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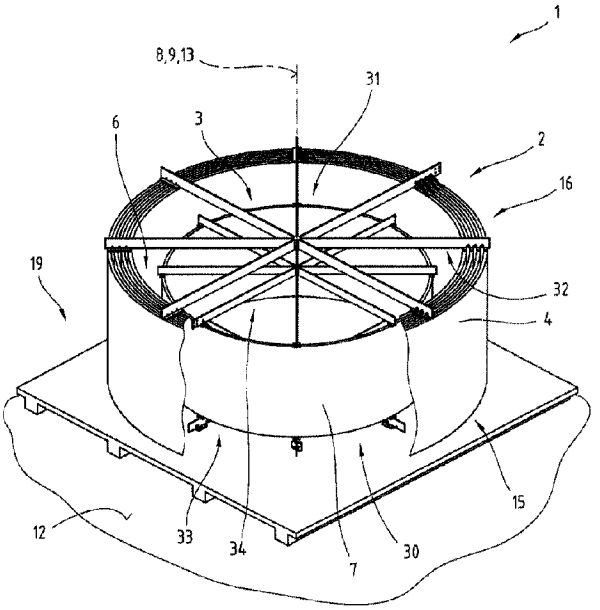


(57) Abrégé/Abstract:
The invention relates to a method for supplying coils (2, 3) at a supply location, transporting the coils (2, 3) from the supply location to an installation location and installing the coils (2, 3) at the installation location to form a coil assembly (1). A first and a second coil (2, 3) and a transport platform (19) are provided. One of the coils (2, 3), and then the other of the coils (2, 3) is then respectively arranged coaxially with respect thereto at the transport platform (19) and supported thereon. The joint transport takes place from the supply location to the installation location at which the coils (2, 3) are removed from the transport platform (19) and at least two of the coils (2, 3) are assembled to form a coil assembly (1) on an installation surface (12) having a preferably horizontal orientation.

Abstract

The invention relates to a method for supplying coils (2, 3) at a supply location, transporting the coils (2, 3) from the supply location to an installation location and installing the coils (2, 3) at the installation location to form a coil assembly (1). A first and a second coil (2, 3) and a transport platform (19) are provided. One of the coils (2, 3), and then the other of the coils (2, 3) is then respectively arranged coaxially with respect thereto at the transport platform (19) and supported thereon. The joint transport takes place from the supply location to the installation location at which the coils (2, 3) are removed from the transport platform (19) and at least two of the coils (2, 3) are assembled to form a coil assembly (1) on an installation surface (12) having a preferably horizontal orientation.

Fig. 8

METHOD FOR SUPPLYING, TRANSPORTING AND INSTALLING COILS OF A COIL ASSEMBLY

The invention relates to a method for supplying coils at a supply location, transporting the coils from the supply location to an installation location and installing the coils to form a coil assembly at the installation location.

Up to now, it was common at the Applicant to transport such coils or partial coils of a coil assembly separately and independently of one another. This required more packaging and larger transport capacities.

WO 2013/102231 A2 describes the structure and implicitly also a method for assembling at least two coils to form a coil assembly on a horizontal installation surface, wherein the second, smaller coil is structurally either arranged on top of the first coil and the second, upper coil is carried by the first, lower coil, or the coils are arranged within one another. Due to the much more compact structure of a coil assembly, especially with regard to the space requirement in the vertical direction, a reduction of transport costs may be achieved. However, the installation surface is not a transport platform for transporting the coils between a supply location and an installation location but an installation surface at the installation location. These surfaces are different from one another.

EP 1 595 809 A1 discloses a method with the steps of supplying coils at a supply location, providing a transport platform for transporting the coils from a supply location to an installation location and arranging one of the coils on the platform and supporting it on the platform. Furthermore, arranging the at least one other coil on the platform and supporting it on the platform (stacked and/or next to one another) coaxially with respect to the coil that was arranged first is provided. The coils resting on the platform are then transported from the supply location to the installation location and removed from the transport platform. The coils are cylindrical coils having face end regions, but not coils having winding layers as would be used for a coil assembly. However, the outer dimension of the second coil and the inner dimension of the first coil are selected such that the second coil cannot be arranged within a first coils already located on the platform.

The object of the present invention was to overcome the disadvantages of the prior art and to provide a method by means of which packaging may be reduced and the required transport space may be minimized.

This object is achieved by a method according to the invention.

In the method according to the invention, the following steps are provided:

- providing the first coil having at least one first winding layer, wherein the first coil has a first face end region and a second face end region spaced apart therefrom in the direction of a first longitudinal axis, and wherein at least one of the face end regions is open, and a free core region of the first coil has a clear inner dimension having an inner diameter,
- providing at least one second coil having at least one second winding layer, wherein the second coil has a third face end region and a fourth face end region spaced apart therefrom in the direction of a second longitudinal axis, and the second coil has an outer dimension having an outer diameter, which outer dimension is smaller than the clear inner dimension of the first coil,
- providing multiple first support elements for the first coil and/or multiple second support elements for the at least one second coil,
- providing a transport platform for the coils,
- arranging the first support elements and/or the second support elements, prior to placing the coils on the transport platform, at at least one of the coils at its respective face end region, wherein at least one of the coils may be supported on the transport platform by means of at least three of the support elements,
- arranging one of the coils on the transport platform and supporting it on the transport platform located at the supply location with a perpendicular orientation of its longitudinal axis,
- arranging the at least one other of the coils on the transport platform and supporting it on the transport platform located at the supply location and in this process aligning the respective at least one other of the coils approximately coaxially with respect to the coil already located on the transport platform, and the at least one second, smaller coil with its small outer dimension being arranged within the first coil, or arranging the at least one other of the coils within the coil already located on the transport platform and supporting it on said coil,

- transporting the coil resting on the transport platform from the supply location to the installation location,
- removing the coils from the transport platform and assembling at least two of the coils to form a coil assembly on an installation surface having a horizontal orientation and perpendicularly aligning the first longitudinal axis of the first coil and the second longitudinal axis of the at least one second coil.

In the method steps selected here, it is preferable that due to the dimensional coordination of the coils, the at least one second, smaller coil with its smaller outer dimension in relation to the smallest clear inner dimension of the first coil is arranged approximately coaxially within the first coil for transport. This way, for transport, packaging material for the outer packaging is saved on the one hand, and the space required at the transportation means is reduced. Compact arrangement of the coils inside one another is thus created for transport, and only an outer packaging for the at least two coils is required. In this regard, only the total mass of the coils is to be considered, and the design and stability of the transport platform is to be adjusted thereto. The total transport volume is thus reduced, with the total transport mass being reduced as no transport packaging is required.

Moreover, multiple first support elements are provided for the first coil and/or multiple second support elements are provided for the at least one second coil. This way, the possibility is created that at least one of the coils does not have to be directly placed on the transport platform. This prevents potential damage. In addition, however, lifting operations are facilitated this way.

It is further provided that the first support elements and/or the second support elements are arranged at at least one of the coils, and at least one of the coils is supported on the transport platform by means of at least three of the support elements. By additionally providing separate support elements for the first coil and/or also for the at least one second coil, at least one of the coils is independently installed on the provided transport platform and supported thereon in a load-absorbing manner. By selecting the number of at least three support elements for each separate coil, tilt-free and secure support of each of the coils at the transport platform is achieved.

Another advantageous approach is characterized in that the first support elements and the second support elements are arranged offset relative to one another in the circumferential direction around the longitudinal axes. By arranging the first support elements offset relative to the second support elements, a transport arrangement is created in which mutual colliding of the support elements is reliably prevented if they radially project over the respective coil. Circumferentially offsetting the first and the second support elements here merely refers to the arrangement of the support elements relative to one another at the transport platform. For operational assembly at the installation location, the first and the second support elements are to be arranged aligned with one another in the radial direction at the respective coils to enable mutual support between the first and the second support elements.

Moreover, an approach is advantageous where the first support elements and/or the second support elements are held at the transport platform in a stationary manner, in particular attached thereto. By holding the respective support elements at the transport platform in a stationary manner, accidental shifting of each of the coils may be reliably prevented. The individual support elements may be attached to the carrying platform through a variety of screw connections or the like. The chosen screw connections at least penetrate the support elements and are either directly screwed to the transport platform, or they also penetrate the transport platform, and a screw-nut connection is provided.

Another advantageous approach is characterized in that at least one spacer element, preferably multiple spacer elements are provided, and the spacer element or spacer elements are arranged in the radial direction between the first coil and the at least one second coil. The spacer element or spacer elements between the first coil and the at least one second coil prevent(s) mutual colliding and facilitate(s) mutual coaxial alignment of the coils.

Another approach is characterized in that the first support elements are also arranged at a second face end region of the first coil spaced apart from the first face end region in the axial direction. This way, a support basis for the at least one second coil may be created in the second face end region of the first coil for arranging the coil assembly on top of one another in a tower-like structure.

