

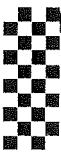
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This document serves as an Oath/Declaration (37 CFR 1.63).	
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TURMOLES

Docket No.: 75523

DECLARATION FOR PATENT APPLICATION AND ASSIGNMENT

Title of the Invention: **CARTRIDGE TYPE HEATER**

As a below named inventor, I hereby declare that:

This declaration is directed to:

- The attached application, or
- United States application or PCT international application number filed on

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

WHEREAS, TÜRK & HILLINGER GMBH

(hereinafter referred to as Assignee) having a place of business at: Föhrenstrasse 20, 78532 Tuttlingen, GERMANY

is desirous of acquiring the entire right, title and interest to said invention and in the Letters Patent to be obtained therefor from the United States;

NOW THEREFORE, be it known by all whom it may concern, that for and in consideration of the sum of One Dollar (\$1.00) (or the equivalent thereof in foreign currency) and other valuable consideration, the receipt of which is hereby acknowledged, I have assigned, sold and set over and by these presents do assign, sell and set over unto the said Assignee for the territory of the United States of America and not elsewhere, the full and exclusive right, title and interest in and to the said invention, said invention, application and Letters Patent to be held and enjoyed by the said Assignee for its own use and behoof and for the use and behoof of its successors and assigns to the full end of the term for which said Letters Patent is granted, as fully and entirely as the same would have been held by me had this Assignment and sale not been made.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than (5) years, or both.

LEGAL NAME OF INVENTOR

INVENTOR: **Andreas SCHLIPP**

Inventor's signature

Date

May, 9th 2016

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CARTRIDGE TYPE HEATER

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of priority under 35 U.S.C. §119 of German Utility Model Application 20 2015 102 449.5 filed May 12, 2015, the entire contents of which are incorporated herein by reference.

5

FIELD OF THE INVENTION

[0002] The present invention relates to a cartridge type heater.

BACKGROUND OF THE INVENTION

[0003] Cartridge type heaters are electric heaters, in which the electric heating element, which may be embodied, e.g., by a resistance wire wound on a carrier and by a coiled resistance wire, is arranged in the interior of a jacket pipe made of metal, which protects the heating element from environmental effects. The heat transport from the electric heating element to the

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metal jacket may be guaranteed here, for example, by a filling material, e.g., magnesium oxide or Micanite plates, which is provided at least between the electric heating element and the jacket pipe, has good thermal conductivity and is, furthermore, electrically insulating if resistance wires are used.

5 **[0004]** It is desirable for many applications that the jacket pipe be grounded by connecting it to a protective ground via a protective ground wire. The connection is brought about according to the state of the art especially by welding or soldering the protective ground wire to the jacket pipe made of metal. Especially in the case of metals that lend themselves poorly to welding or soldering, e.g., in the case of jacket pipes made of titanium or aluminum, 10 clamping of the protective ground wire on the jacket pipe is also resorted to in some cases, but this makes possible only an error-prone and relatively reliable electrical contacting.

[0005] The same problem arises in case of cartridge type heaters for low voltage or protective voltage, in which the jacket pipe consisting of metal functions as a return conductor and must therefore be connected to an electrical conductor, even though these cartridge type 15 heaters do not require a protective ground.

SUMMARY OF THE INVENTION

[0006] An object of the present invention is to provide a cartridge type heater, whose jacket pipe consisting of metal can be connected to a conductor, e.g., a protective ground wire, in a simple and reliable manner. This object is accomplished by a cartridge type heater of the

present invention.

[0007] The cartridge type heater according to the present invention has, just as the prior-art cartridge type heaters as well, a jacket pipe consisting of metal and an electric heating element, which is arranged within the jacket pipe consisting of metal. The electric heating
5 element may be embodied, e.g., as a resistance wire wound on a carrier or as a coiled resistance wire, and a filling material preferably establishes the heat-conducting contact between the electric heating element and the jacket pipe. It should be noted that the term "jacket pipe" does not imply a limitation to a pipe with a circular cross section, so that the jacket pipe may also have another cross section, especially an oval, polygonal or flat cross section.

10 **[0008]** It is essential for the present invention that at least one terminal lug connected in one piece to the jacket pipe consisting of metal is present. A considerably improved contact behavior is attained due to this measure.

