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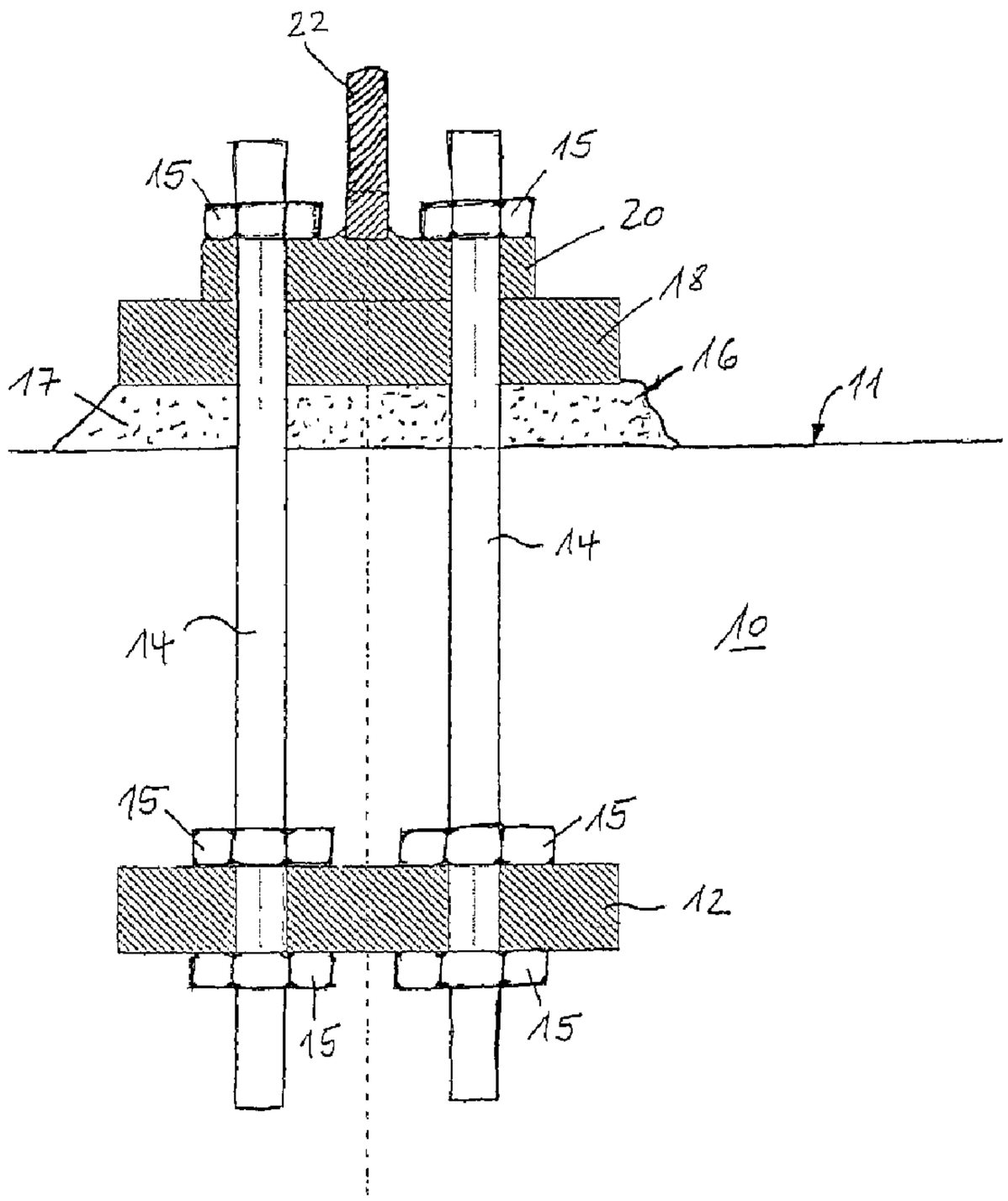
(54) Titre : PROCEDE PERMETTANT D'ERIGER UNE TOUR
(54) Title: METHOD FOR ERECTING A TOWER



(57) Abrégé/Abstract:
The invention relates to a method for erecting a tower, especially a tower pertaining to a wind energy installation comprising a foundation provided with segment anchors, connection elements protruding from the top of the foundation by a pre-determined

(21) 2 561 431

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(57) Abrégé(suite)/Abstract(continued):
measure. A ring is levelled, aligned and fixed at the top of the foundation. A join created by the levelling, alignment and fixing of the ring is lined with a sealing compound. Said sealing compound is set and a lower tower segment is placed on the levelled, aligned and fixed ring, and joined thereto.

