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(71) Applicant: **Ye, Kong Meng**
Guangdong 523681 (CN)

(72) Inventor: **Ye, Kong Meng**
Guangdong 523681 (CN)

(74) Representative: **Verhees, Godefridus Josephus
Maria**
Brabants Octrooibureau B.V.
De Pinckart 54
5674 CC Nuenen (NL)

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(54) **POSITIONING PIPE CAPABLE OF LOCKING ROUND PIPE AND SAFETY GUARDRAIL WITH POSITIONING PIPE**

(57) A positioning pipe capable of effectively locking a round pipe comprises a pipe body and a pipe locking member, the pipe body is provided with a pipe locking hole; an annular frame is formed by extending from the pipe locking hole toward the outside; at least one position adjusting groove is formed in the frame and extends from a free end to the inside; the frame is divided into a plurality

of frame blocks by the position adjusting groove; the pipe locking member includes a body portion and a locking member arranged on the body portion; the round pipe is inserted into the pipe locking hole and the frame; the body portion of the pipe locking member sleeves the frame; and the body portion is locked on the frame through the locking member.

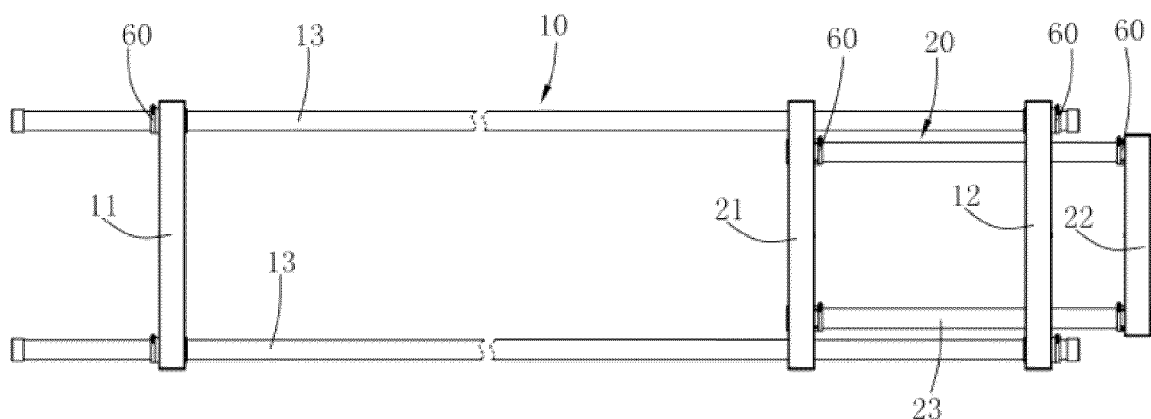


Fig. 1

Description

FIELD OF THE INVENTION

[0001] The present invention relates to a positioning pipe, and more particularly to a positioning pipe capable of effectively locking a round pipe and a safety guardrail provided with the positioning pipe.

BACKGROUND OF THE INVENTION

[0002] A railway safety guardrail is usually suspended and locked on a support of rails of a railway and includes a plurality of fiberglass round pipes and fiberglass square pipes, that are mounted to intersect each other, wherein each fiberglass round pipe passes through the corresponding fiberglass square pipe and is fixed by a screw. Since the fiberglass pipe like a glass product is very hard but has no any gripping force, the shaking of passing trains or high-speed rails will cause a greater friction between the fiberglass pipes and the screws, which will cause pores of the fiberglass to become larger and loosened, resulting in a significant reduction in the service life of the safety guardrail.

[0003] Secondly, the fiberglass pipe is characterized in that once a hole is drilled in the complete square pipe, the drilled hole must be sealed with resin immediately to prevent the fiberglass pipe from aggravating its own structural damage. However, if the fiberglass pipes are fixed with screws, there is no way to coat the screws and the fiberglass pipes with resin, such that the resulting products in this way are defective products.

[0004] In addition, the most troublesome thing in machining is to drill round holes in the fiberglass square pipes and fix the fiberglass round pipes into the square pipes with the screws, which will produce more fiberglass pipe powder. The fiberglass pipe powder will cause allergies to many people, such as extreme itching, stinging like acupuncture, red spots on the skin like acupuncture and other phenomenon, such that staff cannot work stably. New staff must be screened for those who are not allergic, which makes recruitment particularly difficult; and in turn, the products are not suitable for mass production.

SUMMARY OF THE INVENTION

[0005] For those purpose, an objective of the present invention is to provide a positioning pipe capable of effectively locking a circular pipe and a safety guardrail provided with the positioning pipe.

[0006] A positioning pipe capable of effectively locking a round pipe comprises a pipe body and a pipe locking member, wherein the pipe body is provided with a pipe locking hole; an annular frame is formed by extending from the pipe locking hole toward the outside; at least one position adjusting groove is formed in the frame and extends from a free end to the inside; the frame is divided

into a plurality of frame blocks by the position adjusting groove; the pipe locking member comprises a body portion and a locking member arranged on the body portion; the round pipe is inserted into the pipe locking hole and the frame; the body portion of the pipe locking member sleeves the frame; and the body portion is locked on the frame through the locking member.

