

A Narrow Space Rescue Training Device

Field of Invention

[0001] The present invention relates to a disaster rescue training facility, in particular a narrow space rescue training device in the form of a three-dimensional grid framework.

Background of invention

[0002] Fire and earthquake-induced collapse of buildings, along with the occasional mine collapses and other disasters have caused unnecessary casualties due to poor rescue conditions. Relevant government departments now realise the importance of fire fighters' rescue ability, thus gradually customising training facilities, such as bringing in the likes of narrow space rescue training, introducing smoke and heat training rooms, and increasing training to improve fire fighters' rescue abilities to train them to adapt to various harsh environments experienced in rescue missions.

[0003] These kinds of training facilities, whether domestically produced or imported, are mostly bulky, made up of a fixed structure, not easy to install and unable to be disassembled and be re-assembled. After some time of usage, trainees will become familiar with the training rescue routes, which will not help in the trainee's ability to adapt to different environments and to plan a rescue based on their judgement. In addition, re-configuring a fixed structure is very time-consuming and labour intensive, which adds to inconveniences.

Summary of invention

[0004] In view of the deficiencies of current training facilities as stated above, the present invention provides a kind of narrow space rescue training device. The narrow space rescue training device uses exclusive components according to the present invention to assemble into a three dimensional grid framework. It is easy to assemble, easy to disassemble and be reassembled, thus it is able to create the various training modes for fire and rescue missions in narrow spaces.

[0005] This narrow space rescue training device comprises a three dimensional grid framework. The three dimensional grid framework comprises a plurality of multidirectional connectors disposed at equally spaced apart distances and in multiple layers; wherein: two

adjacent multidirectional connectors are plug-connected by a horizontal frame pipe, and two adjacent multidirectional connectors disposed in adjacent layers are plug-connected by an erect frame pipe, so that four adjacent erect frame pipes in each layer form a space unit; each multidirectional connector comprises multiple pin plugs, such that two adjacent pin plugs are substantially perpendicular to each other; detachable barriers are disposed in the space units to create obstacles for training; and mesh plates are disposed on floors in the space units or sidewalls in some space units, so that some space units form channels in the rescue training device.

10 [0006] In one embodiment, each of the multidirectional connectors located at the four corners of the top layer comprises a three-directional connector, the multidirectional connector located at the side comprises a four-directional connector, and the multidirectional connector located at the interior of the grid framework comprises a five-directional connector.

15 [0007] The above three directional connector comprises two slotted pin plugs and an internally threaded pin plug, such that slots of the two slotted pin plugs are matched and spliced to form an L-shaped joint, and in use, a square washer and the internally threaded pin plug are respectively disposed on the top and bottom of the spliced L-shaped joint, and a screw passes through the square washer in a top down manner and secures the spliced L-shaped joint to the internally threaded pin plug.

25 [0008] The above four directional connector comprises a slotted pin plug, a double slotted pin plugs and an internally threaded pin plug, such that two slots of the slotted pin plug and the double slotted pin plug are matched and spliced to form a T-shaped joint. In use, a square washer and the internally threaded pin plug are disposed respectively on the top and bottom of the spliced T-shaped joint, and a screw passes through the square washer in a top down manner and secures the T-shaped joint to the internally threaded pin plug.

30 [0009] The above five directional connector two double slotted pin plugs and an internally threaded pin plugs, such that two slots of the double slotted pin plugs are matched and spliced to form a cross-shaped joint, and in use, a square washer and the internally threaded pin plug are respectively disposed on the top and bottom of the spliced cross-shaped joint,

and a screw passes through the square washer in a top down and secures the cross-shaped joint to the internally threaded pin plug.

[0010] Each of the above multidirectional connectors located on the four corners at the intermediate level comprises a four directional connector, the multidirectional connector at the side comprises a five-directional connector, and the multidirectional connector at the interior comprises a six-directional connector.

[0011] The above intermediate level's four directional connector comprises two slotted pin plugs, hollow pin plug and internally threaded pin plugs, such that the slots of the two slotted pin plugs are matched and spliced to form an L-shaped joint. In use, the hollow pin plug and the pin plug internally threaded are respectively disposed on the top and bottom of the spliced L-shaped joint, and a long screw inserted through the hollow pin plug in a top down manner secures the L-shaped joint to the internally threaded pin plug.

[0012] The above intermediate level's five directional connector comprises a slotted pin plug, a double slotted pin plug, a hollow pin plug and an internally threaded pin plug, such that two slots of the slotted pin plug and double slotted pin plug are matched and spliced to form a T-shaped joint. In use, the hollow pin plug and the internally threaded pin plug are respectively disposed on the top and bottom of the spliced T-shaped joint, and a long screw inserted through the hollow pin plug in a top down manner secures the T-shaped joint to the internally threaded pin plug.

