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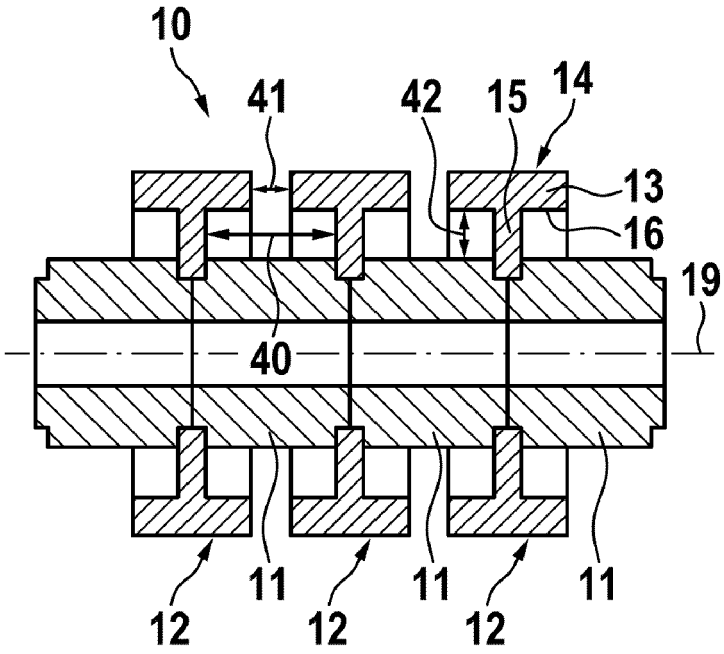
(54) Slipring with increased creepage distance

(57) A slip ring module (10) comprises a body (11) holding a plurality of sliding tracks (12). The sliding tracks have a T-shaped cross-section with a support portion (15) and a contact portion (13) further providing a contact surface (14). A slip ring brush, which may be a wire brush or carbon brush, is sliding on the contact surface to provide contact to the slip ring module which may rotate against the brush. The contact portion is wider than the support portion, resulting in an enlarged creepage distance (40) at the surface of the body. This further results in an increased isolation and life time of the slip ring module.

Fig. 1



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Description

Field of the invention

[0001] The invention relates to slip rings and part thereof. It specifically relates to slip ring modules having an increased insulation and an increased creepage distance. Slip rings are used for transferring electrical signals or power between parts rotating relative to each other. Slip rings generally have circular tracks of an electrically conductive material at a first part and brushes of a further electrically conductive material at a second part where the brushes are sliding at the conductive tracks.

Description of the related art

[0002] A slip ring is disclosed in US 6,283,638 B1. The slip ring comprises a cylindrical slip ring module having cylindrical sliding tracks of a conductive material and brush blocks further comprising brushes for sliding on the sliding tracks. The brush blocks and therefore the brushes are rotatable against the module. The embodiment disclosed in this document specifically has wire brushes comprising a comparatively thin metal wire. The sliding tracks of the module comprise V-shaped grooves to guide the wire at a predetermined position. The creepage distance between neighbored sliding tracks determines the electrical isolation and is mainly given by the distance between neighbored tracks. Therefore, the length of a slip ring module increases with increasing isolation requirements as the creepage distance has to be increased.

[0003] Another slip ring module is disclosed in US 5,734,218. Here, the plurality of metal sliding tracks is pressed into a slip ring module base member. There are barriers between neighboring tracks to hold the tracks in place and to increase the creepage distance and therefore the isolation. The disadvantage of this embodiment is that during insertion of the sliding tracks, the barriers are deformed. This requires a base material having at least a certain degree of resilience. This requires a further support of the slip ring module, as the module body of a resilient material is not sufficiently stiff.

Summary of the invention

[0004] The problem to be solved by the invention is to provide a slip ring module having increased creepage distance between neighboring sliding tracks while providing a high mechanical stability and stiffness of the slip ring module. Furthermore, the manufacturing process should be simple and inexpensive. The slip ring module should have a long life time and preferably a high current-carrying capacity.

[0005] Solutions of the problem are described in the independent claims. The dependent claims relate to further improvements of the invention.