[0007] Further, the positioning pipe further comprises an inner sleeve which is assembled in the pipe locking hole; the round pipe is inserted into the inner sleeve; the frame is arranged on the inner sleeve; and an outer diameter of the frame is consistent with an inner diameter of the pipe locking hole.

[0008] Further, the inner sleeve comprises a main body portion and a limiting portion; the limiting portion and the frame are respectively arranged at both ends of the main body portion; an outer diameter of the limiting portion is larger than an inner diameter of the pipe locking hole; and the limiting portion limits the inner sleeve.

[0009] Further, the frame is integrally formed on the outer surface of the positioning pipe, and an inner diameter of the frame is consistent with the inner diameter of the pipe locking hole.

[0010] Further, a locking portion is correspondingly arranged at both ends of the body portion, each of the two locking portions is provided with a positioning hole, and the two positioning holes are coaxial; and the locking member is inserted into the two positioning holes.

[0011] Further, each positioning hole is provided with an inner thread inside; each locking member is provided with an outer thread outside; and the locking member is screwed into the two positioning holes.

[0012] Further, the frame is further provided with a limiting step portion which is configured to limit the pipe locking member.

[0013] Further, the positioning pipe and the round pipe are both fiberglass pipes.

[0014] A safety guardrail provided with a positioning pipe capable of effectively locking a round pipe comprises a main support and a telescopic support movably assembled on the main support, wherein each of the main support and the telescopic support comprises positioning pipes and round pipes, the round pipes being inserted into the positioning pipes; and each positioning pipe is the positioning pipe capable of effectively locking the round pipe according to any one of claims 1 to 8.

[0015] Further, the main support comprises a first positioning pipe, a second positioning pipe, two horizontally extending first round pipe, and four pipe locking members, which are mounted vertically in parallel, wherein the two first round pipes are inserted into the first positioning pipe and the second positioning pipe and are arranged in parallel; the telescopic support comprises a third positioning pipe, a fourth positioning pipe, two horizontally extending second round pipes, and four pipe locking members, which are mounted vertically in parallel, wherein the two second round pipes are inserted into the third positioning pipe and the fourth positioning pipe

and are arranged in parallel; the two second round pipes are arranged inside the two first round pipes, and the second positioning pipe and the third positioning pipe are both inserted into the two first round pipes and the two second round pipes; each of the first positioning pipe and the fourth positioning pipe is provided with two longitudinally-through pipe locking holes, and each of the second positioning pipe and the third positioning pipe is provided with two pipe locking holes and two mounting holes respectively, wherein the two pipe locking holes in the second positioning pipe are respectively formed in the outer sides of the two mounting holes, and the two pipe locking holes in the third positioning pipe are formed between the two mounting holes.

[0016] Further, the positioning pipe further comprises a tubular inner sleeve which is assembled in the pipe locking pipe; and the round pipe is inserted into the inner sleeve.

[0017] Further, the inner sleeve comprises a main body portion, and a limiting portion and a frame which are arranged on both ends of the main body portion respectively, wherein an outer diameter of the limiting portion is larger than the main body portion and the frame; and the limiting portion limits the inner sleeve.

[0018] Further, the frame is provided with a guide groove that extends from outside to inside, wherein the guide groove divides the frame into more than two leading-in blocks.

[0019] Further, a locking portion is correspondingly arranged at both ends of the body portion, each of the two locking portions is provided with a positioning hole, and the two positioning holes are coaxial; and the locking members are inserted into the two positioning holes.

[0020] Further, each positioning hole is provided with an inner thread inside. each locking member is provided with an outer thread outside, and the locking member is screwed into the two positioning holes.

[0021] Further, the frame is further provided with a limiting step portion which is configured to limit the pipe locking member.

[0022] Further, the positioning pipe and the round pipe are both fiberglass pipes.

[0023] In summary, according to the present invention, the positioning pipe is provided with the pipe locking holes, the frame and the pipe locking members thereon, and the frame is provided with the plurality of position adjusting grooves which divides the frame into a plurality of frame blocks, such that the whole frame has higher elasticity; in addition to simple locking with the pipe locking members, the round pipe can be locked inside the positioning pipe securely and non-destructively. The present invention is simple in structure, convenient to mount, and safe and environment-friendly, and suitable for mass production; and is high in practicability and has a strong promotion significance.

[0024] The invention further relates to an assembly of a positioning pipe and a round pipe, wherein the round pipe has a circular cross-section and the positioning pipe

is provided with a through hole in the pipe which passes through the pipe wall on two opposite wall parts of the pipe wall and through which the round pipe is slid, which assembly is provided with a sleeve being open at both ends and being provided with at least one groove extending from the first end, the sleeve being disposed about the round pipe and fixed relative to the positioning pipe, and which assembly is provided with a pipe locking member being around the sleeve near the first end of the sleeve, the pipe locking member clamps the sleeve on the round pipe.

[0025] In an embodiment of the assembly the sleeve projects through the two holes in said wall parts and is provided at a second end with a limiting portion, preferably a projecting ridge, which is in contact with a boundary wall of the through hole in a wall portion of said pipe wall portions of the positioning pipe, wherein the sleeve with the limiting portion does not fit through the through hole, and wherein the pipe locking member abuts against the other wall part of said wall parts of the pipe wall, so that the sleeve and thus also the round pipe is fixed with respect to the positioning pipe.