[0013] The above intermediate level's six directional connector comprises two double slotted pin plug, a hollow pin plug and an internally threaded pin plug, such that two slots of the double slotted pin plugs are matched and spliced to form a cross-shaped joint. In use, the hollow pin plug and the internally threaded pin plug are respectively disposed on the top and bottom of the spliced cross-shaped joint, and a long screw inserted through the hollow pin plug in a top down manner secures the cross-shaped joint to the internally threaded pin plug.

[0014] The multidirectional connector located at the four corners at the bottom level of the grid framework comprises a three-directional connector, the multidirectional connector at the

side comprises a four-directional connector, and the multidirectional connector at the interior of the grid framework comprises a five-directional connector.

[0015] The above three directional connector comprises two slotted pin plugs, an internally threaded pin plug and a ground screw, such that slots of the two slotted pin plugs are matched and spliced to form an L-shaped joint. In use, the internally threaded pin plug is disposed on top of the L-shaped joint, whilst a square washer and a rectangular plate are disposed at the bottom. The ground screw passes through the rectangular plate and the square washer to secure the L-shaped joint to the internally threaded pin plug.

[0016] The above four directional connector comprises a slotted pin plug, a double slotted pin plugs, an internally threaded pin plug and a ground screw, such that two slots of the slotted pin plug and the double slotted pin plug are matched and spliced to form a T-shaped joint. In use, the internally threaded pin plug is disposed on the top of the T-shaped joint, whilst a square washer and a triangular plate are disposed at the bottom. The ground screw passes through the triangular plate and the square washer to secure the T-shaped joint to the internally threaded pin plug.

[0017] The above five directional connector comprises two double slotted pin plugs, an internally threaded pin plug and a ground screw, such that two slots of the double slotted pin plugs are matched and spliced to form a cross-shaped joint. In use, the internally threaded pin plug is disposed on the top of the cross-shaped joint, whilst a square washer and a square plate are disposed at the bottom, and the ground screw passes through the square plate and the square washer to secure the cross-shaped joint to the internally threaded pin plug.

[0018] The horizontal frame pipes and erect frame pipes in the three dimensional grid framework comprise square metal pipes. The plug portions of the two ends of the metal pipe have screw holes.

[0019] The multiple barriers comprise a door panel, two door panels, diagonal opening plates, round plate, square plate, rectangular plate, manhole plate, ladders, tunnels, ramps or ladder board.

[0020] In another embodiment, the present invention provides a method of configuring a spatial rescue training device. The spatial rescue training device comprises: forming a three dimensional grid framework having a plurality of multidirectional connectors disposed at
5 equally spaced apart distances and in multiple layers, plug connecting two adjacent multidirectional connectors disposed in a layer with a horizontal frame pipe, and plug connecting two adjacent multidirectional connectors disposed in two adjacent layers with a vertical frame pipe so that the four adjacent erect frame pipes between two adjacent layers form a space unit; wherein, each of the multidirectional connectors have multiple pin plugs,
10 such that two adjacent pin plugs are substantially perpendicular to each other.

[0021] The above method further comprises disposing barriers or obstacles in some of the space units; and disposing mesh plates on floors of the space units or sidewalls in some of the space units to form channels in the spatial rescue training device.

15 [0022] Traditional rescue training devices is made up of a fixed structure. After some time of usage, trainees will become familiar with rescue routes, which is not conducive for the trainee's ability to adapt to environments and to plan a rescue based on their judgement, and the reassembling is very time-consuming and labour intensive, which is add to
20 inconveniences. However the three dimensional grid framework of the present invention is assembled by multidirectional connectors, frame pipes and various exclusive components made of black iron. It is safe and secure, easy to install, easy to disassemble and reassemble, easy to disassemble and reassemble into frameworks of different shapes. Configured with
25 barriers and other obstacles, it can form new training devices, satisfying various training requirements.

[0023] The use of mesh plates with hooks to hang in the opening of the space unit of this framework's outer wall surface makes it easy to rescue trainees who feel unwell during the middle of training, thus ensuring the personal safety of trainees.