[0006] The slip ring module of a first embodiment comprises a body of an isolating material holding at least one sliding track. The at least one sliding track has a support portion which is held by the body, further supporting a contact portion. The support portion is adjacent to an inner surface of a contact portion which is further opposed to a contact surface. There may be a brush sliding on the contact surface. Preferably, the support portion is distant from the contact portion. Most preferably, only the support portion is in contact with the body, whereas the contact portion has no contact with the body. It is preferred, if there is a gap of more than 0.1 mm, most preferably 1 mm between the inner surface and the body. Preferably, the sliding track has a T-shaped cross-section. Any other shape like an L- or a Z-shape may also be suitable. As the support portions extend from the body, there is a creepage distance defined by the distance along the surface of the body between neighboring support portions of neighboring sliding tracks. Most preferably, the contact portions of the sliding tracks are wider than the support portions, resulting in a smaller distance between neighboring contact portions of neighboring sliding tracks. This results in a lower pitch of the sliding tracks, which means the distance between neighboring sliding tracks is smaller and the slip ring modules can be built more compact. In most applications and also according to many isolation standards, the air gap between neighboring conductors may be smaller than the creepage distance, as material surfaces like the surface of the body are more critical. Such surfaces are subject to contamination, for example by carbon brush wear or other debris, which may reduce the isolation there-between. Therefore it is beneficial to have a creepage distance larger than the air gap between neighboring sliding tracks. Preferably, the creepage distance is 1.3- and 3-times the size of the air gap. Most preferably, the creepage distance is between 1.5- and 2.5-times the size of the air gap.

[0007] In most slip ring designs, the width of the contact surface of a sliding track is determined by current-carrying characteristics of the contact surface. If a certain number of wires or a certain size of carbon brushes is running on a sliding track, a certain width is required. Furthermore, the width of the sliding track is often determined by the current-carrying capacity through the sliding track itself. This is specifically critical with large diameter slip rings having a significant length of the sliding tracks. Here, a long sliding track has a significant resistance causing voltage drop and dissipation of power. By the support portion, which preferably is of the same material as the contact portion, and which preferably is of the same piece as the contact portion, the current-carrying capacity can be significantly increased and the resistance and therefore also the power dissipation can be decreased. Therefore, slip ring modules and sliding tracks according to this embodiment are suitable to higher current-carrying capacity than the slip ring modules known from prior art. A further benefit is that besides a generally lower heat dissipation due to the lower resistance, there is a better dissipation of the generated heat

due to a higher radiation surface which increases radiation and convection. Furthermore, there is a better air flow at the outer side of the contact portion and in addition at the inner surface of the contact portion, which further helps to dissipate heat from the sliding tracks and the slip ring module. Due to an airstream at the inner side of the contact portion, and therefore between the contact portion and the surface of the body, removal of debris from the surface of the body is further improved, which results in a longer lifetime and higher isolation.

[0008] In a preferred embodiment, a slip ring module comprises a plurality of body segments and a plurality of sliding tracks. Preferably, one sliding track is held by one body segment. Preferably, the body segments are designed such that they can be stacked together for obtaining slip ring modules with a plurality of sliding tracks. Preferably, the width of the body segments is such that the required creepage distance between neighboring sliding tracks is predetermined. In an alternate embodiment, there may be plurality of sliding tracks held by a body segment.

[0009] According to another embodiment, in an alternating manner body segments and sliding tracks may be stacked together. This may result in a sequence of body segments and sliding tracks. It is preferred if a body segment comprises means for holding at least one sliding track. Such means may be a groove.

[0010] In another embodiment, sliding tracks are cast or molded into a body.

[0011] In another embodiment, a means for blowing air or another cooling medium in between the tracks is provided. Such a means may be a fan or a pump. There may be a pipe or a duct for guiding the air flow.

[0012] Another embodiment relates to a slip ring having at least one slip ring module as disclosed herein, and at least one sliding brush which may be held by a brush block. The at least one sliding brush is sliding on at least one of the sliding tracks to allow the transfer of electrical current.

[0013] A method for manufacturing a slip ring module comprises the step of providing at least one sliding track having a support portion and a contact portion with a contact surface, wherein the width of the support portion is less than the width of the contact portion, casting the at least one sliding track into a slip ring module body.

[0014] According to another embodiment, a method for providing a slip ring module may comprise providing at least one body segment having a body of an insulating material and a sliding track, wherein the width of the support portion is less than the width of the contact portion, casting the at least one sliding track into a slip ring module body.

[0015] Further steps may comprise stacking a plurality of such body segments to a slip ring module.