A method variant is also advantageous where the coils are put together or assembled to form a coil assembly by arranging the coils in a tower-like manner on top of one another, and the first coil is assembled first at the installation location, and its first face end region is supported on the installation surface by means of the first support elements. This way, a secure basis for supporting the second coils is created during assembly. In this regard, the first support elements may also be supported on the installation surface with interposed isolator elements. This way, spatial distancing of the coil arrangement from the installation surface may be achieved.

A method variant is also advantageous where the support elements are fork-shaped and each comprise a support element basis and at least one inner support element prong and at least one outer support element prong, the support element prongs each projecting upward from the support element basis and being spaced apart from one another, thereby forming a receiving slot. By configuring the support elements in this fork-like manner, each coil, in particular a selected winding layer of said coil, may be received in the respective receiving slot and thus held positioned in the radial direction. In this regard, the width of the receiving slot between the support element prongs is preferably adapted to the respective radial thickness of the respective winding layer in order to ensure secure reception on the one hand, and almost unmovable positioning relative to the transport platform on the other hand.

Another approach is characterized in that the first support elements are arranged at the at least one first winding layer of the first coil such that the at least one first winding layer is received in the first receiving slot, and the at least one inner support element prong is located on the side of the at least one first winding layer facing the first longitudinal axis, and the at least one outer support element prong is located on the side of the at least one first winding layer facing away from the first longitudinal axis, and the first support element basis rests on the transport platform. By forming the support element prongs provided on both sides and adapting the dimensions of the receiving slot formed between them, optimal and secure positioning of the coils both during transport and at the subsequent installation location may thus be achieved, depending on the selected fit.

Furthermore, an approach is advantageous where the second support elements are arranged at the at least one second winding layer of the second coil such that the at least one second winding layer is received in the second receiving slot, and the at least one inner support element prong is located on side of the at least one second winding layer facing the second longitudinal axis, and the at least one outer support element prong is located on the side of the at least one second winding layer facing away from the second longitudinal axis, and the second support element basis rests on the transport platform. This way, the second coil may also be securely positioned at the transport platform and, if necessary, also held in a stationary manner independently of the first coil.

Another advantageous approach is characterized in that the second support elements are arranged around the second longitudinal axis at equal spacing relative to the first support elements. This way, secure mutual support of the respectively associated first and second support elements may be ensured.

Another approach is characterized in that a coupling element is attached to each of the first support elements located in the second face end region of the first coil, the coupling elements being arranged projecting in the direction of the first longitudinal axis. However, a coupling element may also be attached to each of the second support elements of the second coil as well, the coupling elements being arranged projecting forward in the direction facing away from the second longitudinal axis. By providing a coupling element between each of the first support elements and each of the second support elements, the coils may still be arranged on top of one another. The coupling elements are necessary in particular if the first and the second support element bases are arranged, when viewed in the axial direction, in a non-overlapping position in the radial direction relative to one another. Depending on the mounting process, the coupling elements may either be arranged and attached at the first support elements and/or at the second support elements of the second coil.

A method variant is also advantageous where the second coil with the second support elements located thereat is supportingly arranged at the first support elements with interposing the respective coupling elements, and each of the coupling elements that has not yet been con-

nected to one of the support elements is connected thereto. This way, a secure mutual connection of the first and second support elements respectively facing or associated with one another and working together is created.

Another approach is characterized in that at least individual ones of the first support elements are connected in a stationary manner to the at least one first winding layer of the first coil and/or at least individual ones of the second support elements are connected in a stationary manner to the at least one second winding layer of the second coil. This way, stable and fixed assembly and secure mounting of the individual support elements at the respective winding layer may be achieved.

Furthermore, an approach is advantageous where the second longitudinal axis of the second coil is aligned with respect to the first longitudinal axis of the first coil, and the longitudinal axes define a joint longitudinal central axis. This way, exact coaxial arrangement and alignment of the coils on top of one another may be achieved.

Finally, another advantageous approach is characterized in that for transporting the coils and/or when putting them together or assembling them to form the coil assembly, pitch compensation elements may be arranged or formed at least between individual ones of the first support elements and the at least one first winding layer and/or at least between individual ones of the second support elements and the at least one second winding layer. This way, a secure and close fit of the at least one winding layer at the respective support element may be ensured despite the winding operation performed.

For better understanding of the invention, the latter is explained in detail with reference to the following figures.

The following is shown in highly simplified, schematic representation:

Fig. 1 a schematic representation of a coil assembly assembled to form a tower;

Fig. 2 a schematic representation of a simplified construction of the coils assembled to form a tower;

Fig. 3 a schematic representation of the first, lower coil according to Fig. 2;

Fig. 4 a schematic representation of the second, upper coil according to Fig. 2 with a view of the upper side;

Fig. 5 a schematic representation of a support element for supporting up to three winding layers of a coil;

Fig. 6 a schematic representation of another support element for supporting a winding layer of a coil;

Fig. 7 a schematic representation of a possibility of arranging the coils on a transport platform;

Fig. 8 a schematic representation and a partially sectional view of a possible arrangement of two coils inside one another on a transport platform.

First of all, it should be noted that in the embodiments described in different ways, identical parts are given identical reference numbers or identical component names, and the disclosures contained in the entire description may be correspondingly applied to identical parts with identical reference numbers or identical component names. Moreover, the position indications used in the description, such as at the top, at the bottom, lateral, etc. directly refer to the figure shown and described, and, if a position changes, said position indications are to be correspondingly applied to the new position.

In the following, the term "in particular" shall be understood as referring to a possible, more specific embodiment or a closer specification of an object or method step; however, it does not necessarily refer to a compulsory, preferred embodiment thereof or to a compulsory approach.

In Figs. 1 to 7, a coil assembly 1 and its components are shown in a simplified manner, which coil assembly comprises a first or lower, preferably starless coil 2 and at least one second or

upper coil 3. Multiple coils may also be arranged on top of one another into a coil tower to form the coil assembly 1.

The coils 2, 3 may also be referred to as inductors, in particular as air-core reactors, and mostly have considerable masses and ensuing large dimensions. Such coils 2, 3 of the coil assembly 1 preferably do not have an iron core. The coils 2, 3 or the coil assembly 1 compiled therefrom are mostly used in the medium-, high- or maximum voltage ranges. Together, the coils 2, 3 form a coil assembly set, which coils together either form the coil assembly 1 which has not yet been assembled or composed, or the coil assembly 1 which has already been composed and is ready for use. However, irrespective of this, it would also be possible with the method described below to arrange a larger first coil 2 and at least one smaller second coil 3 within the first coil 2 and to transport them together. Said coils 2, 3 may then each form a separate, independent coil of the coil assembly 1 at the installation location.

The first coil 2 comprises at least one first winding layer 4; however, the first coil 2 may also comprise multiple winding layers 4 arranged concentrically to one another. The multiple arrangement of first winding layers 4 is indicated in Fig. 1.

The first winding layer 4 or the individual first winding layers 4 are each preferably hollow-cylindrical and arranged spaced apart from one another. If multiple first winding layers 4 are provided, they are preferably connected in parallel and magnetically coupled. Furthermore, if multiple first winding layers 4 are provided, they are mostly held at a predetermined distance from one another by means of spacer bodies 5. The spacer body/bodies 5 may also be configured as gap strips and referred to as such. In its hollow-cylindrical internal space, the first coil 2 may form a predominantly free core region 6.

The second coil 3 also comprises at least one second winding layer 7, which is preferably hollow-cylindrical as well. However, multiple second winding layers 7 arranged concentrically to one another may also be provided for forming the second coil 3. Due to the preferably hollow-cylindrical configuration of the coils 2, 3 or their winding layers 4, 7, a first longitudinal axis 8 is defined by the first coil 2, and a second longitudinal axis 9 is defined by the second coil 3. The longitudinal axes 8, 9 may also be referred to as longitudinal central axes.

It is further provided, as can be better seen from Figs. 3 and 4, that a clear width or a clear inner dimension 10 of the first coil 2, in particular its first winding layer 4, which is closest to the first longitudinal axis 8, is selected or configured larger than an outer dimension 11 of the second coil 3, in particular its second winding layer 7, which is arranged furthest from the second longitudinal axis 9. Due to the hollow-cylindrical winding layers 4, 7 shown here, the aforementioned dimensions are diameters with the respective center in one of the longitudinal axes 8, 9. The difference in dimension between the outer dimension 11 (outer diameter) of the second coil 3 and the inner dimension 10 (inner diameter) of the first coil 2 is selected such that the second coil 3 may be arranged within the first coil 2. Depending on the size and dimension of the coils 2, 3, the gap between the second coil 3 and the first coil 2 may be a few millimeters up to one centimeter or several centimeters, or even up to several decimeters.

