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(54) **Interrupter insert for a circuit breaker arrangement**

(57) Interrupter insert for a circuit breaker arrangement comprising a cylindrically shaped insulating part (1), within which a pair of corresponding electrical contact pieces (3a, 3b) are coaxially arranged and are concentrically surrounded by a shield (6) between the contact pieces (3a, 3b) at one side and an inner wall (7) of the insulating part (1) at the other side, wherein on both front

ends of the shield (6) an annular gap (8a, 8b) to the inner wall (7) is provided, wherein each annular gap (8a; 8b) is at least partly filled with a brazing material (9) in order to permanently attach the shield (6) on both front ends to the inner wall (7) of the insulating part (1) by brazing to an inner oriented metallization or by direct active brazing to the ceramic body.

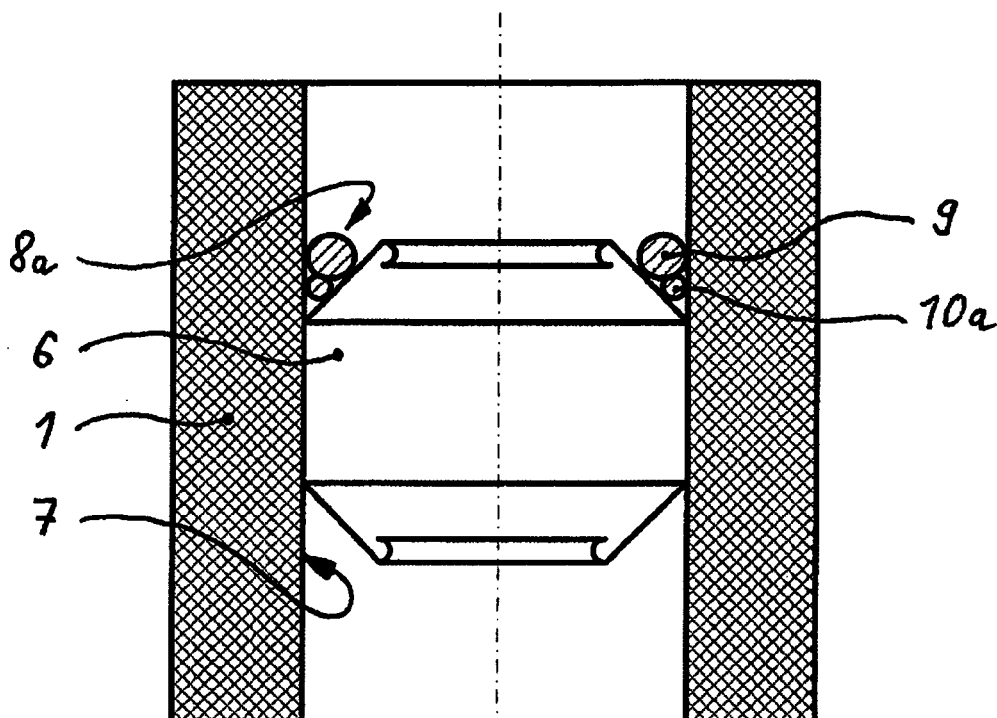


Fig.2

Description

Field of the invention

[0001] The present invention relates to an interrupter insert for a circuit breaker arrangement comprising a cylindrically shaped isolating part, in with a pair of corresponding electrical contact pieces are coaxially arranged and are concentrically surrounded by a shield between the contact pieces of one side and an inner wall of the isolating part of the other side, wherein on both front ends of the shield an annular gap to the inner wall is provided.

[0002] Circuit breakers of that kind are widely used especially for medium voltage applications in the range between 1 and 72kV of a high current level. These breakers interrupt the current by creating and extinguishing the arc in a vacuum container. Modern vacuum circuit-breakers attend to have a longer life expectancy than conventional air circuit-breakers. Nevertheless, the present invention is not only applicable to vacuum circuit-breakers, but also for air circuit-breakers or modern (SF₆) circuit-breakers having a chamber filled with sulfur hexafluoride gas.