[0026] In a further embodiment of the assembly the sleeve with a second end is attached to the positioning pipe at the location of the boundary wall of the through hole in one of said wall parts of the positioning pipe, the sleeve extending outwardly from this wall part.

[0027] The invention further relates to a safety rail comprising two interconnected supports each comprising at least one pipe, the pipe of the one support being connected to the pipe of the other support, characterized in that the two pipes form part of an assembly according to the invention.

[0028] In an embodiment of the safety rail each support comprises two spaced parallel round pipes and two spaced parallel connecting pipes which are provided near the ends with pipe locking holes through which the round pipes protrude, the round pipes being attached to the connecting pipes, wherein of each support in one of the connecting pipes there are mounting holes through which the round pipes of the other support are slidable, the mounting holes in one of the connecting pipes of one of the supports are positioned between the ends and the pipe locking holes and the mounting holes in one of the connecting pipes of the other support are located between the pipe locking holes.

[0029] In a further embodiment of the safety guardrail one of the supports being a main support comprising a first positioning pipe, a second positioning pipe, two horizontally extending first round pipes, and four pipe locking members, which are mounted vertically in parallel, wherein the two first round pipes are both inserted into the first positioning pipe and the second positioning pipe and arranged in parallel; the other of the supports being a telescopic support comprising a third positioning pipe, a fourth positioning pipe, two horizontally extending second round pipes, and four pipe locking members, which are mounted vertically in parallel, wherein the two second

round pipes are both inserted into the third positioning pipe and the fourth positioning pipe and are arranged in parallel; the two second round pipes are arranged inside the two first round pipes, and the second positioning pipe and the third positioning pipe are both inserted into the two first round pipes and the two second round pipes; each of the first positioning pipe and the fourth positioning pipe is provided with two longitudinally-through pipe locking holes, and each of the second positioning pipe and the third positioning pipe is provided with two pipe locking holes and two mounting holes respectively, wherein the two pipe locking holes in the second positioning pipe are respectively formed in the outer sides of the two mounting holes, and the two pipe locking holes in the third positioning pipe are formed between the two mounting holes.

BRIEF DESCRIPTION OF THE DRAWINGS

[0030]

FIG. 1 is a schematic structural diagram of a safety guardrail provided with a positioning pipe capable of effectively locking a round pipe;

FIG. 2 is a schematic diagram of an exploded structure of the safety guardrail in FIG. 1;

FIG. 3 is a stereoscopic structural diagram of the safety guardrail in FIG. 1;

FIG. 4 is a partially exploded schematic diagram of a first embodiment of the safety guardrail in FIG. 3; FIG. 5 is a schematic structural diagram of a pipe locking member and a frame in FIG. 4;

FIG. 6 is a schematic structural diagram of a second embodiment of the safety guardrail in FIG. 3; and

FIG. 7 is a schematic structural diagram of an inner sleeve in FIG. 6.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0031] In order to make the objectives, technical solutions and advantages of the present invention clearer, the following will describe the present invention in detail in conjunction with accompany drawings and embodiments.

[0032] FIGS. 1 to 5 show a first embodiment of a safety guardrail provided with a positioning pipe capable of effectively locking a round pipe. The safety guardrail provided with the positioning pipe capable of effectively locking the round pipe comprises a main support 10 and a telescopic support 20 movably assembled on the main support 10, wherein the telescopic support 20 is telescopically movable along the main support 10.

[0033] The main support 10 comprises a first positioning pipe 11, a second positioning pipe 12, two horizontally extending first round pipes 13, and four pipe locking members 60, which are mounted vertically in parallel, wherein the two first round pipes 13 are both inserted into the first positioning pipe 11 and the second position-

ing pipe 12 and are locked by the pipe locking members 60. The telescopic support 20 comprises a third positioning pipe 21, a fourth positioning pipe 22, two horizontally extending second round pipes 23, and four pipe locking members 60, which are mounted vertically in parallel, wherein the two second round pipes 23 are both inserted into the third positioning pipe 21 and the fourth positioning pipe 22 and are locked by the pipe locking members 60. The two second round pipes 23 are arranged inside the two first round pipes 13, and the second positioning pipe 12 and the third positioning pipe 21 are both arranged on the two first round pipes 13 and the two second round pipes 23 in a penetrating manner. In this embodiment, the positioning pipe and the round pipe are both fiber-glass pipes.

[0034] In this embodiment, the first positioning pipe 11, the second positioning pipe 12, the third positioning pipe 21 and the fourth positioning pipe 22 are square pipes. It may be understood that the positioning pipe may also be a regular-shaped pipe such as a round pipe and a polygonal pipe, or other irregular-shaped pipe, and its specific structure is not limited here. Each of the first positioning pipe 11 and the fourth positioning pipe 22 is provided with two longitudinally-through pipe locking holes 31, and each of the second positioning pipe 12 and the third positioning pipe 21 is provided with two pipe locking holes 31 and two mounting holes 41 respectively, wherein the two pipe locking holes 31 in the second positioning pipe 12 are respectively formed in the outer sides of the two mounting holes 41 in an extension direction of the second positioning pipe 12; and the two pipe locking holes 31 in the third positioning pipe 21 are formed between the two mounting holes 41 in an extension direction of the third positioning pipe 21. The round pipe that is inserted into each pipe locking hole 31 is locked by mounting the pipe locking member 60.