The coil assembly 1 is manufactured and in most cases transported to the installation location either directly from the factory or a dedicated warehouse. The location intended for supplying the coils 2, 3 is referred to as supply location here, where the preparatory work for transport and any packaging are carried out. Due to the starless or coreless configuration of at least the first coil 2, the second coil 3 – at least for joint transport of the coils 2, 3 and until they are assembled or put together – is supposed to be received within the first coil 2 in its free core region 6. This is described in detail below.

In the completely set and operational position of the coil assembly 1, in particular of at least the two coils 2, 3, a different arrangement with respect to one another may be selected. Basically, installation is carried out at the installation location, which has or forms a predominantly horizontal installation surface 12. The installation surface 12 is preferably formed by a flat surface (contact plane) and may in particular be realized by the ground or the floor of a building and/or a foundation. Moreover, in the case of a tower-like stacking of the coils 2, 3, the two longitudinal axes 8, 9 should preferably be aligned with one another and form a joint longitudinal central axis 13. For supporting the first coil 2 on the installation surface 12, first support elements 14, which are shown in a simplified manner, are provided. Depending on the configuration of the coil 2 and the number of first winding layers 4, the first support elements 14 may be adapted thereto. The first support elements 14 are preferably arranged in the area of a first face end region 15 and also of a second face end region 16 of the first coil 2. The first face end region 15 faces the installation surface 12. The second face end region 16 is

arranged opposite of the first face end region 15 in the axial direction and thus faces the second coil 3.

In the embodiment shown here, it is provided that the first coil 2 is supported on the installation surface 12 by means of at least three of the first support elements 14, with interposed isolator elements where applicable, and forms a supporting base at least for the second coil 3. The two longitudinal axes 8, 9 of the coils 2, 3 have a substantially normal orientation with respect to the installation surface 12. In the case of a horizontal orientation of the installation surface 12, the longitudinal axes 8, 9 have a perpendicular orientation.

In the arrangement selected here where the coils 2, 3 are arranged on top of one another, at least the second coil 3 rests on the side of the first coil 2 facing away from the installation surface 12, namely on the second face end region 16. This way, a tower-like structure of the coil assembly 1 is created. For supporting the second coil 3 on the first coil 2, support elements 17 are provided for the second coil 3.

For bridging the respective radial distance due to the differences in dimension between the first coil 2 and the second coil 3 described above, a coupling element 18 is provided between each first support element 14 and a second support element 17 to be coupled therewith. The respective coupling element 18 is preferably plate-shaped or has a flat profile.

For the sake of simplicity and clarity, it is shown in the depiction in Fig. 2 that each of the coils 2, 3 only comprises one winding layer 4, 7. However, each of the coils 2, 3 may also comprise multiple winding layers 4, 7.

For transporting the coils 2, 3 from the supply location to the installation location, a transport platform 19 is provided, on which the coils 2, 3 are placed and then transported. The transport platform 19 may be configured in any desired way and be realized, for example, in the form of a plate, a pallet, or the like. A possible arrangement is shown in Fig. 7.

After the coils 2, 3 have been placed down, a box-like crate may be arranged on the transport platform 19 for protecting them. For placing down each of the coils 2, 3, the support ele-

ments 14, 17 described above are provided. At least three support elements 14, 17 are required for each of the coils 2, 3. When all necessary components have been provided, one of the coils 2, 3 is placed on the transport platform 19 by means of the support elements 14, 17 provided for this purpose. Subsequently, the other coil 3, 2 is also placed on the transport platform 19 by means of the support elements 17, 14 provided for this purpose. Either the smaller, second coil 3 may be placed down first, and afterwards the larger, first coil 2. However, regardless of this, it would also be possible to place the larger, first coil 2 on the transport platform 19 first, and only then the smaller, second coil 3.

It may be advantageous if the first support elements 14 and the second support elements 17 are arranged offset relative to one another in the circumferential direction around the longitudinal axes 8, 9. This way, access to the support elements 14, 17 may be facilitated, and possible mutual collisions may be prevented.

In this regard, the coils 2, 3 are aligned and arranged approximately coaxially relative to one another, with the smaller, second coil 3 being arranged within the first coil 2. For this purpose, the free and coreless core region 6 of the first coil 2 is provided. The approximately coaxial orientation is selected in order to prevent mutual damage. The first support elements 14 and/or the second support elements 17 may be held at the transport platform 19 in a stationary manner after they have been installed. This may, for example, be effected through fastening means, such as screws, threaded elements or the like. Moreover, at least one spacer element 20 may be provided. Preferably, multiple spacer elements 20 are provided, with the spacer element 20 or the spacer elements 20 being arranged in the radial direction between the first coil 2 and the at least one second coil 3. The spacer element 20 is elastically flexible to a certain extent and may further have a wedge-shaped longitudinal profile. Preferably, the material has elastically resilient properties in order to be held in a preloaded position between the coils 2, 3 in its mounting position. Preferably, the spacer element 20 extends approximately over the entire height of the coils 2, 3. When one of the coils 2, 3 is removed from the transport platform 19, the spacer elements 20 may prevent mutual damage at the sides or surfaces of the coils 2, 3 facing one another.

When this has been carried out, further protective and/or packaging elements may be arranged around the coils 2, 3. After the preparation for transport has been completed, the coils 2, 3 are

ready for dispatch and subsequent transport to the installation location. After they have been transported and have reached the installation location, the coils 2, 3 are removed and taken down from the transport platform 19.

In a possible embodiment, the coils 2, 3 may be arranged in a tower-like structure on top of one another at the installation location on the installation surface 12, which preferable has a horizontal orientation, and the coil assembly 1 may be formed from said coils 2, 3. In the tower-like structure, the two longitudinal axes 8 and 9 are aligned with one another for forming the joint longitudinal central axis 13 and arranged at a normal and thus perpendicular orientation with respect to the installation surface 12.

The construction of the support elements 14, 17, which have already been mentioned above, is to be adapted accordingly, depending on the configuration and number of winding layers 4, 7. Basically, the respective structure is substantially identical; however, only the first support element 14 shall be described in more detail below. The details and the description are to be analogously applied to the second support element 17, with the first support element 14 being depicted in Fig. 5, and the second support element 17 in Fig. 6. The first support element 14 could not only be arranged at the first coil 2, but also at the second coil 3, or only at the second coil 3. The same may also apply to the second support element 17. However, the second support element 17 could likewise not only be arranged at the second coil 3, but also at the first coil 2, or only at the first coil 2.

The first support element 14 shown in a simplified manner in Fig. 5 is fork-shaped and comprises a first support element basis 21 as well as at least one inner support element prong 22 and one outer support element prong 23. The first support element prongs 22, 23 project upward from the first support element basis 21 or protrude from it. The support element prongs 22, 23 are spaced apart from one another, thereby forming a first receiving slot 24. The first support element basis 21 serves for supporting the first coil 2 in a load-absorbing manner on a base, i.e. the installation surface 12 and/or the transport platform 19. As already mentioned above, the first support element 14 may be supported at the base by means of an isolator, if necessary.

The second support element 17 shown in a simplified manner in Fig. 6 is fork-shaped as well and comprises a second support element basis 25 as well as at least one inner support element prong 26 and one outer support element prong 27. The second support element prongs 26, 27 project upward from the second support element basis 25 or protrude from it. The support element prongs 26, 27 are spaced apart from one another as well, thereby forming a second receiving slot 28. During transport, the second support element basis 25 may be supported on the transport platform 19. In the installed state, the second support element basis 25 is supported, by means of the coupling element 18, against the first support element basis 21 of the first support element 14.

Preferably, at least for transporting the coils 2, 3, the support elements 14, 17 provided for this purpose are arranged at each of them. The arrangement may be loose and/or fixed, and also stationary. The stationary arrangement may also be referred to as attachment, which may, for example during manufacturing, be effected through the resin used in this process as a binding agent. Prior to arranging and possibly attaching the support elements 14, 17 at the respective coil 2, 3, due to the winding process for forming the individual winding layers 4, 7, pitch compensation elements 29 may be arranged between the respective support element 14, 17 and the winding layer 4, 7; however, only one of said pitch compensation elements 29 is indicated in Fig. 5 with dashed lines. The pitch compensation element(s) 29 may either be formed by a separate component and/or constitute or form a direct and integral part of the support elements 14 and/or 17.

The first support elements 14 are arranged at the at least one first winding layer 4 of the first coil 2 such that the at least one first winding layer 4 is received in the first receiving slot 24. The at least one inner support element prong 23 of the first support element 14 is located on the side of the at least one first winding layer 4 facing the first longitudinal axis 8. The at least one outer support element prong 23 of the first support element 14, on the other hand, is located on the side of the at least one first winding layer 4 facing away from the first longitudinal axis 8.

Analogously, the second support elements 17 are arranged at the at least one second winding layer 7 of the second coil 3 such that the at least one second winding layer 7 is received in the

second receiving slot 28. The at least one inner support element prong 26 of the second support element 17 is located on the side of the at least one second winding layer 7 facing the second longitudinal axis 9. The at least one outer support element prong 27 of the second support element 17 is located on the side of the at least one second winding layer 7 facing away from the second longitudinal axis 9.