[0016] A further method for providing a slip ring module may be stacking a sequence of at least one body segment, a sliding track, and another body segment, which may be followed by further sliding tracks and body segments.

Description of Drawings

[0017] In the following the invention will be described by way of example, without limitation of the general inventive concept, on examples of embodiment with reference to the drawings.

Figure 1 shows a first embodiment with sliding tracks held in body segments.

Figure 2 shows a front view of the first embodiment.

Figure 3 shows a second embodiment with sliding tracks cast into a body.

Figure 4 shows a front view of the second embodiment.

Figure 5 shows a further embodiment with L-shaped sliding tracks.

Figure 6 shows another embodiment with further increased creepage distance.

Figure 7 shows a slip ring module with a brush block holding brushes.

[0018] In Figure 1 a first embodiment is shown. A slip ring module 10 with sliding tracks 12 is held by body segments 11. A plurality of body segments 11 are stacked together to form a slip ring module body. These body segments hold a plurality of sliding tracks 12. Each sliding track is a ring-shaped member preferably having a T-shaped cross-section. Each sliding track comprises a support portion 15 which is held by the body segments 11, and a contact portion 13, further having a contact surface 14 for contacting a sliding brush. It is preferred, if the support portion is of the same material as and most preferably one piece with the contact portion. Opposing to the contact surface 14 and adjacent to the support portion 15 there is an inner surface 16 of the contact portion 13, which has a distance of at least 0.1 mm to the body segments 11. Along the surface of the body segments 11 and between neighboring sliding tracks 12, there is a creepage distance 40. Between the contact portions 13 of neighboring sliding tracks, there is an air gap 41. In this embodiment, the creepage distance 40 is larger than the air gap 41. This results in a comparatively compact slip ring module having a high current-carrying capacity and a high isolation. Preferably, the creepage distance is 1.3- and 3-times the size of the air gap. Most preferably, the creepage distance is between 1.5- and 2.5-times the size of the air gap. The slip ring module may rotate around a rotation axis, which preferably is also the center axis 19 of the slip ring module. Preferably, at least the contact surface of the sliding tracks is rota-

tionally symmetrical to the center axis 19. It is further preferred, if the body and most preferably the whole slip ring module is at least approximately rotationally symmetrical to the center axis 19.

[0019] In Figure 2, a front view of the first embodiment is shown. Here, it is shown, that the sliding tracks are rotationally symmetrical around a center axis 19.

[0020] Figure 3 shows a further embodiment of a slip ring module 20, where the sliding tracks 12 are cast into a body 21. Preferably, the body 21 comprises an isolating material like a plastic material, which most preferably is stiff enough to hold the sliding tracks in place. As shown in this embodiment, the sliding tracks may extend through the body 21 into a hollow inner space, where they may be contacted by cables or wires.

[0021] In Figure 4, a front view of the second embodiment is shown. Here, it is shown, that the sliding tracks are rotationally symmetrical around a center axis 19.

[0022] In Figure 5, a further embodiment with L-shaped sliding tracks is shown. Such L-shaped sliding tracks may be combined with all embodiments disclosed herein.

[0023] In Figure 6 shows another embodiment with further increased creepage distance is shown. Here, grooves 23 are provided in the surface of the body, further increasing the creepage distance.

[0024] In Figure 7, a slip ring module with a brush block holding brushes is shown. The slip ring module 10 comprises a plurality of sliding tracks as disclosed herein. The sliding tracks may be contacted by a plurality of module wires or module cables 18, which preferably are soldered, welded or screwed to the support portions of the sliding tracks. Due to the support portions being distant from the contact surface of the sliding tracks, soldering or welding can easily be done without damaging the sensitive contact surface of the sliding tracks. Furthermore, a brush block 30 is disclosed having a plurality of brushes 31. Each of the brushes is in contact with one sliding track of the module. The brushes 31 may be held by a printed circuit board 36 which further may comprise conductor tracks for connecting the brushes to a brush block cable connector 37 which is further connected to a brush block cable 38.

