(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 626 872 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
14.08.2013 Bulletin 2013/33

(51) Int Cl.:
H01F 27/30 *(2006.01)*

(21) Application number: **13460005.5**

(22) Date of filing: **13.02.2013**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **13.02.2012 PCT/PL2012/000754**

(71) Applicant: **ABB Sp.zo.o.**
04-713 Warszawa (PL)

(72) Inventors:
- **Ciesielski, Slawomir**
  95-100 Zgierz (PL)
- **Sobczyk, Przemyslaw**
  92-414 Lodz (PL)

(74) Representative: **Chochorowska-Winiarska, Krystyna**
ABB Sp. z o. o.,
Ul. Zeganska 1
04-713 Warszawa (PL)

(54) **Transformer windings support**

(57) The subject of the utility model is a support of transformer windings applied in distribution transformers to maintain the proper distance between pressing beams and transformer windings. The transformer winding support is distinctive in that it has the form of a flat block (1) consisting of two separate elements: a wedge (6) and a base (2), which is a guide for the wedge (6) and equipped with a sliding surface (3) which contacts the first contact surface (8) or the second contact surface (8') of the wedge (6).

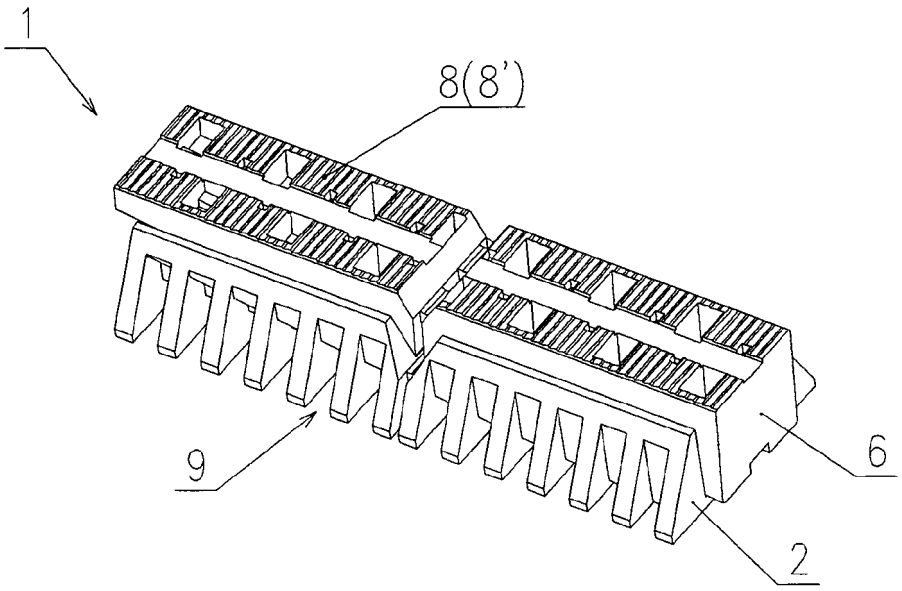

Fig. 1

EP 2 626 872 A1

Description

[0001] The subject of the invention is a support for transformer windings applied in distribution transformers to maintain the proper distance between pressing beams and transformer windings.

[0002] The distribution transformer known from the specification of Polish Patent No. 191667 includes a ferromagnetic core assembly consisting of transformer plates in packets closed with pressing beams, and has windings arranged on the core columns which have cooling ducts. The transformer is equipped with winding supports which are placed between the windings and upper and lower pressing beams. These supports are made of plywood in the form of cuboid insulating pads of fixed thickness. This construction disenables a distance between the pressing beams and windings to be corrected. Moreover, the supports known in the form of cuboid pads, after being placed between the end face of windings and pressing beams, can obstruct the cooling ducts in the windings and then decrease the cooling capacity of the entire unit.

[0003] The essence of the invention is that the winding support has the form of a flat block which consists of two separate elements a wedge and a base. The base is a guide for the wedge and has a sliding surface which is in contact with the first or second contact surface of the wedge. Preferably, the first and second contact surface of the wedge incline to each other at an acute angle α. Preferably, the support has two external supporting surfaces where one of them is created by the external surface of the base while the other surface is created by the first or second contact surface of the wedge. Preferably, the base sliding surface inclines towards the external surface of the base at an acute angle α.