This way, it is possible to use the same support elements 14, 17 both for transport and when installing and arranging the coils 2, 3 on top of one another, in particular if they are connected to the at least one winding layer 4, 7 in a stationary manner.

After transport to the installation location, installation and final mounting at the installation surface 12 provided for this purpose are to be carried out. For this purpose, the first coil 2 is to be connected to the isolator(s) first, if applicable, and subsequently supported on the installation surface 12 by means of the first support elements 14. If they are already present, this is carried out by means of the already present first support elements 14. It would also be possible not to use the first support elements 14 used during transport for final mounting, but to use new, separate support elements 14 for this. Arranging the first support elements 14 at the at least one first winding layer 4 of the first coil 2 is carried out analogously, as was already described above in detail.

For being able to support the at least one second coil 3 at the first coil 2, the first support elements 14 are to be arranged at the second face end region 16 of the first coil 2 spaced apart from the first face end region 15 in the axial direction as well. This may already be directly carried out during manufacturing of the first coil 2, or only during assembly and mounting.

Furthermore, for the tower-like structure, the coupling element 18 described above is to be arranged at the first support elements 14 and/or at the second support elements 17 and attached thereto. This may, for example, be effected by means of a screw connection, a rivet connection or a clamp connection. At the support elements 14, 17 facing and to be coupled with one another, preferably only one of the coupling elements 18 is to be used. The coupling elements 18 are arranged such that they either project from the first support elements 14 in the direction of the first longitudinal axis 8, or project from the second support elements 17 to the side or in the direction facing away from the second longitudinal axis 9. In this regard, the

coupling elements 18 are to be connected either to the first support elements 14 or to the second support elements 17 first.

If the second support elements 17 are already present at the second coil 3, in particular attached thereto, support at the first coil 2 is carried out by means of the already present second support elements 17. If this is not the case, the second support elements 17 are to be arranged analogously at a third face end region 30 of the second coil 3, as was already described above in detail. The third face end region 30 either faces the transport platform 19 or the first coil 2. Basically, this is always the same face end region 30 of the second coil 3.

If another coil, which is not shown, is to be provided above or on the second coil 3, the second support elements 17 are to be arranged or affixed in a fourth face end region 31 as well. However, regardless of this, the second support elements 17 in the fourth face end region 31 may also serve for attaching a cover element, such as a roof, electrical connections, or the like.

If the first support elements 14, the second support elements 17 and the coupling element 18 between each of them are in a position aligned to one another, the respective coupling element 18 may be connected to the support element 14 or 17, which has not yet been connected at that time. For this purpose, the second support elements 17 are to be arranged around the second longitudinal axis 9 at equal spacing relative to the first support elements 14, or vice versa.

After the aligning and mounting process of the coils 2, 3 has been completed, the second longitudinal axis 9 of the second coil 3 is aligned with respect to the first longitudinal axis 8 of the first coil 2. The longitudinal axes 8 and 9 then define the joint longitudinal central axis 13.

In Fig. 8, another and possibly independent way of arranging a first coil 2 and a second coil 3 received therein is shown, with the same reference numbers or component names as in preceding Figs. 1 to 7 being used again for identical parts. To avoid unnecessary repetition, reference is made to the detailed description in preceding Figs. 1 to 7.

In the coils 2, 3 arranged within one another here, no support elements 14, 17 have been directly arranged and provided for placement on the transport platform 19. However, the support elements 14, 17 may be affixed subsequently and mounted at the coils 2, 3. In this arrangement, the outer, first coil 2 is shown with multiple first winding layers 4 – namely with four first winding layers 4 – and, for the sake of simplicity, the smaller, second coil 3 is only shown with one single second winding layer 7, although it would also be possible to provide multiple of them in the second coil 3. However, each of the coils 2, 3 could also comprise only one single winding layer 4, 7.

In addition, an alternative is shown where the first, larger coil 2 may comprise at its second face end region 16 a preferably star-shaped first holding device 32, which may also be referred to as winding star. To be able to receive at least the second coil 3 in its core region 6, the first face end region 15 is to be configured in an open and free manner. The first coil 2 may then be pulled from above over the second coil 3, which has already been placed on the transport platform 19 or is located thereon. In this case, the second coil 3 may have or be provided with a second holding device 33 at least at its third face end region 30 and/or a third holding device 34 at its fourth face end region 31 as well. The second holding device 33 and also the third holding device 34 are each preferably star-shaped and may again be referred to as winding stars. To enable arranging the coils 2, 3 within one another, depending on the configuration of the coils 2, 3, in particular in the case of coils with the star-shaped holding devices 32, 33, 34 described above, the length or height of the inner second, smaller coil 3 should be equal at the most, however, preferably smaller than the length or height of the outer first coil 2.

In this regard, lengths or heights of the inner coil 3 of approximately 50 % up to 100 %, preferably approximately 70 % to 90 % of the length or height of the outer coil 2 have proven to be favorable. If in the outer first coil 2, the first holding device 32 (winding star) shown in Fig. 8 is arranged at the second face end region 16 facing away from the transport platform 19, the overall height of the second coil 3 may be 100 % of the length or height of the outer coil 2 at the most, however, preferably slightly smaller.

If, however, in the first outer coil 2, the first holding device 32 (winding star) is arranged at the first face end region 15 facing the transport platform 19, or if no first holding device 32

(no winding star) is provided – as described in Figs. 1 to 7 –, the length or height of the inner second coil 3 may be starting from 50 % up to 150 % relative to the first coil 2. However, it would also be possible to arrange the first holding device 32 at the second face end region 16 of the first coil 2 and to support the first coil 2 by means of the first holding device 32 upside down at the transport platform 19 for transport. In this case, the first face end region 15 facing away from the transport platform 19 would be open, and the second coil 3 may be inserted from above into the open core region 6 of the first coil 2 and be received therein.

This way, coils 2, 3 with a maximum of three winding stars or holding devices 32, 33, 34 may be transported within one another as well, but only if the height dimensions have been coordinated or if the first holding device 32 (winding star) of the first coil 2 is arranged at the bottom and the second coil 3 with or without its star-shaped holding devices 33, 34 rests on the first holding device 32 of the first coil 2. In this case, the second coil 3 is indirectly and not directly supported on the transport platform 19. Irrespective of this, however, also in this case, the first, larger coil 2 could be supported with the first support elements 14 at its first, open face end region 15 at the transport platform 19, at least for transport. It would also be possible to arrange the first support elements 14 in a stationary and fixed manner in the area of the first face end region 15.

It would also be possible to either arrange the coils 2, 3 shown in Fig. 8 in a tower-like arrangement on top of one another, or to install the coils 2, 3 next to one another to form the coil assembly 1.

Finally, it should be noted that the individual method steps and their time sequence do not necessarily have to be carried out in the specified order, but that a different time sequence is possible as well.

The embodiments show possible variations; however, it should be noted at this point that the invention is not limited to its variations specifically shown; rather, various combinations of the individual variations are possible, and this variation possibility based on the technical teaching of the present invention is subject to the skills of the person skilled in the art active in this technical field.

The scope of protection is determined by the claims. However, the description and the drawings are to be used for construing the claims. The individual features or feature combinations of the different embodiments shown and described may constitute independent inventive solutions. The object underlying the independent inventive solutions may be gathered from the description.

All indications of ranges of values in the present description are to be understood such that they also include any and all sub-ranges therefrom; for example, the indication 1 to 10 is to be understood such that all sub-ranges are included, starting at the lower limit 1 up to the upper limit 10, i.e. all sub-ranges start with a lower limit of 1 or larger and end at an upper limit of 10 or less, e.g. 1 to 1.7, or 3.2 to 8.1, or 5.5 to 10.

As a matter of form, it should finally be noted that for better understanding of the structure, some of the elements have been represented unscaled and/or enlarged and/or in reduced size.

