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(54) **SYSTEM OF CONTACTS FOR AN ON-LOAD TAP CHANGER DEVICE**

(57) The invention relates to a system for associating electrical contacts (1) with the rest of the components of a tap changer device, comprising per phase a first electrical contact (2, 3) associated with a tap (6, 7, 8, 9, 10, 11, 12, 13, 14, 15), a second electrical contact (4, 5) associated with at least one switching means (22, 23), and a third electrical contact (16, 17, 18, 19) associated with at least one tap selection means (20), wherein the first electrical contact (2,3) and second electrical contact (4, 5) are incorporated in a plate (21) leaving at least one of their ends free and in correspondence with the third electrical contact (16, 17, 18, 19) on a longitudinal axis (27) of the first and second electrical contacts (2, 3, 4, 5), the longitudinal axis (27) of the first and second contacts (2, 3, 4, 5) being parallel to an axis (28) of the tap selection means (20).

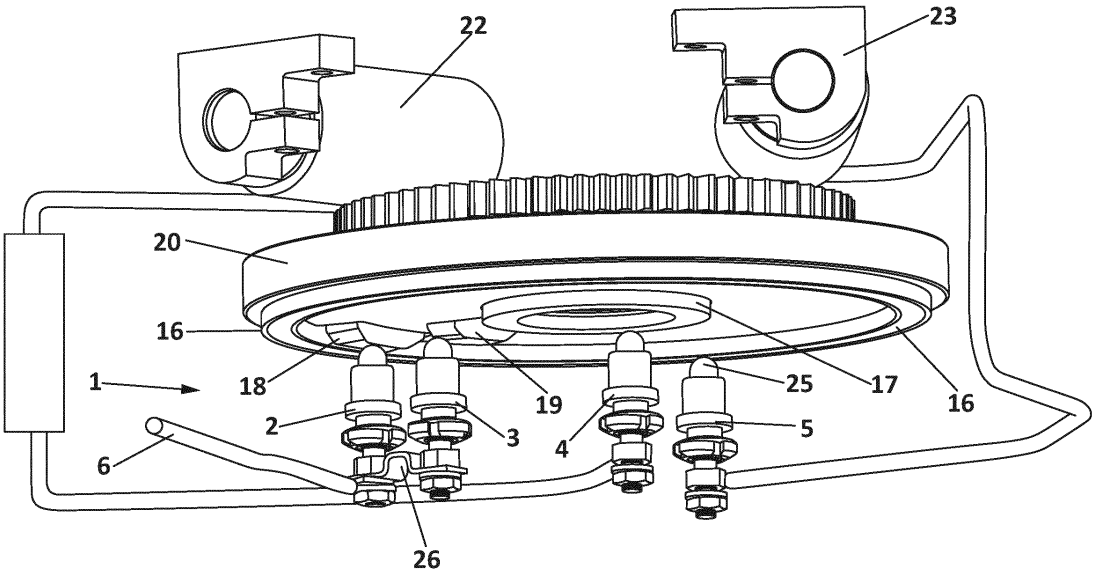

FIG. 1

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Description

Object of the Invention

[0001] The invention relates to a system of electrical contacts for application in on-load tap changer devices, and specifically to the association of these contacts with the rest of the components of the tap changer device, as well as to the arrangement of said contacts which has an effect on the compact size of the tap changer device and on the electrical connection established between same.

Background of the Invention

[0002] A tap changer device for application in transformers can consist of an off-load or on-load tap changer, i.e., it can allow changing taps with the transformer being de-energized or energized. The tap changer device increases or reduces the number of turns of the primary winding by means of the change between taps, thereby changing the transformation ratio, or in other words varying the voltage in the secondary winding of the transformer.

[0003] It is common to use the on-load tap changer device in high/low-voltage distribution transformers, the service of which cannot be interrupted so as to not seriously jeopardize operation of the distribution system and users of the distribution grid.

[0004] A tap changer device, which can be a three-phase or single-phase device, comprises for each phase a plurality of electrical contacts, which are associated with taps, switching means, and at least one selection means for selecting said taps, such that the actuation of the switching means and the actuation of the tap selection means are intrinsically coordinated to perform the connection-disconnection between these electrical contacts and the taps, thereby obtaining the changing of said taps.

