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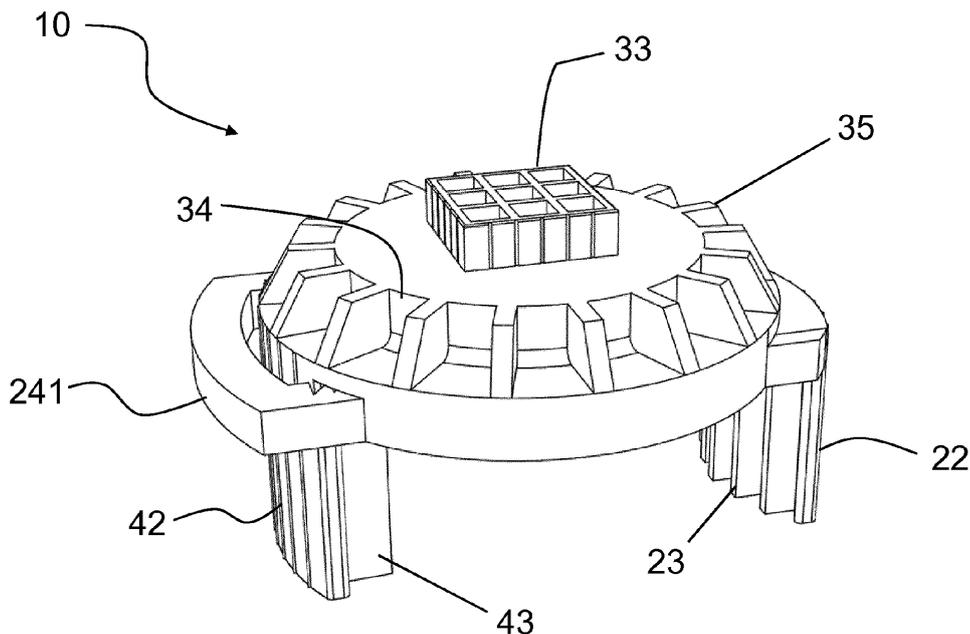
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(54) **RETAINING MEMBER FOR A PRESSING DEVICE FOR A CAST-RESIN DRY-TYPE ELECTRIC TRANSFORMER**

(57) It is described a retaining member (10) for a pressing device (1) for a cast-resin dry-type electric transformer, comprising a disk (30, 31, 34, 35) configured to form a support base for the pressing device on a winding

(8) of the cast-resin dry-type electric transformer and legs (22, 42) for mounting astride the winding, wherein the distance between said legs is adjustable to adapt to the winding section.



**Fig. 4**

**Description**TECHNICAL FIELD

**[0001]** The present invention relates to the field of cast-resin dry-type electric transformers. In particular, the present invention relates to an electric transformer of the aforementioned type with a retaining member for a pressing device configured to be mounted to the medium voltage coil.

BACKGROUND ART

**[0002]** The electric network provides to the users electric power in form of an alternating voltage, generally called "low voltage". This low voltage typically has an amplitude of the order of several hundred Volts. However, in case of large users such as factories, shopping centers or the like, electric power can be provided in the form of "medium voltage", whose magnitude is typically of the order of ten of thousands Volts. In this case, the user uses an electric transformer to convert the medium voltage coming from the electric network into low voltage.

**[0003]** As is known, a transformer is an electric machine suitable for transforming an input voltage (and the input current associated thereto) into an output voltage (and into an output current associated thereto).

**[0004]** Typically, a transformer comprises a primary winding and a secondary winding. The primary and secondary windings are electrically insulated from each other and are coupled by a magnetic circuit; for example, the primary and secondary windings can be wrapped concentrically on a magnetic core.

**[0005]** An input alternating voltage applied to the ends of the primary winding induces a magnetic flux in the magnetic core. In turn, such magnetic flux induces an output alternating voltage at the ends of the secondary winding. As known, the ratio between the amplitude of the output voltage and the amplitude of the input voltage is equal to the ratio between the number of coils of the secondary winding and the number of coils of the primary winding.

**[0006]** Since electrical power is generally supplied as a three-phase voltage, medium to low voltage transformers typically comprise three elements, commonly referred to as "columns". Each column comprises a magnetic core, a primary winding and a secondary winding, to transform a phase of the input medium voltage into a respective phase of the output low voltage.

**[0007]** The magnetic cores are typically formed by plurality of sheets of magnetic material (e.g., oriented grain silicon) coated with an insulating material, packed and tightened against each other. The magnetic cores of the columns are not independent of each other but are branches of a single magnetic circuit with three branches. The cores of the columns are connected to each other at both their ends by rectilinear yokes, also formed by the above mentioned sheets.

**[0008]** Moreover, typically, the magnetic core is pressed at the yokes by means of a pair of horizontal elements (made, for example, in the form of steel sections), commonly referred to as "yoke clamps", connected to each other by means of crossbars. Pressing devices are then fixed to the yoke clamps, configured to press the columns of the transformer, in particular the medium voltage winding contained in the casing.

**[0009]** In order to block a known pressing device to a yoke clamp typically a screw is used generally coupled with two nuts, in turn coupled with respective counter-nuts to prevent loosening. In addition, typically, washers are used to improve the locking of the nuts. The pressure exerted by the device on the medium voltage winding of the transformer is regulated by screwing the screw and the nuts.

**[0010]** From the Italian patent application no. 102014902311923 of 25.11.2014 in the name of the same Applicants, a pressing device for a cast-resin dry-type electric transformer is known, said pressing device being configured to block a winding (medium and/or low voltage) with respect to a yoke clamp.

**[0011]** EP 2 117 019 discloses a modular device for clamping and positioning power transformer windings, particularly for a dry-type transformer with resin-encapsulated windings.

SUMMARY OF THE INVENTION

**[0012]** The Applicants have noted that in some occasions it is desirable to provide greater stability of the windings with respect to the yoke clamps, so as to maintain a perfect alignment of the windings. In particular, greater stability is required when the transformer can be subjected to impacts and/or vibrations. In this regard, critical situations are created during the transport of a transformer from the place of production to the place where it is to be installed. Other critical situations can occur due to landslides and/or earthquakes. It would be desirable that the transformer remains stable even when the place where it is installed is subjected to an earthquake.

**[0013]** The Applicants have perceived the need to provide greater stability to the windings even in the above mentioned critical conditions.

**[0014]** According to the Applicants, such greater stability can be provided by coupling to a pressing device a retaining member configured to arrange itself astride a winding. Preferably, the retaining member is configured to adapt to the thickness of the winding to which it is fixed.

**[0015]** According to a first aspect, the present invention provides a retaining member for a pressing device for a cast-resin dry-type electric transformer, comprising a disk configured to form a support base for the pressing device on a winding of the cast-resin dry-type electric transformer and legs for mounting astride the winding, wherein the distance between said legs is adjustable to adapt the winding section.

**[0016]** The retaining member preferably comprises:

- (a) a first body having a first leg extending downwards and a first notched wall, and
- (b) a second body having a second leg and a second notched wall,

wherein said first notched wall and said second notched wall are configured to engage so that the distance between said legs can vary between at least two positions.