List of reference numbers

1	Coil assembly
2	First coil
3	Second coil
4	First winding layer
5	Spacer body
6	Core region
7	Second winding layer
8	First longitudinal axis
9	Second longitudinal axis
10	Inner dimension
11	Outer dimension
12	Installation surface
13	Longitudinal central axis
14	First support element
15	First face end region
16	Second face end region
17	Second support element
18	Coupling element
19	Transport platform
20	Spacer element
21	First support element basis
22	Inner support element prong
23	Outer support element prong
24	First receiving slot
25	Second support element basis
26	Inner support element prong
27	Outer support element prong
28	Second receiving slot
29	Pitch compensation element
30	Third face end region
31	Fourth face end region
32	First holding device
33	Second holding device
34	Third holding device

We Claim:

1. A method for supplying coils (2, 3) at a supply location, transporting the coils (2, 3) from the supply location to an installation location and installing the coils (2, 3) at the installation location to form a coil assembly (1), comprising the following steps:

- providing the first coil (2) having at least one first winding layer (4), wherein the first coil (2) has a first face end region (15) and a second face end region (16) spaced apart therefrom in the direction of a first longitudinal axis (8), and wherein at least one of the face end regions (15, 16) is open, and a free core region (6) of the first coil (2) has a clear inner dimension (10) having an inner diameter,
- providing at least one second coil (3) having at least one second winding layer (7), wherein the second coil (3) has a third face end region (30) and a fourth face end region (31) spaced apart therefrom in the direction of a second longitudinal axis (9), and the second coil (3) has an outer dimension (11) having an outer diameter, which outer dimension (11) is smaller than the clear inner dimension (10) of the first coil (2),
- providing multiple first support elements (14) for the first coil (2) and/or multiple second support elements (17) for the at least one second coil (3),
- providing a transport platform (19) for the coils (2, 3),
- arranging the first support elements (14) and/or the second support elements (17), prior to placing the coils (2, 3) on the transport platform (19), at at least one of the coils (2, 3) at its respective face end region (15, 16; 30, 31), wherein at least one of the coils (2, 3) may be supported on the transport platform (19) by means of at least three of the support elements (14, 17),
- arranging one of the coils (2, 3) on the transport platform (19) and supporting it on the transport platform (19) located at the supply location with a perpendicular orientation of its longitudinal axis (8, 9),
- arranging the at least one other of the coils (3, 2) on the transport platform (19) and supporting it on the transport platform (19) located at the supply location and in this process aligning the respective at least one other of the coils (3, 2) approximately coaxially with respect to the coil (2, 3) already located on the transport platform (19), and the at least one second, smaller coil (3) with its small outer dimension being arranged within the first coil (2), or arranging the at least one other of the coils (3, 2)

within the coil (2, 3) already located on the transport platform (19) and supporting it on said coil (2, 3),

- transporting the coils (2, 3) resting on the transport platform (19) from the supply location to the installation location,
- removing the coils (2, 3) from the transport platform (19) and assembling at least two of the coils (2, 3) to form a coil assembly (1) on an installation surface (12) having a horizontal orientation and perpendicularly aligning the first longitudinal axis (8) of the first coil (2) and the second longitudinal axis (9) of the at least one second coil (3).

2. The method according to claim 1, characterized in that the first support elements (14) and the second support elements (17) are arranged offset relative to one another in the circumferential direction around the longitudinal axes (8, 9).

3. The method according to claim 1 or claim 2, characterized in that the first support elements (14) and/or the second support elements (17) are held at the transport platform (19) in a stationary manner.

4. The method according to any one of claims 1 to 3, characterized in that multiple spacer elements (20) are provided, and the spacer elements (20) are arranged in the radial direction between the first coil (2) and the at least one second coil (3).

5. The method according to any one of claims 1 to 4, characterized in that the first support elements (14) are also arranged at a second face end region (16) of the first coil (2) spaced apart from the first face end region (15) in the axial direction.

6. The method according to any one of claims 1 to 5, characterized in that the coils (2, 3) are assembled to form a coil assembly (1) by arranging the coils (2, 3) in a tower-like manner on top of one another, and the first coil (2) is assembled first at the installation location, and its first face end region (15) is supported on the installation surface (12) by means of the first support elements (14).

7. The method according to any one of claims 1 to 6, characterized in that the support elements (14; 17) are fork-shaped and each comprise a support element

basis (21; 25) and at least one inner support element prong (22; 26) and at least one outer support element prong (23; 27), wherein the support element prongs (22, 23; 26, 27) each project upward from the support element basis (21; 25) and are spaced apart from one another, thereby forming a receiving slot (24; 28).

8. The method according to claim 7, characterized in that the first support elements (14) are arranged at the at least one first winding layer (4) of the first coil (2) such that the at least one first winding layer (4) is received in the first receiving slot (24), and the at least one inner support element prong (22) is located on the side of the at least one first winding layer (4) facing the first longitudinal axis (8), and the at least one outer support element prong (23) is located on the side of the at least one first winding layer (4) facing away from the first longitudinal axis (8), and the first support element basis (21) rests on the transport platform (19).

9. The method according to claim 7, characterized in that the second support elements (17) are arranged at the at least one second winding layer (7) of the second coil (3) such that the at least one second winding layer (7) is received in the second receiving slot (28), and the at least one inner support element prong (26) is located on the side of the at least one second winding layer (7) facing the second longitudinal axis (9), and the at least one outer support element prong (27) is located on the side of the at least one second winding layer (7) facing away from the second longitudinal axis (9), and the second support element basis (25) rests on the transport platform (19).

10. The method according to any one of claims 5 to 9, characterized in that the second support elements (17) are arranged around the second longitudinal axis (9) at equal spacing relative to the first support elements (14).

11. The method according to any one of claims 5 to 10, characterized in that a coupling element (18) is attached to each of the first support elements (14) located in the second face end region (16) of the first coil (2), the coupling elements (18) being arranged projecting in the direction of the first longitudinal axis (8).

12. The method according to any one of claims 1 to 10, characterized in that a coupling element (18) is attached to each of the second support elements (17) of the second coil (3), wherein the coupling elements (18) are arranged projecting forward in the direction facing away from the second longitudinal axis (9).

13. The method according to claim 11 or claim 12, characterized in that the second coil (3) with the second support elements (17) located thereat is supportingly arranged at the first support elements (14) with interposing the respective coupling elements (18), and each of the coupling elements (18) that has not yet been connected to one of the support elements (14, 17) is connected thereto.

14. The method according to any one of claims 1 to 13, characterized in that at least individual ones of the first support elements (14) are connected in a stationary manner to the at least one first winding layer (4) of the first coil (2) and/or at least individual ones of the second support elements (17) are connected in a stationary manner with the at one second winding layer (7) of the second coil (3).

15. The method according to any one of claims 1 to 14, characterized in that the second longitudinal axis (9) of the second coil (3) is aligned with respect to the first longitudinal axis (8) of the first coil (2), and the longitudinal axes (8, 9) define a joint longitudinal central axis (13).

16. The method according to any one of claims 1 to 15, characterized in that for transporting the coils (2, 3) and/or when assembling the coils (2, 3) to form the coil assembly (1), pitch compensation elements (29) are arranged or formed at least between individual ones of the first support elements (14) and the at least one first winding layer (4) and/or at least between individual ones of the second support elements (17) and the at least one second winding layer (7).