[0004] Preferably, the base has sidewalls limiting the sliding surface constructed from parallel ribs which are allocated perpendicularly along the base length and separated with sidewalls of variable height. Preferably, the base sidewalls have their side edges located within a distance bigger than or equal to a width of the first and second contact surface of the wedge. Preferably, the first contact surface of the wedge has a groove located along an axis of the wedge and the second contact surface has a groove located along an axis of the wedge as well, however, the depth of each groove is different. Preferably, from the first contact surface and the second contact surface of the wedge the cuboid recesses are made alternately located in a row on both sides of grooves formed as cuboid containers which sidewalls and bottoms form an openwork supporting structure of the wedge. Preferably, in the bottoms of each wedge container there are ports. Preferably, the wedge has an edge recess located on the first contact surface and an edge cut-out located on the second contact surface, whereat the edge recess and the edge cut-out are located vis-à-vis and the wedge has a narrowing in the form of a flat bridge which connects the edge recess and the edge cut-out. Preferably, on the base sliding surface there are ports allocated along a longitudinal axis of the base. Preferably, the base has edge recesses located opposite each other in the sidewalls; and a slot located opposite the edge recesses on the side of the base external surface and a narrowing in the sliding surface in the form of a strip connecting the recesses and the slot. Preferably, the sliding surface of the base and the first and second contact surface have irregularities in the form of notches or furrows. Preferably, the base and the wedge are made from a thermoplastic insulating material.

[0005] The Transformer Windings Support as per this invention makes possible the distance between the pressing beams and transformer windings to be fluently adjusted and this is possible because of the two-piece structure of the applied support which enables its height to be changed. Furthermore, since each of the elements of the support can be manually divided, it is possible to create a complete series of support types which can be used in the distribution transformers of different types. The support has an openwork structure and because of this it does not obstruct the escape holes of the winding cooling ducts and does not reduce cooling of the entire unit.

[0006] The subject of the invention is depicted in an example embodiment in drawings where fig. 1 presents the support in an axonometric projection; fig. 2 - the side view of the support located between a pressing beam and windings; fig. 3 - the support base in an axonometric projection; fig. 4 - the top view of the support base; fig. 5 - the support base from fig. 4 demonstrated in the longitudinal section "A-A"; fig. 6 - the support base from fig. 5 in the cross-section "B-B"; fig. 7 - the support base from fig. 5 in the cross-section "C-C"; fig. 8 - the support wedge in an axonometric projection; fig. 9 - the top view of the support wedge; and fig. 10 - the support wedge from fig. 9 in the longitudinal section "D-D".

[0007] The Transformer Windings Support as per this invention constitutes a spatial casting made from a thermoplastic insulating material in a form close to a flat block **1** with sloping chamfered sidewalls divided into two elements where the first constitutes the support base **2,** which is provided with the sliding surface 3 located slantwise in relation to the side edges **4** of sidewalls **5** of the base **2;** and the second constitutes the support wedge **6,** which has the form of longitudinal block equipped with two parallel sidewalls **7** and **7'** shaped as elongated isosceles trapezoids which are connected via their flat walls with the contact surfaces **8** and **8'** of the wedge **6.** The width of the surfaces **8** and **8'** of the wedge **6** is equal or less than a distance **S** between the sidewalls **4** of the base **2.** The sliding surface **3** of the base **2** inclines towards the external surface **9** of the base **2** at an acute angle α. The wedge sliding surfaces **8** and **8'** incline to each other at an acute angle α. Therefore, after placing the wedge **6** between the sidewalls **4** of the base **2** at an appropriate level the Transformer windings support takes the form of a generally flat block **1** with sloping chamfered

sidewalls and two external supporting surfaces where one of them is created by an external surface **9** of the base **2** while the other surface is created by one of the contact surface **8** or **8'** of the wedge **6.** The external supporting surfaces can slide in parallel under the influence of an external force applied to one of the end walls **10, 10'** of the base **2** or **11, 11'** of the wedge **6,** forming a support of adjustable height. The contact surface **8** or **8'** of the wedge **6** has the longitudinal groove **19** or **19',** which guides the wedge along the steel pressing beam during the support installation. The wedge **6** reversed with its shallower groove towards the steel beam causes that the support becomes higher what extends a range of adjustment of the support height. The support can be applied also in case of the pressing beams made of plywood. In this case the support rests on the pressing beam with the entire contact surface **8** or **8'** of the wedge **6.**