**[0017]** The first body preferably comprises two notched walls facing two respective rectilinear walls so as to define two interlocking zones.

**[0018]** The second body preferably comprises a frame with two long sides, each long side comprising a second notched wall, wherein each long side is configured to penetrate a respective interlocking zone so that the first notched walls engage the second notched walls.

**[0019]** The retaining member preferably further comprises a coupling member for connecting the retaining member to the lower body of the pressing device.

**[0020]** The coupling member is preferably an upwardly projecting member having a non-circular cross section.

**[0021]** According to a further aspect, the present invention provides a pressing device coupled to a retaining member of the type indicated above.

**[0022]** According to a third aspect, the present invention provides a cast-resin dry-type electrical transformer, comprising a winding, a yoke clamp and a pressing device coupled to a retaining member of the above mentioned type for blocking the winding to the yoke clamp.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0023]** The present invention will become clearer in the light of the following detailed description, given by way of example and not of limitation, to be read with reference to the accompanying drawings wherein:

- Figure 1 is a schematic axonometric view of a pressing device coupled to a retaining member according to the present invention, mounted astride a winding of a cast-resin dry-type transformer;
- Figure 2 is similar to Figure 1 but is taken from another angle;
- Figure 3 is an axonometric view of the retaining member of the present invention mounted astride a winding;
- Figure 4 is a first axonometric view of the retaining member of the present invention while it is not in use;
- Figure 5 is a second axonometric view of the retaining member of the present invention while it is not in use;
- Figure 6 is a bottom view of the retaining member of the present invention while it is not in use;
- Figures 7 and 8 are two views of the female body of the retaining member; and
- Figures 9 and 10 are two views of the male body of the retaining member.

#### DETAILED DESCRIPTION

**[0024]** Figures, or some of them, may not be in scale.

**[0025]** Figures 1 and 2 show a pressing device 1 coupled to a retaining member 10 according to the present invention. The retaining member 10 is mounted astride a winding 8 of a cast-resin dry-type transformer. The pressing device 1 is fixed to a yoke clamp 9, shown only partially in Figures 1 and 2. The transformer is also not shown in a complete way.

**[0026]** The pressing device 1 preferably comprises an upper body 2 and a lower body 5. The upper body 2 and the lower body 5 are configured to translate with respect to each other. Preferably, the upper body 2 is configured to translate with respect to the lower body 5 so as to adapt to the distance between the medium-voltage winding and the yoke clamp.

**[0027]** The upper body 2 is preferably provided with a screw (not shown) to lock it firmly to the yoke clamp.

**[0028]** The upper body 2 is substantially mushroom-shaped and preferably comprises a cap 3 and a shank 4. The shank 4 preferably has a hexagonal section or, in any case, such as to prevent rotation of the upper body 2 with respect to the lower body 5.

**[0029]** In turn, the lower body 5 has a hole coaxial to the axis of the pressing device with a section complementary to the section of the shank 4 of the upper body 2.

**[0030]** The lower body 5 of the pressing device preferably comprises a cylindrical core 6 and a plurality of rings 7 radially projecting from the cylindrical core 6. Preferably, the rings 7 are substantially parallel to each other. Preferably, the rings 7 are substantially equally spaced from each other.

**[0031]** The upper body 2 and the lower body 5 are preferably of the same material, for example thermoplastic resin or similar material. Suitable materials are, for example, Nylon PA 6/66 (possibly loaded with fibers or glass spheres in a variable percentage, for example between 30 and 60%), PBT (Polybutylene terephthalate), PPA, PPS or the like. In particular, it is preferable to use one of the above mentioned materials with self-extinguishing features. Advantageously they can be made by molding.

**[0032]** The retaining member 10 according to the present invention is shown in Figures 1 and 2 coupled to the pressing device 1 and astride a medium voltage winding 8. In particular, the retaining member 10 is coupled to the lower part of the lower body 5 of the pressing device 1. In Figure 3 it is shown without the pressing device.

**[0033]** According to the present invention, the retaining member 10 comprises a male body 20 and a female body 30. In Figures 4 and 5 the male body 20 and the female body 30 are shown coupled to each other while in the other figures they are shown separate.

**[0034]** The retaining member 10 is made of a thermoplastic resin or another similar material. Suitable materials are, for example, Nylon PA 6/66 (possibly loaded with fibers or glass spheres in a variable percentage, for ex-

ample between 30 and 60%), PBT (Polybutylene terephthalate), PPA, PPS or the like. In particular, it is preferable to use one of above mentioned materials with self-extinguishing characteristics. Advantageously it can be made by molding.

**[0035]** The retaining member 10 is configured to form a stable support base for the pressing device 1. In particular, it is configured to mount astride a winding 8, typically of the medium voltage winding of a cast-resin dry-type transformer. Advantageously, the retaining member 10 is configured to adapt to the section of the winding 8 and to retain the winding 8 with respect to the yoke clamp 9.

**[0036]** The female body 30 comprises a disk 31 which forms the support base for the lower body 5. The female body 30 also comprises a fixed leg 42 which extends perpendicularly in a direction (downward). Preferably, the female body 30 also comprises a coupling member 33 for coupling with the pressing device 1. The coupling member 33 extends in the opposite direction to the leg 32.

**[0037]** As shown in the various figures, preferably the disk 31 has a circular shape but, of course, it may also have a shape other than the circular one. Superiorly, preferably, it has a cylindrical body 34 with radial fins 35 extending up to the circumference of the disk 31. The coupling member 33 is arranged projecting upwardly with respect to the cylindrical body 34.

**[0038]** According to embodiments, the coupling member 33 has a non-circular cross-section, preferably a regular polygon cross-section. Preferably, the section of the coupling member 33 is square (as shown, for example, in Figure 4) or hexagonal. Of course, at the lower face of the lower body 5 of the pressing device 1 there is a cavity (female) of a shape and depth complementary to the coupling member (male) 33. The coupling member 33 projects with respect to the cylindrical body 34 by a few millimeters, preferably between 2 mm and 10 mm.

**[0039]** The lower face of the disk 31 preferably comprises two sides 36, each one delimited (in plan) by a rectilinear wall 37 (along a circumferential cord) and by a circular arc wall 38 subtended by said rectilinear wall 37. The two rectilinear walls 37 are preferably parallel and of the same length.

**[0040]** The two sides 36 of the lower face of the disk 31 delimit a channel 38.

**[0041]** Inside the channel 38 two notched walls 39 are provided, a first notched wall 39 facing and parallel to one of the sides 36 and a second notched wall 39 facing and parallel to the other side 36. In this way two interlocking zones are realized, each one delimited by a rectilinear wall 37 and the respective notched wall 39 facing thereto. The notches have a saw tooth shape or the like.

**[0042]** The notched walls 39 have a first height for a first portion 391 and have a second height in the remaining portion 392. The first height is smaller than the second height. In this way a first step 40 and a second step 41 are formed as shown in Figure 8.

**[0043]** The fixed leg 42 extends downwardly starting

from the end of the uppermost notched walls 392. The fixed leg 42 preferably has a shape that follows the perimeter of the disk 31. Preferably, stiffening baffles 43 are provided to stiffen the fixed leg 42. The stiffening baffles 43 start from the surface that joins the higher notched walls.