Fig.1

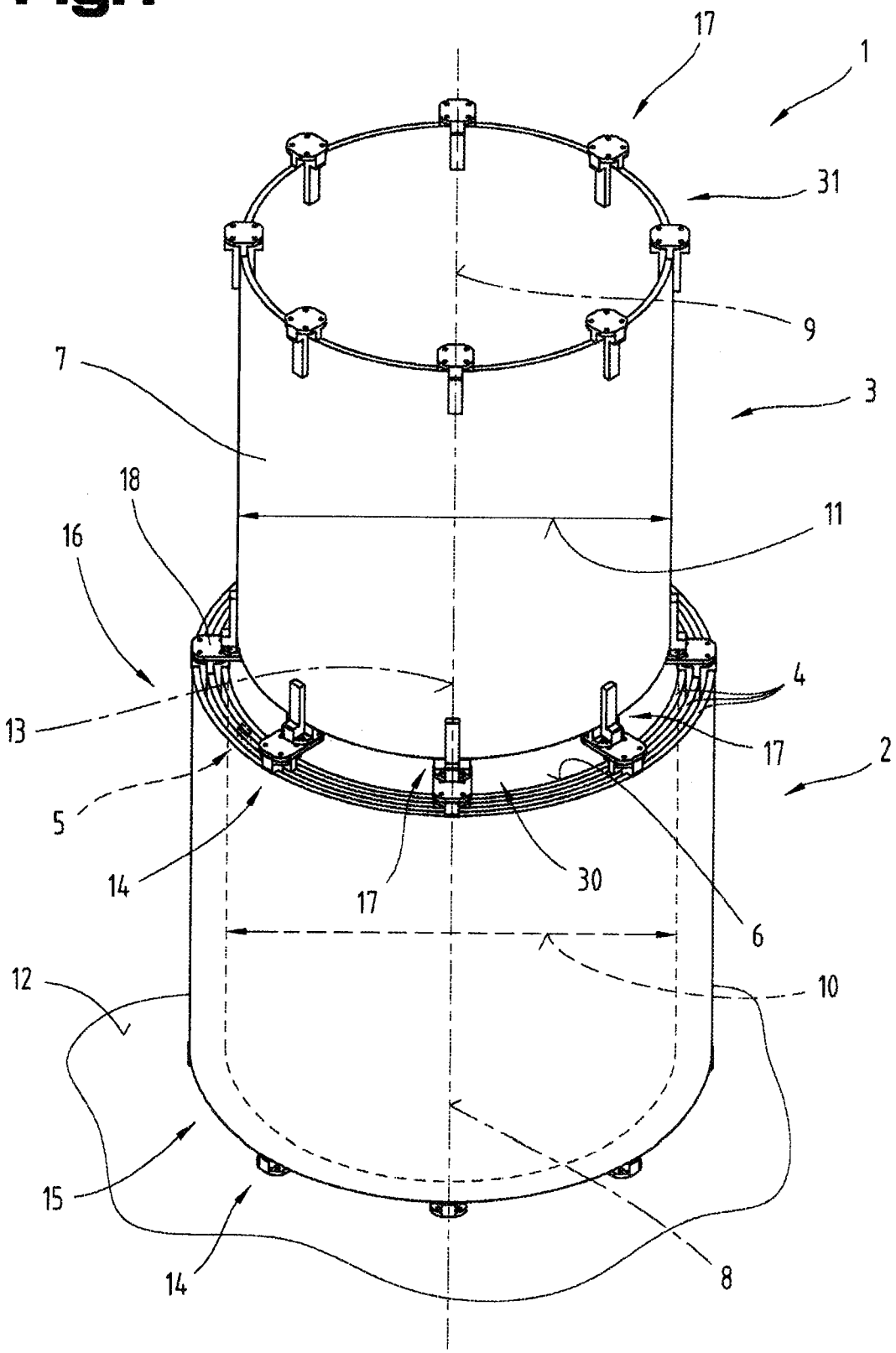


Fig.2

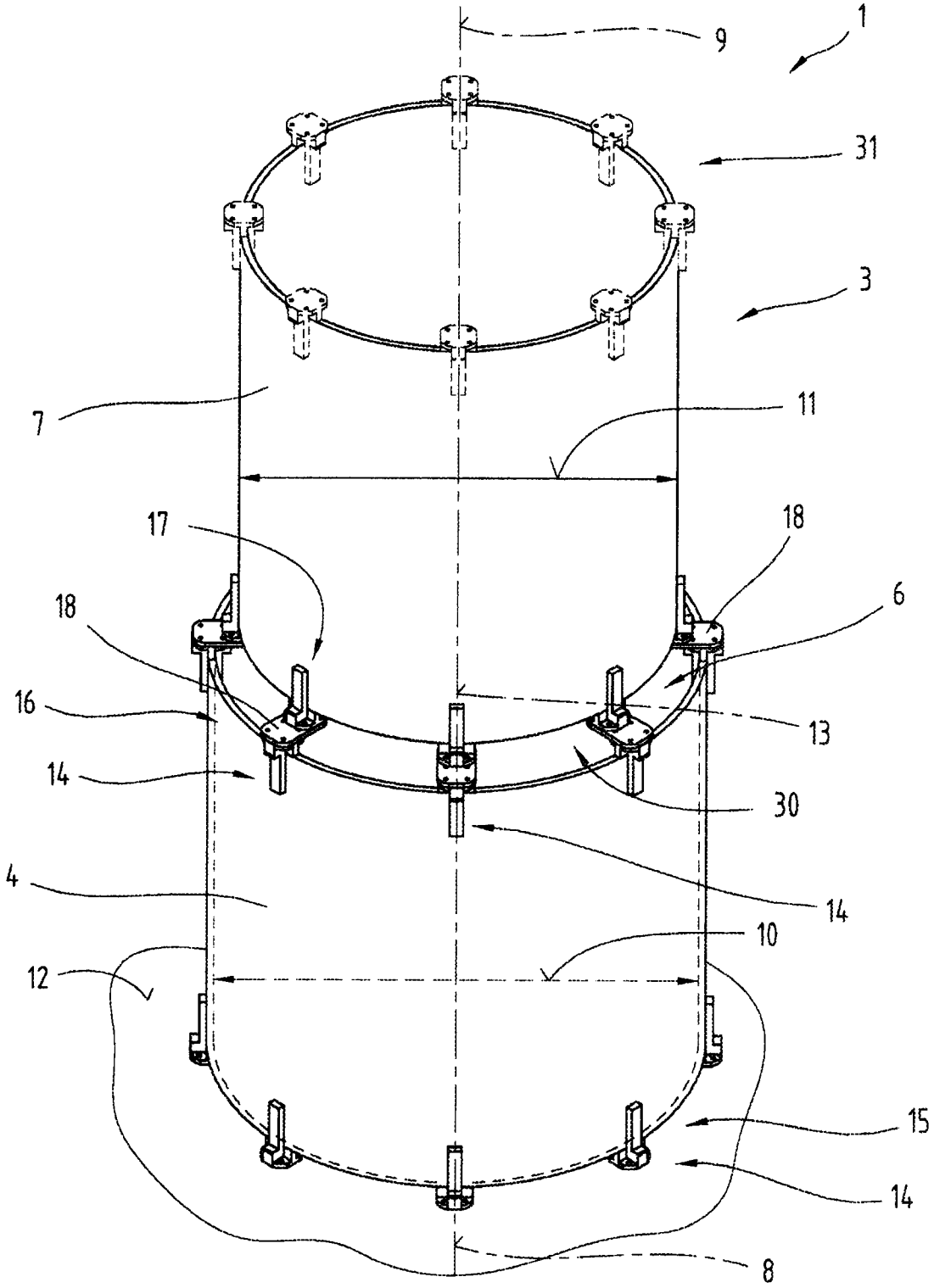


Fig.3

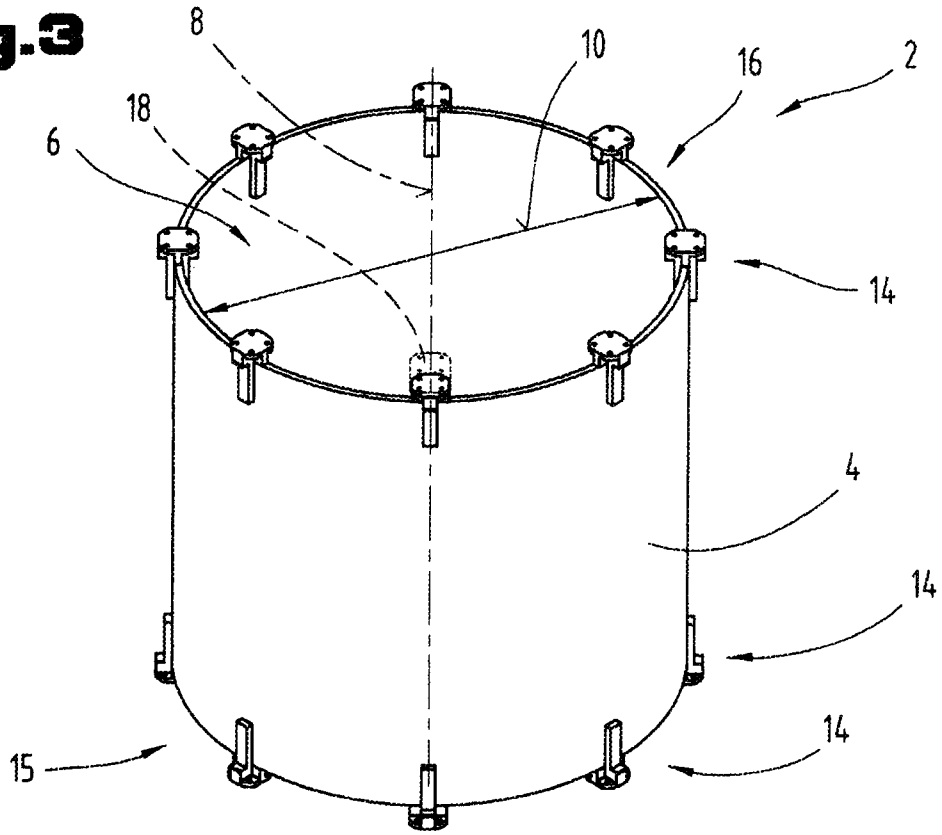


Fig.4