Background of the invention

[0003] The WO 2006/002560 A1 discloses a circuit breaker arrangement having a vacuum interrupter chamber with an isolating ceramic wall. Inside the interrupter chamber a pair of electrical contacts is coaxially arranged. One of both electrical contacts is moveable in order to form an electrical switch. The electrical contacts are located within a vacuum and the switching operation itself takes place under a vacuum atmosphere. During the switching process, in particular under short-circuit conditions, the aim is to extinguish the arc produced as quickly as possible. Said arc as such is a high-energy plasma flow which generates vaporization processes within the vacuum interrupter chamber. In order that no metallic layer is formed on the inside of the ceramic wall material of the interrupter chamber after a large number of switching operations, and therefore the isolating capacity of the unit is reduced, shielding components made from metallic materials with relatively thin walls are generally introduced within the vacuum interrupter chamber and are arranged in the vicinity of the arc gap between the electrical contacts and the isolation.

[0004] The metal vapor flowing away which is brought about by the switching operation then condenses on the surface of these shields. Furthermore, other high energy plasma jets, which likewise come from the contact region, are also accommodated by the shield. As a result, the voltage-isolating function of the ceramic sleeve of the vacuum interrupter chamber inside is maintained.

[0005] The DE 10 2004 006 609 A1 discloses a metal shield for on interrupter chamber of a medium-voltage or high-voltage circuit breaker. The metallic shield consists of an alloy containing copper with chromium and/or zir-

conium components in order to increase the durability of the shielding. The metal shield is principally cylindrical but has a barrel - shaped form. Both border rings on each and side of the shield are formed by bending in order to realize an adequate shielding function.

[0006] For a suitable shield design on floating potential there is a need for a join to the outer cylindrically shaped isolating part which mostly consists of ceramic material. Usually, two ceramic parts are used which are brazed between the ceramic surfaces to a flange from the shielding part. The shield can also be brazed to an inner step of a metallized ceramic area. In this case a metallization has to be produced on said inner step. However, such a production technology causes a manual manufacturing. A more efficient known solution is based on a groove inside the ceramic corresponding with a toolknop inside this groove in order to fix the shield on this certain position.

[0007] It is an object of the present invention to provide a shield on floating potential inside an isolating part of an interrupter insert which is reliable attached to the inner wall of the isolating part suitable for automatic production.

Summary of the invention

[0008] According to the invention an interrupter insert for a circuit-breaker arrangement is provided comprising a cylindrically shaped isolating part with an inner shield between the contact pieces and an inner wall of said isolating part, wherein on both front ends of the shield an annular gap to the inner wall is provided, wherein each annual gap is at least partly filled with a brazing material in order to permanently attach the shield on both front ends of the inner wall of the isolating part by active brazing. Furthermore an inner metallization can take place at a defined inner ceramic wall to provide an area were a standard brazing material closes the gap between the ceramic and the shield.

[0009] The attachment solution of the present invention does not need form-fitting means for fixing the cylindrically formed shield within the isolating part. Moreover, the gap between the cylindrically shield and the inner wall of the isolating part is completely or partly sealed since the brazing material avoids that vapor or small particles enter the small gap area. The invention allows a positioning of the shield inside the isolating part in order to braze both parts one to another during an automatic production step.

[0010] In order to hold the bracing material in place during the automatic brazing production step an additional brazing or active brazing alloy could be used. Said active brazing alloy is preferably positioned below the brazing material inside the annular gap in order to avoid an entry of melted brazing material between the middle section of the shield and the inner wall of the isolating part. The brazing or active brazing alloy can be ring shaped and, therefore, adapted to the form of the annular gap. The annular gap has a V-shaped cross section. Al-

ternatively, the active brazing alloy can also consist of powder material or wall shaped parts for filling the gap. Preferably the active brazing alloy consists of titanium chromium aluminium, tin oxide, zirconium or alloyed material of mixed elements and alloyed steel.

[0011] In addition to such an active brazing alloy the standard brazing material according to present invention can consist of a silver copper composition.

[0012] According to another aspect of the invention, the generally cylindrical shaped shield as a form like a barrel. It is positioned and corresponds to the exact cylindrically shaped isolating part. The isolating part as well as the shield part preferably consists of metal or ceramic material.