Abstract

A method of erecting a pylon, in particular a pylon of a wind power installation, which has a foundation with segment anchors, wherein connecting elements project beyond the top side of the foundation by a predetermined amount. A ring is levelled, aligned and fixed at the top side of the foundation. A gap produced by levelling, aligning and fixing of the ring is underlaid with a grouting material. The grouting material is set and a lower pylon segment is placed on the levelled, aligned and fixed ring and connected thereto.

Method for erecting a tower

The present invention concerns a method of erecting a tower or pylon and a wind power installation with such a pylon.

US No 6 050 038 discloses a foundation system. DE 100 45 735 A1 discloses a means of fixing a column on a concrete foundation. DE 102 26 996 A1 discloses a method of producing a foundation, in particular for a pylon of a wind power installation.

It is known in the state of the art, when erecting a pylon in particular for a wind power installation, for a lower pylon segment to be placed on the connecting elements which project out of a foundation, with a base flange. That lower pylon segment is properly aligned (levelled) and fixed in the aligned position. In that case there is a gap between the base flange of the lower pylon segment and the top side of the foundation. That gap is filled with a grouting material which then has to set before it can be loaded and the pylon further constructed thereon. Setting can certainly take up to 24 hours.

A large crane is required for handling the lower pylon segment. That crane however is only further used for constructing the pylon after the grouting material has set. Shifting the crane for the period during which the gap grouting is setting is however too complicated and expensive and

therefore does not happen. Accordingly the costly crane is stopped and inactive for 24 hours.

Therefore the object of the invention is to rationalise the structure of a pylon, in particular a pylon of a wind power installation.

That object is attained by a method of erecting a pylon as set forth in claim 1, a wind power installation with a pylon as set forth in claim 3 and use of a levelling ring for erecting a pylon as set forth in claim 5.

Therefore there is provided a method of erecting a pylon, in particular a pylon of a wind power installation, which has a foundation with segment anchors, wherein the connecting elements project beyond the top side of the foundation by a predetermined amount. A ring is levelled, aligned and fixed at the top side of the foundation. A gap which has been formed by levelling, aligning and fixing of the ring is underlaid with a grouting material. After the grouting material has set a lower pylon segment is placed on the levelled, aligned and fixed ring and connected thereto. In that case the ring may also be formed from a plurality of segments.

In that respect the invention is based on the realisation that it is not levelling of the lower pylon section that is important, but the fact that it is exactly aligned in situ. That however can also be achieved using a levelling ring. Such a levelling ring is comparable to a flange ring which can be handled with a markedly lower level of effort and expenditure than the lower pylon section, for example with a vehicle-mounted crane. Also precise alignment (levelling) of the levelling ring is simpler than the corresponding procedure in relation to a pylon section. In addition the levelling ring, when of greater width and/or thickness, can be made from a less high-grade material than the pylon flange. The pylon flange can also be reduced in its width. In that way it is possible to make better use of the transport width.

After alignment and fixing the levelling ring can be underlaid with grouting material in known manner and the material can set. During that time however the (vehicle-mounted) crane can already be used for other tasks while the crane required for handling the pylon sections is not yet needed.

It is only when the material in the gap has hardened that the large crane must be ready to erect the pylon, for example of a wind power installation, and can then relatively quickly erect the pylon segment by segment.

A particularly rational structure for the pylon can be implemented if prefabricated finished parts, in particular concrete finished parts, are used for the foundation. They are delivered ready for installation on the building site and connected to produce a foundation which can then be further used immediately and thus in such a way as to save time.

The invention is described hereinafter with reference to the Figures.

Figure 1 is a diagrammatic view in section of a portion of a pylon base,

Figure 2a shows a plan view of a pylon base,

Figure 2b shows a view in section taken along line A-A of the pylon base of Figure 2a,

Figure 2c shows a view on an enlarged scale of the portion X in Figure 2B, and

Figure 3 shows a perspective view of a pylon base.