[0035] An axially extending frame 50 is formed by extending from the pipe locking hole 31 toward the outside. In this embodiment, a cross section of the frame 50 is in a circular ring shape. At least one position adjusting groove 51 is formed in the frame 50 and extends from a free end to the inside. In this embodiment, four position adjusting grooves 51 are provided, which divide the frame 50 uniformly into a plurality of frame blocks 52; and the plurality of spaced-apart frame blocks 52 makes the whole frame have higher elasticity. The frame 50 is further provided with a limiting step portion 53 which is configured to limit the pipe locking members 60.

[0036] The pipe locking member 60 comprises a body portion 61 and a locking member 62 arranged on the body portion 61; a locking portion 611 is correspondingly arranged at both ends of the body portion, each of the two locking portions 611 is provided with a positioning hole 612, and the two positioning holes 612 are coaxial; and each positioning hole 612 is provided with an inner thread inside. Each locking member 62 is provided with an outer thread outside. The locking member 62 is locked inside the two positioning holes 612, thereby locking the

body portion, and the tightness degree in locking can be adjusted according to needs. Furthermore, the shape size of an inner diameter of each pipe locking member 60 is matched with an appearance size of the frame 50. Specifically, the inner diameter of the pipe locking member 60 will be equal to or slightly smaller than the outer diameter of the frame 50, such that the frame 50 can be compressed inward to lock the round pipe.

[0037] During the mounting process, the round pipe is inserted into the pipe locking hole 31, the body portion 61 of the pipe locking member 60 is then assembled on the frame 50, and the pipe locking member 62 is locked on the body portion 61, thereby realizing secure and non-destructive mounting of the round pipe and the positioning pipe.

[0038] FIG. 6 and FIG. 7 show a second embodiment of the safety guardrail provided with the positioning pipe capable of effectively locking the round pipe. The structure in this embodiment and the structure of the first embodiment are substantially the same, but are different just in that: the frame 50 is arranged on a separate inner sleeve 70, rather than on the positioning pipe. The inner sleeve 70 comprises a main body portion 71, and a limiting portion 72 and a frame 50a which are arranged on both ends of the main body portion 71, wherein an outer diameter of the limiting portion 72 is larger than the main body portion 71 and the frame 50a. The limiting portion 72 is configured to limit the inner sleeve 70. An outer diameter of the main body portion 71 and an outer diameter of the frame 50a are respectively equal to or slightly smaller than the inner diameter of the pipe locking hole 31. The structure of the frame 50a is basically the same as that of the frame 50.

[0039] During the mounting process, the inner sleeve 70 is installed into the pipe locking hole 31; the inner surface of the limiting portion 72 is limited on the outer surface of the positioning pipe; the main body portion 71 extends into the pipe locking hole 31; and the frame 50a extends out of the pipe locking hole 31. Then, the round pipe is inserted into the inner sleeve 70, the body portion 61 of the pipe locking member 60 is assembled on the frame 50a, and the locking member 62 passes through the two positioning holes 612 and is locked, such that the round pipe is securely locked in the positioning pipe. However, the round pipe that is inserted into the mounting hole 41 is movably adjustable in the case of not being locked.

[0040] When the positioning pipe is prepared by using a plastic injection part and a casting process, the round pipe may be locked inside the positioning pipe by using the frame 50 and the pipe locking members 60 in the first embodiment. Of course, the round pipe may also be locked inside the positioning pipe by using the inner sleeve 70 in the second embodiment. However, when the positioning pipe is prepared by using a process other than a plastic injection part and a casting process, the round pipe may be locked inside the positioning pipe by using the inner sleeve 70 in the second embodiment.

[0041] In summary, according to the present invention, the positioning pipe is provided with the pipe locking holes 31, the frame 50 and the pipe locking members 60, and the frame 50 is provided with the plurality of position adjusting grooves 51 which divides the frame 50 into a plurality of frame blocks 52, such that the whole frame 50 has higher elasticity; in addition to simple locking with the pipe locking members 60, the round pipe can be locked inside the positioning pipe securely and non-destructively. The present invention is simple in structure, convenient to mount, and safe and environment-friendly, and suitable for mass production; and is high in practicability and has a strong promotion significance.

[0042] The above-mentioned embodiment only expresses an embodiment of the present invention, with more specific and detailed description, but it should not be understood as a limitation to the patent scope of the present invention. It should be pointed out that for those of ordinary skill in the art, without departing from the concept of the present invention, several modifications and improvements can be made, and these all fall within the protection scope of the present invention. Therefore, the protection scope of the present invention shall be subject to the appended claims.