[0008] The support base is made from a thermoplastic casting and its sidewalls **5** are constructed from lateral, parallel, ribs **12** which are allocated along the support sidewalls and separated with sidewalls of variable height **13** and integrated with the sliding surface **3** of the base what forms an openwork structure of the support base. The perpendicular ribs **12** in the end view have the shape of isosceles trapezoids which, excepting the first one, are provided with symmetrical rectangular incisions **14, 14'** of variable depth which increases along with the increase of distance from the first rib. The incision profiles are shown on Fig. 6 and Fig. 7. On the sliding surface **3** the ports **15** are allocated along a longitudinal axis of the base **2.** The sliding surface **3** of the base has irregularities **16** in the form of notches or furrows increasing friction. Furthermore, the support base **2** has edge recesses **17** shaped into a "V" form located opposite each other on both sides **5** in the sidewalls; and a slot **17'** located opposite the edge recesses **17** on the side of the base external surface **9.** The bottom edges of the recesses are connected with a narrow strip **18.** The recesses **17, 17'** and the strip **18** enable the base to be broken manually and divided into separate parts which together with the wedge **6** can create the complete series of various support types which can be used in the distribution transformers of different types.

[0009] The wedge is made from a thermoplastic casting with a general contour of a block having two rectangular walls with the contact surfaces **8** and **8',** which are situated in planes inclining to each other at an angle α. On both contact surfaces **8** and **8'** the longitudinal grooves **19, 19'** are made placed centrally along the length of wedge **6.** The depth of the groove **19'** is bigger than the depth of the groove **19.** Furthermore, on each of the surfaces of the wedge **6** there are the cuboid recesses shaped in the form of cuboid containers **20** alternately located in a row on both sides of grooves **19** and **19'.** The sidewalls and bottoms of these containers **20** form the openwork supporting structure of the wedge whereat the bottoms of recesses of one contact surface are located inversely to the bottoms of the other contact surface in each row along the grove **19** and **19'.** The bottoms of containers and parts of walls together with the contact surfaces **8, 8'** constitute the sliding surface of the wedge **6.** Opposite each bottom of one row on the same contact surface the container of the other row is situated with its bottom located on the other contact surface. In the bottom of each container **20** the port **21** is made. Furthermore, the external surface of container bottoms **20** is provided with irregularities **22** in the form of notches or furrows increasing friction. The wedge has the edge recess **23** and edge cut-outs **23'** shaped respectively into the "V" and slot form and allocated opposite each other on both contact surfaces **8** and **8'** accordingly. The bottom edges of cut-outs are connected with the flat bridge **24.** The recesses **23, 23'** and the bridge **24** enable the wedge to be broken manually and divided into smaller elements which after being placed on the base **2** can create the complete series of support types which can be used in the distribution transformers of different types.

List of designations on drawings

1	- Support
2	- Support Base
3	- Base Sliding Surface
4	- Side Edge of Base Sidewall
5	- Base Sidewall
6	- Support Wedge
7, 7'	- Wedge Sidewalls
8	- First Contact Surface of Wedge
8'	- Second Contact Surface of Wedge
9	- External Surface of Base
10, 10'	- Base End-walls
11, 11'	- Wedge End-walls
12	- Base Ribs
13	-Sidewalls Separating Base Ribs
14, 14'	- Base Rectangular Incisions
15	- Ports in Base
16	- Irregularities of Base Sliding Surface
17	- Base Edge Recess
17'	- Base Slot
18	- Strip between Base Recesses
19, 19'	- Wedge Longitudinal Grooves
20	- Wedge Cuboid Recess
21	- Wedge Ports
22	- Irregularities of Wedge Contact Surfaces
23	- Wedge Edge Recess
23'	- Wedge Edge Cut-out
24	- Bridge between Wedge Recesses

Claims

1. The transformer winding support is **characterized in that** it has the form of a flat block (1) consisting

of two separate elements a wedge (6) and a base (2) being a guide for the wedge (6) and equipped with a sliding surface (3) which contacts the first contact surface (8) or the second contact surface (8') of the wedge (6).

2. The support according to Claim 1, wherein the first contact surface (8) and the second contact surface (8') of the wedge (6) incline each other at an acute angle α.

