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(54) CORBEL, METHOD AND ARRANGEMENT FOR SUPPORTING A FIRST STRUCTURAL ELEMENT AT A SECOND STRUCTURAL ELEMENT

(57) Presented is a corbel (1) for supporting a first structural element (2) at a second structural element (3) and a method and an arrangement. The corbel (1) comprises a first support part (4) configured to be cast into second structural element (3), and a second support part (5) that is fastened by bolts (6) to the first support part (4) and on which second support part (5) the first structural element (2) is configured to be supported. Reinforcement rods (9) are attached to the first support part (4) and extend from the first support part (4) on opposite sides of the second support part (5) beyond the second support part (5) so that the reinforcement rods (9) are configured to extend into concrete of the first structural element (2).

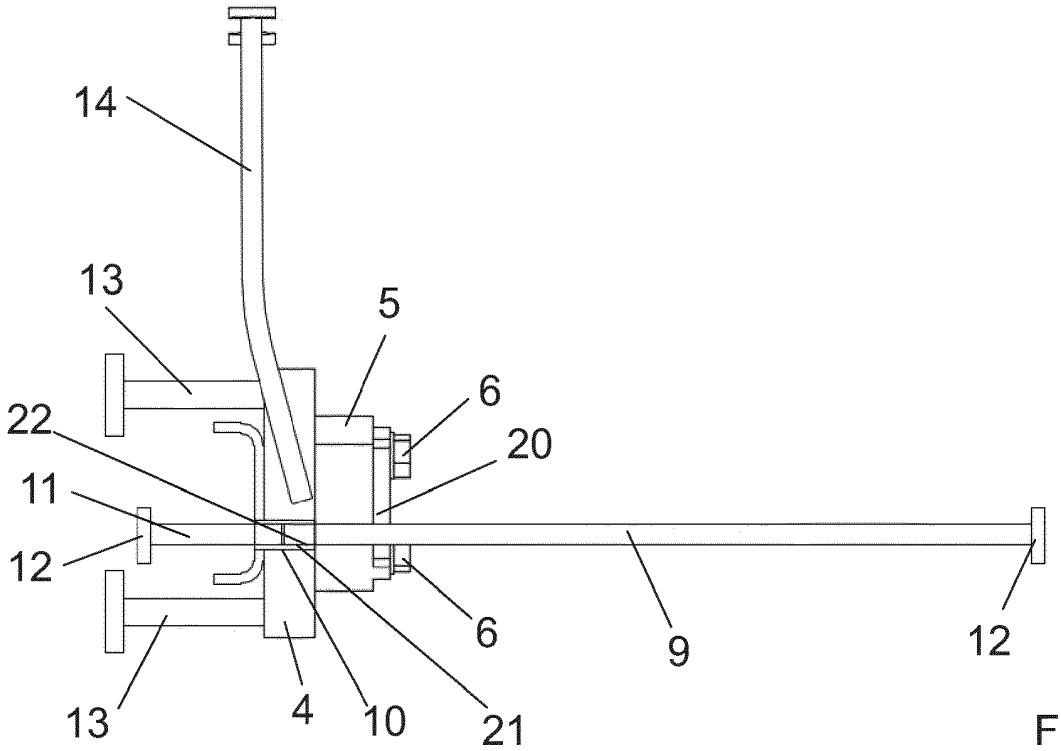

FIG 8

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Description

Field of the invention

[0001] The invention relates to a corbel for supporting a first structural element comprising concrete at a second structural element comprising concrete as defined in the preamble of independent claim 1.

[0002] The invention also relates to an arrangement for supporting a first structural element comprising concrete at a second structural element comprising concrete as defined in the preamble of independent claim 9.

[0003] The invention also relates to a method for supporting a first structural element comprising concrete at a second structural element comprising concrete as defined in the preamble of independent claim 18.

[0004] Document WO 02/33185 presents a bracket for supporting a structural element, such as a precast concrete beam, on a concrete pile or similar support structure in a building. The bracket comprises a first support part which is cast at least partly into the concrete pile. The first support part comprises a bracket part for supporting the structural element so that the structural element bears against the concrete pile. The bracket part is movably fastened to the first support part, which is cast at least partly into the concrete pile, such that the position of the bracket part with regard to the concrete pile can be changed.

Objective of the invention

[0005] The object of the invention is to provide a corbel for supporting a first structural element comprising concrete at a second structural element comprising concrete and to provide a method and an arrangement for supporting a first structural element comprising concrete at a second structural element comprising concrete having improved robustness such as improved ability to prevent disproportional collapse.

Short description of the invention

[0006] The corbel of the invention is characterized by the definitions of independent claim 1.

[0007] Preferred embodiments of the corbel are defined in the dependent claims 2 to 8.

[0008] The arrangement of the invention is correspondingly characterized by the definitions of independent claim 9.

[0009] Preferred embodiments of the arrangement are defined in the dependent claims 10 to 17.

[0010] The method of the invention is correspondingly characterized by the definitions of independent claim 18.

[0011] Preferred embodiments of the method are defined in the dependent claims 19 to 26.

List of figures

[0012] In the following the invention will described in more detail by referring to the figures of which

Figure 1 shows an arrangement according to the prior art for supporting a first structural component comprising concrete that is in the form of a composite steel-concrete beam at a second structural component comprising concrete that is in the form of a reinforced concrete column,
Figure 2 shows a first embodiment of the arrangement for supporting a first structural component comprising concrete that is in the form of a composite steel-concrete beam at a second structural component comprising concrete that is in the form of a reinforced concrete column,
Figure 3 shows in partly transparent view the first embodiment of the arrangement illustrated in figure 2 as seen from above,
Figure 4 shows a second embodiment of the arrangement for supporting a first structural component comprising concrete that is in the form of a composite steel-concrete beam at a second structural component comprising concrete that is in the form of a reinforced concrete column,
Figure 5 shows a detail of a variant of the arrangement for supporting a first structural component comprising concrete that is in the form of a composite steel-concrete beam at a second structural component comprising concrete that is in the form of a reinforced concrete column,
Figure 6 shows a detail of a variant of the arrangement for supporting a first structural component comprising concrete that is in the form of a composite steel-concrete beam at a second structural component comprising concrete that is in the form of a reinforced concrete column,
Figure 7 shows the first embodiment of the arrangement illustrated in figure 2 as cut along plane A-A in figure 2,
Figure 8 shows a first embodiment of the corbel,
Figure 9 shows the corbel shown in figure 8 as seen from above, and
Figure 10 shows a second embodiment of the corbel.

Detailed description of the invention

[0013] First the corbel 1 for supporting a first structural element 2 comprising concrete at a second structural element 3 comprising concrete and some variants and embodiment of the corbel will be described in greater detail.

[0014] The corbel 1 comprises a first support part 4 configured to be cast at least partly into concrete of the second structural element 3 comprising concrete.

[0015] In the embodiments illustrated in the figures the second structural element 3 comprising concrete is in the form of a reinforced concrete column.

[0016] In the embodiments illustrated in the figures the first structural component 2 comprising concrete is in the form of a steel-concrete composite beam having an outer steel shell structure 15 limiting an inner space 16 filled with or configured to be filled with concrete.