Claims

1. A positioning pipe (11, 12, 21, 22) capable of effectively locking a round pipe (13, 23), comprising a pipe body and a pipe locking member (60), wherein the pipe body is provided with a pipe locking hole (31); an annular frame (50) is formed by extending from the pipe locking hole (31) toward the outside; at least one position adjusting groove (51) is formed in the frame (50) and extends from a free end to the inside; the frame (50) is divided into a plurality of frame blocks (52) by the position adjusting groove (51); the pipe locking member (60) comprises a body portion (61) and a locking member (62) arranged on the body portion (61); the round pipe (13, 23) is inserted into the pipe locking hole (31) and the frame (50); the body portion (61) of the pipe locking member (60) sleeves the frame (50); and the body portion (61) is locked on the frame (50) through the locking member (60).
2. Positioning pipe capable of effectively locking the round pipe of claim 1, further comprising an inner sleeve (70) which is assembled in the pipe locking hole (31); the round pipe (13, 23) is inserted into the inner sleeve (70); the frame (50) is arranged on the inner sleeve (70); and an outer diameter of the frame (50) is consistent with an inner diameter of the pipe locking hole (31).
3. Positioning pipe capable of effectively locking the round pipe of claim 2, wherein the inner sleeve (70)

comprises a main body portion (71) and a limiting portion (72); the limiting portion (72) and the frame (50) are respectively arranged at both ends of the main body portion (70); an outer diameter of the limiting portion (72) is larger than an inner diameter of the pipe locking hole (31); and the limiting portion (72) limits the inner sleeve (70).

4. Positioning pipe capable of effectively locking the round pipe of claim 1, wherein the frame (50) is integrally formed on the outer surface of the positioning pipe (11, 12, 21, 22), and an inner diameter of the frame (50) is consistent with the inner diameter of the pipe locking hole (31).

5. Positioning pipe capable of effectively locking the round pipe of claim 1, wherein a locking portion (611) is correspondingly arranged at both ends of the body portion (61), each of the two locking portions (611) is provided with a positioning hole (612), and the two positioning holes (612) are coaxial; and the locking members (60) are inserted into the two positioning holes (612).

6. Positioning pipe capable of effectively locking the round pipe of claim 5, wherein each positioning hole (612) is provided with an inner thread inside; each locking member (60) is provided with an outer thread outside, and the locking members (60) are screwed into the two positioning holes (612).

7. Positioning pipe capable of effectively locking the round pipe of claim 1, wherein the frame (50) is further provided with a limiting step portion (53) which is configured to limit the pipe locking member (60).

8. Positioning pipe capable of effectively locking the round pipe of claim 1, wherein the positioning pipe (11, 12, 21, 22) and the round pipe (13, 23) are both fiberglass pipes.

9. An assembly of a positioning pipe (11, 12, 21, 22) and a round pipe (13, 23), wherein the round pipe (13, 23) has a circular cross-section and the positioning pipe (11, 12, 21, 22) is provided with a through hole (31, 41) in the pipe which passes through the pipe wall on two opposite wall parts of the pipe wall and through which the round pipe (13, 23) is slid, which assembly is provided with a sleeve (70) being open at both ends and being provided with at least one groove (51) extending from the first end, the sleeve (70) being disposed about the round pipe (13, 23) and fixed relative to the positioning pipe (11, 12, 21, 22), and which assembly is provided with a pipe locking member (60) being around the sleeve (70) near the first end of the sleeve, the pipe locking member (60) clamps the sleeve (70) on the round pipe (13, 23).

10. Assembly according to claim 9, **characterized in that** the sleeve (70) projects through the two holes (31, 41) in said wall parts and is provided at a second end with a limiting portion (72), preferably a projecting ridge, which is in contact with a boundary wall of the through hole (31) in a wall portion of said pipe wall portions of the positioning pipe (12, 21, 22), wherein the sleeve (70) with the limiting portion (72) does not fit through the through hole (31), and wherein the pipe locking member (60) abuts against the other wall part of said wall parts of the pipe wall, so that the sleeve (70) and thus also the round pipe (13, 23) is fixed with respect to the positioning pipe (12, 21, 22).

11. Assembly according to claim 9, **characterized in that** the sleeve with a second end is attached to the positioning pipe (11, 12, 21, 22) at the location of the boundary wall of the through hole (31, 41) in one of said wall parts of the positioning pipe (11, 12, 21, 22), the sleeve extending outwardly from this wall part.

12. An assembly according to claim 9, 10 or 11, **characterized in that** the two pipes (11, 12, 21, 22, 13, 23) are made of glass fiber.

13. A safety rail comprising two interconnected supports (10, 20) each comprising at least one pipe (11, 12, 21, 22, 13, 23), the pipe (12, 13) of the one support (10) being connected to the pipe (21, 23) of the other support (20), **characterized in that** the two pipes (12, 13, 21, 23) form part of an assembly according to any one of the preceding claims 9-12.

14. Safety rail according to claim 13, **characterized in that** each support (10, 20) comprises two spaced parallel round pipes (13, 23) and two spaced parallel connecting pipes (11, 12, 21, 22) which are provided near the ends with pipe locking holes (31) through which the round pipes (13, 23) protrude, the round pipes (13, 23) being attached to the connecting pipes (11, 12, 21, 22), wherein of each support (10) in one of the connecting pipes (12) there are mounting holes (41) through which the round pipes (23) of the other support (20) are slidable, the mounting holes (41) in one of the connecting pipes (21) of one of the supports (20) are positioned between the ends and the pipe locking holes (31) and the mounting holes (41) in one of the connecting pipes (12) of the other support (10) are located between the pipe locking holes (31).