List of reference numerals

[0025]

10 slip ring module
11 body segment
12 sliding track
13 contact portion
14 contact surface
15 support portion
16 inner surface
18 module cable
19 center axis
20 slip ring module
21 body
23 grooves
30 brush block
31 brush
36 printed circuit board
37 brush block connector
38 brush block cable
40 creepage distance
41 air gap
42 radial gap

Claims

1. Slip ring module (10, 20) comprising a body (11, 21) holding at least one sliding track (12),
characterized in that
the at least one sliding track has a contact portion (13) further having a contact surface (14), an inner surface (16) opposing thereto and a support portion (15) adjacent to the inner surface (16) which is held by the body (11, 21), wherein the width of the support portion is less than the width of the contact portion and a radial gap (42) is provided between the inner surface and the body (11, 21).

2. Slip ring module according to claim 1,
characterized in that
the contact portion (13) is of the same material as the support portion (15).

3. Slip ring module according to any one of the previous claims,
characterized in that
that the contact portion is one piece with the support portion.

4. Slip ring module according to any one of the previous claims,
characterized in that
the at least one sliding track has a T-shaped cross-section.

5. Slip ring module according to any one of the previous claims,
characterized in that
the creepage distance (40) between neighboring support portions is larger than the air gap between neighboring contact portions.

6. Slip ring module according to claim 5,
characterized in that
the distance between neighboring support portions is between 1.3- and 3-times larger than the air gap between neighboring contact portions.

7. Slip ring module according to claim 5,
characterized in that
the distance between neighboring support portions

is between 1.5- and 2.5-times larger than the air gap between neighboring contact portions.

8. Slip ring module according to any one of the previous claims,
characterized in that
the width of the radial gap (42) is more than 0.1 mm.

9. Slip ring module according to any one of the previous claims,
characterized in that
the body comprises a plurality of body segments (11).

10. Slip ring module according to any one of the previous claims,
characterized in that
at least one groove is provided in the surface of the module.

11. Method for providing a slip ring module by providing at least one sliding track (12) having a contact portion (13) and a support portion (15), further holding the support portion (15) by a body (11, 21).