[0017] The corbel 1 comprises a second support part 5 that is fastened by bolts 6 to the first support part 4 so that a first face 7 of the first support part 4 abuts a second face 8 of the second support part 5 and on which second support part 5 the first structural element 2 is configured to be supported. The first support part is preferably, but not necessarily, provided with threaded holes (not shown in the figures) configured to receive and cooperate with the bolts 6 and the second support part 5 is preferably, but not necessarily, provided with through holes (not shown in the figures) configured to receive and be penetrated by the bolts 6 when the second support part 5 is fastened by the bolts 5 to the first support part. Said trough holes have preferably, but not necessarily, an inner diameter that is larger than the outer diameter of the bolts 6 so as to enable to adjust the fastening position of the second support part 5 with respect to the first support part 4 so at to in result adjust the relative position between the first structural element 2 comprising concrete and he second structural element 3 comprising concrete.

[0018] The corbel 1 comprises additionally preferably, but not necessarily, a stopper 20 configured to provides additional securing of the second structural element 3 comprising concrete on the corbel 1. The stopper 20 can for example have larger lateral extensions than the second support element 5. Such possible stopper 20 is preferably, but not necessarily, fastened by means of the bolts 6 at a free end of the corbel 1 so that the second support part 5 is arranged between the first support part 4 and the stopper when the second support part 5 and the stopper 20 is fastened by means of the bolts 6 to the first support part 4.

[0019] The first structural element 2 has preferably, but not necessarily, a recess 19 at the end of the first structural element 2 into which the second support part 2 of the corbel 1 is configured to penetrate so that the first structural element 2 is configured to be supported on the second support part 2 of the corbel 1 inside the recess 19. The recess 19 extends preferably, but not necessarily, from a lower edge (not marked with a reference numeral) of the end of the first structural element 2.

[0020] The corbel 1 comprises reinforcement rods 9 attached to the first support part 4 and extending from the first support part 4 on opposite sides of the second support part 5 beyond the second support part 5 so that the reinforcement rods 9 are configured to extend into concrete of the first structural element 2 comprising concrete. This provides for increased robustness in the connection between the first structural element 2 and the second structural element 3 because the reinforcement rods 9 connects the first structural component 2 directly to the corbel's 1 first support part 4 that is anchored by casting at least partly into concrete of the second structural component 3. The reinforcement rods 9 can also function as tensile reinforcement against disproportional collapse.

[0021] The first support part 4 can, as illustrated in the figures, have essentially the form of a cuboid and by the reinforcement rods 9 extend perpendicularly in relation to the first support part 4.

[0022] The reinforcement rods 9 are preferably, but not necessarily, fastened to the first support part 4 by means of sockets 10 fastened on opposite sides of the first support part 4 so that the sockets 10 are provided with an inner threading 21 and by the reinforcement rods 9 being provided with a co-operating outer threading 22. This makes the supporting of the first structural element 2 on the second support part 5 of the corbel 1 easier especially in cases where the first structural element 2 is in the form of a composite steel-concrete beam having an inner space 16 intended to be filled with concrete first after that the first structural element 2 has been supported on the second support part 5 of the corbel 1. In such cases the reinforcement rods 9 can be fastened to the sockets 10 after that the first structural element 2 has been supported on the second support part 5 of the corbel 1 by utilizing the inner space 16 of the first structural element 2 i.e. from the inner space 16 of the first structural element 2 and after that the reinforcement rods 9 have been fastened to the sockets 10, the inner space 16 of the first structural element 2 is at least partly filled with concrete resulting in that the reinforcement rods 9 will extend into the concrete of the first structural element 2. Additional reinforcement rods 11 are preferably, but not necessarily, fastened to the sockets 10 and extending in the opposite direction from sockets 10 in relation to the reinforcement rods 9. This provides for increased robustness. The optional additional reinforcement rods 11 are preferably, but not necessarily, provided with a headed end 12 configured to anchor the additional reinforcement rods 11 in concrete of the first structural element 2.

[0023] The reinforcement rods 9 can alternatively be fastened to the first support part 4 by welding.

[0024] The reinforcement rods 9 are preferably, but not necessarily, provided with a headed end 12 configured to anchor the reinforcement rods 9 in concrete of the first structural element 2.

[0025] The first support part 4 of the corbel 1 is preferably, but not necessarily, additionally provided with first anchoring studs 13 extending from the first support part 4 transversely in relation to the first face of the first support part 4.

[0026] The first support part 4 of the corbel 1 is preferably, but not necessarily, additionally provided with second anchoring studs 14 extending from the first support part 4 partly inclined and partly in parallel in relation to the first face 7 of the first support part 4.

[0027] The first face 7 of the first support part 4 comprises preferably, but not necessarily, a first serrated surface (not illustrated in the figures) configured to cooperate with a second serrated surface (not illustrated in the

figures) at the second face 8 of the second support part 5 so at to provide for enhanced robustness in the connection between first face 7 of the first support part 4 and the second face 8 of the second support part 5.

[0028] Next the arrangement for supporting a first structural element comprising concrete at a second structural element 3 comprising concrete and some preferred variants and embodiments of the arrangement will be described in greater detail.

[0029] In the arrangement a first support part 4 of a corbel 1 is cast at least partly into concrete of the second structural element 3 comprising concrete.

[0030] In the embodiments illustrated in the figures the second structural element 3 comprising concrete is in the form of a reinforced concrete column.

[0031] In the embodiments illustrated in the figures the first structural component 2 comprising concrete is in the form of a steel-concrete composite beam having an outer steel shell structure 15 limiting an inner space 16 filled with or configured to be filled with concrete.

[0032] In the arrangement a second support part 5 of the corbel 1 is fastened by bolts 6 to the first support part 4 so that a first face 7 of the first support part 4 abuts a second face 8 of the second support part 5. The first support part is preferably, but not necessarily, provided with threaded holes (not shown in the figures) configured to receive and cooperate with the bolts 6 and the second support part 5 is preferably, but not necessarily, provided with through holes (not shown in the figures) configured to receive and be penetrated by the bolts 6 when the second support part 5 is fastened by the bolts 5 to the first support part. Said trough holes have preferably, but not necessarily, an inner diameter that is larger than the outer diameter of the bolts 6 so as to enable to adjust the fastening position of the second support part 5 with respect to the first support part 4 so at to in result adjust the relative position between the first structural element 2 comprising concrete and he second structural element 3 comprising concrete.

[0033] The corbel 1 comprises additionally preferably, but not necessarily, a stopper 20 configured to provides additional securing of the second structural element 3 comprising concrete on the corbel 1. The stopper 20 can for example have larger lateral extensions than the second support element 5. Such possible stopper 20 is preferably, but not necessarily, fastened by means of the bolts 6 at a free end of the corbel 1 so that the second support part 5 is arranged between the first support part 4 and the stopper when the second support part 5 and the stopper 20 is fastened by means of the bolts 6 to the first support part 4.

[0034] In the arrangement the first structural element 2 is supported on the second support part 5 of the corbel 1. The first structural element 2 has preferably, but not necessarily, a recess 19 at the end of the first structural element 2 into which the second support part 2 of the corbel 1 is configured to penetrate so that the first structural element 2 is configured to be supported on the second support part 2 of the corbel 1 inside the recess 19. The recess 19 extends preferably, but not necessarily, from an lower edge (not marked with a reference numeral) of the end of the first structural element 2.