15. Safety guardrail according to claim 13 or 14, **characterized in that** one of the supports being a main support comprising a first positioning pipe, a second positioning pipe, two horizontally extending first round pipes, and four pipe locking members, which

are mounted vertically in parallel, wherein the two first round pipes are both inserted into the first positioning pipe and the second positioning pipe and arranged in parallel; the other of the supports being a telescopic support comprising a third positioning pipe, a fourth positioning pipe, two horizontally extending second round pipes, and four pipe locking members, which are mounted vertically in parallel, wherein the two second round pipes are both inserted into the third positioning pipe and the fourth positioning pipe and are arranged in parallel; the two second round pipes are arranged inside the two first round pipes, and the second positioning pipe and the third positioning pipe are both inserted into the two first round pipes and the two second round pipes; each of the first positioning pipe and the fourth positioning pipe is provided with two longitudinally-through pipe locking holes, and each of the second positioning pipe and the third positioning pipe is provided with two pipe locking holes and two mounting holes respectively, wherein the two pipe locking holes in the second positioning pipe are respectively formed in the outer sides of the two mounting holes, and the two pipe locking holes in the third positioning pipe are formed between the two mounting holes.

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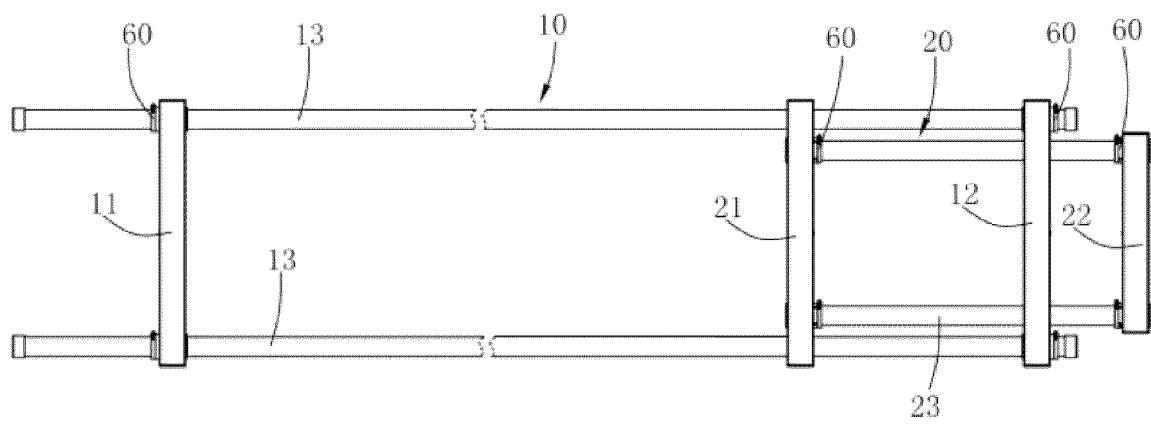