**[0044]** The channel 38, in the area opposite the fixed leg and at the interlocking zones, has a substantially flat surface 44. The stepped block which defines the notched walls 39 projects with respect to said substantially flat surface 44.

**[0045]** The male body 20 of the retaining member is shown isolated from the female body 30 in Figures 9 and 10.

**[0046]** The male body 20 is substantially L-shaped with the base 21 of the L configured to engage the female body and the leg of the L which comprises the movable leg 22 of the retaining member 10. The movable leg 22 of the retaining member 10 is very similar to the fixed leg 42 and has stiffening baffles 23 to stiffen the movable leg 22.

**[0047]** The base 24 of the L has a substantially rectangular shape with the two short sides 241 and 242 curved. The base of the L is not full but it is a sort of frame. Internally, the two long sides 243, 244 of the L comprise notches 29 complementary to the notches 39 of the female body 30.

**[0048]** The surface 25 below the movable leg 22 is recessed with respect to the plane defined by the rest of the frame which forms the base of the L. As will be clear later this aspect allows the surface 25 to overcome the top of the surface between the lowest notched walls 391 of the female body 30.

**[0049]** As shown in Figures 5 and 6, the male body 20 is configured to interlocking into the female body 30 and form a single robust fixing member 10.

**[0050]** Advantageously, thanks to the complementary notches 39 and 29 of the male body 20 and of the female body 30, the distance between the two legs 42, 22 can be adjusted according to the requirements and in particular according to the width of the winding 8. The two legs 42, 22 contribute to firmly hold the retaining member 10 to the winding 8 and to the pressing device 1, which in turn is fixed to the yoke clamp 9. The thickness of the frame, at the long sides 241, 243, is such to stay with precision in the interlocking zones of the female body 30.

**[0051]** The minimum distance between the two legs 22, 42 is achieved when the recessed surface 25 below the movable leg 22 overcomes the top of the surface between the lowest notched walls 391 of the female body 30. The maximum distance between the two legs 22, 42 is achieved when the short curved side 241 of the base of the L is near the outer surface of the fixed leg 42.

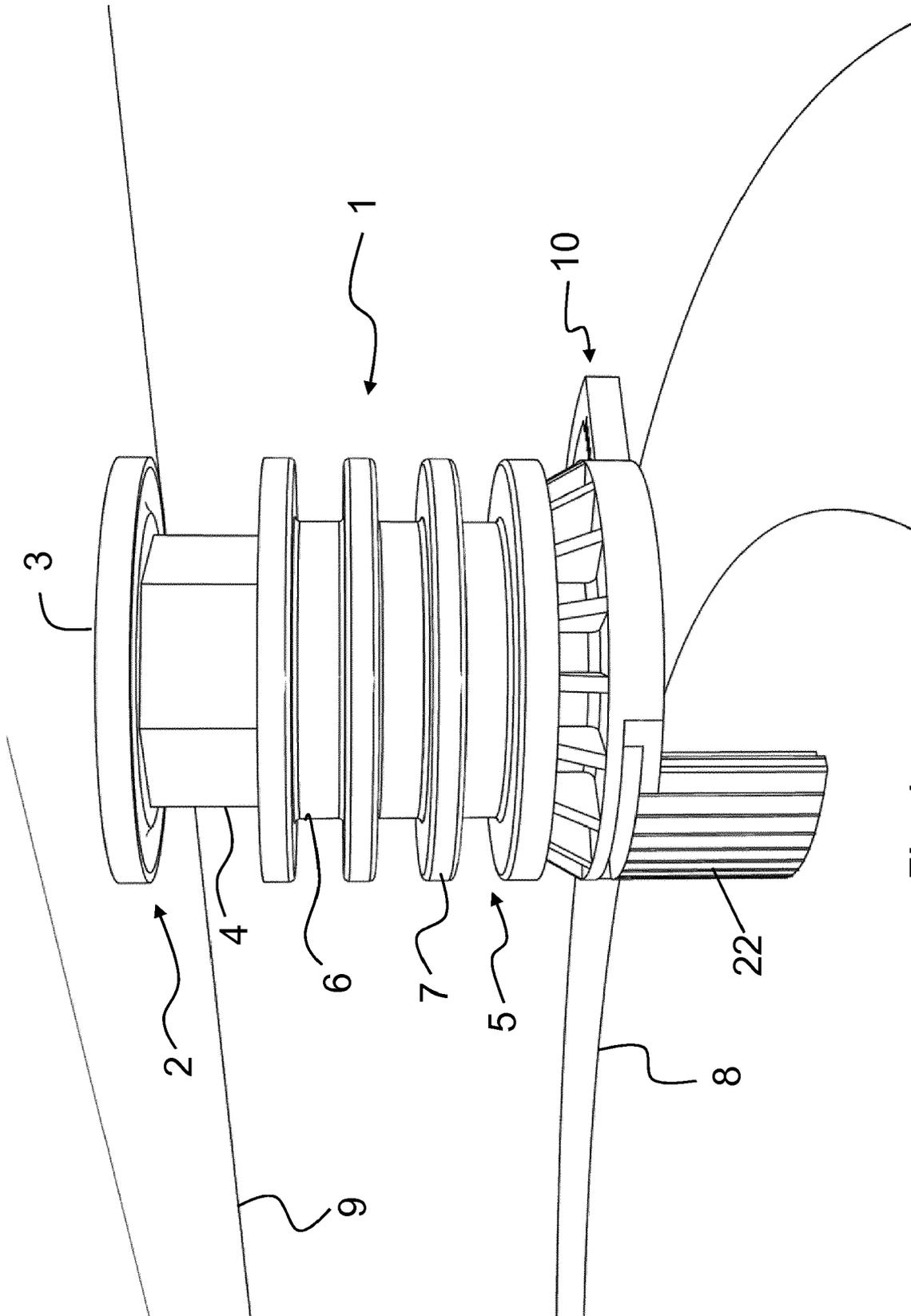
**[0052]** Among the advantages of the retaining member according to the invention there is the fact that it provides greater stability in lateral movements and creates a bond between the yoke clamp and the winding by embracing the winding on both sides. Moreover, the retaining mem-

ber according to the invention helps the alignment between the yoke clamp and the winding.