A foundation 10 can be in the form of a prefabricated finished part foundation but also in the form of an on-site mixed concrete foundation or a foundation made from supplied ready-mix concrete. One or more segment anchors 12 are provided in the foundation 10. Those segment anchors 12 can be adapted in shape and number to the particular demands of the foundation. Thus it is possible to use a segment anchor which for example is in one piece in relation to on-site mixed concrete foundations or foundations produced from ready-mix concrete, that segment anchor being woven into the reinforcement. In the case of prefabricated finished part foundations in contrast a plurality of segment anchors are used, which are adapted in respect of their shape to the finished part. It will be appreciated that a plurality of segment anchors can also be used in relation to an on-site mixed concrete structure or a structure produced from supplied ready-mix concrete.

Connecting elements 14 are connected to the segment anchor 12. The connecting elements 14 can be in the form of screwthreaded rods which are fixed with nuts 15 in a predetermined position to the segment anchor 12. The fixing elements 14 extend a predetermined distance outside the foundation 10 above the top side 11 of the foundation. Instead of a screw connection it is also possible to use a welded connection.

A levelling ring 18 which is formed in one piece or a plurality of pieces is then arranged on the top side 11 of the foundation. The levelling ring 18 is exactly levelled so that it forms a perfectly aligned base for the pylon.

When the levelling ring 18 is aligned a gap 16 inevitably occurs between the top side 11 of the foundation and the levelling ring 18. As soon as the levelling ring 18 is fixed in its predetermined position the gap 16 is filled with a grouting material 16. After setting or hardening of that grouting material 17 the levelling ring 18 can be loaded in its desired position and a lower pylon segment with a lower flange ring 20 and an illustrated pylon wall plate 22 can be placed on the levelling ring 18. The screwthreaded rods 14 engage through suitably positioned holes in the levelling ring 18 and in the lower flange ring 20 of the lower pylon section and nuts 15 are fitted thereon in order to connect the lower pylon section fixedly to the foundation 10 by way of the levelling ring 18.

Figure 2a shows a plan view of a pylon base. Figure 2b shows a cross-section taken along line A-A in Figure 2a. As in Figure 1, shown here is a foundation 10 with a foundation surface 11. In particular two segment anchors 12 and four screwthreaded rods 14 are shown. The portion X is shown on an enlarged scale in Figure 2c. That view substantially corresponds to the view in Figure 1.

Figure 3 shows a perspective view of the pylon base with a portion thereof cut open. Levelling of the pylon base is effected as described with reference to Figure 1.

As the pylon for example of a wind power installation can now be constructed in one go a crane only has to be provided once for speedy pylon erection, but until then the crane can perform other tasks.

Logistical tasks are also simplified. Hitherto the lower pylon section had to be on site at least 24 hours before the other parts of the pylon in order to be able to satisfactorily install it. It will be appreciated that the other parts of the pylon could also be supplied at the same time. They however could not be constructed at the same time and therefore took up additional space on the building site, for the waiting time.

The method according to the invention means that the pylon segments can be delivered in a transport process to the erection point just in time. That also eliminates additional transloading procedures, more specifically firstly from the transport vehicle to intermediate storage on the ground and then later from there to the location of installation. Rather pylon segments which are delivered just in time can be unloaded from the transport vehicle and fitted in place immediately.

With the above-described solution care is to be taken to ensure that the grouting material must always be applied with a (material-dependent) minimum thickness as that grouting material is required to transmit the forces from the pylon to the foundation. If the grouting material is applied too thinly, that layer can fracture and give rise to considerable damage.

The above-described solution has been found to be advantageous in terms of rationalising the erection of a pylon, in particular a pylon of a wind power installation. On the other hand the costs and material properties also play a not insignificant part. It should be pointed out that the lowermost flange of a pylon segment must be made from a very high-grade material in order to be able to carry the loads originating from the pylon. If a pylon of that kind is set up on a concrete foundation then the concrete is the weaker one of the two aspects of the connection. Accordingly the pylon flange must be broader in width so that the concrete of the foundation is not overloaded. Consequently the flange in the lower pylon segment must be of a width which is oversized in relation to the steel which is used in that respect. That is to be considered as a disadvantage in particular in terms of the costs of the steel used in that respect.

By virtue of the insertion of the levelling ring it is now possible in accordance with the invention to insert a kind of transitional step between

the highly loadable but cost-intensive steel of the lower pylon segment and the lower-loadable concrete of the foundation. Thus the levelling ring can be of a sufficient width to transmit the loads of the wind power installation to the foundation without risk. On the other hand it is possible to use better or cheaper steel at that location and thus the flange on the lower pylon segment can be made correspondingly narrower and thus less expensively in terms of material and cost.