Fig. 1

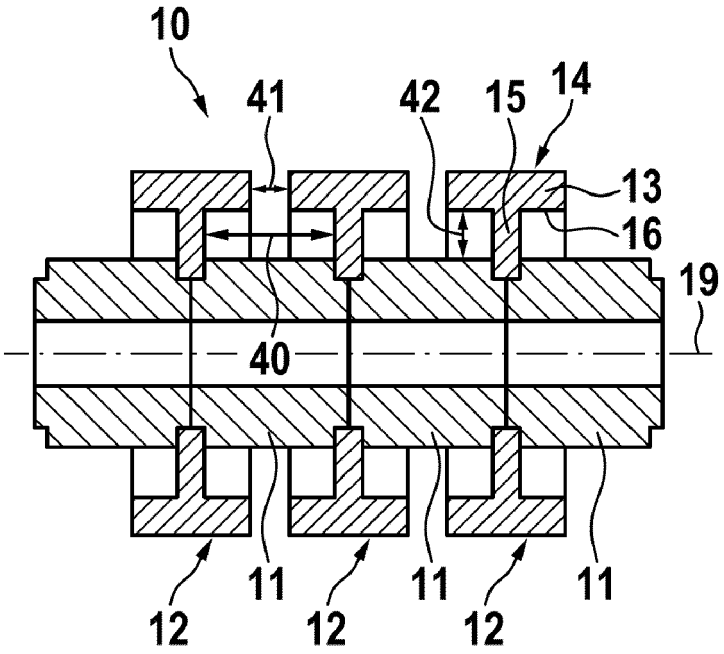


Fig. 2

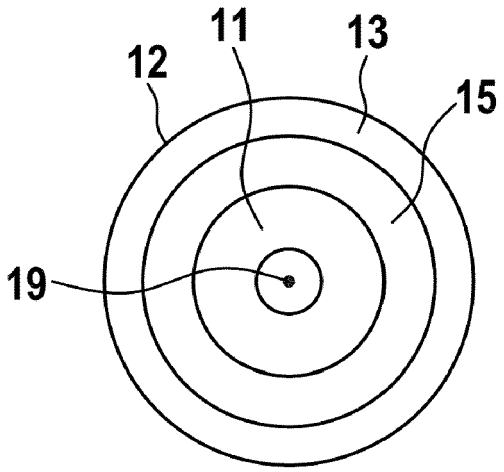


Fig. 3

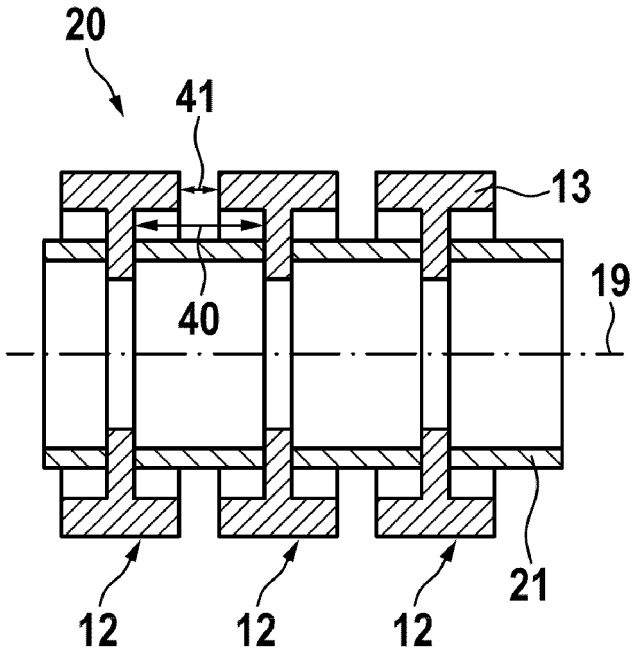


Fig. 4

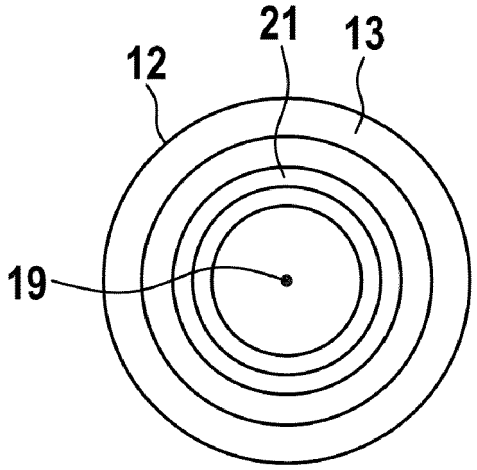


Fig. 5

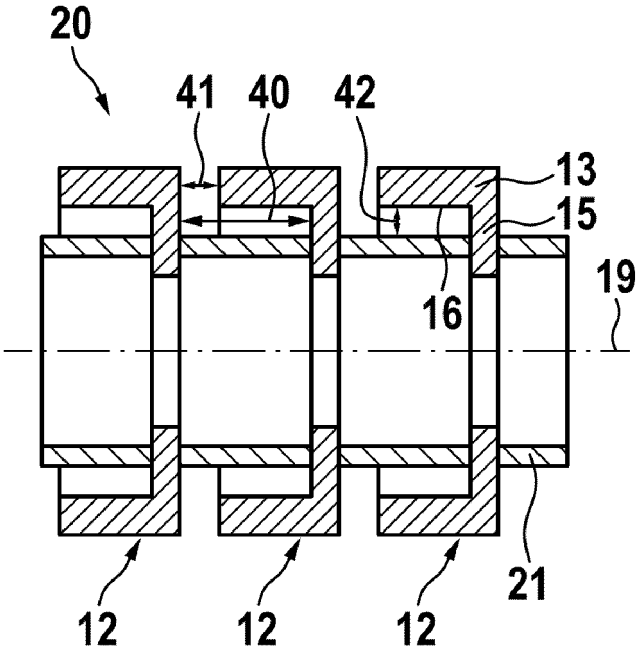


Fig. 6

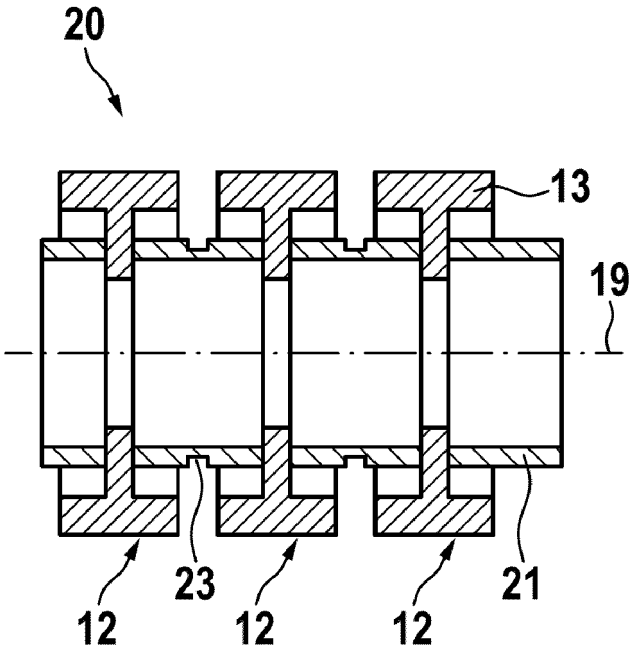
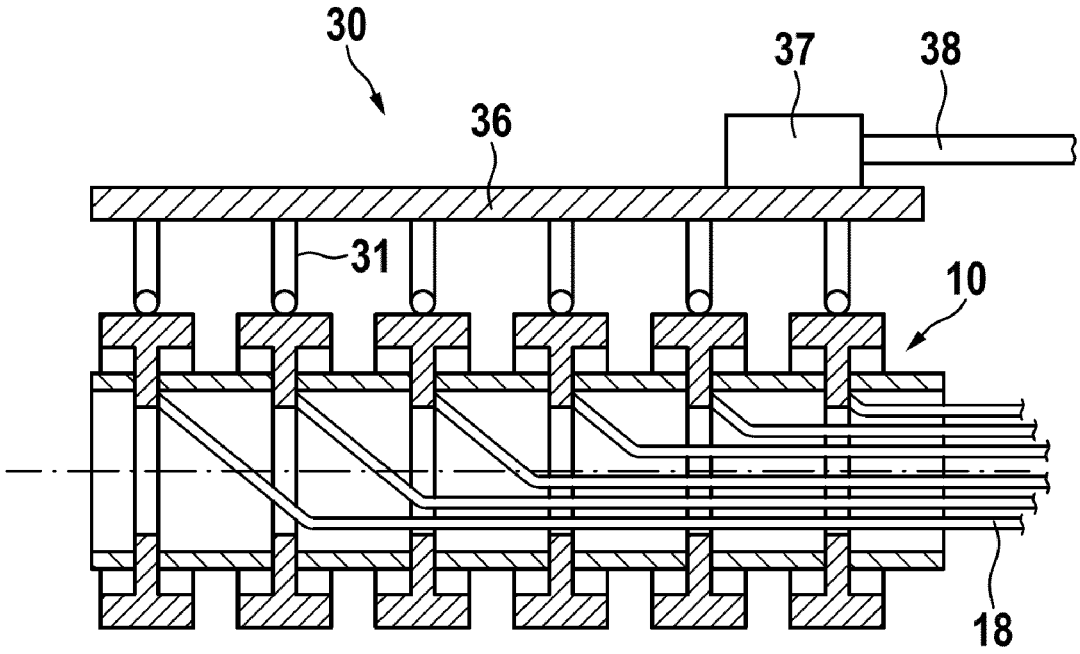


Fig. 7



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EUROPEAN SEARCH REPORT

Application Number
EP 14 19 2687

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	GB 154 878 A (LOECKNITZER EISENWERK GES MIT) 7 April 1921 (1921-04-07) * page 1, line 36 - line 50; figures 1,2 * -----	1-11	INV. H01R39/08 ADD. H01R43/10
X	US 1 378 049 A (MILLS CHESTER B) 17 May 1921 (1921-05-17) * page 1, line 50 - line 85; figure 2 * -----	1-11	
X	FR 401 241 A (JACQUET FRERES SOC [FR]) 21 August 1909 (1909-08-21) * page 1, line 42 - page 2, line 58; figure 2 * -----	1-11	
X	US 1 756 004 A (BARR JOHN M ET AL) 22 April 1930 (1930-04-22)	11	
A	* figure 1 * -----	1-10	
			TECHNICAL FIELDS SEARCHED (IPC) H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	28 April 2015	Philippot, Bertrand

CATEGORY OF CITED DOCUMENTS

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28-04-2015

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 154878 A	07-04-1921	CH 88279 A	16-02-1921
		GB 154878 A	07-04-1921
US 1378049 A	17-05-1921	NONE	
FR 401241 A	21-08-1909	----------	
US 1756004 A	22-04-1930	NONE	

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

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Patent documents cited in the description

- US 6283638 B1 **[0002]**
- US 5734218 A **[0003]**