Brief Description of the drawings:

[0024] Figure 1 illustrates a schematic narrow space rescue training device according to an embodiment of the present invention;

- 5 Figure 2 illustrates a schematic two-layer structure of a three dimensional grid framework according to another embodiment of the present invention;

Figures 3-5 illustrate the structures of a top level three-directional connector, four-directional connector and five-directional connector shown in Figure 2;

- 10 Figures 6-8 illustrate the structures of a middle level four-directional connector, five-directional connector and six-directional connector shown in Figure 2;

Figures 9-11 illustrate the structures of a bottom level three-directional connector, four-directional connector and five-directional connector shown in Figure 2;

Figures 12-15 illustrate embodiments of a hollow pin plug, internally threaded pin plug, slotted pin plug and double slot pin plugs shown in Figure 2; and

- 15 Figure 16 illustrates an embodiment of the horizontal, vertical or erect frame pipe shown in Figure 2.

Description of Invention

- 20 [0025] To describe the structural features of the present invention – that is, a newly designed three dimensional narrow space rescue training device 1, as shown in Figure 1, it is easier to do so using a simplified, schematic diagram shown in Figure 2, which exemplify a two-layer structure, three dimensional grid framework. As shown in Figure 2, the three dimensional grid framework comprises 3 plates configured in layers. They are a top level plate 10, middle
25 level plate 20 and bottom level plate 30. Each of the plates comprises 12 multidirectional connectors distributed or spaced apart in rows and columns of equal distances.

- [0026] The multidirectional connector situated at each the four corners of the top level plate 10 is a three directional connector 11. The multidirectional connector at the side, top level are
30 four-directional connectors 13 and 17. The multidirectional connector in the interior, top level is a five-directional connector 15. The top level plate 10's two adjacent connectors have horizontal frame pipes 12, 14, 16, 18 connected or plugged in between. For example, the two adjacent connectors in the same column, the horizontal frame pipe 12 is plugged in between.

Similarly, the adjacent top level three directional connector 11 and top level four directional connector 17 in the same row, the horizontal frame pipe 18 is plugged or connected in between. The other horizontal frame pipe 14 is plugged between top level four directional connector 13 and top level five directional connector 15. For the adjacent top level three directional connector 11 and top level four directional connector 13 in the same column, the horizontal frame pipe 12 is connected or plugged between. The other horizontal frame pipe 16 is plugged between the adjacent top level four directional connector 17 and top level five directional connector 15 in the same column, and so on.

[0027] The multidirectional connector situated at the four corners of the middle level plate 20 is a four-dimensional connector 21. The multidirectional connectors at the side, middle level are four directional connectors 23 and 27. The multidirectional connector in the interior, middle level is a five-directional connector 25. The middle level plate 20's two adjacent connectors have horizontal frame pipes 22, 24, 26, 28 connected or plugged in between. For example, the two adjacent connectors in the same column, the horizontal frame pipe 22, 26 is plugged in between. Similarly, the adjacent middle level four-directional connector 21 and middle level five directional connector 27 in the same row, the horizontal frame pipe 28 is plug connected in between. The other horizontal frame pipe 24 is plugged between middle level five directional connector 23 and middle level six directional connector 25. For the adjacent middle level four directional connector 21 and middle level five directional connector 23 in the same column, the horizontal frame pipe 22 is plugged between. The other horizontal frame pipe 26 is plugged between the adjacent middle level five-directional connector 27 and middle level six-directional connector 25 in the same column, and so on.

[0028] The multidirectional connector situated at the four corners of the bottom level plate 30 is a three dimensional connector 31. The multidirectional connectors at the side are bottom level four directional connectors 33 and 37. The multidirectional connector in the interior is bottom level five directional connector 35. Bottom level plate 30's two adjacent connectors each have horizontal frame pipes 32, 34, 36, 38 connected or plugged in between. For example, the two adjacent connectors 31, 33 in the same column, the horizontal frame pipe 32 is plug connected in between. Similarly, the adjacent bottom level three directional connector 31 and bottom level four directional connector 37 in the same row, the horizontal frame pipe 38 is plugged in between. The other horizontal frame pipe 34 is plugged between

bottom level four directional connector 33 and bottom level five directional connector 35. For the adjacent bottom level three directional connector 31 and bottom level four directional connector 33 in the same column, the horizontal frame pipe 32 is plugged between. The other horizontal frame pipe 36 is plugged between the adjacent bottom level four directional connector 37 and bottom level five directional connector 35 in the same column, and so on.