A further advantage is enjoyed when the levelling ring is made in the form of segments and can thus be stacked and transported in segment-wise manner. If the levelling ring is of a large diameter, that is not a problem in accordance with the invention from the point of view of transportation because it can be stacked in segment-wise manner. The lower pylon segment has a narrower base flange of a smaller width as now the base flange can be material-specifically sized. The transport width can thus also be correspondingly reduced.

Erection for example of a pylon of a wind power installation on land was described in the example set forth hereinbefore. Erecting a pylon of a wind power installation off-shore, that is to say in the water or in the sea, can also be effected by means of the above-described levelling ring and a corresponding levelling procedure before a lower pylon segment is mounted in place.

CLAIMS

1. A method of erecting a pylon, in particular a pylon of a wind power installation, which has a foundation with segment anchors, wherein connecting elements project beyond the top side of the foundation by a predetermined amount, comprising the steps:

levelling, aligning and fixing a ring at the top side of the foundation,

underlaying a gap produced by levelling, aligning and fixing of the ring with a grouting material,

setting of the grouting material,

placing a lower pylon segment with a lower flange ring (20) on the levelled, aligned and fixed ring, and

connecting the lower flange ring to the ring by means of the connecting elements.

2. A method according to claim 1 wherein concrete finished parts are used for the foundation (10).

3. A wind power installation comprising

a pylon which has at least one pylon segment

a foundation (10) with segment anchors (12),

connecting elements (14) which project a predetermined distance above the top side of the foundation (10),

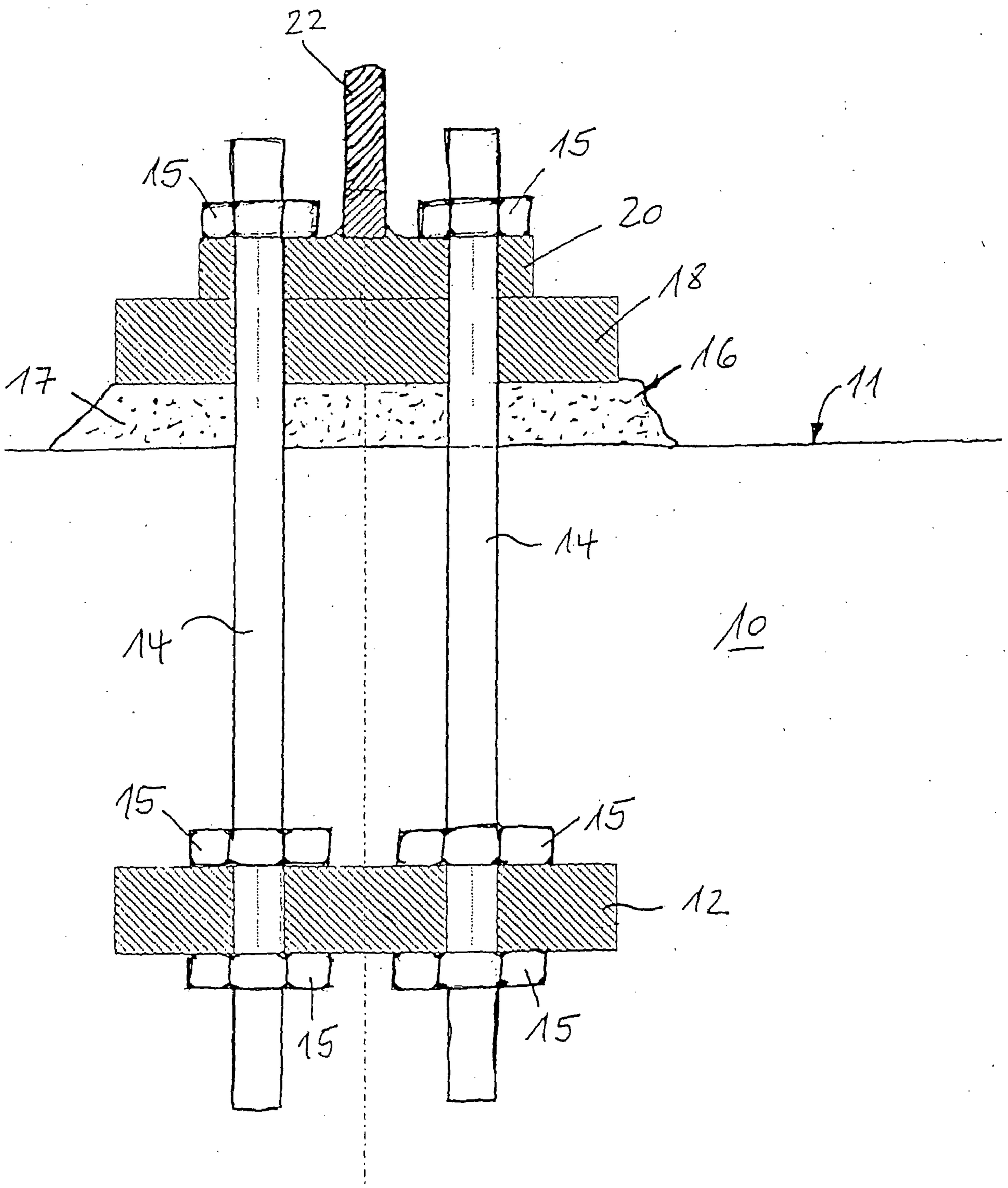
a levelling ring (18) which is aligned and fixed on the top side of the foundation, and