[0035] In the arrangement reinforcement rods 9 are attached to the first support part 4 of the corbel 1 and extend from the first support part 4 of the corbel 1 on opposite sides of the second support part 5 of the corbel 1 beyond the second support part 5 of the corbel 1 into concrete of the first structural element 2 comprising concrete. This provides for increased robustness in the connection between the first structural element 2 and the second structural element 3 because the reinforcement rods 9 connects the first structural component 2 directly to the corbel's 1 first support part 4 that is anchored by casting at least partly into concrete of the second structural component 3. The reinforcement rods 9 can also function as tensile reinforcement against disproportional collapse.

[0036] The first support part 4 has preferably, but not necessarily, essentially the form of a cuboid and the reinforcement rods 9 extend preferably, but not necessarily, perpendicularly in relation to the first support part 4.

[0037] The reinforcement rods 9 are preferably, but not necessarily, fastened to the first support part 4 by means of sockets 10 fastened on opposite sides of the first support part 4 so that the sockets 10 are provided with an inner threading 21 and by the reinforcement rods 9 being provided with a co-operating outer threading 22. Additional reinforcement rods 11 are preferably, but not necessarily, fastened to the sockets 10 and extend in the opposite direction from sockets 10 in relation to the reinforcement rods 9. The optional additional reinforcement rods 11 are preferably, but not necessarily, provided with a headed end 12 configured to anchor the additional reinforcement rods 11 in concrete of the second structural element 3.

[0038] The reinforcement rods 9 can alternatively be fastened to the first support part 4 of the corbel 1 by welding.

[0039] The reinforcement rods 9 are preferably, but not necessarily, provided with a headed end 12 configured to anchor the reinforcement rods 9 in concrete of the first structural element 2.

[0040] The first support part 4 is preferably, but not necessarily, additionally provided with first anchoring studs 13 extending from the first support part 4 transversely in relation to the first face 7 of the first support part 4.

[0041] The first support part 4 is preferably, but not necessarily, additionally provided with second anchoring studs 14 extending from the first support part 4 partly inclined and partly in parallel in relation to the first face 7 of the first support part 4.

[0042] The first face 7 of the first support part 4 comprises preferably, but not necessarily, a first serrated surface (not illustrated in the figures) configured to cooperate with a second serrated surface (not illustrated in the

figures) at the second face 8 of the second support part 5 so at to provide for enhanced robustness in the connection between first face 7 of the first support part 4 and the second face 8 of the second support part 5.

[0043] In the arrangement, the first structural element 2 comprising concrete is preferably, but not necessarily, a steel-concrete composite beam having an outer steel shell structure 15 liming an inner space 16 filled with concrete. In such case the outer steel shell structure 15 has preferably, but not necessarily an end plate 17 at each end so that the reinforcement rods 9 extend through the end plate 17 of the outer steel shell structure 15 in openings 18 provided in the end plate 17 in the outer steel shell structure 15. Such openings 18 have preferably, but not necessarily, an inner diameter or cross section that is larger than the outer diameter or cross section of the reinforcement rods 9 so as to allow positioning of the first structural element 2 comprising concrete in various positions with respect to the reinforcement rods 9.

[0044] Next the method for supporting a first structural element 2 comprising concrete at a second structural element 3 comprising concrete and some preferred embodiment and variants of the method will be described in greater detail

[0045] The method comprises a casting step for casting a first support part 4 of a corbel 1 at least partly into concrete of the second structural element 3 comprising concrete. The first support part is preferably, but not necessarily, provided with threaded holes (not shown in the figures) configured to receive and cooperate with the bolts 6 and the second support part 5 is preferably, but not necessarily, provided with through holes (not shown in the figures) configured to receive and be penetrated by the bolts 6 when the second support part 5 is fastened by the bolts 5 to the first support part. Said trough holes have preferably, but not necessarily, an inner diameter that is larger than the outer diameter of the bolts 6 so as to enable to adjust the fastening position of the second support part 5 with respect to the first support part 4 so at to in result adjust the relative position between the first structural element 2 comprising concrete and he second structural element 3 comprising concrete.

[0046] The corbel 1 comprises additionally preferably, but not necessarily, a stopper 20 configured to provides additional securing of the second structural element 3 comprising concrete on the corbel 1. The stopper 20 can for example have larger lateral extensions than the second support element 5. Such possible stopper 20 is preferably, but not necessarily, fastened by means of the bolts 6 at a free end of the corbel 1 so that the second support part 5 is arranged between the first support part 4 and the stopper when the second support part 5 and the stopper 20 is fastened by means of the bolts 6 to the first support part 4.

[0047] In the embodiments illustrated in the figures the second structural element 3 comprising concrete is in the form of a reinforced concrete column.

[0048] In the embodiments illustrated in the figures the first structural component 2 comprising concrete is in the form of a steel-concrete composite beam having an outer steel shell structure 15 limiting an inner space 16 filled with or configured to be filled with concrete.

[0049] The method comprises a fastening step for fastening a second support part 5 of the corbel 1 by bolts 6 to the first support part 4 so that a first face 7 of the first support part 4 abuts a second face 8 of the second support part 5.

[0050] The method comprises a supporting step for supporting the first structural element 2 on the second support part 5 of the corbel 1.

[0051] The method comprises an attaching step for attaching reinforcement rods 9 to the first support part 4 of the corbel 1 to extend from the first support part 4 of the corbel 1 on opposite sides of the second support part 5 of the corbel 1 beyond the second support part 5 of the corbel 1 into concrete of the first structural element 2 comprising concrete. This provides for increased robustness in the connection between the first structural element 2 and the second structural element 3 because the reinforcement rods 9 connects the first structural component 2 directly to the corbel's 1 first support part 4 that is anchored by casting at least partly into concrete of the second structural component 3. The reinforcement rods 9 can also function as tensile reinforcement against disproportional collapse.

[0052] The method comprises preferably, but not necessarily, providing for the casting step a first support part 4 having essentially the form of a cuboid, and attaching in the attaching step the reinforcement rods 9 to extend perpendicularly in relation to the first support part 4.

[0053] The method comprises preferably, but not necessarily, attaching the reinforcement rods 9 to the first support part 4 in attaching step by means of sockets 10 fastened on opposite sides of the first support part 4 by providing the sockets 10 with an inner threading 21 and by providing the reinforcement rods 9 with a co-operating outer threading 22. In such embodiment of the method, the method comprises preferably, but not necessarily, fastening additional reinforcement rods 11 to the sockets 10 to extend in the opposite direction from sockets 10 in relation to the reinforcement rods 9. In such embodiment of the method, the method comprises preferably, but not necessarily, providing the additional reinforcement rods 11 being with a headed end 12 configured to anchor the additional reinforcement rods 11 in concrete of the second structural element 3.

[0054] The method can alternatively comprise attaching the reinforcement rods 9 to the first support part 4 in the attaching step by welding.

[0055] The method comprises preferably, but not necessarily, providing the reinforcement rods 9 with a headed end 12 configured to anchor the reinforcement rods 9 in concrete of the first structural element 2.

[0056] The method comprises preferably, but not necessarily, providing the first support part 4 additionally with first anchoring studs 13 extending from the first support

part 4 transversely in relation to the first face 7 of the first support part 4.