3. The support according to Claim 1 or 2, wherein it has two external supporting surfaces where one of them is created by an external surface (9) of the base (2) while the other surface is created by the first contact surface (8) or the second contact surface (8') of the wedge (6).

4. The support according to Claim 3, wherein the sliding surface (3) of the base (2) inclines towards the external surface (9) of the base (2) at an acute angle α.

5. The support according to Claim 1 or 2, wherein the base (2) has sidewalls (5) limiting the sliding surface (3) constructed from parallel ribs (12) which are located perpendicularly along the base (2) length and separated with sidewalls (13) of variable height.

6. The support according to Claim 5, wherein the sidewalls (5) of the base (2) have their side edges (4) situated within the distance S which is bigger than or equal to a width of the first contact surface (8) and the second contact surface (8') of the wedge (6).

7. The support according to Claim 1 or 2, wherein the first contact surface (8) of the wedge (6) has a groove (19) located along an axis of the wedge (6) and a second contact surface (8') has a groove (19') located along an axis of the wedge (6); however, the depth of grooves (19) and (19') is different.

8. The support according to Claim 7 or 2, wherein from the first contact surface (8) and the second contact surface (8') of the wedge (6) the cuboid recesses are made alternately located in a row on both sides of grooves (19) and (19') in the form of cuboid containers (20) whose sidewalls and bottoms form the openwork supporting structure of the wedge (6).

9. The support according to Claim 8, wherein in the bottom of each container (20) of the wedge (6) there are ports (21).

10. The support according to Claim 1 or 2, wherein the wedge (6) has an edge recess (23) situated on the first contact surface (8) and an edge cut-out (23') situated on the second contact surface (8'), whereat the edge recess (23) and the edge cut-out (23') are located vis-à-vis and the wedge (6) has a narrowing in the form of a flat bridge (24) which connects the edge recess (23) and the edge cut-out (23').

11. The support according to Claim 1, wherein on the sliding surface (3) of the base (2) the ports (15) are allocated along the longitudinal axis of the base (2).

12. The support according to Claim 1, wherein the base (2) has edge recesses (17) located opposite each other in the sidewalls (5); and a slot (17') located opposite the edge recesses (17) on the side of the external base surface (9) and a narrowing in the sliding surface (3) in the form of a strip (18) connecting the recesses (17) and the slot (17').

13. The support according to Claim 1 or 2, wherein the sliding surface (3) of the base (2) and the first contact surface (8) as well as the second contact surface (8') are provided with irregularities (16) and (22) in the form of notches or furrows.

14. The support according to Claim 1 or 2, wherein the base (2) and the wedge (6) are made from a thermoplastic insulating material.