[0029] At the top and bottom of two adjacent multidirectional connectors disposed in two adjacent plates, an erect frame pipe 40 is plug connected in between. Four adjacent erect frame pipes 40 between two adjacent plates form a space unit 70. For example, the top level three directional connector 11 and middle level four directional 21 (disposed respectively in the top level plate 10 and middle level plate 20), the erect frame pipe 40 is connected or plugged in between. Four adjacent erect frame pipes 40 in between top level plate 10 and middle level plate 20 form the space unit 70. Six space units 70 are formed between top level plate 10 and middle level plate 20 in Figure 1. Thus, the two layer structural three dimensional grid framework shown in Figure 2 has a total of 12 such space unit 70. According to training requirements, by setting up barriers between or in these space units 70, various training units can be configured. These training units can also be connected by passages between adjacent three dimensional grid frameworks. In addition, detachable metal mesh can be installed between the space units 70, so that trainees who become unwell can be easily rescued.

[0030] Referring to Figure 3, the above top level three-directional connector 11 is made up of two slotted pin plugs 111, 112 and an internally threaded pin plug 113. The slots 105 (as seen in Figure 14) of the two slotted pin plugs 111, 112 are matched and spliced to form an L-shaped joint, which is used to plug connect two horizontal frame pipes together. A square washer 118 and the internally threaded pin plug 113 are respectively disposed on the top and bottom of the spliced L-shaped joint. A screw 115 passes through the square washer 118 in a top down manner and the spliced L-shaped joint is then screwed to the internally threaded pin plug 113. Two adjacent pin plugs of the 3 pin plugs at the top level three directional connector 11 are substantially at 90 degrees to each other. The internally threaded pin plug 113 is used to plug connect with an end of the erect frame pipe 40.

[0031] The above four-directional connector 13 as shown in Figure 4 is made up of a slotted pin plug 131, a double slotted pin plug 132 and an internally threaded pin plug 133. The two slots 105, 205 (as seen in Figures 14 and 15) of the slotted pin plug 131 and the double slotted pin plug 132 are matched and spliced to form a T-shaped joint, which is used to plug connect three horizontal frame pipes together. A square washer 138 and the internally threaded pin plug 133 are respectively disposed on the top and bottom of the spliced T-shaped joint. A screw 135 passes through the square washer 138 in a top down manner and the spliced T-shaped joint is then screwed to the internally threaded pin plug 133. Two adjacent pin plugs of the 4-pin plugs at the top level four directional connector 13 are substantially at 90 degrees to each other. The internally threaded pin plug 133 is used to plug connect with an end of the erect frame pipe 40.

[0032] The above five-directional connector 15 as shown in Figure 5 is made up of two double slotted pin plugs 151, 152 and an internally threaded pin plug 153. The two slots 205 (as seen in Figure 15) of the two double-slotted pin plugs 151, 152 are matched and spliced to form a cross-shaped joint, which is used to plug connect four horizontal frame pipes together. A square washer 158 and the internally threaded pin plug 153 are respectively disposed on the top and bottom of the spliced cross-shaped joint. A screw 155 passes through the square washer 158 in a top down manner and the spliced cross-shaped joint is then screwed to the internally threaded pin plug 153. Two adjacent pin plugs of the 5-pin plugs at the top level five directional connector 15 are substantially at 90 degrees to each other. The internally threaded pin plug 153 is used to plug connect with an end of the erect frame pipe 40.

[0033] Referring to Figure 6, the above middle level four-directional connector 21 is made up of two slotted pin plugs 211, 212, a hollow pin plug 214 and an internally threaded pin plug 213. The slots 105 (as seen in Figure 14) of the two slotted pin plugs 211, 212 are matched and spliced to form an L-shaped joint, which is used to plug connect two horizontal frame pipes together. The hollow pin plug 214 and the internally threaded pin plug 213 are respectively disposed on the top and bottom of the spliced L-shaped joint. In use, a long screw 215 is inserted through the hollow pin plug 214 in a top down manner so that the spliced L-shaped joint is screwed securely to the internally threaded pin plug 213. In use, a spring washer 217 is disposed below the head 216 of the screw 215. Two adjacent pin plugs of the 4-pin plugs at the middle level five-directional connector 21 are substantially at 90

degrees to each other. The internally threaded pin plug 213 and hollow pin plug 214 are used to plug connect with separate erect frame pipes 40.

[0034] Referring to Figure 7, the above five-directional connector 23 is made up of a slotted pin plug 231, a double slotted pin plug 232, a hollow pin plug 234 and an internally threaded pin plug 233. The two slots 105, 205 (as seen in Figures 14 and 15) of the slotted pin plug 231 and double slotted pin plug 232 are matched and spliced to form a T-shaped joint, which is used to plug connect three horizontal frame pipes together. The hollow pin plug 234 and the internally threaded pin plug 233 are respectively disposed on the top and bottom of the spliced T-shaped joint. In use, a long screw 235 is inserted through the hollow pin plug 234 in a top down manner so that the spliced T-shaped joint is screwed securely to the internally threaded pin plug 233. In use, a spring washer 237 is disposed below the head 236 of the screw 235. Two adjacent pin plugs of the 5-pin plugs at the middle level five-directional connector 25 are substantially at 90 degrees to each other. The internally threaded pin plug 233 and the hollow pin plug 234 are used to plug connect with the separate erect frame pipes 40.