[0057] The method comprises preferably, but not necessarily, providing the first support part 4 additionally with second anchoring studs (14) extending from the first support part 4 partly inclined and partly in parallel in relation to the first face 7 of the first support part 4.

[0058] The method comprises preferably, but not necessarily, providing the first face 7 of the first support part 4 with a first serrated surface (not illustrated in the figures) and by providing the second face 8 of the second support part 5 with a second serrated surface (not illustrated in the figures) configured to cooperate with the first serrated surface of the first face 7 of the first support part 4 so at to provide for enhanced robustness in the connection between first face 7 of the first support part 4 and the second face 8 of the second support part 5.

[0059] The method comprises preferably, but not necessarily, providing for the supporting step a first structural element 2 comprising concrete being a steel-concrete composite beam having an outer steel shell structure 15 liming an inner space 16 to be filled with concrete, wherein the outer steel shell structure 15 having an end plate 17 at each end. Such embodiment of the method comprises providing openings 2 in the end plate 17 in the outer steel shell structure 15, and arranging the reinforcement rods 9 to extend through openings 18 provided in the end plate 17 of the outer steel shell structure 15 into the inner space 16 of the steel-concrete composite beam prior filling the inner space 16 with concrete. Such openings 18 are preferably, but not necessarily, provided with an inner diameter or cross section that is larger than the outer diameter or cross section of the reinforcement rods 9 so as to allow positioning of the first structural element 2 comprising concrete in various positions with respect to the reinforcement rods 9.

[0060] It is apparent to a person skilled in the art that as technology advanced, the basic idea of the invention can be implemented in various ways. The invention and its embodiments are therefore not restricted to the above examples, but they may vary within the scope of the claims.

Claims

1. A corbel (1) for supporting a first structural element (2) comprising concrete at a second structural element (3) comprising concrete, the corbel (1) comprising

   a first support part (4) configured to be cast at least partly into concrete of the second structural element (3) comprising concrete, and
   a second support part (5) that is fastened by bolts (6) to the first support part (4) so that a first face (7) of the first support part (4) abuts a second face (8) of the second support part (5) and on which second support part (5) the first structural element (2) is configured to be supported, **characterized**
   by reinforcement rods (9) attached to the first support part (4) and extending from the first support part (4) on opposite sides of the second support part (5) beyond the second support part (5) so that the reinforcement rods (9) are configured to extend into concrete of the first structural element (2) comprising concrete.

2. The corbel (1) according to claim 1, **characterized by** the first support part (4) having essentially the form of a cuboid and by the reinforcement rods (9) extend perpendicularly in relation to the first support part (4).

3. The corbel (1) according to claim 1 or 2, **characterized**

   by the reinforcement rods (9) being fastened to the first support part (4) by means of sockets (10) fastened on opposite sides of the first support part (4), and
   by the sockets (10) being provided with an inner threading (21) and by the reinforcement rods (9) being provided with a co-operating outer threading (22).

4. The corbel (1) according to claim 3, **characterized by** additional reinforcement rods (11) fastened to the sockets (10) and extending in the opposite direction from sockets (10) in relation to the reinforcement rods (9).

5. The corbel (1) according to claim 4, **characterized by** the additional reinforcement rods (11) being provided with a headed end (12) configured to anchor the additional reinforcement rods (11) in concrete of the first structural element (2).

6. The corbel (1) according to any of the claims 1 to 5, **characterized**
   by the reinforcement rods (9) being provided with a headed end (12) configured to anchor the reinforcement rods (9) in concrete of the first structural element (2).

7. The corbel (1) according to any of the claims 1 to 6, **characterized**
   by the first support part (4) being additionally provided with first anchoring studs (13) extending from the first support part (4) transversely in relation to the first face of the first support part (4).

8. The corbel (1) according to any of the claims 1 to 7, **characterized**
   by the first support part (4) being additionally provid-

ed with second anchoring studs (14) extending from the first support part (4) partly inclined and partly in parallel in relation to the first face (7) of the first support part (4).

9. Arrangement for supporting a first structural element comprising concrete at a second structural element (3) comprising concrete, wherein the arrangement comprising

a first support part (4) of a corbel (1) is cast at least partly into concrete of the second structural element (3) comprising concrete,
a second support part (5) of the corbel (1) is fastened by bolts (6) to the first support part (4) so that a first face (7) of the first support part (4) abuts a second face (8) of the second support part (5), and
the first structural element (2) is supported on the second support part (5) of the corbel (1),
characterized
by reinforcement rods (9) attached to the first support part (4) of the corbel (1) and extending from the first support part (4) of the corbel (1) on opposite sides of the second support part (5) of the corbel (1) beyond the second support part (5) of the corbel (1) into concrete of the first structural element (2) comprising concrete.

10. The arrangement according to claim 9, **characterized**
by the first support part (4) having essentially the form of a cuboid and by the reinforcement rods (9) extend perpendicularly in relation to the first support part (4).

11. The arrangement according to claim 9 or 10, **characterized**

by the reinforcement rods (9) being fastened to the first support part (4) by means of sockets (10) fastened on opposite sides of the first support part (4), and
by the sockets (10) being provided with an inner threading (21) and by the reinforcement rods (9) being provided with a co-operating outer threading (22).

12. The arrangement according to claim 11, **characterized**
by additional reinforcement rods (11) fastened to the sockets (10) and extending in the opposite direction from sockets (10) in relation to the reinforcement rods (9).

13. The arrangement according to claim 12, **characterized**
by the additional reinforcement rods (11) being provided with a headed end (12) configured to anchor the additional reinforcement rods (11) in concrete of the second structural element (3).

14. The arrangement according to any of the claims 9 to 13, **characterized**
by the reinforcement rods (9) being provided with a headed end (12) configured to anchor the reinforcement rods (9) in concrete of the first structural element (2).

15. The arrangement according to any of the claims 9 to 14, **characterized**
by the first support part (4) being additionally provided with first anchoring studs (13) extending from the first support part (4) transversely in relation to the first face (7) of the first support part (4).

16. The arrangement according to any of the claims 9 to 15, **characterized**
by the first support part (4) being additionally provided with second anchoring studs (14) extending from the first support part (4) partly inclined and partly in parallel in relation to the first face (7) of the first support part (4).

17. The arrangement according to any of the claims 9 to 16, **characterized**

by the first structural element (2) comprising concrete being a steel-concrete composite beam having an outer steel shell structure (15) liming an inner space (16) filled with concrete,
by the outer steel shell structure (15) having an end plate (17) at each end,
by the reinforcement rods (9) extending through the end plate (17) of the outer steel shell structure (15) in openings (18) provided in the end plate (17) in the outer steel shell structure (15).

18. Method for supporting a first structural element (2) comprising concrete at a second structural element (3) comprising, wherein the method comprises

a casting step for casting a first support part (4) of a corbel (1) at least partly into concrete of the second structural element (3) comprising concrete,
a fastening step for fastening a second support part (5) of the corbel (1) by bolts (6) to the first support part (4) so that a first face (7) of the first support part (4) abuts a second face (8) of the second support part (5), and
a supporting step for supporting the first structural element (2) on the second support part (5) of the corbel (1),

characterized

by an attaching step for attaching reinforcement rods (9) to the first support part (4) of the corbel (1) to extend from the first support part (4) of the corbel (1) on opposite sides of the second support part (5) of the corbel (1) beyond the second support part (5) of the corbel (1) into concrete of the first structural element (2) comprising concrete.