a grouting material (17) which underlays a gap produced by aligning and fixing of the levelling ring (18),

wherein a lower pylon segment with a lower flange ring (20) is placed on the levelling ring (18) and the lower flange ring (20) is connected to the connecting elements (14).

4. Use of a levelling ring (18) for erecting a pylon, in particular a pylon of a wind power installation, wherein the levelling ring after alignment and fixing is underlaid with a grouting material (17) wherein the grouting material is first set before a lower pylon segment with a lower flange ring is placed on the levelling ring (18) and the lower flange ring (20) is connected to the levelling ring (18).

Fig. 1



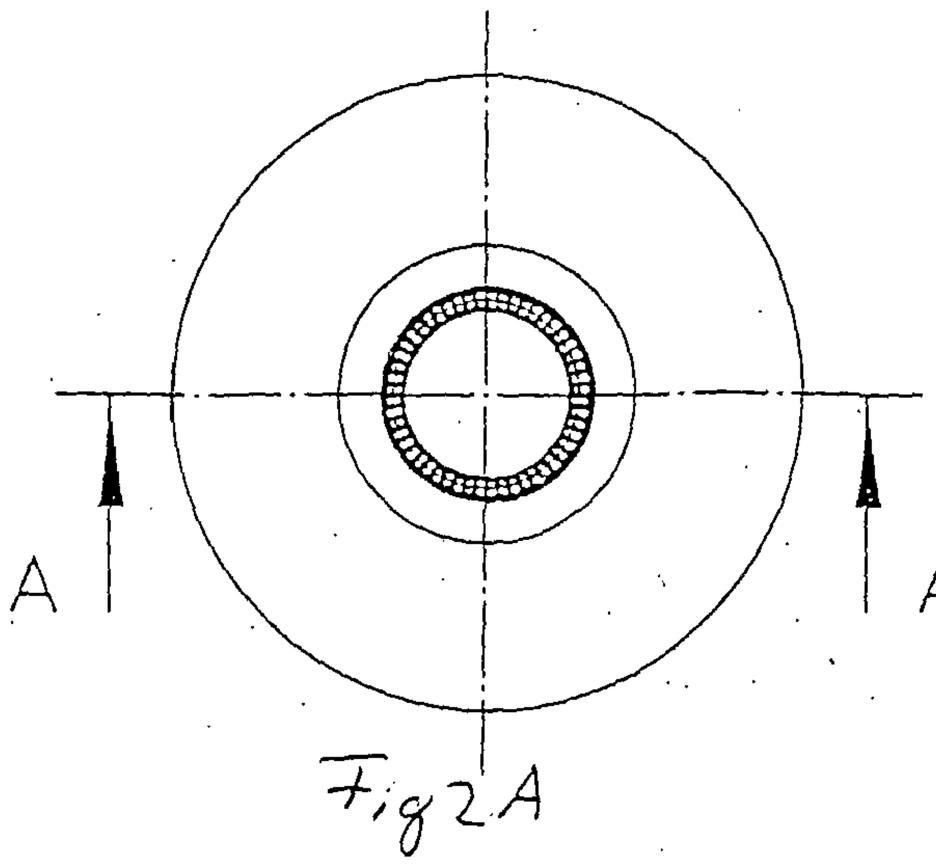


Fig 2A

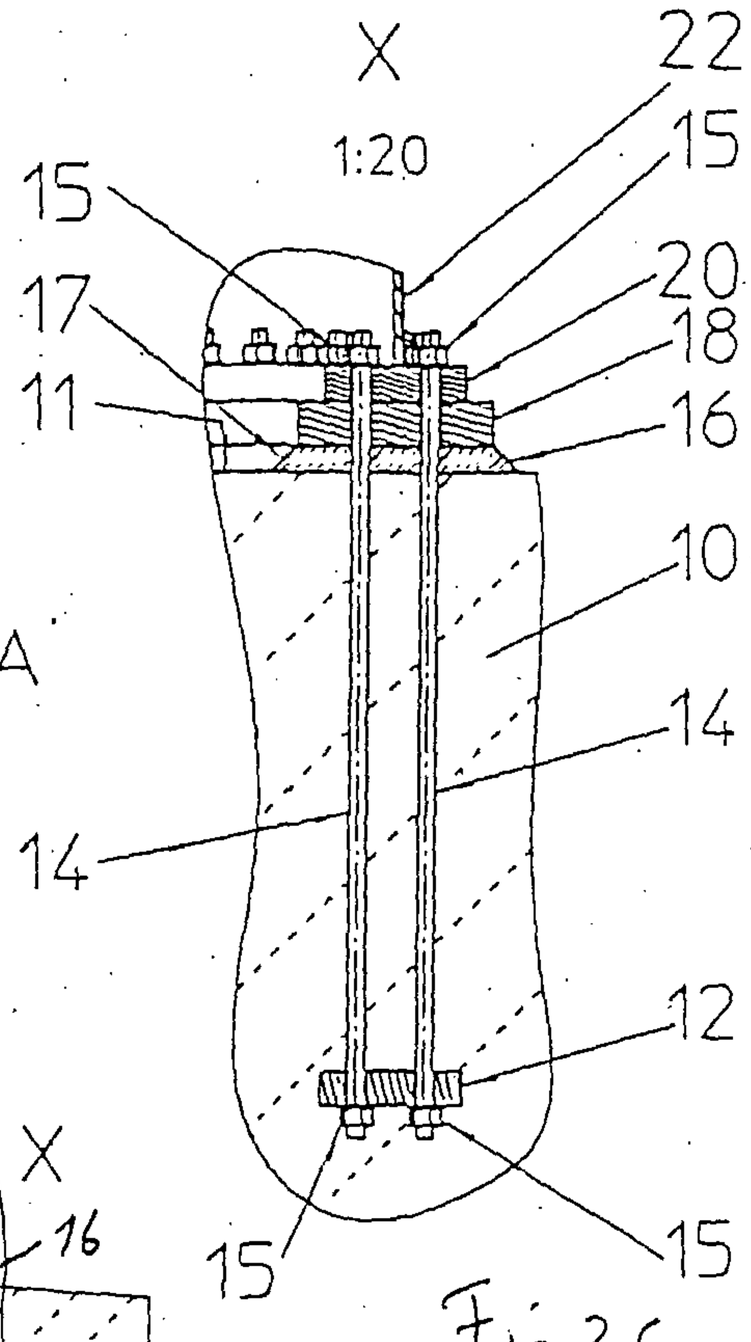


Fig 2C

A-A
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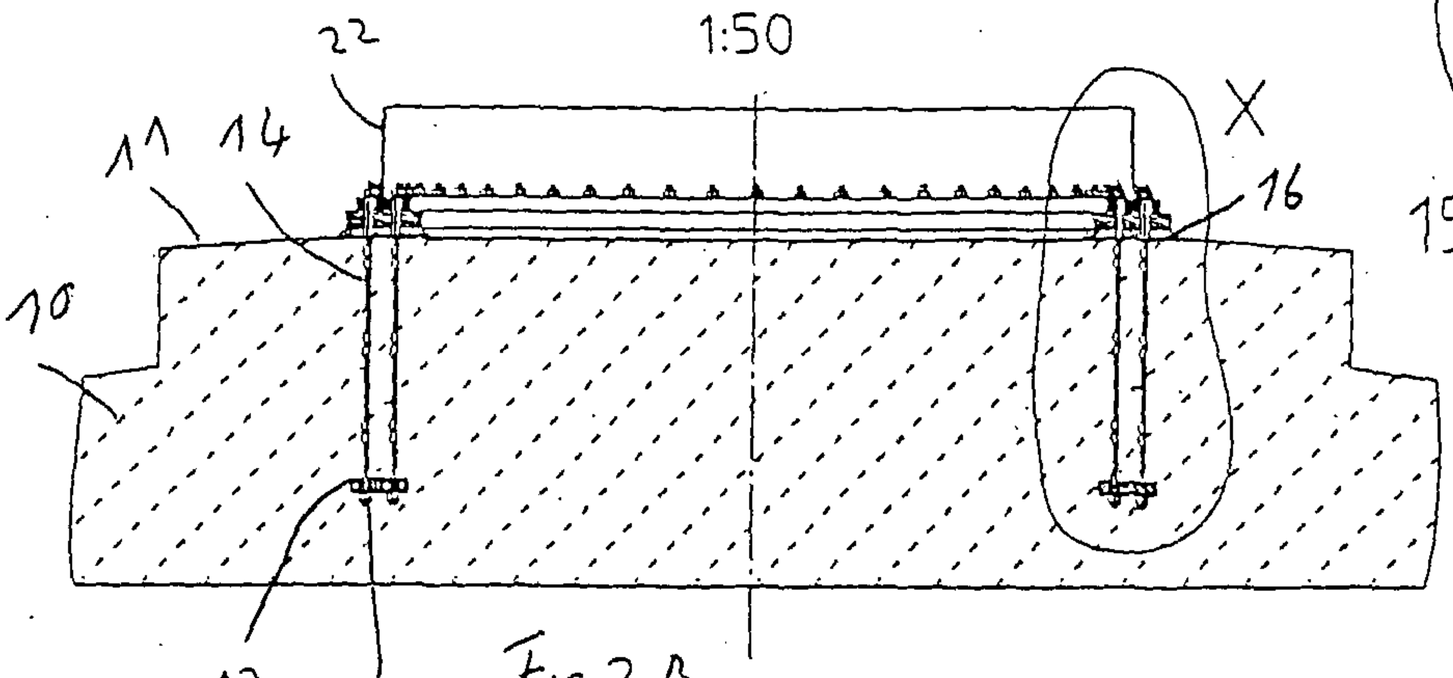