[0005] Examples of the state of the art in which the contact or the electrical connection between said contacts is established such that the longitudinal axes of the contacts do not coincide, i.e., for example, in a connection between a first contact and a second contact, the first contact has its longitudinal axis arranged horizontally and that of the second contact is arranged vertically, are known today. The example from patent document WO2013156268A1 or US2014159847A1 can be cited in this sense.

[0006] However, establishing connection between contacts in this way has the drawback of considerably increasing the dimensions of the tap changer device since one of the contacts is arranged with its axis located horizontally and the other one vertically, which requires positioning one of the contacts at the side of the other contact, thereby taking up a larger surface in plan view, which ultimately involves the need for more space to make the connection between contacts. This entails an increase in dimensions of the transformer where the tap changer device is installed, which in turn implies using a larger volume of dielectric fluid, an increase in the total weight of the transformer, the need to use a larger capacity pit for collecting dielectric fluid, etc., which therefore makes it necessary to vary the constructive arrangement of the transformer.

Description of the Invention

[0007] The present invention solves the aforementioned drawbacks by providing a system of contacts for an on-load tap changer device envisaged for being used in a distribution transformer, obtaining as a result a compact tap changer device, having a reduced volume and weight, which allows an automatic voltage control and ultimately does not make it necessary to vary the constructive arrangement of the transformer.

[0008] Specifically, for the purpose of achieving a compact tap changer device, where said device can be a three-phase or single-phase tap changer device, the system of contacts object of the present invention comprises:

- at least a first electrical contact per phase associated with at least one tap also arranged for each phase,
- at least a second electrical contact per phase associated with at least one switching means also arranged for each phase, and
- at least a third electrical contact per phase associated with at least one tap selection means also arranged for each phase.

[0009] Such that the first electrical contact and the second electrical contact are incorporated in a plate fixed to the structure of the tap changer device, leaving at least one of their ends projecting from the fixed plate free, where said plate can be made of insulating material, with said first and second electrical contacts facing and in correspondence with the third electrical contact which is mobile and arranged in the tap selection means. More specifically, the first and second electrical contacts are facing at their free end the third electrical contact on the longitudinal axis of said first and second electrical contacts, whereby being able to establish an axial electrical contact. Likewise, the longitudinal axis of the first and second electrical contacts is parallel to the axis of the tap selection means where the third electrical contact is assembled.

[0010] Therefore, when the longitudinal axes of all the electrical contacts coincide in one and the same direction and the first and second electrical contacts are arranged axially facing the third electrical contact, the need to position the third electrical contact at the side of the first/second electrical contact is prevented. The space required for arranging the electrical contacts in the on-load tap changer device is thereby reduced, and ultimately the dimensions of the latter are reduced, rendering it more compact. Furthermore, due to the reduced size of the first and second electrical contacts, located adjacent to one another, it is possible to incorporate a larger number

of taps in the on-load tap changer device without reducing the safety distance between them.

[0011] Preferably, the electrical contact which is established between the first/second electrical contact and the third electrical contact is axial and sliding, where it is the third electrical contact which slides over the first and second electrical contacts. Said third electrical contact is assembled integrally with the tap selection means comprising a rotational movement. This third electrical contact comprises two contacts with an annular geometry which can be concentric and two other contacts with a geometry in the form of an annular sector, with one of the contacts with an annular geometry being at the same potential as one of the contacts with a geometry in the shape of an annular sector and the other contact with an annular geometry at the same potential as the other contact with a geometry in the shape of an annular sector.

[0012] The first electrical contact, which may comprise a pair of electrical contacts attached by conductive means, and the second electrical contact comprise at least one elastic means, for example, a spring, axially pushing at least one end of said first and second electrical contacts against the third electrical contact, thereby assuring connection between the electrical contacts and at the same time providing mechanical adaptability.