[0035] Referring to Figure 8, the above middle level six-directional connector 25 is made up of two double slotted pin plugs 251, 252, a hollow pin plug 254 and an internally threaded pin plug 253. The two slots 205 (as seen in Figure 15) of the double slotted pin plugs 251, 252 are matched and spliced to form a cross-shaped joint, which is used to plug connect four horizontal frame pipes together. The hollow pin plug 254 and the internally threaded pin plug 253 are respectively disposed on the top and bottom of the spliced cross-shaped joint. In use, a long screw 255 is inserted through the hollow pin plug 254 in a top down manner so that the spliced cross-shaped joint is screwed securely to the internally threaded pin plug 253. In use, a spring washer 257 is disposed below the head 256 of the screw 255. Two adjacent pin plugs of the 6-pin plugs at the middle level six-directional connector 25 are substantially at 90 degrees to each other. The internally threaded pin plug 253 and the hollow pin plug 254 are used to plug connect with separate erect frame pipes 40.

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[0036] Referring to Figure 9, the above bottom level three-directional connector 31 is made up of a slotted pin plug 311, a slotted pin plug 312, an internally threaded pin plug 313 and a ground screw 315. The slots 105 (as seen in Figure 14) of the two slotted pin plugs 311, 312

are matched and spliced to form an L-shaped joint, which is used to plug connect two horizontal frame pipes together. The internally threaded pin plug 313 is disposed on top of the spliced L-shaped joint, whilst a square washer (not labelled in the diagram) and a triangular plate 319 are disposed at the bottom. In use, the ground screw 315 passes through the triangular plate 319, square washer and the spliced L-shaped joint, and they are then screwed securely to the internally threaded pin plug 313. Two adjacent pin plugs of the 3-pin plugs at the bottom level three-directional connector 31 are substantially at 90 degrees to each other. The internally threaded pin plug 313 is used to plug connect with an end of the erect frame pipe 40.

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[0037] Referring to Figure 10, the above bottom level four-directional connector 33 is made up of a slotted pin plug 331, a double slotted pin plug 332, an internally threaded pin plug 333 and a ground screw 335. The two slots 105, 205 (as seen in Figures 14 and 15) of the slotted pin plug 331 and the double slotted pin plug 332 are matched and spliced to form a T-shaped joint, which is used to plug connect three horizontal frame pipes together. In use, the internally threaded pin plug 333 is disposed on the top of the spliced T-shaped joint, whilst a square washer (not labelled in the diagram) and a triangular plate 339 are disposed at the bottom. The ground screw 335 passes through the triangular plate 339, the square washer and the spliced T-shaped joint and they are then screwed securely to the internally threaded pin plug 333. Two adjacent pin plugs of the 4-pin plugs at the bottom level four-directional connector 33 are substantially at 90 degree angle to each other. The internally threaded pin plug 333 is used to plug connect with an end of the erect frame pipe 40.

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[0038] Referring to Figure 11, the above bottom level five-directional connector 35 is made up of a double slotted pin plug 351, a double slotted pin plug 352, an internally threaded pin plug 353 and a ground screw 355. The two slots 205 (as seen in Figure 15) of the double slotted pin plugs 351, 352 are matched and spliced to form a cross-shaped joint, which is used to plug connect four horizontal frame pipes together. In use, the internally threaded pin plug 353 is disposed on the top of the spliced cross-shaped joint, whilst a square washer (not labelled in the diagram) and a square plate 359 are disposed at the bottom of the spliced cross-shaped joint. The ground screw 355 passes through the square plate 359, the square washer and the spliced cross-shaped joint, and they are then screwed to the internally threaded pin plug 353. Two adjacent pin plugs of the 5-pin plugs at the bottom level five-

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directional connector 35 are substantially at 90 degree angle to each other. The internally threaded pin plug 353 is used to plug connect with an end of the erect frame pipe 40.

[0039] The slotted pin plug, double slotted pin plug, hollow pin plug and internally threaded pin plug used for the above connectors are the four special types of pin plugs (shown in Figures 12-15) of the present invention.