Fig. 1

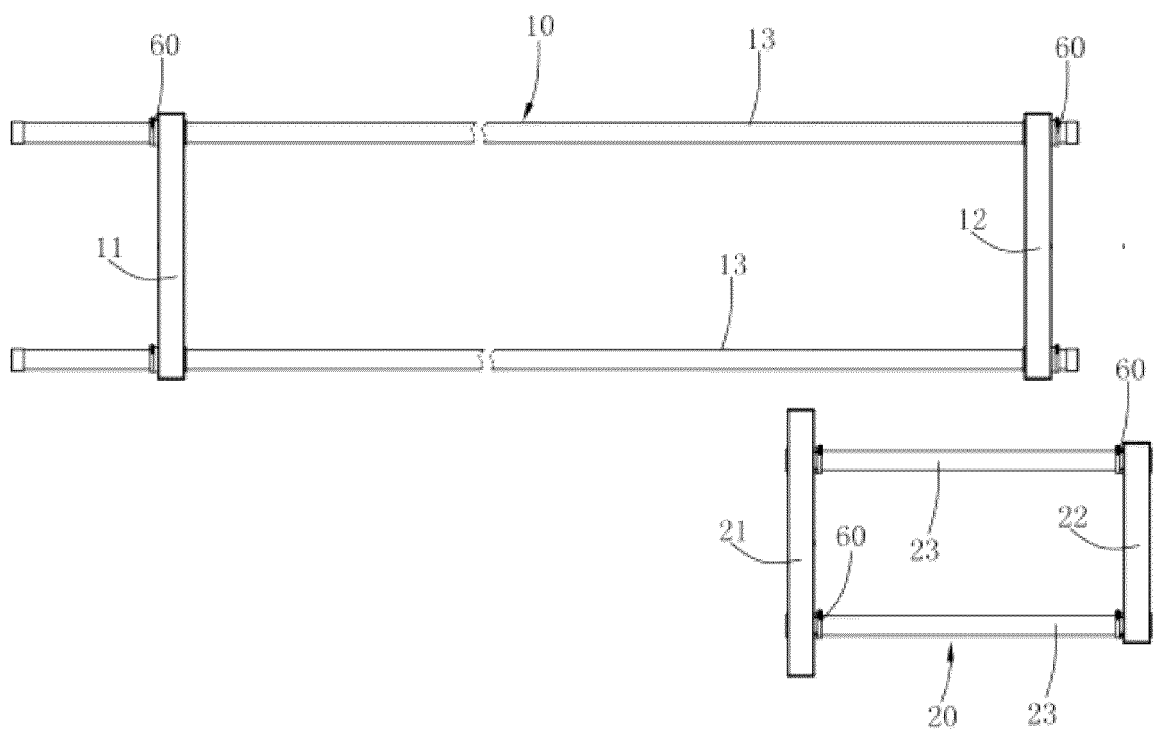


Fig. 2

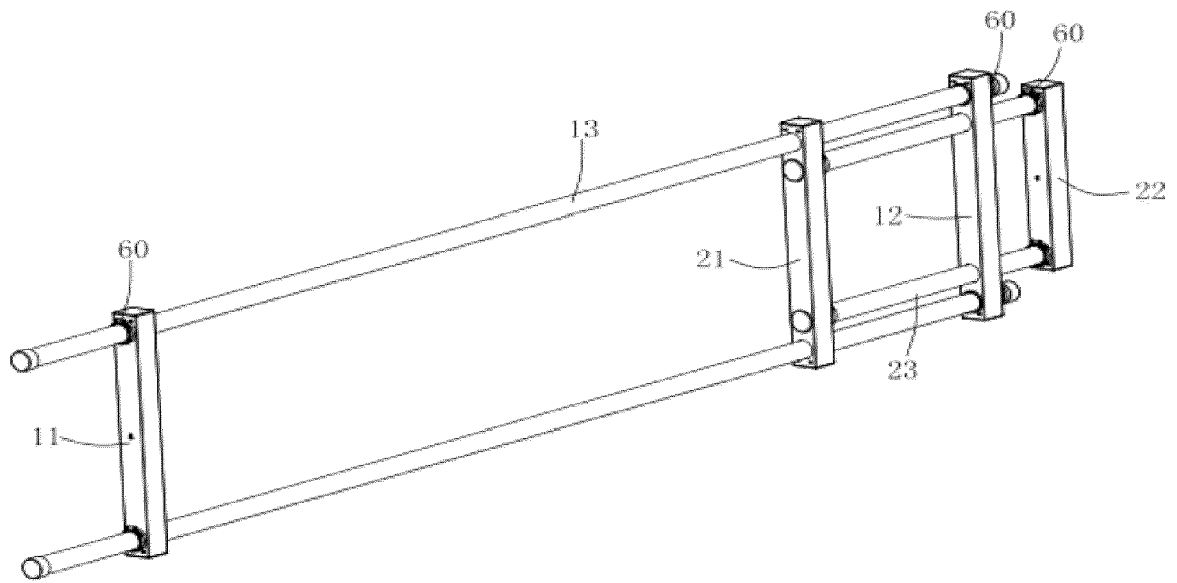


Fig. 3

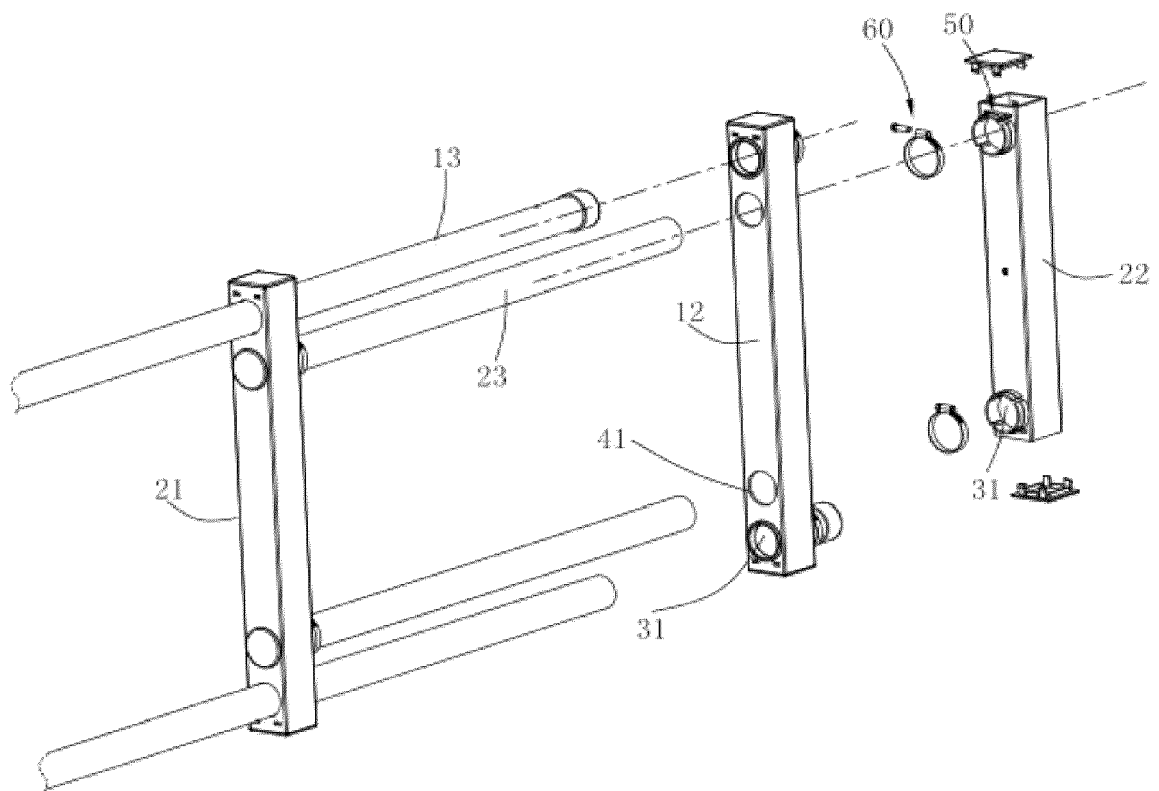


Fig. 4

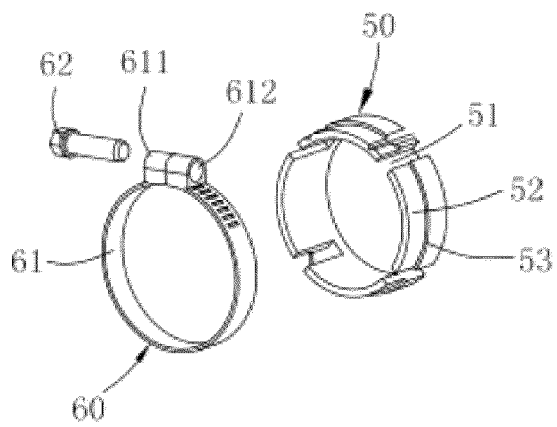


Fig. 5

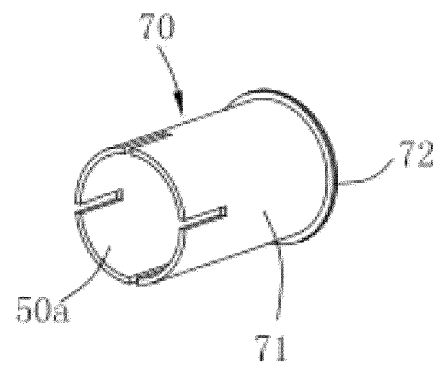


Fig. 7

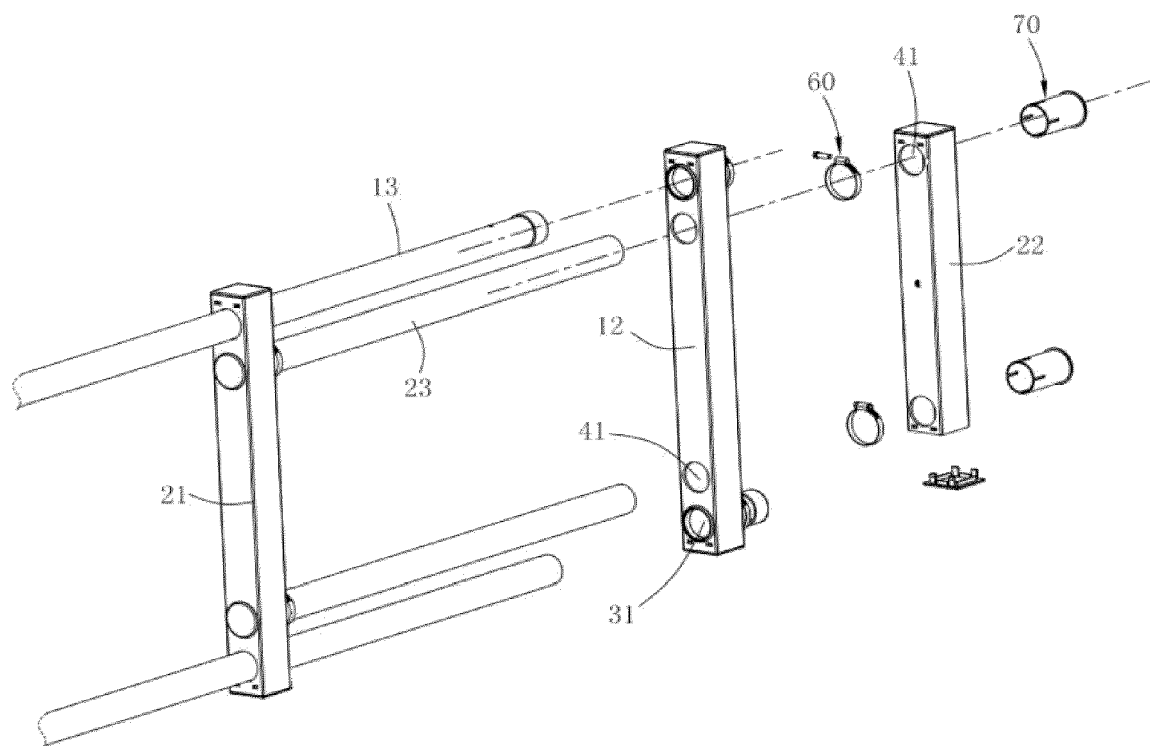


Fig. 6



EUROPEAN SEARCH REPORT

Application Number

EP 22 20 0944

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EPO FORM 1503 03.82 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC) E01B E04H
Place of search Munich		Date of completion of the search 6 February 2023	Examiner Movadat, Robin
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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06-02-2023

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82