[0013] The interrupter insert according to the present invention is particularly designed as a vacuum or protective gas interrupter insert. However, it is also possible to use the solution according to the present invention in connection with open isolating parts for air circuit-breakers or the like.

[0014] The foregoing and other aspects of the invention will become appeared following the detailed description of the invention when considered in conjunction with the enclosed drawings.

Brief description of the drawings

[0015]

Figure 1 is a longitudinal section through a vacuum interrupter insert of medium-voltage circuit breaker, Figure 2 is a schematic longitudinal section to a first embodiment of the invention, and Figure 3 is a schematic longitudinal section to a second embodiment of the invention.

Detailed description of the drawings

[0016] According to Figure 1 a cylindrically shaped isolating part one of a vacuum interrupter insert is on both front ends closed by cover plates 2a and 2b respectively. Two coaxially arranged contact pieces 3a and 3b are arranged inside the vacuum chamber of the interrupter insert. On the distal ends of both electrical contact pieces 3a and 3b corresponding switch contacts 4a and 4b respectively are arranged.

[0017] Both switch contacts are positioned in an axial distance each to another when the electrical switch is not operated. For operation of the electrical switch formed by both contact pieces 3a and 3b the contact piece 3a is axially moveable arranged in relation to the isolating part 1. In order to allow switching operation under vacuum conditions the moveable electrical contact 3a is sealed by a bellow part 5. The other electrical contact piece 3b is rigidly coupled to the isolating part 1.

[0018] Both electrical contact pieces 3a and 3b are concentrically surrounded by a barrel-shaped shield 6. The shield 6 is arranged in the section between the con-

tact pieces 3a and 3b at one side and an inner wall 7 of the isolating part 1 on the other side. That special arrangement causes an annular gap 8a and 8b respectively on each front end of the shield 6.

[0019] According to the present invention each annular gap 8a and 8b is partly filled with a brazing material 9 in order permanently attach the shield 7 to the isolating part 6 of the interrupter insert by active bracing or brazing to an inner metallization which is already provided by the ceramic cylinder.

[0020] Referring to the schematic Figure 2 in addition to the brazing material 9 an active brazing alloy 10a is used in order to hold the brazing material 9 in place during the brazing step. Said active brazing alloy 10a is arranged below the brazing material 9 inside the annular gap 8a (example). On this position the active brazing alloy 10a avoids an entry of melted brazing material 9 between the middle section of the barrel-shaped shield 6 and the inner wall 7 of the isolating part 1.

[0021] According to the first embodiment as shown the active bracing alloy 10a is ring shaped and it is adapted to the form of the annular gap 8a in order to bear on the bottom area of the annular gap 8a.

[0022] According to Figure 3 which shows a second embodiment of the invention the brazing material 9 is combined with an active brazing alloy 10b. The special active brazing alloy 10b of the second embodiment, consists of small ball shaped parts for filling the bottom area of the annular gap 8a'.

[0023] In the examples as described above the isolating part 1 consists of ceramic material and the barrel-shaped shield 6 consists of a bended sheet metal. Of course, other material combinations are also possible as far as they are suitable for brazing or active brazing according to the present invention.

Reference list

[0024]

- | | |
|---|--------------------------|
| 1 | isolating part |
| 2 | cover plate |
| 3 | electrical contact piece |
| 4 | switch contact |
| 5 | bellow part |
| 6 | shield |
| 7 | inner wall |
| 8 | annular gap |
| 9 | brazing material |