Description of the Drawings

[0013]

Figure 1 shows a perspective view of the system of contacts object of the invention corresponding to a phase of a tap changer device, in which there can be seen at least a first electrical contact associated with a tap, at least a second electrical contact associated with at least one switching means, and at least a third electrical contact associated with a tap selection means, where part of the taps and electrical contacts have been omitted from the drawing for a better view of the system of contacts.

Figure 2 shows an elevational view of an on-load tap changer device with an insulating plate in which there are incorporated for each phase at least a first and second electrical contacts, as well as at least a third electrical contact assembled in a tap selection means also arranged for each phase.

Figure 3 shows an elevational section view of at least a first/second electrical contact facing and in correspondence with at least a third electrical contact on the longitudinal axis of the first/second electrical contact, as well as said axis of the first/second electrical contact parallel to the axis of at least one tap selection means.

Figure 4 shows a top plan view of the tap selection means of the invention, in which at least a third electrical contact is arranged.

Preferred Embodiment of the Invention

[0014] A preferred embodiment referring to the aforementioned drawings is described below, without this limiting or reducing the scope of protection of the present invention.

[0015] The system of contacts (1) for application in a tap changer device, as shown in Figure 1, comprises for each phase at least a first electrical contact (2, 3), which can comprise a pair of contacts attached by conductive means (26) and associated with at least one tap (6, 7, 8, 9, 10, 11, 12, 13, 14, 15) of the tap changer device, a second electrical contact (4, 5) associated with at least one switching means (22, 23), and a third electrical contact (16, 17, 18, 19) associated with at least one tap selection means (20).

[0016] As shown in Figure 2, the first electrical contacts (2, 3) and the second electrical contacts (4, 5) are incorporated in a plate (21) fixed to the structure of the tap changer device, leaving at least one of their ends projecting from said plate (21) free, which plate (21) can be made of an insulating material, with the free end of said first and second electrical contacts (2, 3, 4, 5) facing and in correspondence with the third electrical contacts (16, 17, 18, 19) on a longitudinal axis (27) of the first and second electrical contacts (2, 3, 4, 5), as shown in Figure 3. It can also be observed in said Figure 3 how the longitudinal axis (27) of the first and second electrical contacts (2, 3, 4, 5) is parallel to an axis (28) of the tap selection means (20) comprising a circular shape, thereby achieving an orderly grouping of elements of the system of contacts (1) which finally allows providing a compact tap changer device, having a reduced volume and weight.

[0017] Based on the foregoing, as shown in Figures 1 and 3, the electrical connection of the first and second contacts (2, 3, 4, 5) with the third electrical contacts (16, 17, 18, 19) is axial, given that the first and second contacts (2, 3, 4, 5) comprise a movement in the direction of their longitudinal axis (27) and are facing in the same axial direction the third electrical contacts (16, 17, 18, 19), and furthermore sliding, given that the third electrical contacts (16, 17, 18, 19) slide over the first and second contacts (2, 3, 4, 5), the third electrical contacts (16, 17, 18, 19) comprising a rotational movement as they are integral with the tap selection means (20) having this same movement.

[0018] As can be seen in Figure 4, the third electrical contacts (16, 17) comprise an annular geometry and the third electrical contacts (18, 19) comprise a geometry in the form of an annular sector, with the contacts (16) and (17) being concentric. Electrical contact (16) is at the same potential as electrical contact (18), and electrical contact (17) is at the same potential as electrical contact (19).

[0019] Finally, as shown in Figure 3, the first and second electrical contacts (2, 3, 4, 5) comprise at least one elastic means (24) axially pushing at least one end (25)

of said first and second contacts (2, 3, 4, 5) against the third electrical contact (16, 17, 18, 19), thereby assuring the connection between contacts.