19. The method according to claim 18, **characterized**

by providing for the casting step a first support part (4) having essentially the form of a cuboid, and
by attaching in the attaching step the reinforcement rods (9) to extend perpendicularly in relation to the first support part (4).

20. The method according to claim 18 or 19, **characterized**
by attaching the reinforcement rods (9) to the first support part (4) in attaching step by means of sockets (10) fastened on opposite sides of the first support part (4) by providing the sockets (10) with an inner threading (21) and by providing the reinforcement rods (9) with a co-operating outer threading (22).

21. The method according to claim 20, **characterized**
by fastening additional reinforcement rods (11) to the sockets (10) to extend in the opposite direction from sockets (10) in relation to the reinforcement rods (9).

22. The method according to claim 21, **characterized**
by providing the additional reinforcement rods (11) with a headed end (12) configured to anchor the additional reinforcement rods (11) in concrete of the second structural element (3).

23. The method according to any of the claims 18 to 22, **characterized**
by providing the reinforcement rods (9) being with a headed end (12) configured to anchor the reinforcement rods (9) in concrete of the first structural element (2).

24. The method according to any of the claims 18 to 23, **characterized**
by providing the first support part (4) additionally with first anchoring studs (13) extending from the first support part (4) transversely in relation to the first face (7) of the first support part (4).

25. The method according to any of the claims 18 to 24, **characterized**
by providing the first support part (4) additionally with second anchoring studs (14) extending from the first support part (4) partly inclined and partly in parallel in relation to the first face (7) of the first support part (4).

26. The method according to any of the claims 18 to 25, **characterized**

by providing for the supporting step a first structural element (2) comprising concrete being a steel-concrete composite beam having an outer steel shell structure (15) liming an inner space (16) to be filled with concrete, wherein the outer steel shell structure (15) having an end plate (17) at each end,
by providing openings (2) in the end plate (17) in the outer steel shell structure (15), and
by arranging the reinforcement rods (9) to extend through the end plate (17) of the outer steel shell structure (15) into the inner space (16) of the steel-concrete composite beam prior filling the inner space (16) with concrete.