10 brazing alloy

Claims

1. Interrupter insert for a circuit breaker arrangement comprising a cylindrically shaped insulating part (1), within which a pair of corresponding electrical contact pieces (3a, 3b) are coaxially arranged and are concentrically surrounded by a shield (6) between the contact pieces (3a, 3b) at one side and an inner wall (7) of the insulating part (1) at the other side, wherein on both front ends of the shield (6) an annular gap (8a, 8b) to the inner wall (7) is provided, **characterized in that** each annular gap (8a; 8b) is at least partly filled with a brazing material (9) in order to permanently attach the shield (6) on both front ends to the inner wall (7) of the insulating part (1) by active brazing or brazing to a metallization which is already provided by the ceramic body. 20
2. Interrupter insert according to Claim 1, **characterized in that** in addition to the brazing material (9) an active brazing alloy (10a) is used in order to hold the brazing material (9) in place during the brazing step. 25
3. Interrupter insert according to Claim 2, **characterized in that** the active brazing alloy (10a) is positioned below the brazing material (6) inside the annular gap (8a) in order to avoid an entry of melted brazing material (9) between the middle section of the shield (6) and the inner wall (7) of the insulating part (1). 30
4. Interrupter insert according to Claim 2, **characterized in that** the active brazing alloy (10a) is ring shaped and adapted to the form of the annular gap (8a). 35
5. Interrupter insert according to Claim 2, **characterized in that** the active brazing alloy (10b) consists of powder material or ball shaped parts for filling the gap (8a'). 40
6. Interrupter insert according to Claim 2, **characterized in that** the active brazing alloy (10a; 10b) consists of titanium, chromium, aluminium, tin oxide, zirconium or alloyed material of mixed elements and alloyed steel. 45
7. Interrupter insert according to Claim 1, **characterized in that** the standard brazing material (10a; 10b) consists of a silvercopper composition. 50
8. Interrupter insert according to Claim 1, **characterized in that** the barrel-shaped shield (6) inside the cylindrically shaped insulating part (1) con-

sists of metal or ceramic material.

9. Interrupter insert according to Claim 1, **characterized in that** the insulating part (1) consists of metal or ceramic material. 5
10. Interrupter insert according to Claim 1, **characterized in that** the interrupter insert is designed as a vacuum or protective gas interrupter insert. 10
11. Medium-voltage circuit breaker comprising at least one interrupter insert for corresponding pole parts operated by a common electromagnetic actuator. 15