Claims

1. System of contacts (1) for an on-load tap changer device, where the system (1) comprises:

   - at least a first electrical contact (2, 3) per phase associated with at least one tap (6, 7, 8, 9, 10, 11, 12, 13, 14, 15) also arranged for each phase,
   - at least a second electrical contact (4, 5) per phase associated with at least one switching means (22, 23) also arranged for each phase, and
   - at least a third electrical contact (16, 17, 18, 19) per phase associated with at least one tap selection means (20) also arranged for each phase,

   characterized in that the first electrical contact (2, 3) and the second electrical contact (4, 5) are incorporated in a plate (21) fixed to the structure of the tap changer device, leaving at least one of their ends projecting from the plate (21) free, with the free end of said first and second electrical contacts (2, 3, 4, 5) facing and in correspondence with the third electrical contact (16, 17, 18, 19) on a longitudinal axis (27) of the first and second electrical contacts (2, 3, 4, 5), the longitudinal axis (27) of the first and second contacts (2, 3, 4, 5) being parallel to an axis (28) of the tap selection means (20).

2. System of contacts (1) according to claim 1, **characterized in that** the electrical contact of the first and second contacts (2, 3, 4, 5) with the third electrical contact (16, 17, 18, 19) is axial and sliding.

3. System of contacts (1) according to claim 2, **characterized in that** the third electrical contact (16, 17, 18, 19) is mobile and integral with the tap selection means (20) comprising a rotational movement.

4. System of contacts (1) according to claim 3, **characterized in that** the third electrical contact (16, 17, 18, 19) comprises two contacts (16, 17) with an annular geometry and two contacts (18, 19) with a geometry in the form of an annular sector.

5. System of contacts (1) according to claim 4, **characterized in that** the electrical contacts (16, 17) with an annular geometry are concentric, with one of said electrical contacts (16, 17) being at the same potential as the contact (18) with a geometry of an annular sector and the other one being at the same potential as the other contact (19) with a geometry of an annular sector.

6. System of contacts (1) according to claim 2, **characterized in that** the first and second electrical contacts (2, 3, 4, 5) comprise at least one elastic means (24) axially pushing at least one end (25) of said first and second contacts (2, 3, 4, 5) against the third electrical contact (16, 17, 18, 19).

7. System of contacts (1) according to claim 5, **characterized in that** the first electrical contact (2, 3) comprises a pair of contacts attached by conductive means (26).