[0040] As shown in Figure 12, the hollow pin plug (such as, pin plug 214) has plug portion 301 and a square plug portion 303 disposed at one end of the plug portion 301. Through the centre of the pin plug 301, there is axial through hole 304. There are a few threaded hole 306, 307 formed on the plug portion 301. The threaded holes 306, 307 are used to screw tighten the horizontal frame pipe 40 that it is plug-connected with.

[0041] As shown in Figure 13, the internally threaded pin plug (such as, pin plug 113, 133, 213, etc) has a plug portion 401 and square connection portion 403 disposed at one end of the plug portion 401. Through the centre of the plug portion 402, there is axial threaded hole 404. There are a few threaded hole 406, 407 formed on the plug portion 401. The threaded holes 306, 307 are used to screw tighten the erect frame pipe 40 that it is plug-connected with.

[0042] As shown in Figure 14, the slotted pin plug (such as, pin plug 111, 112, etc) has a plug portion 101 and slot portion 103 disposed on one end of the plug portion 101. The slot portion 103 has an open slot 105. The slot portion 103's bottom surface has a pit 108 and a hole 104 formed through the pit 108. The slot 105 is to match and fit with the above square plug portion 303 of the hollow pin plug, square plug portion 403 of the internally threaded pin plug or square washers. Threaded holes 106, 107 on the plug portion 101 are used to screw tighten the horizontal frame pipes that are plug-connected to the slotted pin plug.

[0043] As shown in Figure 15, the symmetrical double slotted pin plug (such as, slotted pin plug 132) has a slot portion 203 and two plug portions 201, 202 disposed on each side of the slot portion 203. The slot portion 203 has an open slot 205. The slot portion 203's bottom surface level has a pit 208 and a hole 204 is formed through the pit 208. The slot 205 is to match and fit with the above square plug portion 303 of the hollow pin plug, square plug portion 403 of the internally threaded pin plug or square washers. Threaded holes 206, 207

on the plug portion 201, 202 are used to screw tighten the horizontal frame pipes that are plug connected to the double slotted pin plug.

[0044] It is preferable to use square metal pipe 40 for the horizontal and erect frame pipes in the above three dimensional grid network. As shown in Figure 16, holes 46 are provided for on the top and bottom surfaces of both ends of the square metal pipe 40. Holes 47 are also provided for on the side surfaces of the square metal pipes 40. With screws going through the holes 46, 47 and threaded holes on the plug portions of the multidirectional connector's pin plugs, the horizontal and erect frame pipes 40 can be connected tightly to these multidirectional connectors.

[0045] The execution of the narrow space rescue training device 1 according to the present invention is depicted in a schematic diagram shown in Figure 1. As shown in Figure 1, the device includes a three dimensional grid framework, multiple barriers, multiple metal meshes and passages, etc. set up in or between the framework's space units 70. As shown in Figure 1, the rescue training device is a five-level structured three-dimensional grid framework, constructed by using Figure 2's two-level structure's three dimensional framework's construction method. This three dimensional space rescue device 1 has 6 plates 10-60 configured in layers. Every plate contains a plurality of multidirectional connectors disposed in rows and columns of equally spaced distances. For the same row of two adjacent multidirectional connectors, the horizontal frame pipes are plug connected in between. For the same column of two adjacent multidirectional connectors, the horizontal frame pipes are also plug connected in between. An erect frame pipe 40 is plug connected between two multidirectional connectors that are disposed in two adjacent plates or layers. Four adjacent erect frame pipes 40 between two adjacent plates form a space unit 70. The above multidirectional connectors have multiple pin plugs, such that two adjacent pin plugs are substantially perpendicular to each other. It is preferable to use connectors depicted in Figures 3-5 for the top level three directional connector 11, top level four directional connector 13 and top level five directional connector 15 in plate 10. It is preferable to use connectors depicted in Figures 6-8 for the middle level four directional connector 21, middle level five directional connector 23 and middle level six directional connector 25 in plate 20. It is preferable to use connectors depicted in Figures 9-11 for the bottom level three directional

connector 61, bottom level four directional connector 63 and bottom level five directional connector 65 in plate 60.

[0046] According to training requirements, barriers or obstacles can be chosen from ladder, manhole plate, tunnels, ramps, stairs, panels, round mouth plate, square mouth plate, rectangular mouth plate, a door plate, two door panels, diagonal opening board, and so on. Training modules can be constructed by setting up the chosen barriers/obstacles in or between space units 70. For the wall surface that has no barriers in the training modules, metal mesh are used to close it off (for clarity of illustration, metal meshes not shown in schematic diagram 1). For example, in Figure 1, a ladder 81 is shown in the left front corner linking the space units 70 at levels 1-3. As examples, a manhole plate 82 is disposed in the space unit at level 4; around mouth plate 83 is disposed in space units at level 5; a tunnel 84 is disposed in the third space unit to the right of the of the round mouth plate 83 at level 5; a square mouth plate 86 is disposed at the right back corner space unit at the 5th level; a ramp 85 is disposed in a space unit at level 4; a ladder board 87 is disposed in a space unit in level 3; and a ramp 89 and another tunnel 88 are disposed in space units in the bottommost floor, forming different types of obstacles for training.