PRIOR ART

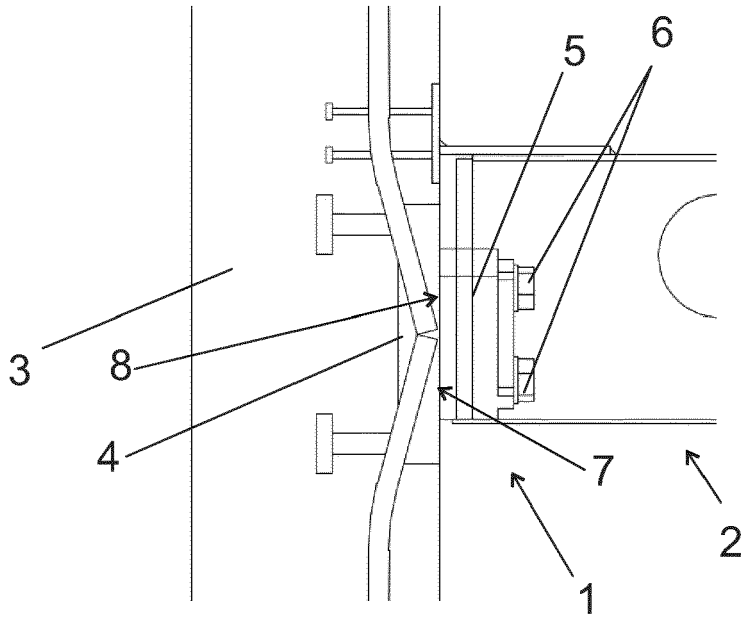

FIG 1

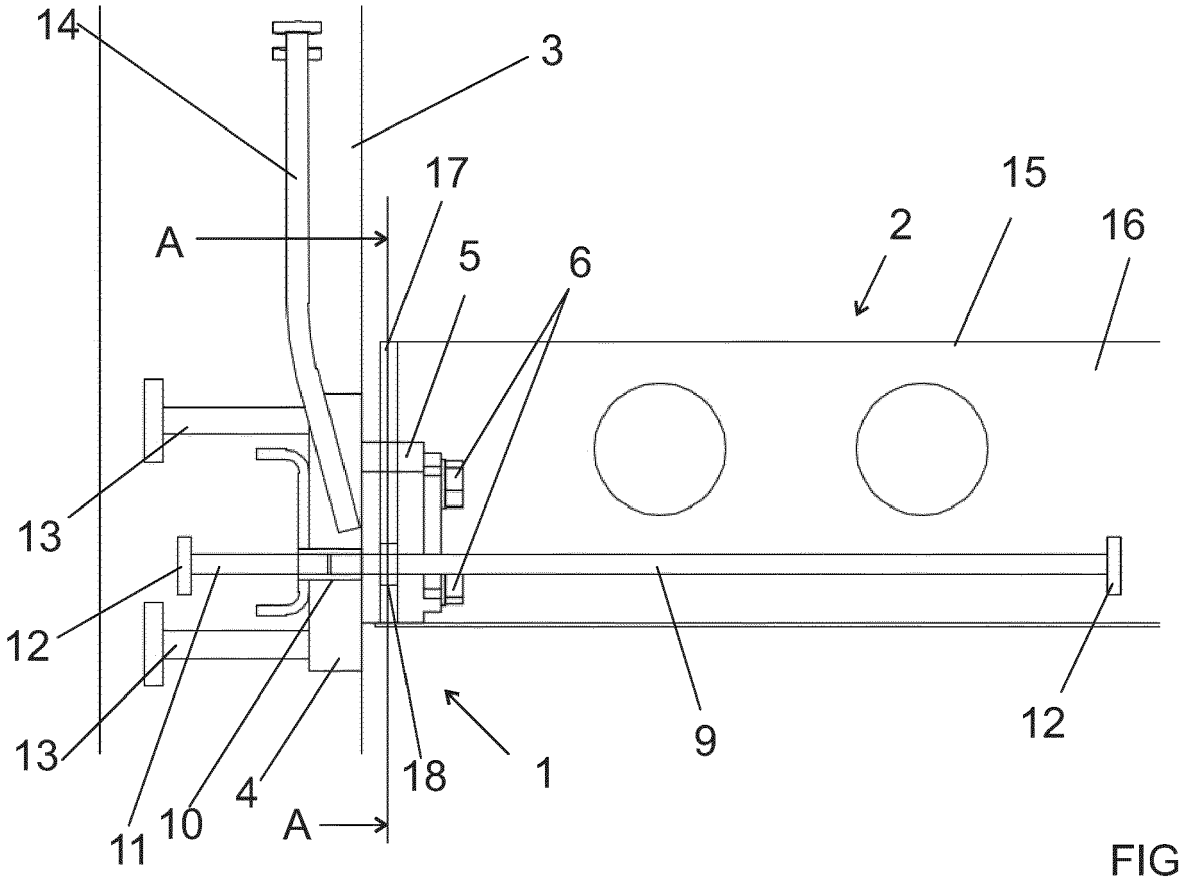

FIG 2

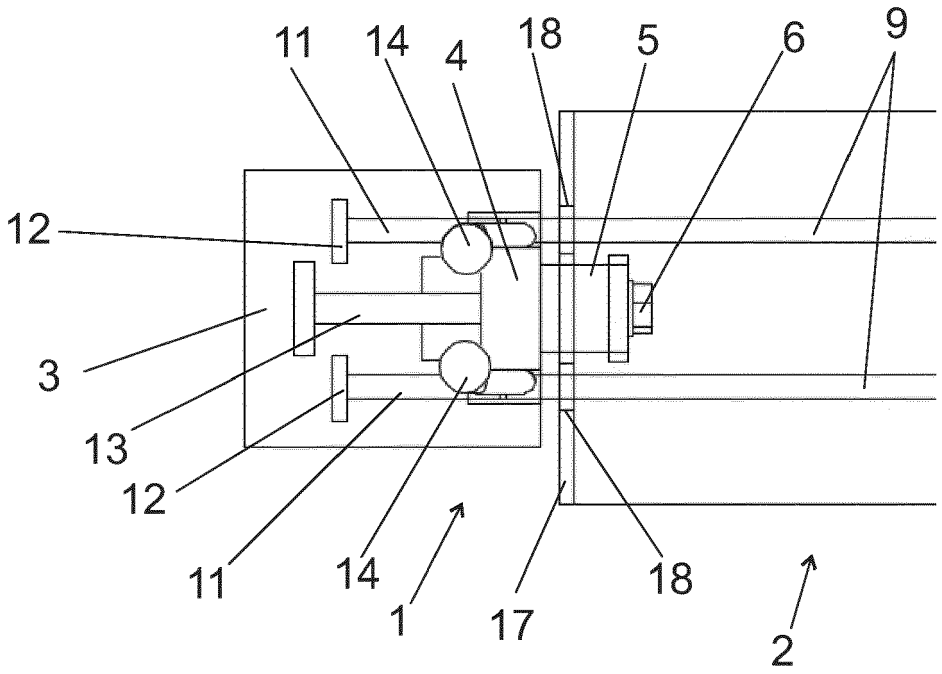

FIG 3