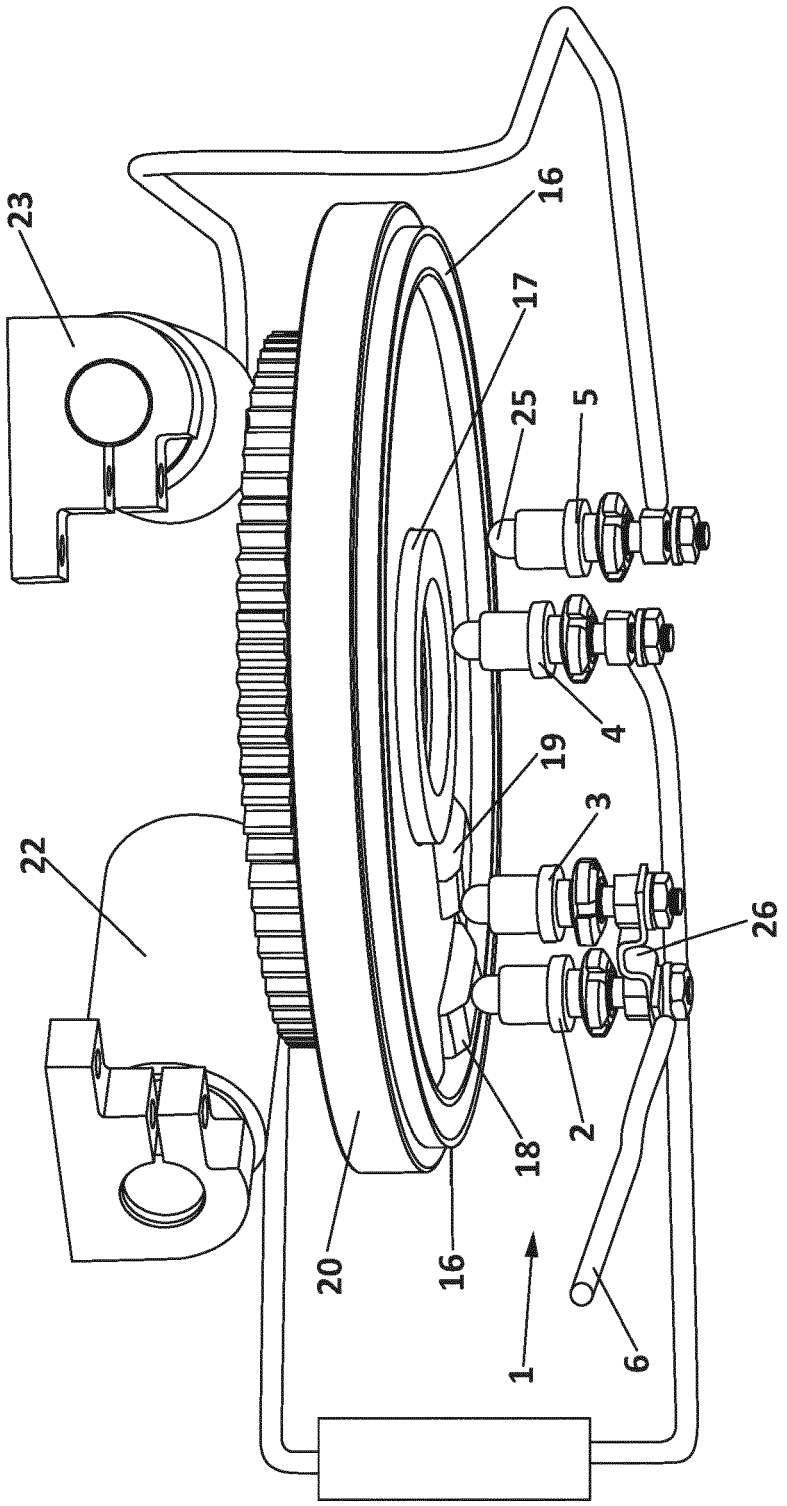

FIG. 1

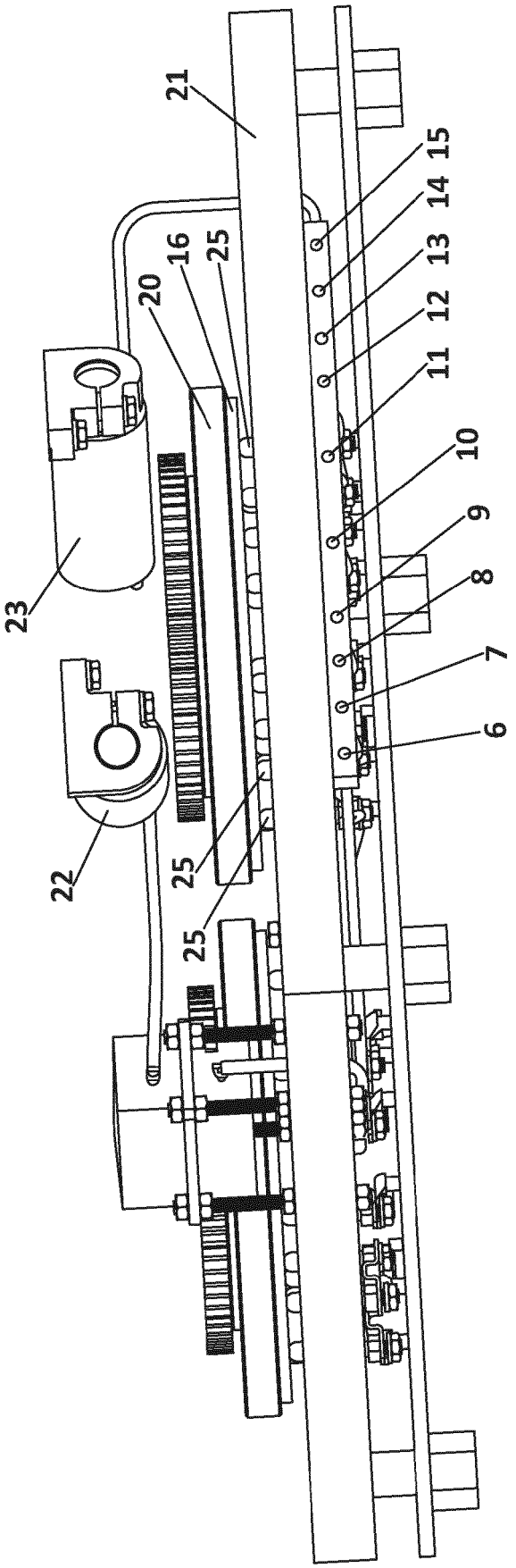

FIG. 2

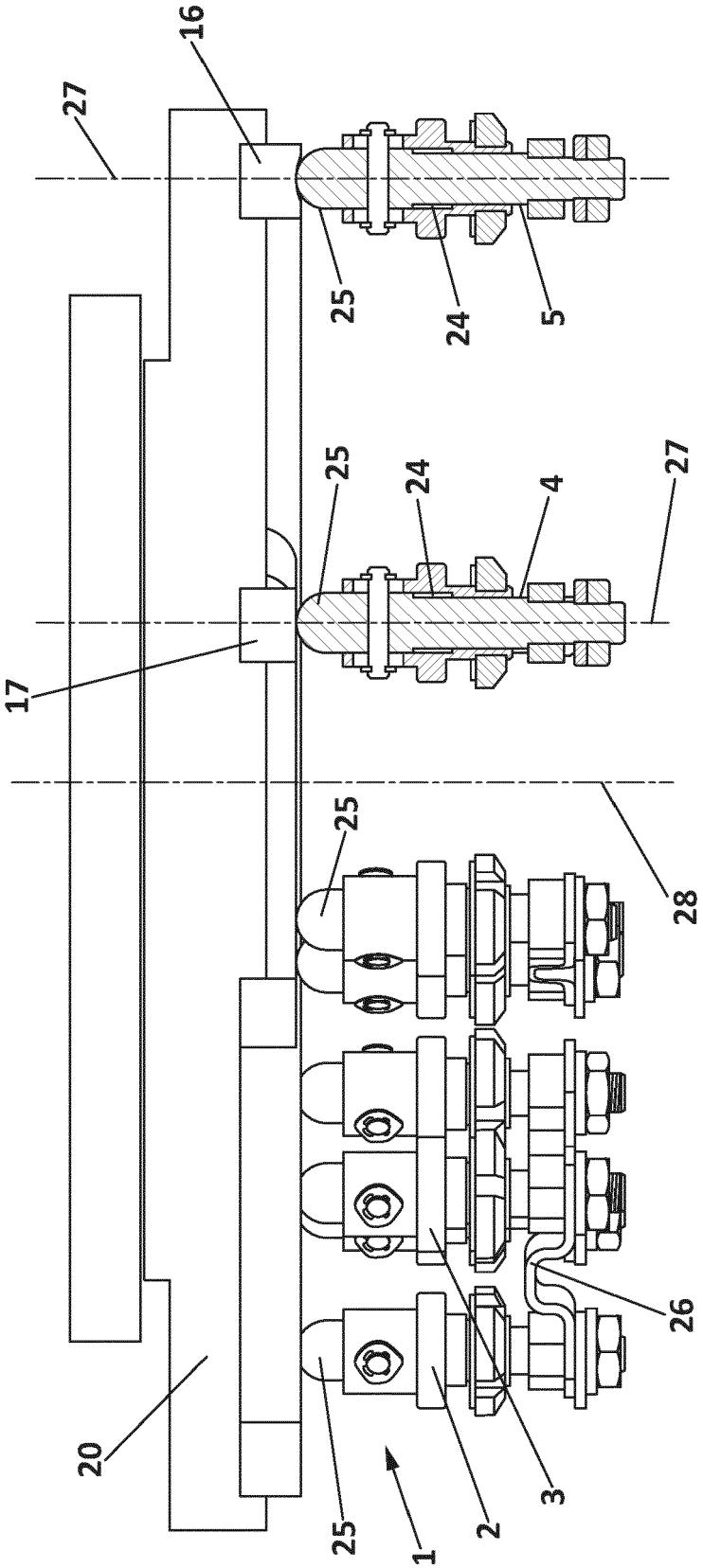

FIG. 3

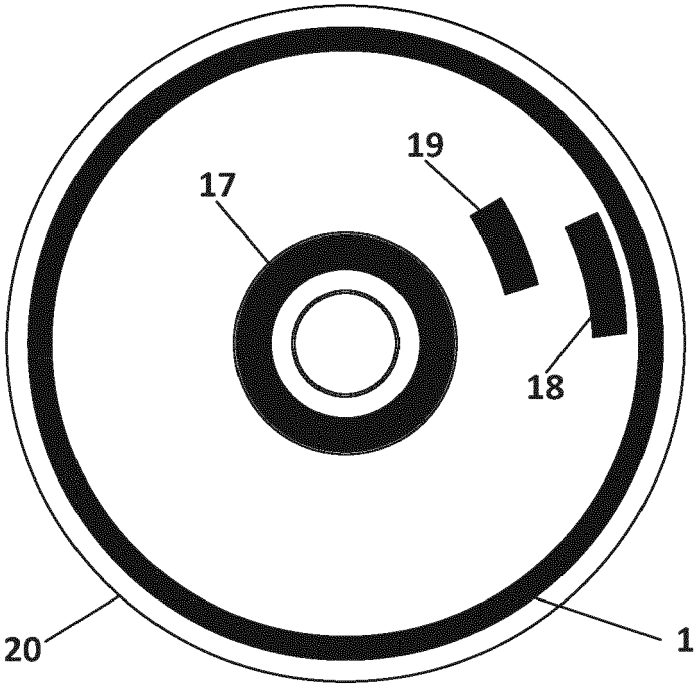

FIG. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 19 38 2453

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	US 2015/311006 A1 (CHEN MIN [GB]) 29 October 2015 (2015-10-29) * page 4, paragraph 0057 - page 6, paragraph 0086; claim 27; figures 3-9,12,13,15 * -----	1-3 4-7	INV. H01H9/00 ADD. H01H1/18 H01H1/56 H01H3/42 H01H3/44
X Y	EP 3 086 343 A1 (ORMAZABAL CORPORATE TECHNOLOGY A I E [ES]) 26 October 2016 (2016-10-26) * page 4, paragraph 0026 - page 5, paragraph 0034; figures 1-4,6,7 * -----	1-3 4-7	