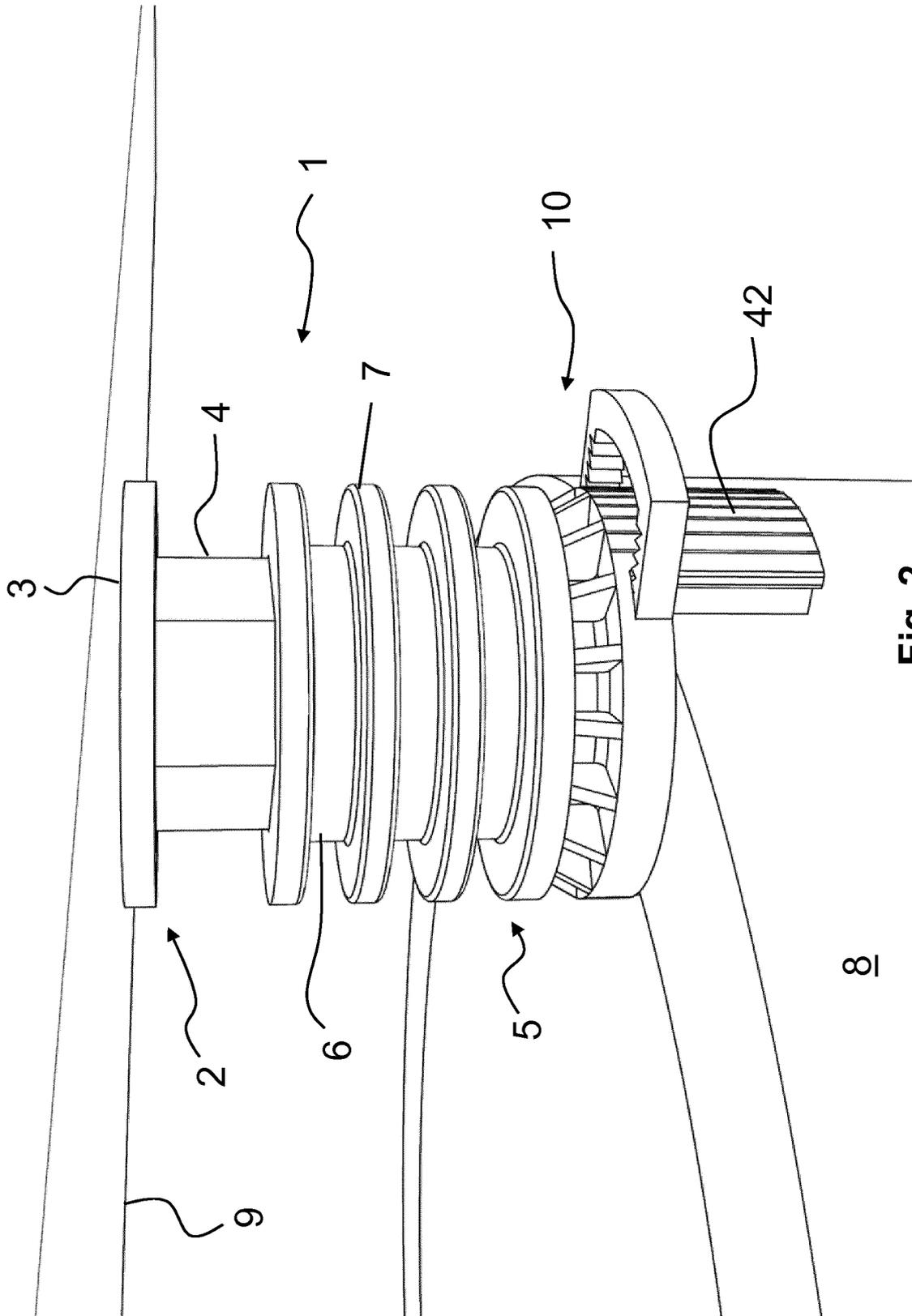
## Claims

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1. A retaining member (10) for a pressing device (1) for a cast-resin dry-type electric transformer, comprising a disk (30, 31, 34, 35) configured to form a support base for the pressing device (1) on a winding (8) of the cast-resin dry-type electric transformer and legs (22, 42) for mounting astride the winding (8), wherein the distance between said legs (22, 42) is adjustable to adapt to the winding section (8). 10
  2. The retaining member (10) of claim 1, comprising:
    - (a) a first body (30) having a first leg (42) extending downwards and a first notched wall (39), and 20
    - (b) a second body (20) having a second leg (22) and a second notched wall (29),

wherein said first notched wall (39) and said second notched wall (29) are configured to engage so that the distance between said legs (22, 42) can vary between at least two positions. 25
  3. The retaining member (10) of claim 2, wherein said first body (30) comprises two notched walls (39) facing two respective rectilinear walls (37) so as to define two interlocking zones. 30
  4. The retaining member (10) of claim 3, wherein said second body comprises a frame with two long sides (243, 244), each long side (243, 244) comprising a second notched wall (29), wherein each long side is configured to penetrate a respective interlocking zone so that the first notched walls (39) engage the second notched walls (29). 35 40
  5. The retaining member (10) of any of the previous claims, further comprising a coupling member (33) for connecting said retaining member (10) to the lower body of the pressing device (1). 45
  6. The retaining member (10) of claim 5, wherein said coupling member (33) is an upwardly projecting member having a non-circular cross-section. 50
  7. A pressing device (1) with a retaining member (10) according to any one of the previous claims.
  8. A cast-resin dry-type electric transformer, comprising a winding (8), a yoke clamp (9) and a pressing device (1) with a retaining member (10) according to claim 7 for blocking said winding (8) to the yoke clamp (9). 55