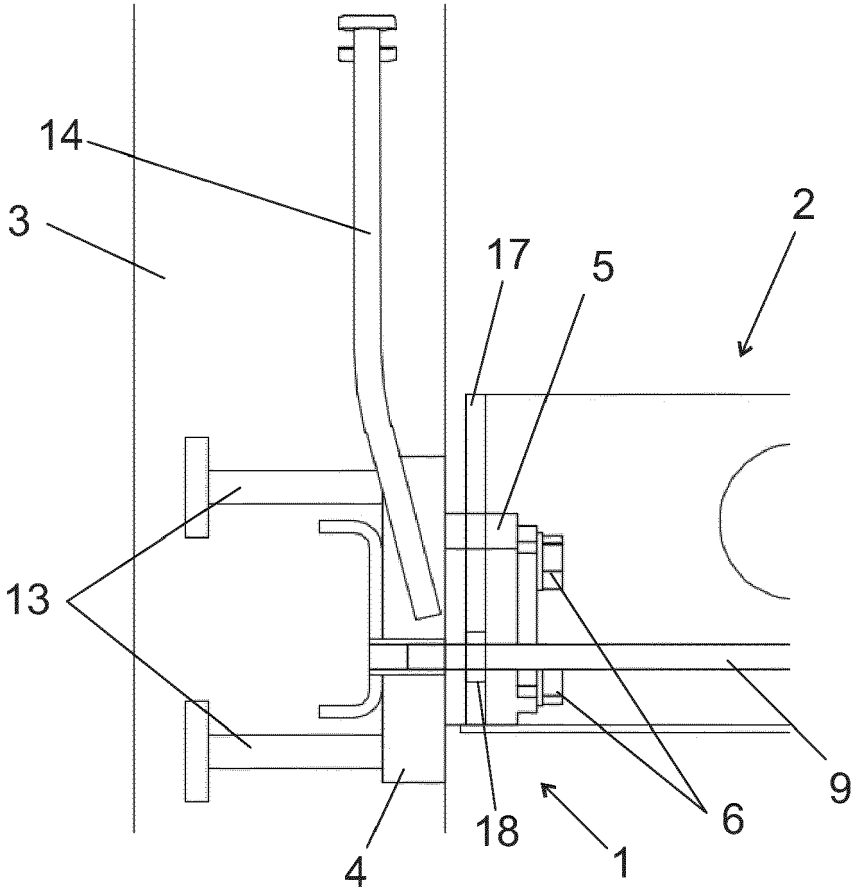

FIG 4

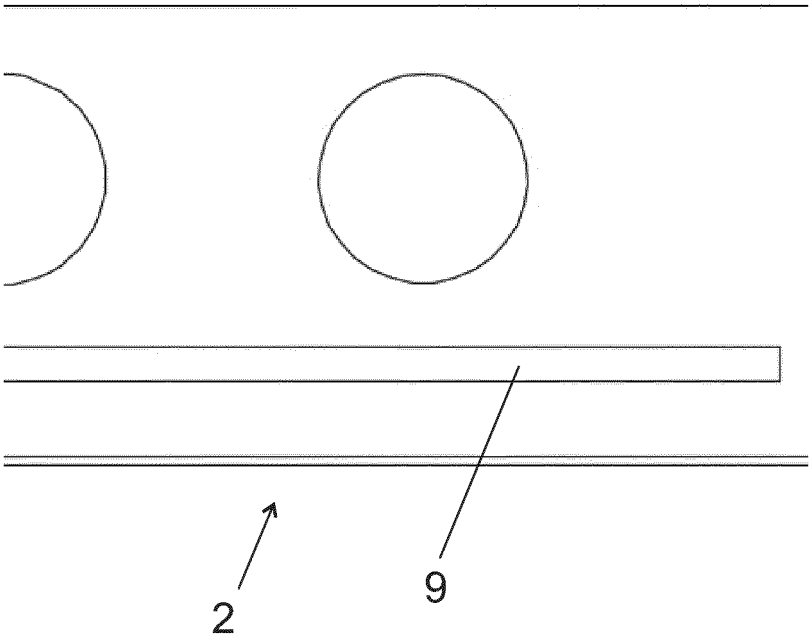

FIG 5

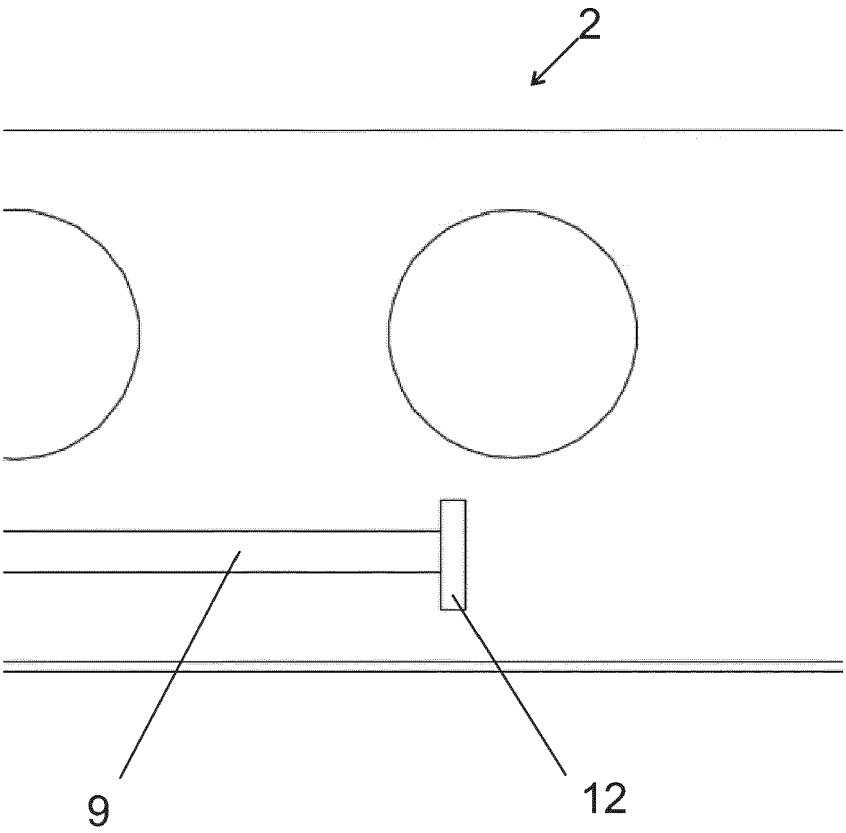

FIG 6

(A-A FIG 2:)