Y A	CN 103 400 715 B (GUIZHOU CHANGZHENG POWER EQUIPMENT CO LTD) 30 September 2015 (2015-09-30) * page 5, paragraph 0040 - paragraph 0047; figures 3-5 * -----	4-7 1-3	
Y A	US 1 867 147 A (ARNOLD HALLER) 12 July 1932 (1932-07-12) * page 1, line 72 - page 3, line 20; figures 1,4,5 * -----	4-7 1-3	TECHNICAL FIELDS SEARCHED (IPC) H01H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	25 September 2019	Pavlov, Valeri

CATEGORY OF CITED DOCUMENTS

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25-09-2019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2015311006 A1	29-10-2015	CA 2892595 A1	12-06-2014
		CN 104995708 A	21-10-2015
		EP 2981982 A2	10-02-2016
		ES 2640323 T3	02-11-2017
		US 2015311006 A1	29-10-2015
		WO 2014087123 A2	12-06-2014
EP 3086343 A1	26-10-2016	AR 104287 A1	12-07-2017
		AU 2016252068 A1	16-11-2017
		BR 112017022703 A2	17-07-2018
		CN 108064409 A	22-05-2018
		EP 3086343 A1	26-10-2016
		EP 3288053 A1	28-02-2018
		ES 2709770 T3	17-04-2019
		PH 12017550120 A1	26-02-2018
		PL 3086343 T3	31-05-2019
		US 2018122591 A1	03-05-2018
		UY 36638 A	30-06-2016
		WO 2016170211 A1	27-10-2016
CN 103400715 B	30-09-2015	NONE	
US 1867147 A	12-07-1932	NONE	

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2013156268 A1 **[0005]**
- US 2014159847 A1 **[0005]**