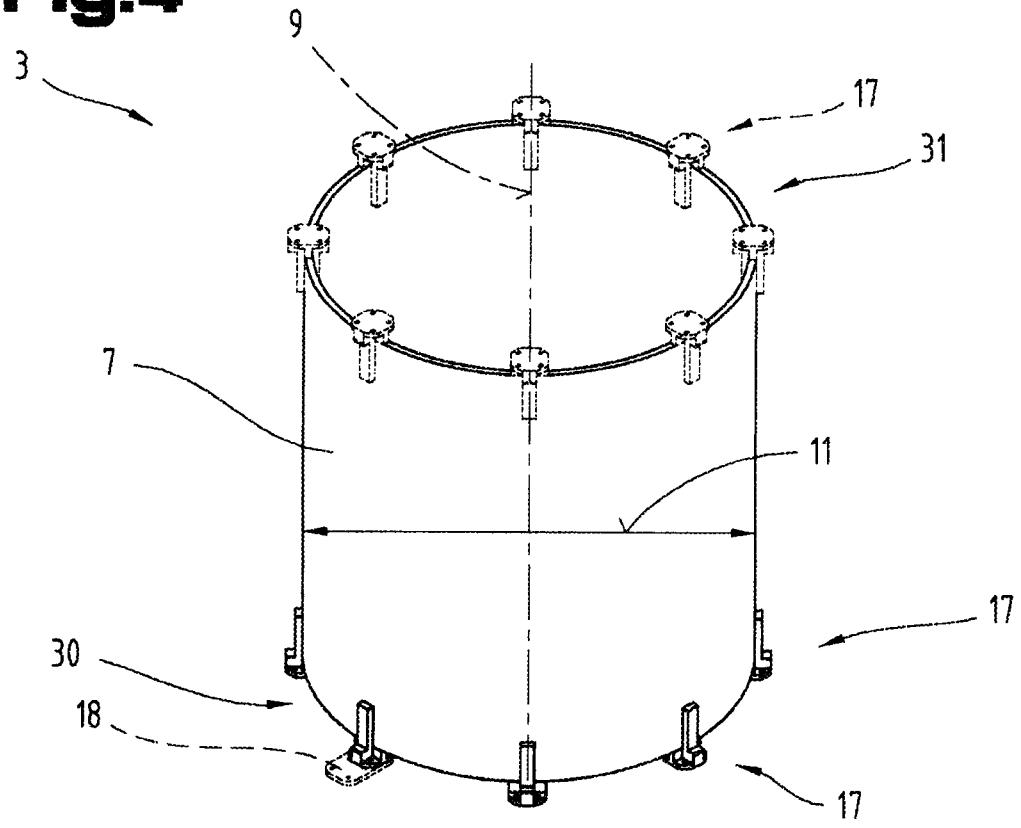


Fig.5

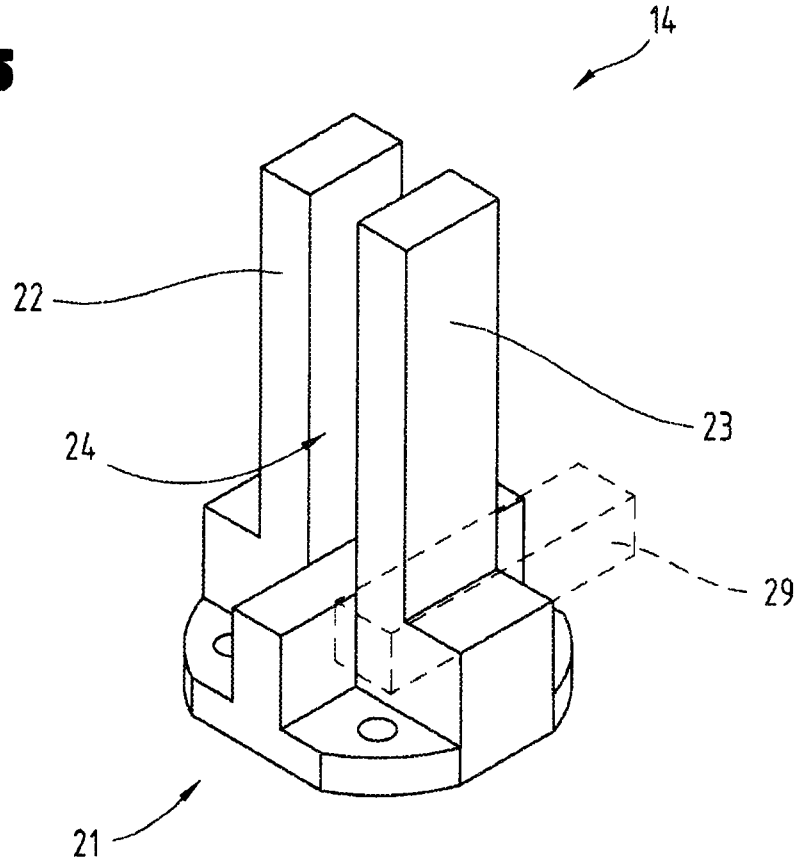


Fig.6

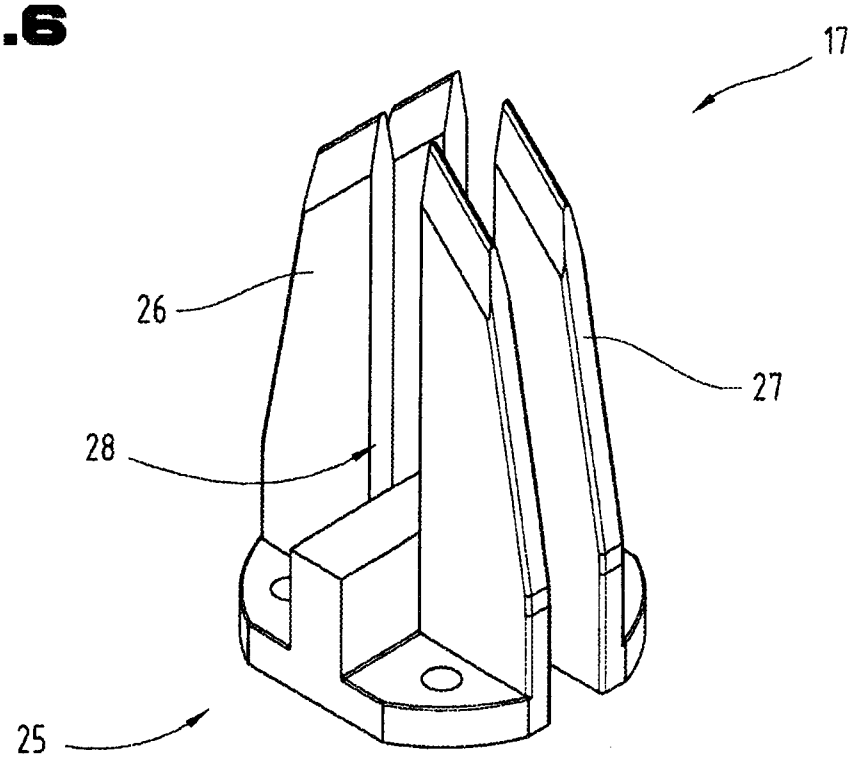


Fig.7

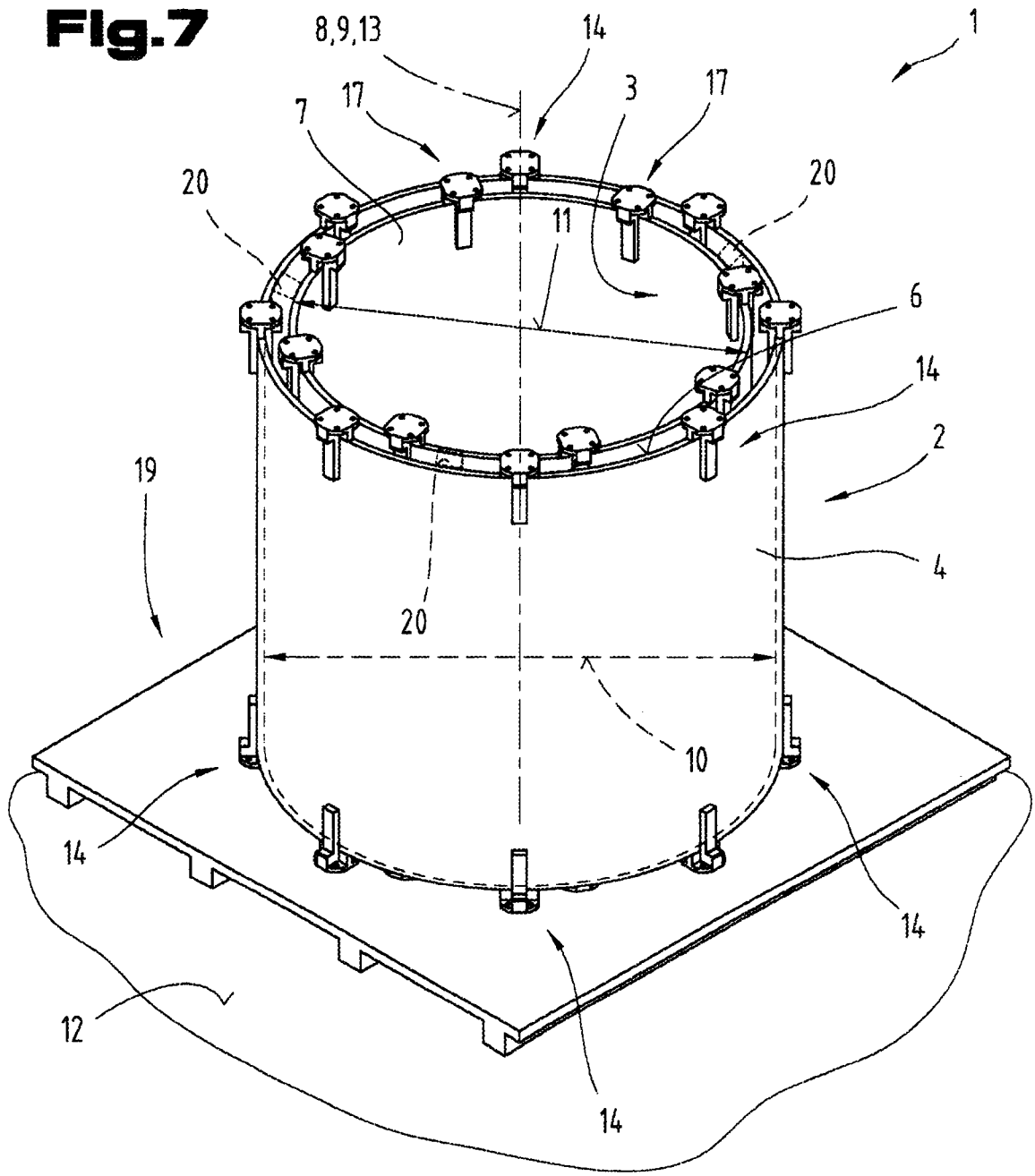