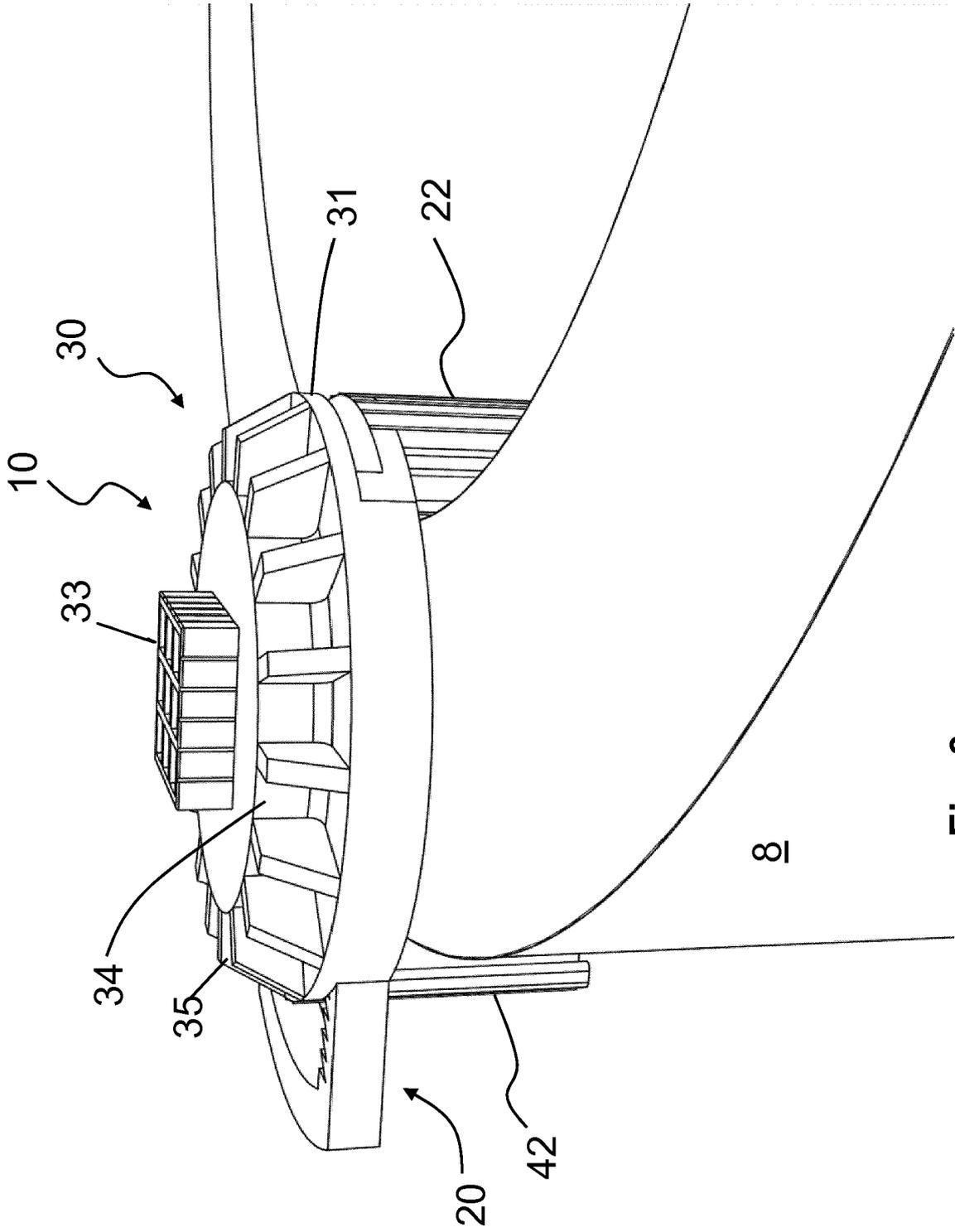


**Fig. 1**

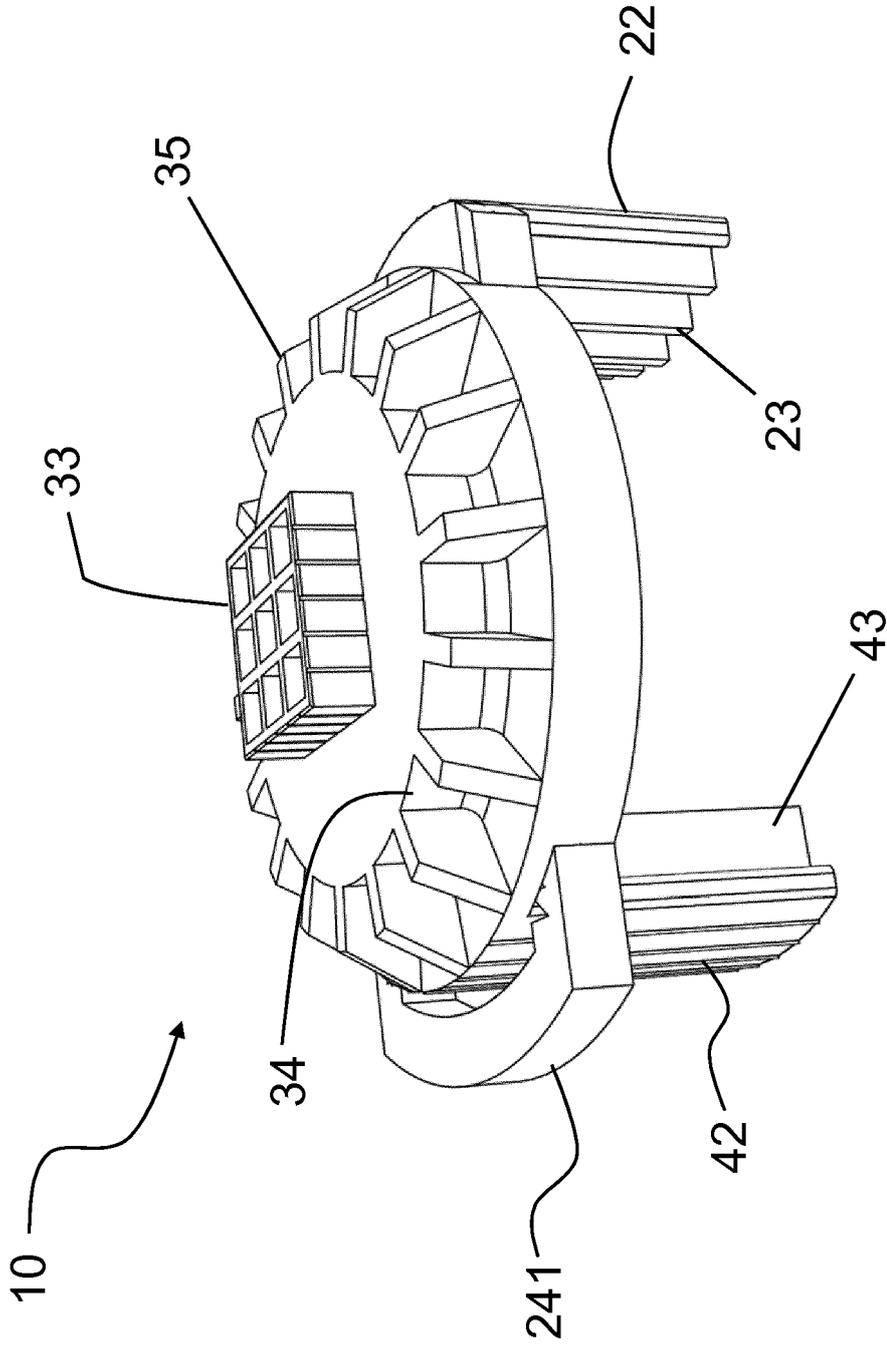


**Fig. 2**