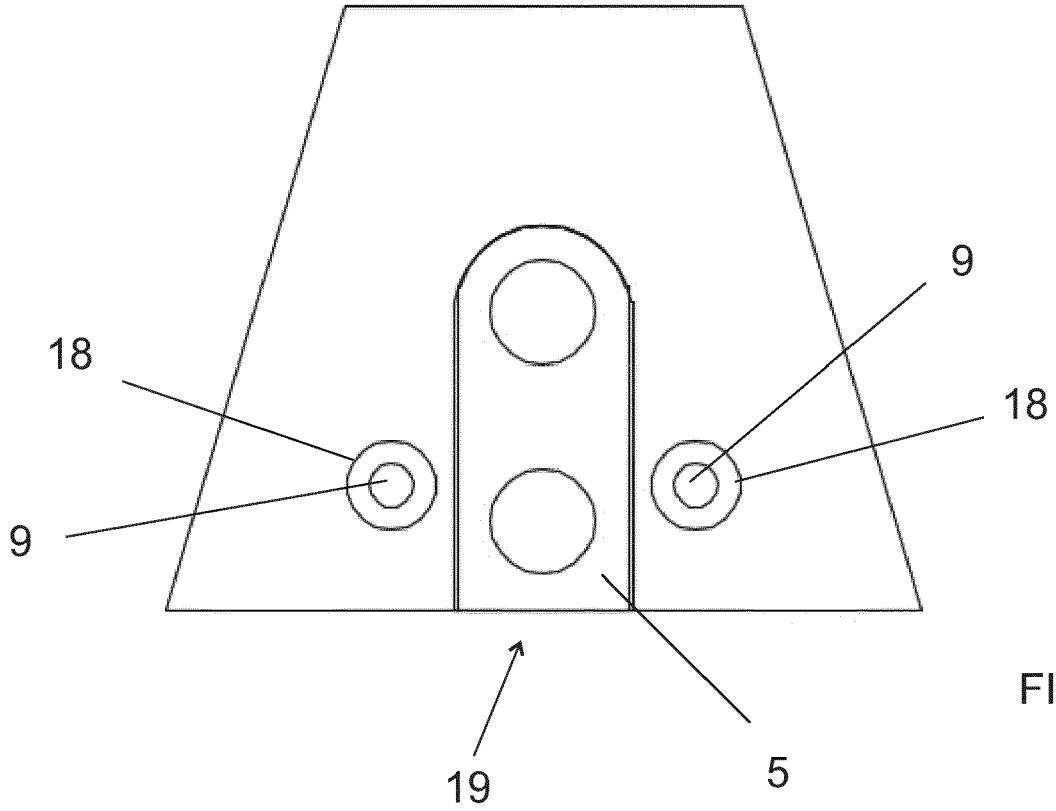

FIG 7

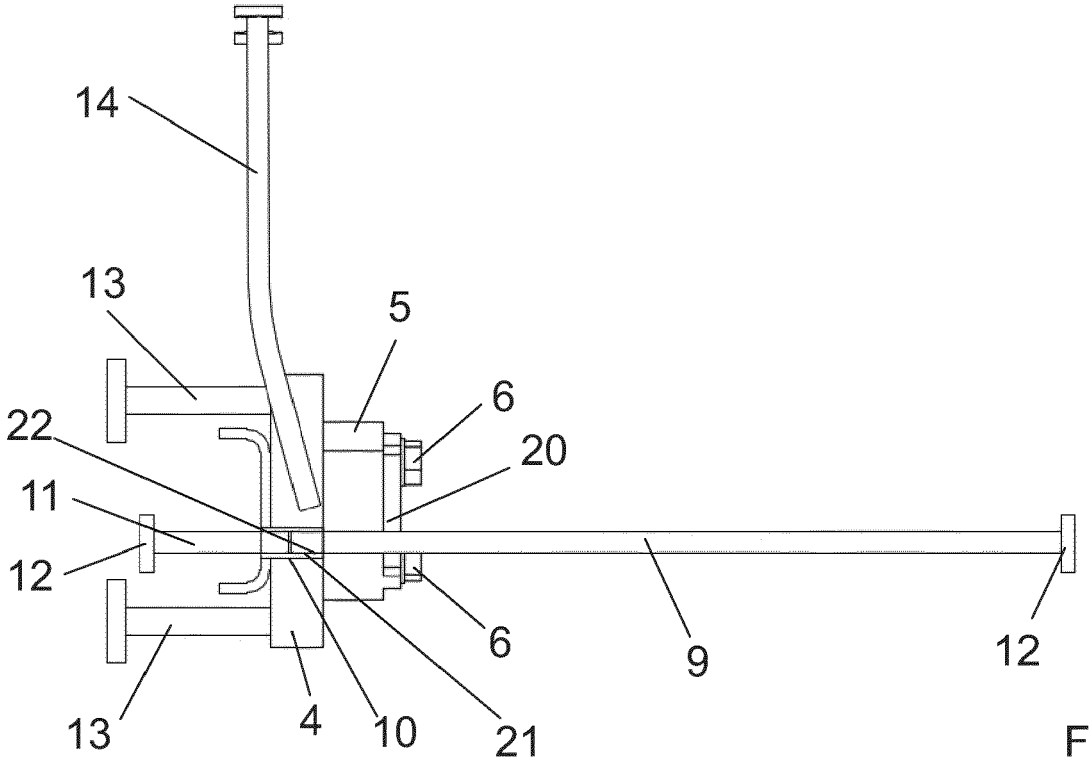

FIG 8

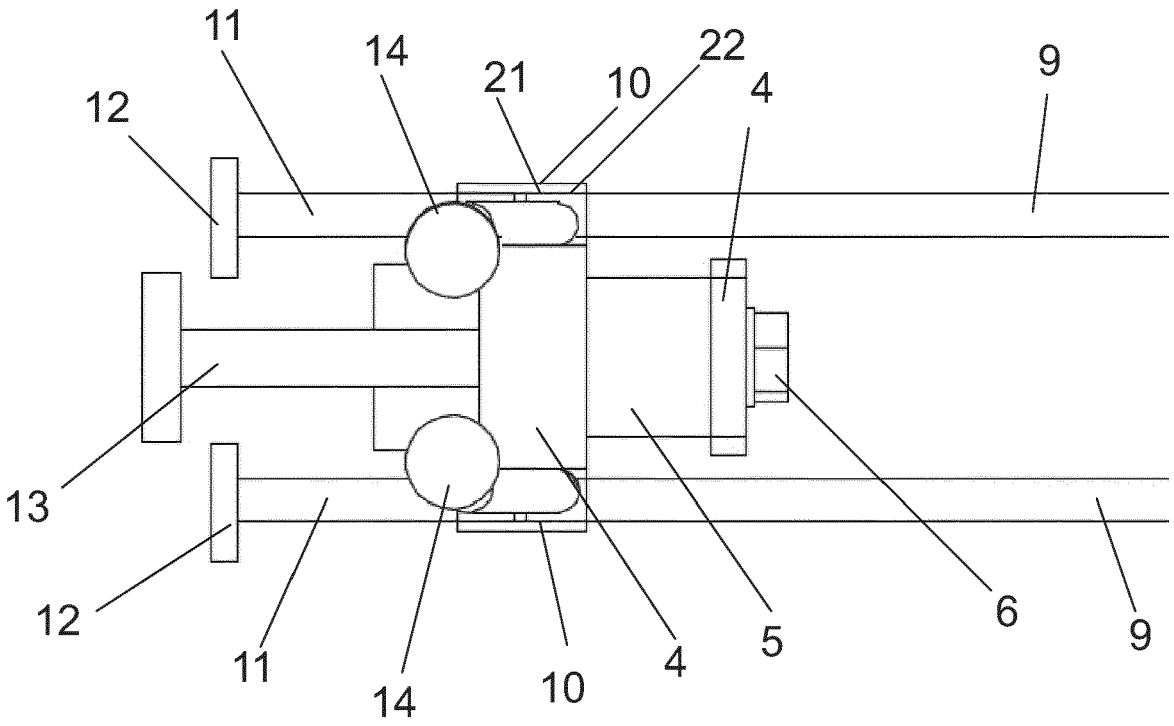

FIG 9

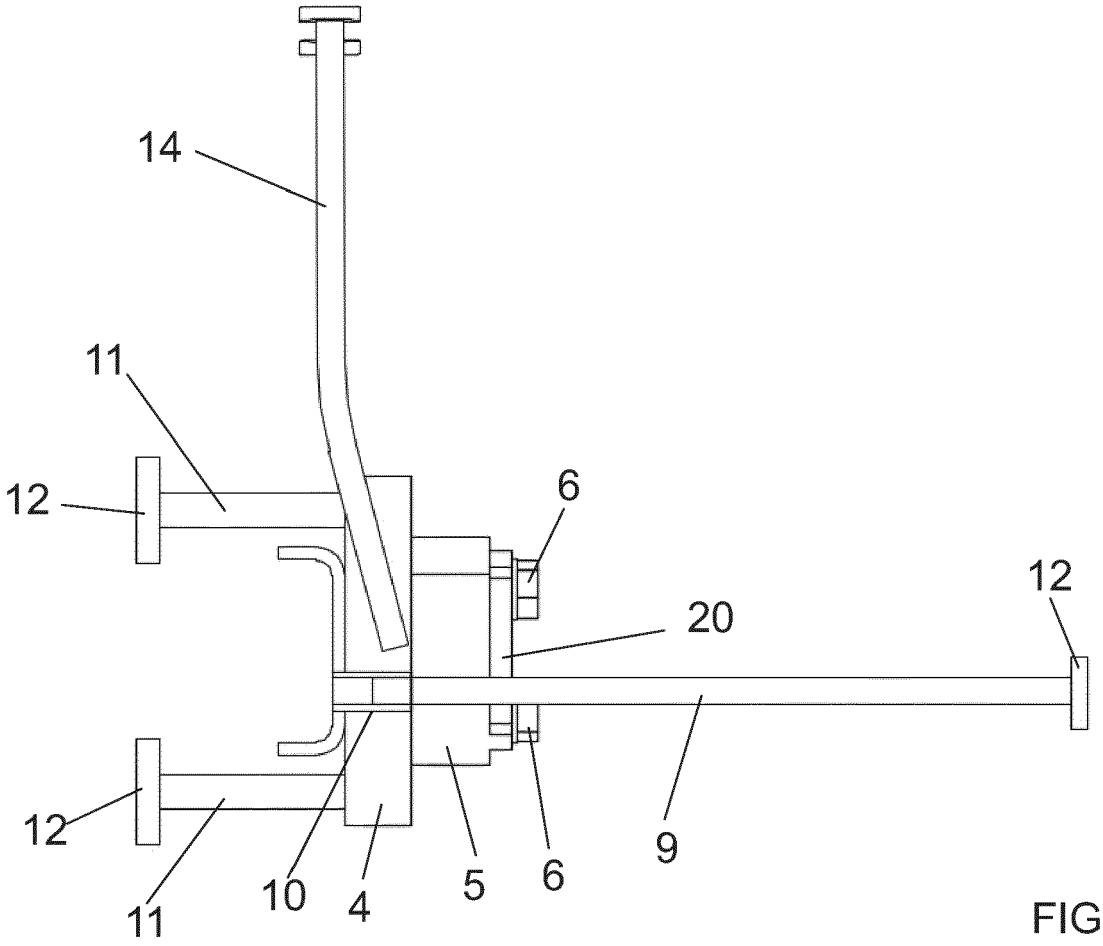

FIG 10

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EUROPEAN SEARCH REPORT

Application Number
EP 21 19 5501

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X,D	WO 02/33185 A1 (TERAESPEIKKO OY [FI]; PULKKANEN JUHA [FI] ET AL.) 25 April 2002 (2002-04-25) * figures 1-5 *	1-3, 6-11, 14-20, 23-26	INV. E04B1/21 E04B1/00
X	DE 27 00 089 A1 (BORSDORF HEINZ [DE]) 6 July 1978 (1978-07-06) * figure 15 *	1-16, 18-25	
X	KR 2019 0027230 A (GS ENGINEERING & CONSTR CORP [KR]; EURO ENG CO LTD [KR]) 14 March 2019 (2019-03-14) * figures 1-10 *	1-26	

TECHNICAL FIELDS SEARCHED (IPC)
E04B

1 The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	24 January 2022	Petrinja, Etiel

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24-01-2022

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0233185 A1	25-04-2002	AT 315142 T	15-02-2006
		AU 1060102 A	29-04-2002
		CN 1469955 A	21-01-2004
		DE 60116519 T2	27-07-2006
		DK 1334244 T3	24-04-2006
		EP 1334244 A1	13-08-2003
		ES 2251515 T3	01-05-2006
		FI 20002303 A	19-04-2002
		JP 2004511689 A	15-04-2004
		KR 20030045815 A	11-06-2003
		NO 326988 B1	30-03-2009
		PL 361026 A1	20-09-2004
		US 2004050012 A1	18-03-2004
		WO 0233185 A1	25-04-2002
DE 2700089 A1	06-07-1978	NONE	
KR 20190027230 A	14-03-2019	NONE	

EPO FORM P0459

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Patent documents cited in the description

- WO 0233185 A **[0004]**