[0047] Various space units or training modules are connected by channels. The bases of the channels are covered with floor boards, whilst the channel's side walls may be formed with metal mesh plates. It is preferable to use mesh and barrier plates with hooks. The use of mesh or barrier plates with hooks for hanging in the opening of the space units of this framework to form wall surfaces makes it easy to re-configure a training module. With the use of metal mesh plates to form the outer walls of the training module, it becomes easier to rescue trainees who feel unwell during training, thus improving on the personal safety of trainees.

[0048] Also, training difficulty can be increased by creating simulated environments, for example, the traditional darkness, fog, high temperature and noise, and so on. Thus, under various kinds of harsh environments, trainers can teach trainees identify directions under physical and mental stress, as in a real rescue mission. At the same time, the trainees learn to control their breathing in different simulated environments.

[0049] The three-dimensional grid framework according to the present invention is assembled by multidirectional connectors, horizontal frame pipes, erect frame pipes, barrier plates, mesh plates and various components. It is easy to install, easy to disassemble and reassemble, easy to disassemble and reassemble into frameworks of different shapes. With the present invention it is easy to re-configure new training devices according to varying training requirements.

[0050] The examples of executional use described above serve only to illustrate the use of the present invention. These examples of executional use and description should not limit the scope of the present invention. Many changes in design without departing from the principle of the present invention are possible but they are considered to fall within the scope of the present invention as defined in the claims.

CLAIMS:

1. A narrow space rescue training device comprising:
 - a three dimensional grid framework; wherein the grid framework comprises a plurality of multidirectional connectors disposed at equally spaced apart distances and in multiple layers;
 - wherein:
 - two adjacent multidirectional connectors are plug-connected by a horizontal frame pipe, and two adjacent multidirectional connectors disposed in adjacent layers are plug-connected by an erect frame pipe, so that four adjacent erect frame pipes in each layer form a space unit;
 - each multidirectional connector comprises multiple pin plugs, such that two adjacent pin plugs are substantially perpendicular to each other;
 - detachable barriers are disposed in the space units to create obstacles for training; and
 - mesh plates are disposed on floors in the space units or sidewalls in some space units, so that some space units form channels in the rescue training device.
2. A device according to claim 1, wherein each of the multidirectional connectors located at the four corners of the top layer comprises a three-directional connector, the multidirectional connector located at the side comprises a four-directional connector, and the multidirectional connector located at the interior of the grid framework comprises a five-directional connector.
3. A device according to claim 2, wherein the three-directional connector comprises two slotted pin plugs and an internally threaded pin plug, such that slots of the two slotted pin plugs are matched and spliced to form an L-shaped joint, and in use, a square washer and the internally threaded pin plug are respectively disposed on the top and bottom of the spliced L-shaped joint, and a screw passes through the square washer in a top down manner and secures the spliced L-shaped joint to the internally threaded pin plug.
4. A device according to claim 2, wherein the four directional connector comprises a slotted pin plug, a double slotted pin plugs and an internally threaded pin plug, such that two slots of the slotted pin plug and the double slotted pin plug are matched and spliced to form a T-shaped joint, and in use, a square washer and the internally threaded pin plug are disposed

respectively on the top and bottom of the spliced T-shaped joint, and a screw passes through the square washer in a top down manner and secures the T-shaped joint to the internally threaded pin plug.

5 5. A device according to claim 2, wherein the five-directional connector comprises two double slotted pin plugs and an internally threaded pin plugs, such that two slots of the double slotted pin plugs are matched and spliced to form a cross-shaped joint, and in use, a square washer and the internally threaded pin plug are respectively disposed on the top and bottom of the spliced cross-shaped joint, and a screw passes through the square washer in a
10 top down and secures the cross-shaped joint to the internally threaded pin plug.

6. A device according to any one of claims 3-5, wherein the slotted pin plug comprises a plug portion and a slot portion, one end of the plug portion has holes and the slot portion has an open slot, and wherein the double slotted pin plug comprises two symmetrical plug
15 portions disposed on each side of a slot portion, with the plug portions having threaded holes and the slot portion has an open slot.