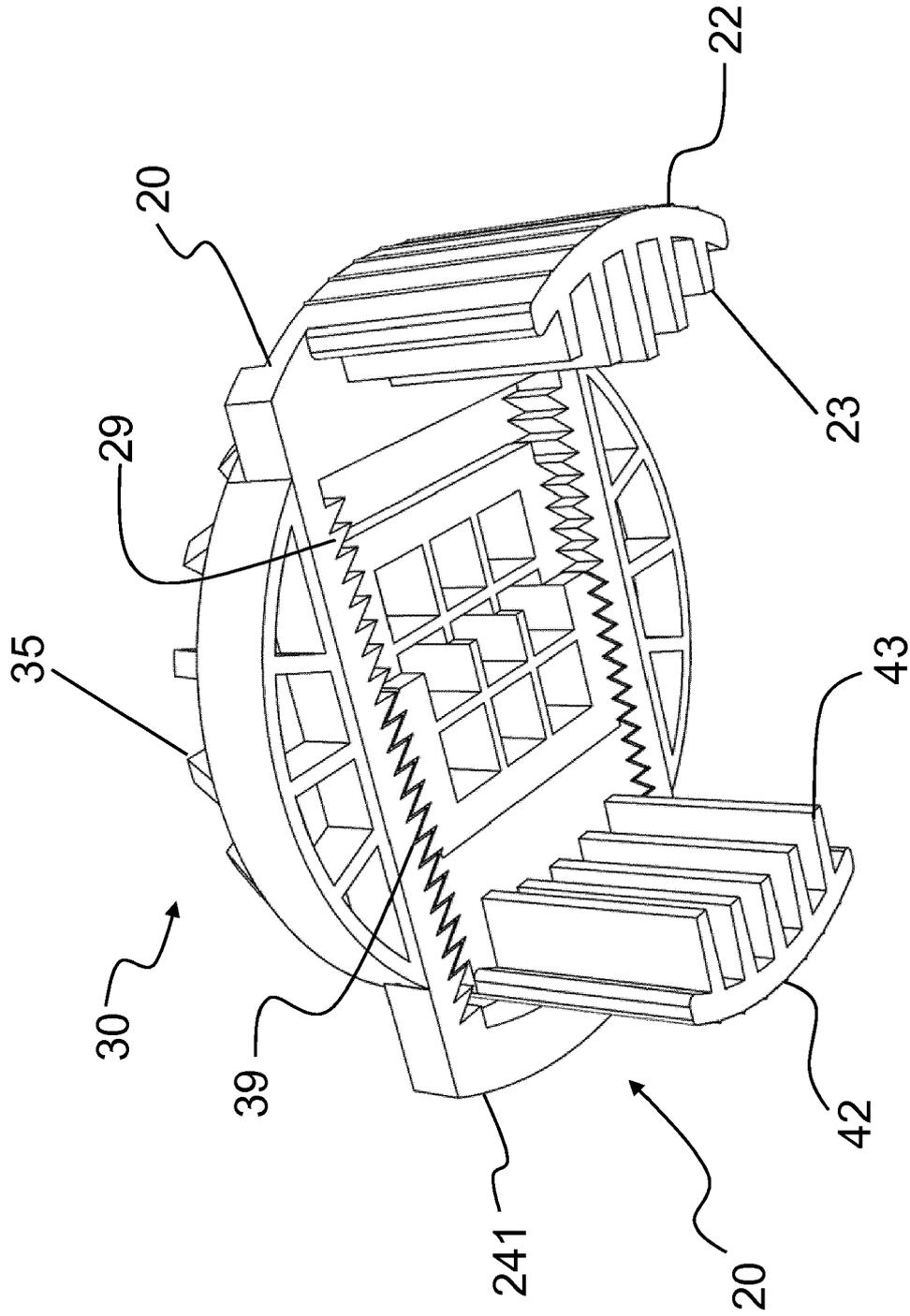
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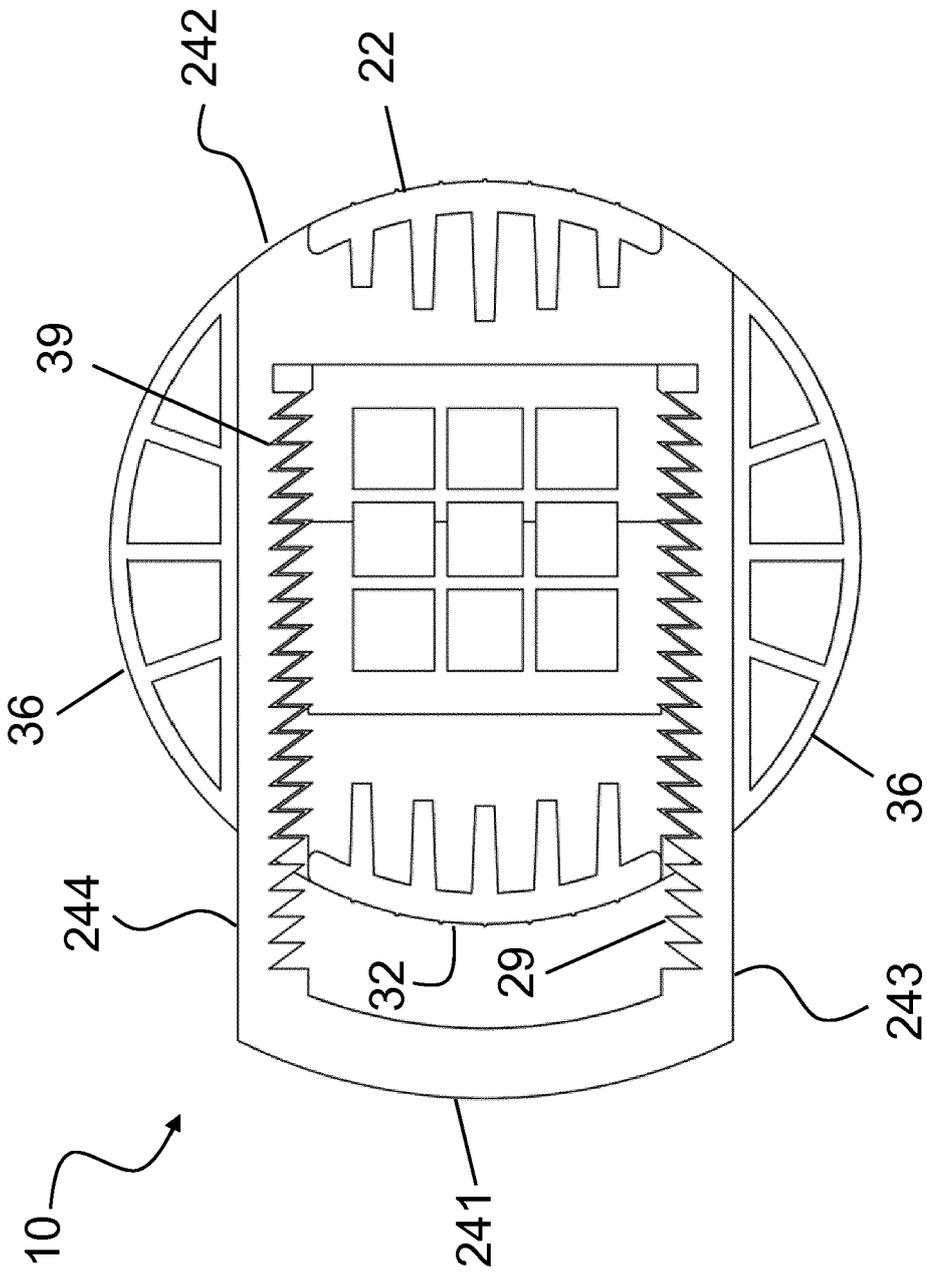
**Fig. 3**