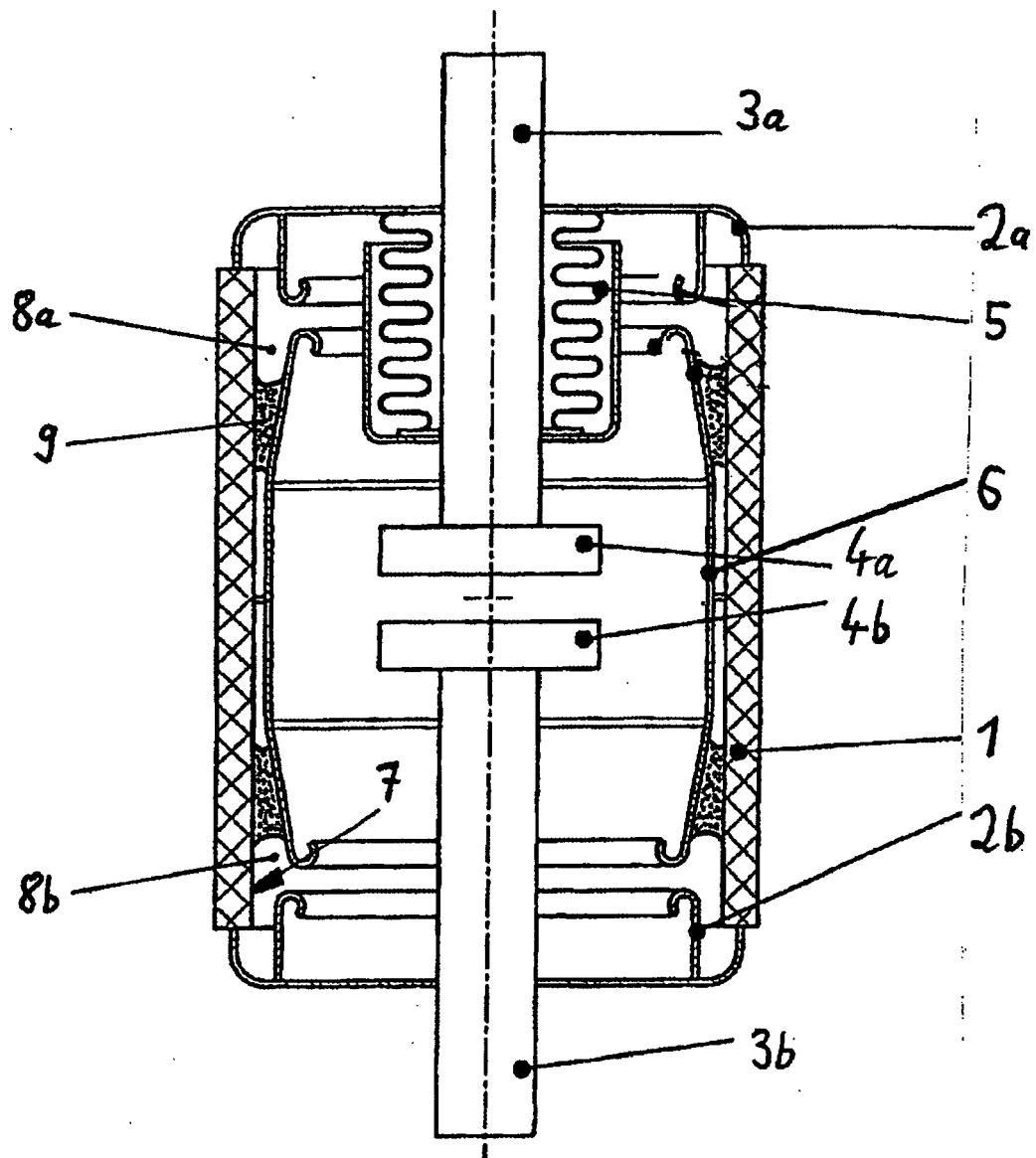


Fig.1

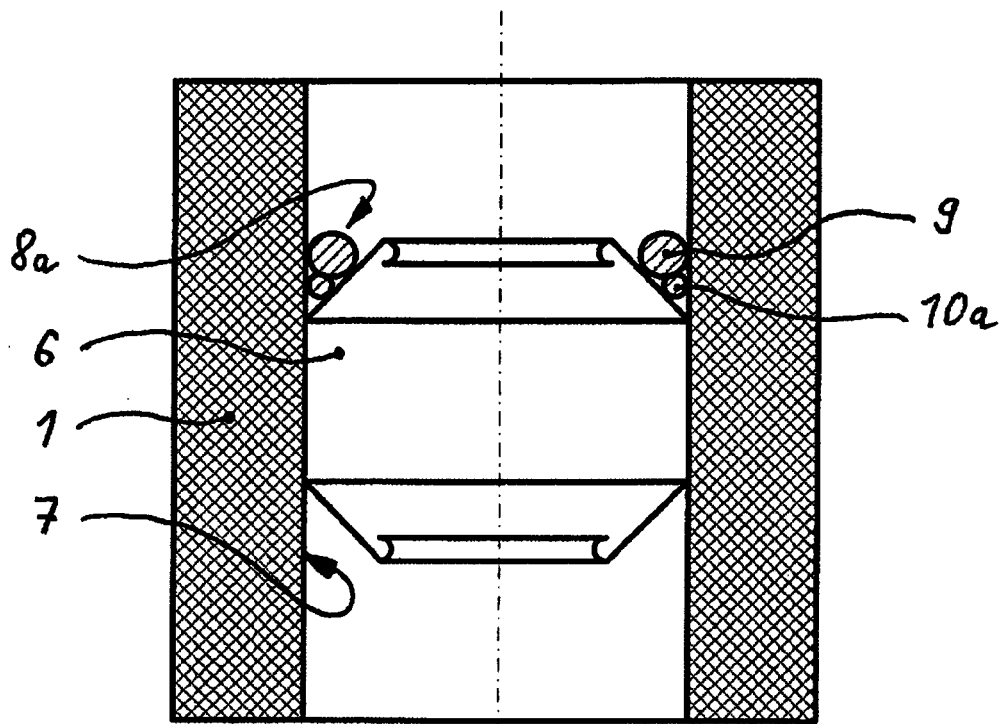


Fig.2

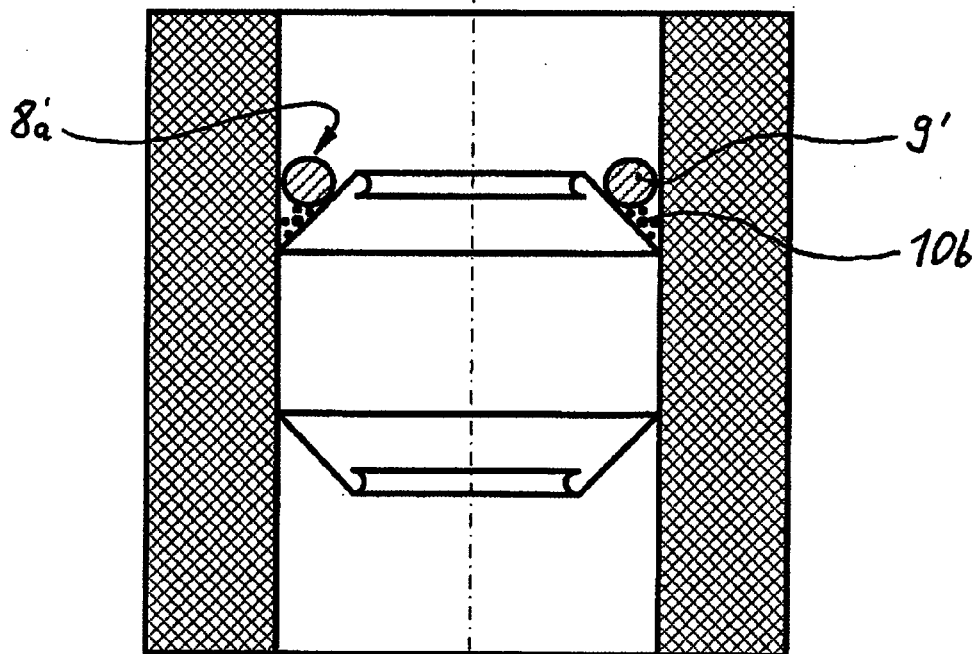


Fig.3

**PARTIAL EUROPEAN SEARCH REPORT**

Application Number

under Rule 62a and/or 63 of the European Patent Convention.
This report shall be considered, for the purposes of
subsequent proceedings, as the European search report

EP 10 01 5934

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	EP 1 367 039 A1 (NGK SPARK PLUG CO [JP]) 3 December 2003 (2003-12-03) * figures 5,6; example 3 *	1-10	INV. H01H33/662
A	EP 1 172 834 A2 (EATON CORP [US]) 16 January 2002 (2002-01-16) * paragraph [0028] - paragraph [0029]; figures 1,2 *	1-10	
A	JP 1 033821 A (HITACHI LTD) 3 February 1989 (1989-02-03) * abstract *	1-10	
			TECHNICAL FIELDS SEARCHED (IPC)
			H01H
INCOMPLETE SEARCH			
The Search Division considers that the present application, or one or more of its claims, does/do not comply with the EPC so that only a partial search (R.62a, 63) has been carried out. Claims searched completely : Claims searched incompletely : Claims not searched : Reason for the limitation of the search: see sheet C			
Place of search		Date of completion of the search	Examiner
Munich		26 July 2011	Dobbs, Harvey
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			

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EPO FORM 1503 03.82 (P04E07)



**INCOMPLETE SEARCH
SHEET C**

Application Number
EP 10 01 5934

Claim(s) completely searchable:
1-10

Claim(s) not searched:
11

Reason for the limitation of the search:

The search has been restricted to the subject-matter of independent claim 1 and claims 2 to 10, which are dependent thereon, as indicated by the applicant in his letter of 13-07-2011 filed in reply to the invitation pursuant to Rule 62a(1) EPC.

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 10 01 5934

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
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26-07-2011

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REFERENCES CITED IN THE DESCRIPTION

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- DE 102004006609 A1 [0005]