7. A device according to claim 1, wherein the multidirectional connectors located on the four corners at the intermediate level comprises a four directional connector, the
20 multidirectional connector at the side comprises a five-directional connector, and the multidirectional connector at the interior comprises a six-directional connector.

8. A device according to claim 7, wherein the four-directional connector comprises two slotted pin plugs, a hollow pin plug and internally threaded pin plugs, such that the slots of
25 the two slotted pin plugs are matched and spliced to form an L-shaped joint, and in use, the hollow pin plug and the internally threaded pin plug are respectively disposed on the top and bottom of the spliced L-shaped joint, and a long screw inserted through the hollow pin plug in a top down manner secures the L-shaped joint to the internally threaded pin plug.

30 9. A device according to claim 7, wherein the five directional connector comprises a slotted pin plug, a double slotted pin plug, a hollow pin plug and an internally threaded pin plug, such that two slots of the slotted pin plug and double slotted pin plug are matched and spliced to form a T-shaped joint, so that in use, the hollow pin plug and the internally

threaded pin plug are respectively disposed on the top and bottom of the spliced T-shaped joint, and a long screw inserted through the hollow pin plug in a top down manner secures the T-shaped joint to the internally threaded pin plug.

5 10. A device according to claim 7, wherein the six directional connector comprises two double slotted pin plug, a hollow pin plug and an internally threaded pin plug, such that two slots of the double slotted pin plugs are matched and spliced to form a cross-shaped joint, so that in use, the hollow pin plug and the internally threaded pin plug are respectively disposed on the top and bottom of the spliced cross-shaped joint, and a long screw inserted through the
10 hollow pin plug in a top down manner secures the cross-shaped joint to the internally threaded pin plug.

11. A device according to claim 1, wherein the multidirectional connectors located on the four corners at the bottom level comprises a three-directional connector, the multidirectional
15 connector at the side comprises a four-directional connector, and the multidirectional connector at the interior of the grid framework comprises a five-directional connector.

12. A device according to claim 11, wherein the three-directional connector comprises two slotted pin plugs, an internally threaded pin plug and a ground screw, such that slots of
20 the two slotted pin plugs are matched and spliced to form an L-shaped joint, so that in use, the internally threaded pin plug is disposed on top of the L-shaped joint, whilst a square washer and a rectangular plate are disposed at the bottom, and the ground screw passes through the rectangular plate and the square washer, and secures the L-shaped joint to the internally threaded pin plug.

25 13. A device according to claim 11, wherein the four-directional connector comprises a slotted pin plug, a double slotted pin plugs, an internally threaded pin plug and a ground screw, such that two slots of the slotted pin plug and the double slotted pin plug are matched and spliced to form a T-shaped joint, and in use, the internally threaded pin plug is disposed
30 on the top of the T-shaped joint, whilst a square washer and a triangular plate are disposed at the bottom, and the ground screw passes through the triangular plate and the square washer, and secures the T-shaped joint to the internally threaded pin plug.

14. A device according to claim 11, wherein the five directional connector comprises two double-slotted pin plugs, an internally threaded pin plug and a ground screw, such that two slots of the double slotted pin plugs are matched and spliced to form a cross-shaped joint, so that in use, the internally threaded pin plug is disposed on the top of the cross-shaped joint, whilst a square washer and a square plate are disposed at the bottom, and the ground screw passes through the square plate and the square washer, and secures the cross-shaped joint to the internally threaded pin plug.

15. A device according to claim 1, wherein the horizontal frame pipe (in row or column) or the erect frame pipe comprises square metal pipes, the connecting parts of the two ends of the metal pipe comprise through holes.

16. A device according to claim 1, wherein the multiple barriers comprise a door panel, two door panels, the diagonal opening plates, round plate, square plate, rectangular plate, manhole plate, ladders, tunnels, ramps or ladder board.

17. A method of configuring a spatial rescue training device comprising:

forming a three dimensional grid framework comprising a plurality of multidirectional connectors disposed at equally spaced apart distances and in multiple layers, plug connecting two adjacent multidirectional connectors disposed in a layer with a horizontal frame pipe, and plug connecting two adjacent multidirectional connectors disposed in two adjacent layers with a vertical frame pipe so that the four adjacent erect frame pipes between two adjacent layers form a space unit; wherein, each of the multidirectional connectors have multiple pin plugs, such that two adjacent pin plugs are substantially perpendicular to each other.

18. A method according to claim 17, further comprising:

disposing barriers or obstacles in some of the space units; and
disposing mesh plates on floors of the space units or sidewalls in some of the space units to form channels in the spatial rescue training device.