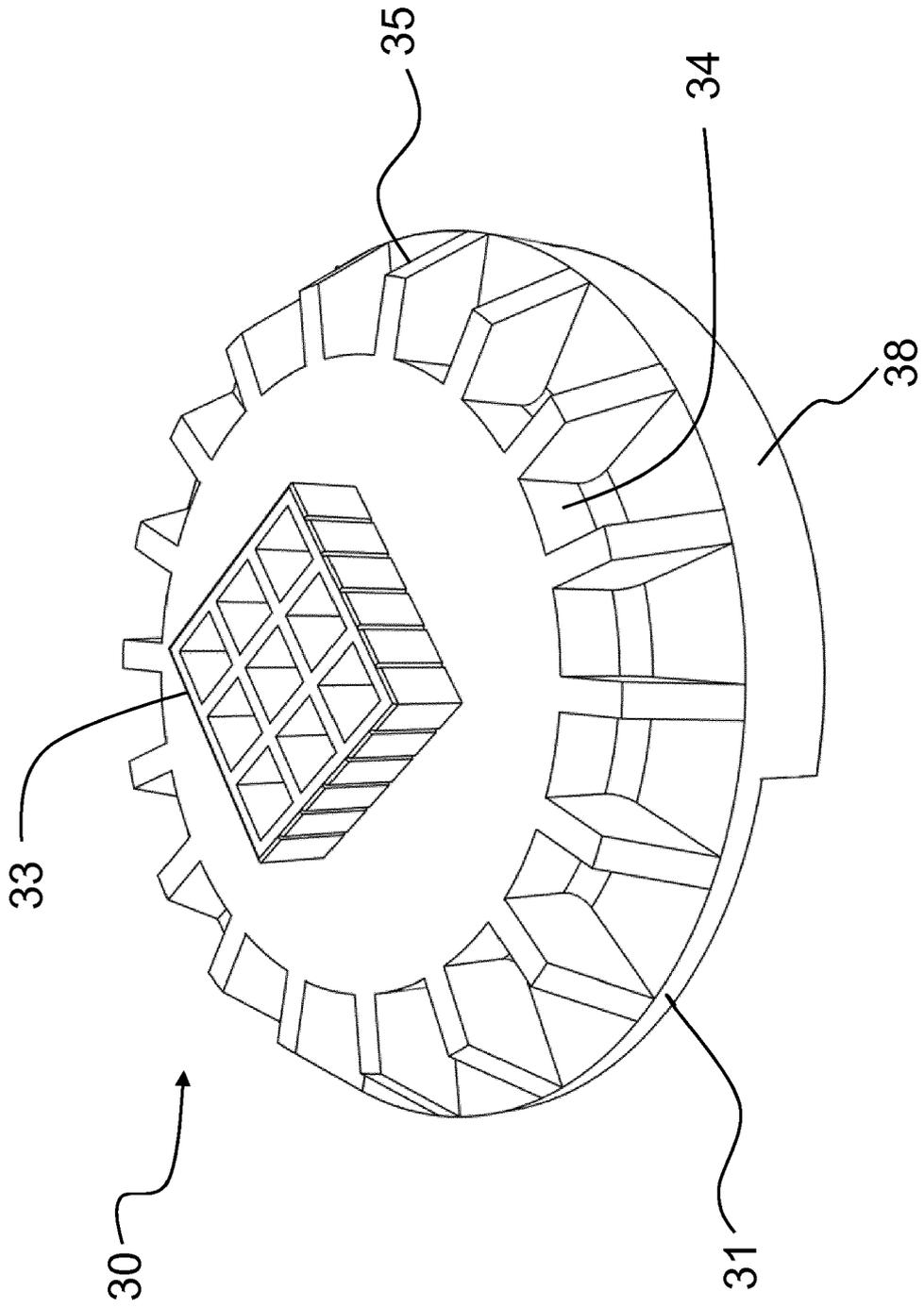
**Fig. 4**



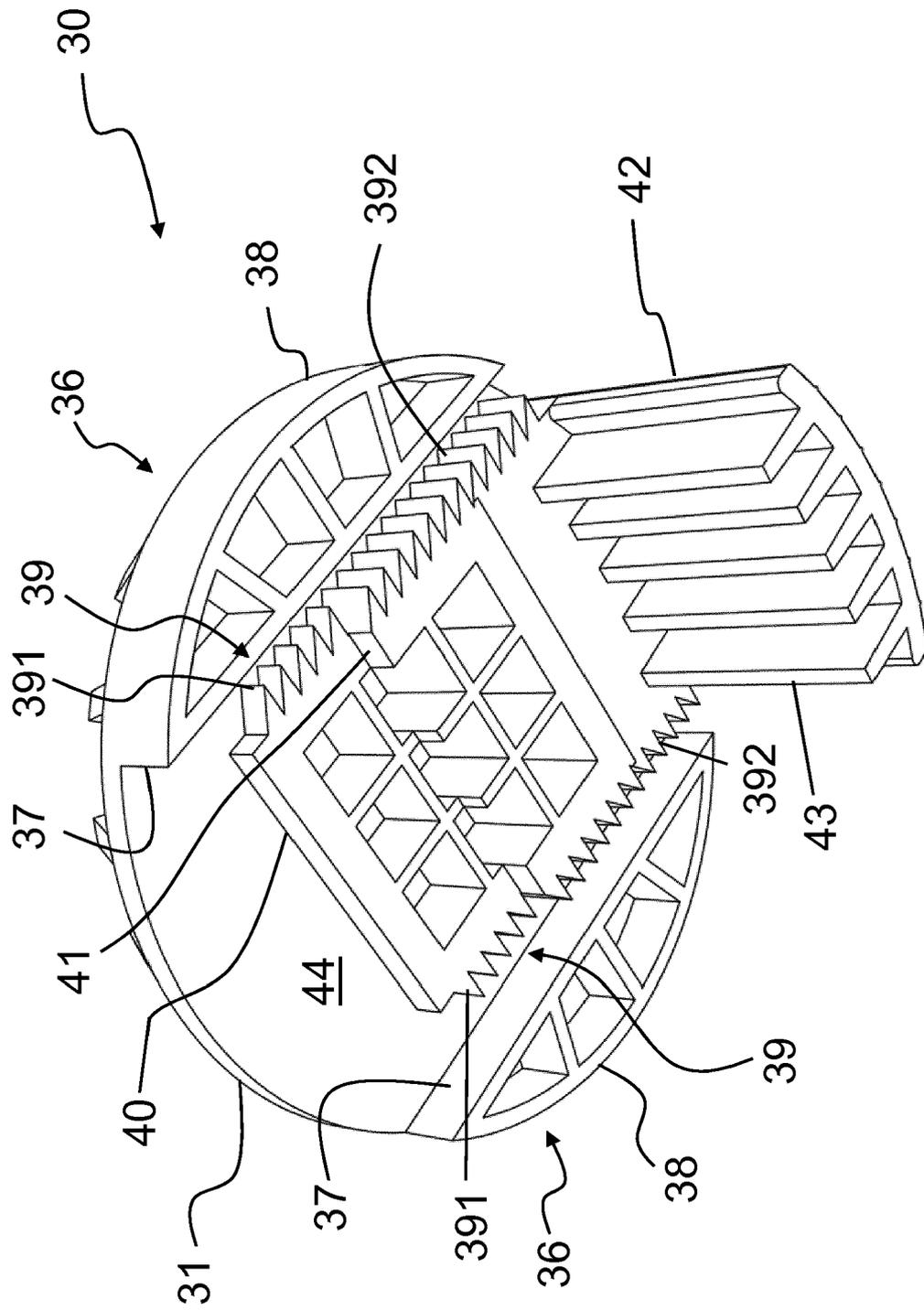
**Fig. 5**



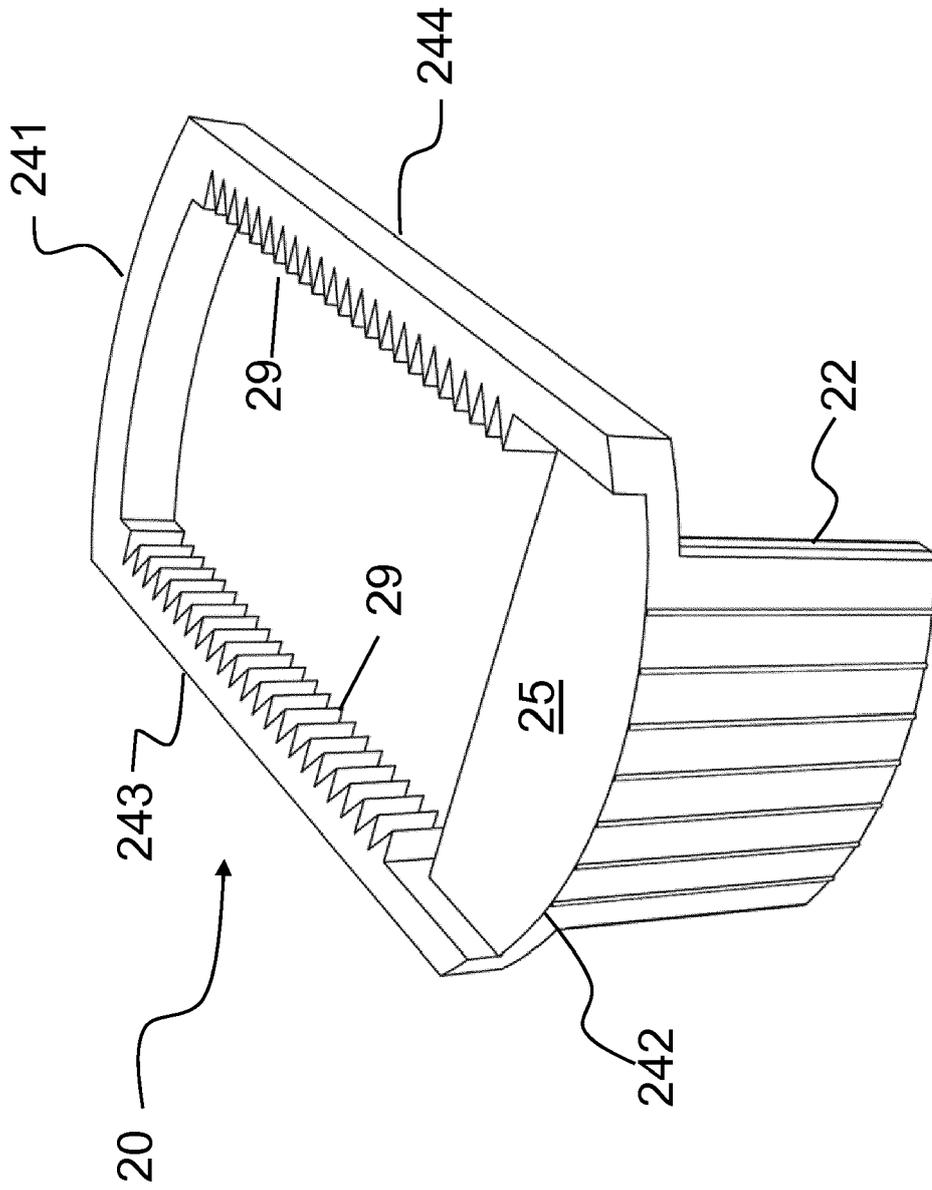
**Fig. 6**



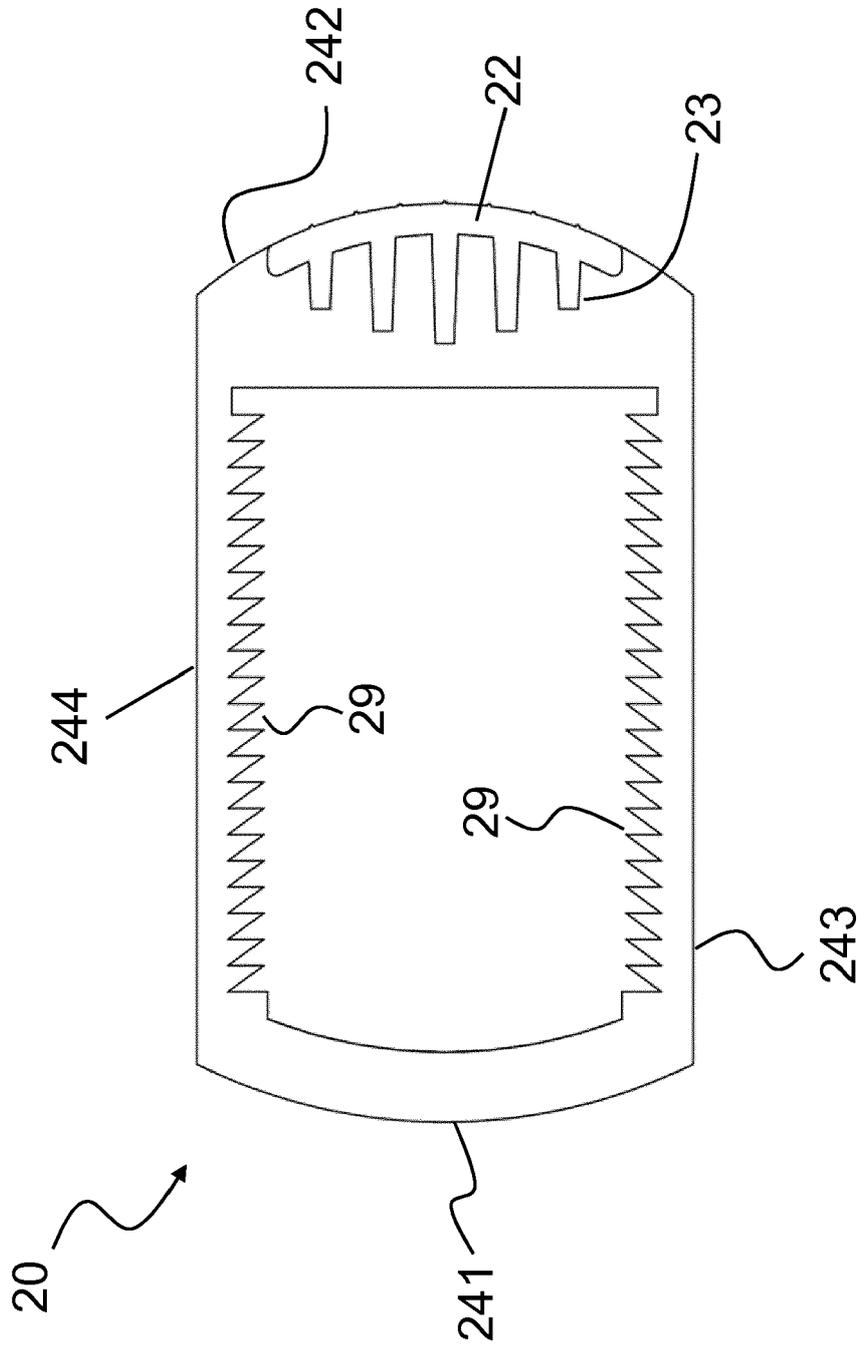
**Fig. 7**



**Fig. 8**



**Fig. 9**



**Fig. 10**



EUROPEAN SEARCH REPORT

Application Number  
EP 19 16 2553

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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			H01F
Place of search		Date of completion of the search	Examiner
Munich		11 July 2019	Tano, Valeria
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
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