segment edge
- 27 – bar support
- 28 – roller support
- 28a – turning roller
- 29 – support extension
- 30 – beam
- 31 – tubular shield
- 32 – tie rod
- 33 – channel
- 34 – floor
- 35 – driver
- 36 – individual drive

Patent Claims

1. An escape tunnel in a building with a centrally situated staircase (1) in the building, the escape tunnel comprising:

at least two telescopically overlapping segments (3, 4), each of which is equipped with a load-bearing skeleton having an inverted U-shape,

wherein a top wall and side walls of the load-bearing skeleton are covered on an outside with layers of a fire-resistant material; and

a self-activating drive system **(13, 32, 36)** that is horizontally shiftable in space **(14)** between the centrally situated staircase **(1)** and an external wall **(2)** of the building,

wherein the escape tunnel is located in a resting position inside the centrally situated staircase **(1)**, and

wherein, in an operating position of the escape tunnel, an outlet section **(15)** is situated within an open exit door **(16)** of the building while an exit **(17)** of the tunnel is situated on an outside of the building.

2. The escape tunnel according to claim 1, wherein adjacent ends of the at least two telescopically overlapping segments **(3, 4)** are interlocked with cover flanges **(5)**.

3. The escape tunnel according to claim 1, further comprising:

at least three telescopically overlapping segments **(3, 3a, 4)**,

wherein ends of adjacent telescopically overlapping segments are interlocked with cover flanges **(5)**.

4. The escape tunnel according to claim 2, wherein the load-bearing skeleton **(6)** of each telescopically overlapping segment **(3, 3a, 4)** is built of lateral spaced frames **(10)** with an outline similar to a letter U, adjacent lateral spaced frames **(10)** being permanently interconnected by means of slanted ties **(11)** and, on lower edges of the load-bearing skeleton **(6)**, being provided traction wheels **(12)**.

5. The escape tunnel according to claim 1,

wherein the at least two telescopically overlapping segments **(3, 3a, 4)** comprise two horizontally spread, parallel, and longitudinally shiftable rails **(22)**, each shiftable rail comprising a channel guide bar **(23)** and a drive toothed bar **(24)**,

wherein front endings **(25)** of the shiftable rails **(22)** are fixed to a front edge **(26)** of a telescopically overlapping segment **(4)**,

there being permanent roller supports **(28)** provided inside the shiftable rails **(22)** and fixed to the walls of the centrally situated staircase **(1)**, whereas toothed bars **(24)** of the shiftable rails **(22)** mesh with toothed wheels **(21)** of the

self-activating drive system **(13)** which is placed within the centrally situated staircase **(1)**.

6. The escape tunnel according to claim 5, wherein rear sections of the shiftable rails **(22)** are surrounded by tubular shields **(31)** made of a fire-resistant material and are mounted on fixed roller supports **(28)**.

7. The escape tunnel according to claim 1,

wherein the self-activating drive system comprises a flexible tie rod **(32)** without an end which is immersed in a channel **(33)** formed in a floor **(34)** of the building and spread parallel to the shiftable rails **(22)** with guide bars **(23)**,

wherein an upper section of the flexible tie rod **(32)** is connected pointwise to a front edge **(26)** of an internal segment **(4)** of the escape tunnel by means of a transversal driver **(35)**.

8. The escape tunnel according to claim 7, wherein the flexible tie rod **(32)** has a form of a leaf chain whereas a cross-section of the channel **(33)** is narrowed upwards.

9. The escape tunnel according to claim 1, wherein the self-activating drive system comprises a set of individual drives **(36)** which are coupled to traction wheels **(12)** of an internal segment **(4)**.