Fig 2B

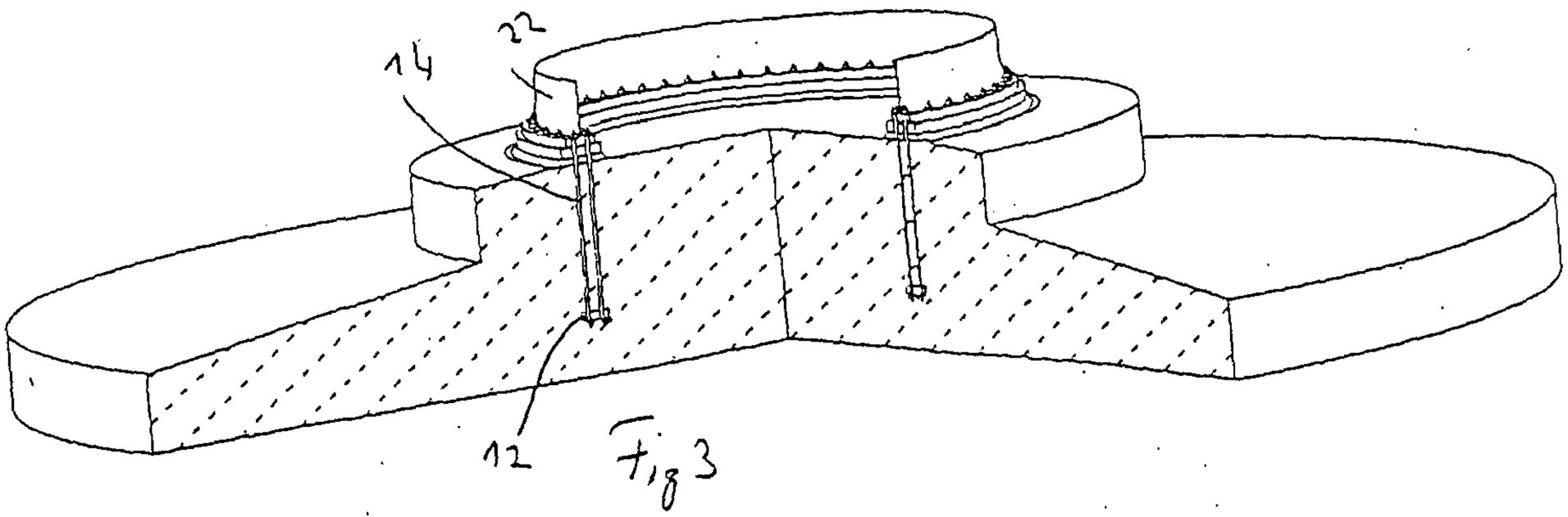
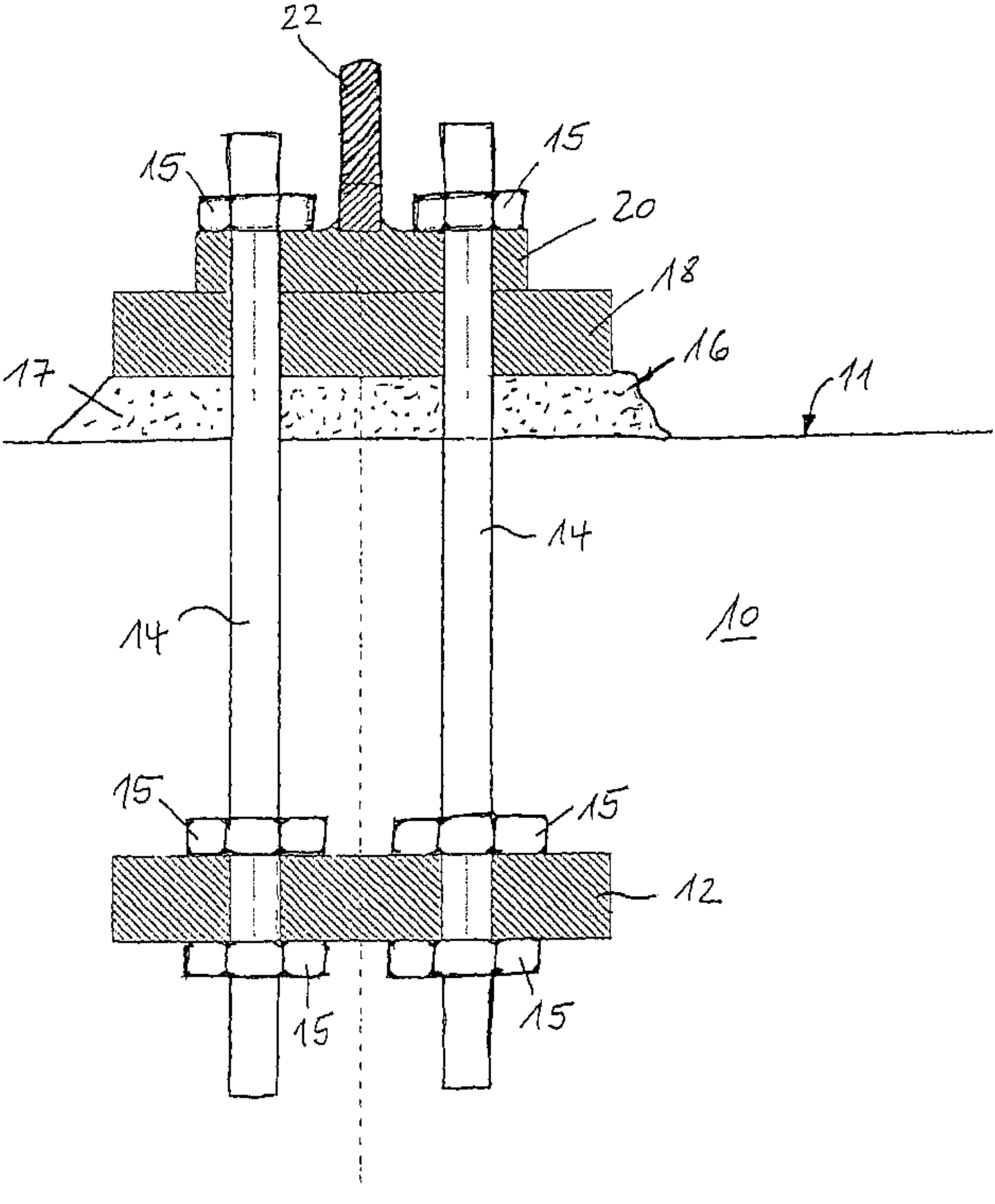


Fig 3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