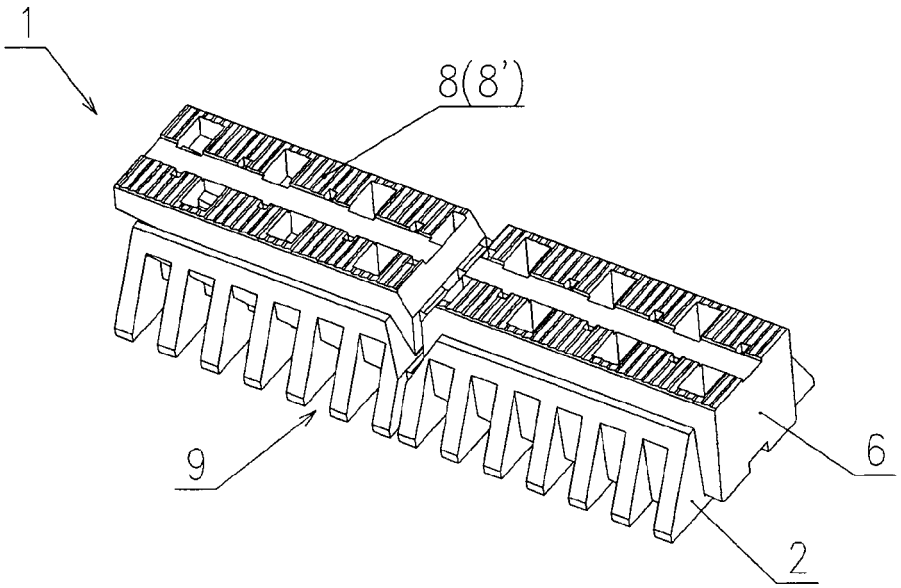

Fig. 1

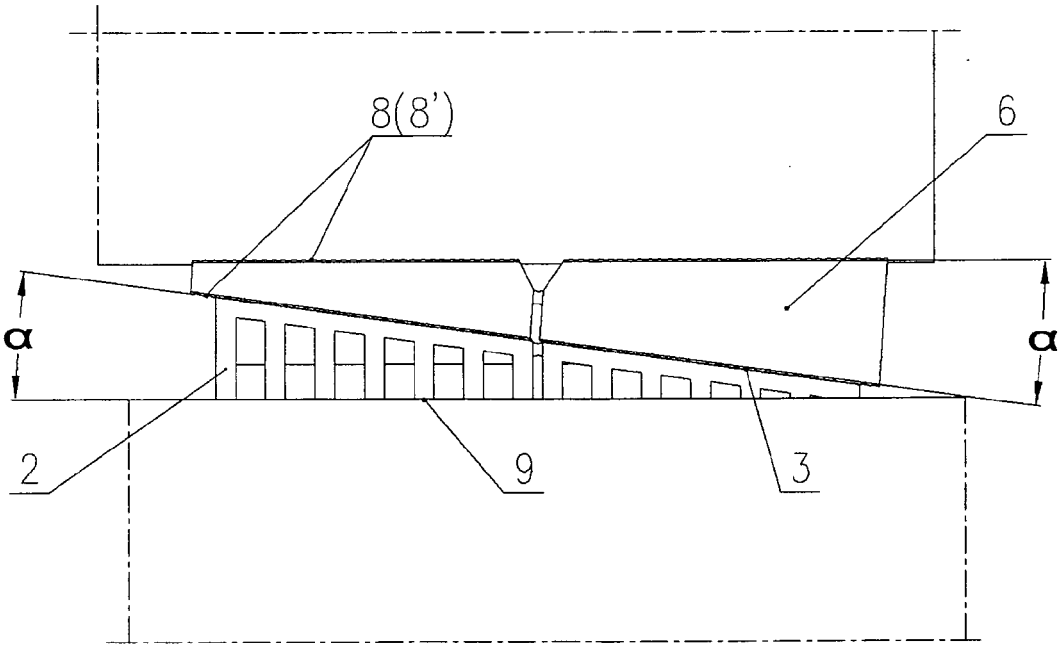

Fig. 2

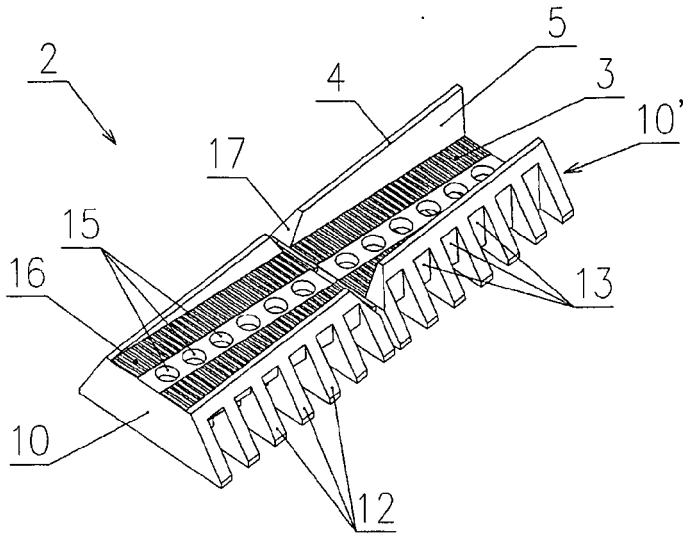

Fig. 3

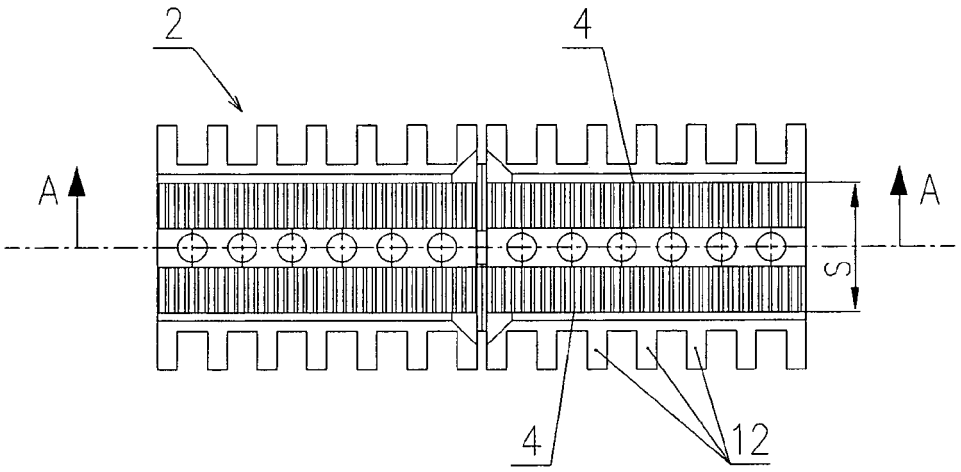

Fig. 4

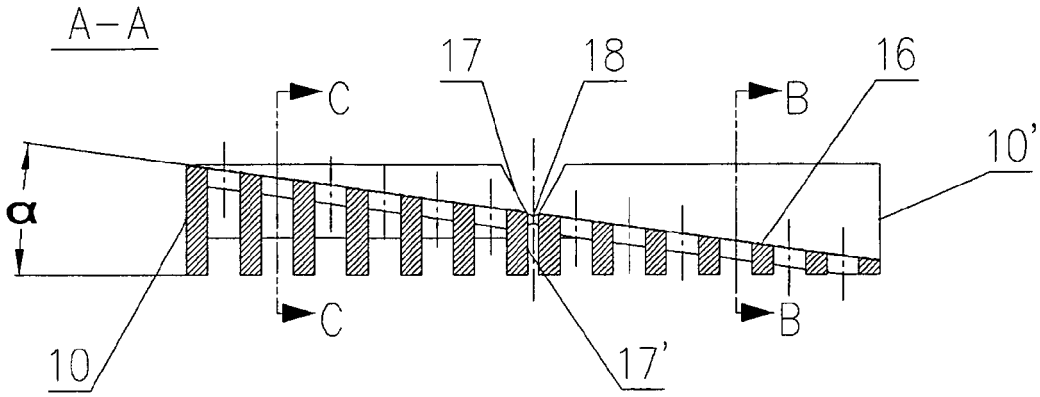

Fig. 5

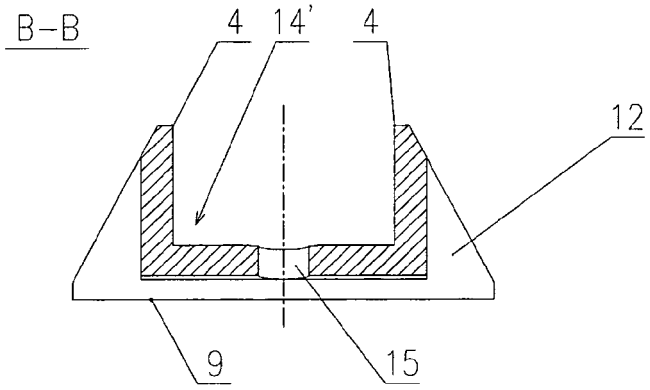

Fig. 6

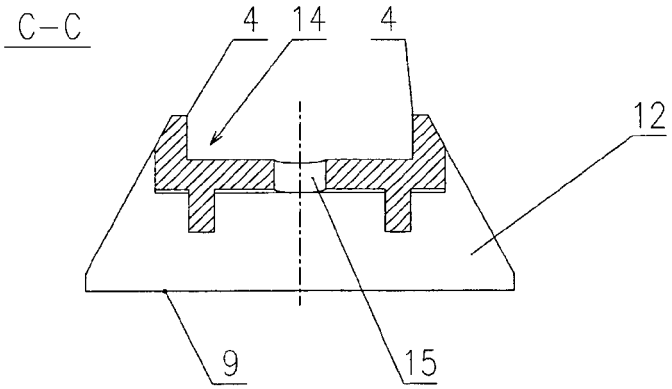

Fig. 7

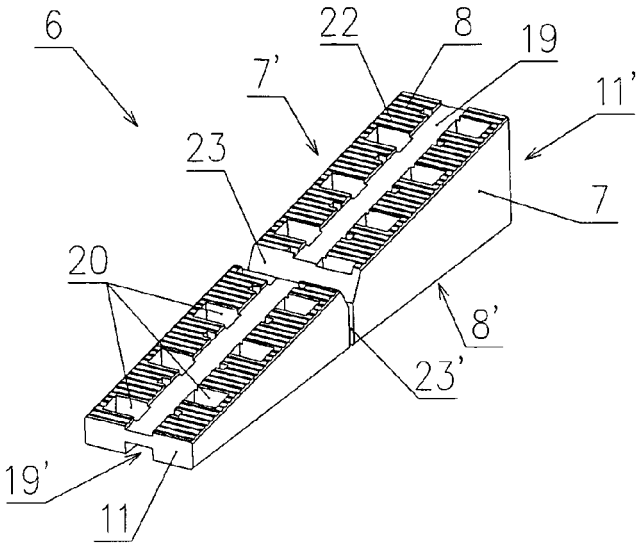

Fig. 8

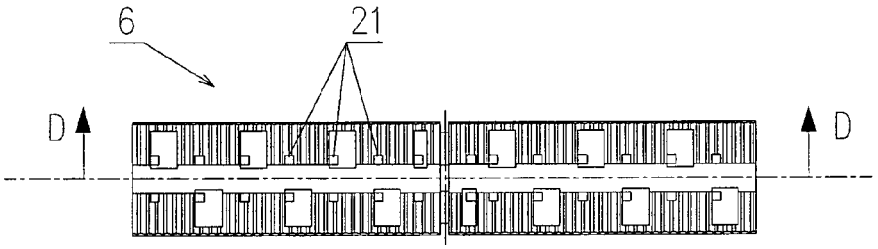

Fig. 9

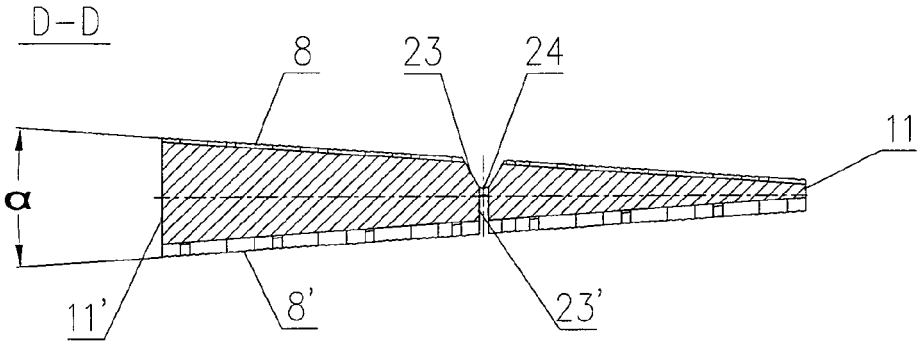

Fig. 10

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 13 46 0005