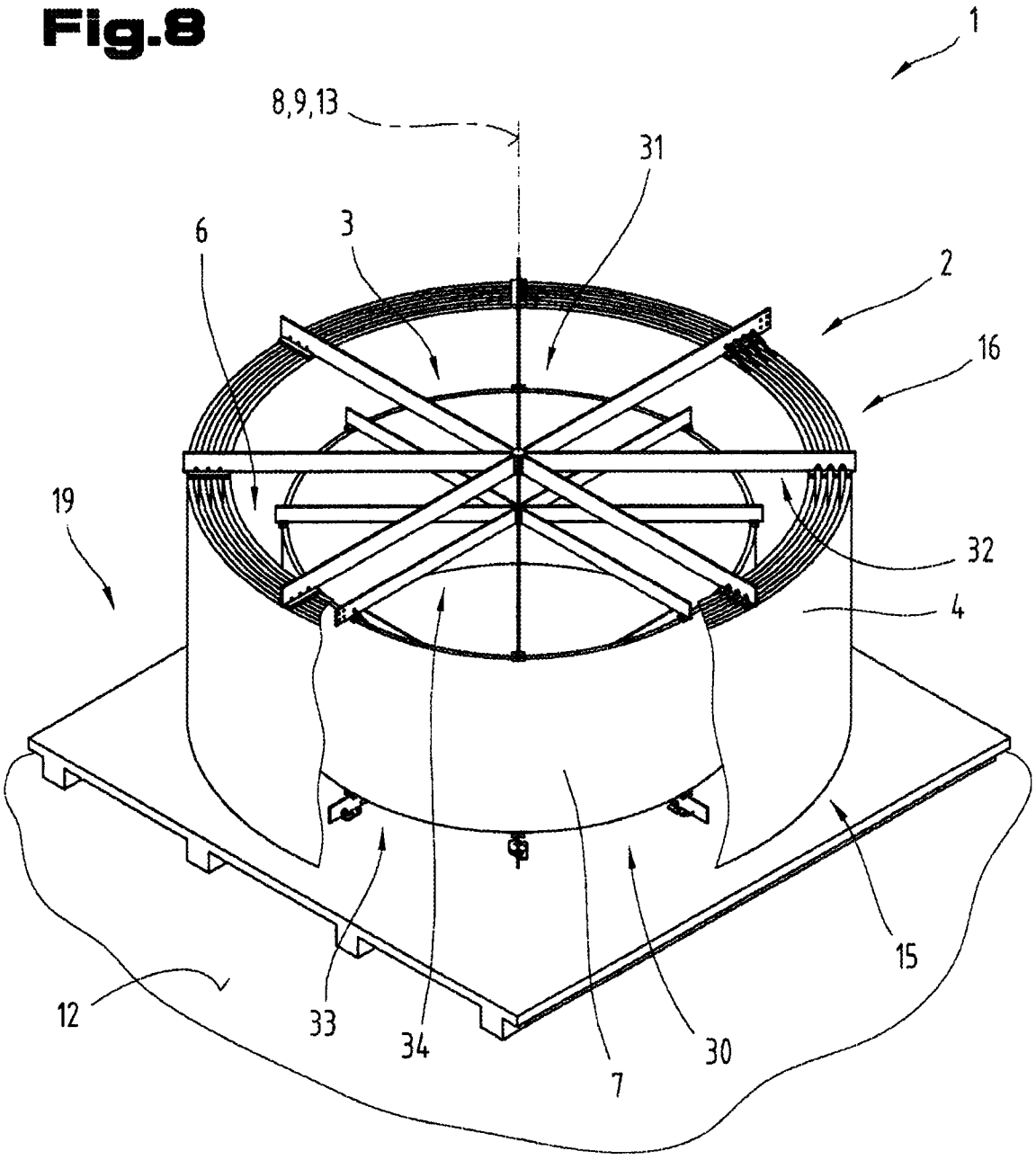
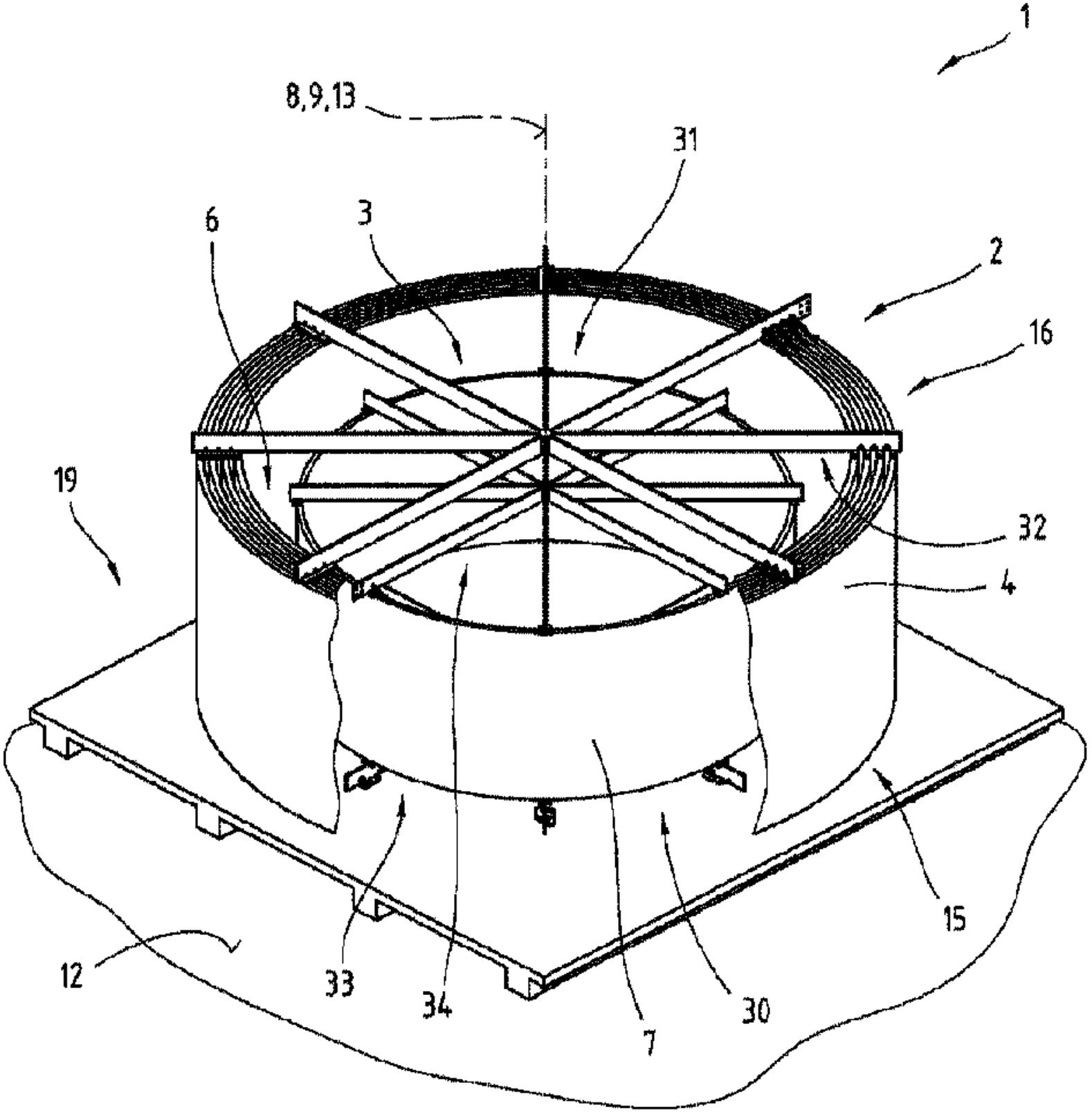


Fig.8

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