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	DE 10 2007 034903 A1 (ABB TECHNOLOGY AG [CH]) 5 February 2009 (2009-02-05) * paragraphs [0017] - [0019], [0049] * * figures 1a, 1b * -----	1-4,6 5,7-14	INV. H01F27/30
Y	EP 2 117 019 A1 (ELETTROMECCANICA DI MARNATE S [IT]) 11 November 2009 (2009-11-11) * paragraphs [0001], [0019], [-0021], [0041], [0065]; figures 1, 2, 8, 9 * -----	5,7-14	
A	FR 2 513 431 A1 (FIGEHOLMS BRUK AB [SE]) 25 March 1983 (1983-03-25) * page 1, lines 1-3 * * page 4, line 24 - page 5, line 10 * * page 5, lines 29-34 * * figures 2, 3 * -----	1-14	
			TECHNICAL FIELDS SEARCHED (IPC) H01F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	27 June 2013	Van den Berg, G

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

3

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 13 46 0005

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

27-06-2013

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 102007034903 A1	05-02-2009	NONE	
EP 2117019 A1	11-11-2009	NONE	
FR 2513431 A1	25-03-1983	CA 1206579 A1	24-06-1986
		CH 657716 A5	15-09-1986
		DE 3233920 A1	07-04-1983
		FR 2513431 A1	25-03-1983
		GB 2109639 A	02-06-1983
		SE 428068 B	30-05-1983
		SE 8105642 A	25-03-1983

EPO FORM P0459

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

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- PL 191667 **[0002]**