[0009] In a preferred embodiment of the present invention, the terminal lug may be arranged at an end of the jacket pipe. It may have, in particular, at least one section that projects
15 over the edge of the jacket pipe consisting of metal; as an alternative or in addition, the terminal lug may have at least one section in which it is formed by a section of the edge area of the jacket pipe consisting of metal, which said latter section is separated by recesses passing through the pipe wall of the jacket pipe from a section of the jacket pipe consisting of metal, which said latter section is located adjacent in the circumferential direction and from a section of the jacket pipe

consisting of metal, which latter section is adjacent against the circumferential direction. The section located adjacent in the circumferential direction and the section located adjacent against the circumferential direction may be directly connected to one another, i.e., pass over into one another or considered to be a single section.

5 **[0010]** In another preferred embodiment of the present invention, the terminal lug is not arranged at the edge, but centrally in a section of the wall surface of the jacket pipe consisting of metal. This can be embodied by punching the terminal lug out of the wall surface or by cutting it out, for example, with a laser. The terminal lug may subsequently be bent, so that it is positioned at an angle to the wall surface of the jacket pipe. Another possibility of embodying a terminal
10 lug arranged centrally in a section of the wall surface of the jacket pipe consisting of metal and being positioned at an angle to the wall surface is to form the terminal lug internally in one piece with the wall of the jacket pipe.

[0011] Consequently, a structure, which is connected in one piece to the jacket pipe and with which a conductor, for example, a protective ground wire can be connected for protective
15 grounding in a more simple manner than with the otherwise unstructured jacket pipe, is provided with the terminal lug in all the variants explained above. This connection can be achieved, for example, by crimping, riveting or screwing, but it is especially advantageous if the terminal lug is configured, at least in its terminal-side end section, as a flat plug or round plug.

[0012] Moreover, an electric connection, which would have to be established, and thus a

potential source of error, is eliminated by the terminal lug configured in one piece with the jacket pipe in all embodiments, but especially in the embodiment of the connection of a flat plug or round plug.

[0013] The present invention is described in detail below with reference to the attached figures. The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this disclosure. For a better understanding of the invention, its operating advantages and specific objects attained by its uses, reference is made to the accompanying drawings and descriptive matter in which preferred embodiments of the invention are illustrated.

10 **BRIEF DESCRIPTION OF THE DRAWINGS**

[0014] In the drawings:

[0015] Figure 1 is a view of a first embodiment of a cartridge type heater;

[0016] Figure 2 is a view of the cartridge type heater of Figure 1 connected to ground wire;

15 **[0017]** Figure 3 is a view of a second embodiment of a cartridge type heater;

[0018] Figure 4 is a view of a third embodiment of a cartridge type heater; and

[0019] Figure 5 is a view of a fourth embodiment of a cartridge type heater.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0020] Referring to the drawings, the same reference numbers are used for identical parts of identical embodiments.

5 **[0021]** Figure 1 shows a cartridge type heater 10 with a jacket pipe 11 consisting of metal and with an electric heating element, which is arranged within the jacket pipe 11 consisting of metal, and therefore only the electric supply lines 12, 13 thereof, which lead into the interior space of the jacket pipe 11 consisting of metal are visible. A terminal lug 14, which is connected in one piece to the jacket pipe 11 consisting of metal, is arranged at the end of the jacket pipe 11
10 consisting of metal, which faces the supply lines 12, 13.

[0022] The terminal lug 14 has a section 14a, which projects over the edge 11a of the jacket pipe 11 consisting of metal. Further, the terminal lug 14 has a section 14b, in which it is formed by a section of the edge area 11b of the jacket pipe 11 consisting of metal, which said section 14b is separated by recesses 15a, 15b passing through the pipe wall of the jacket pipe 11
15 consisting of metal from a section 11c of the jacket pipe 11 consisting of metal, which said section 11c is adjacent in the circumferential direction, and from a section 11d of the jacket pipe 11 consisting of metal, which said section 11d is adjacent against the circumferential direction.

[0023] Figure 2 shows the cartridge type heater from Figure 1 with a protective ground

wire 16, which is connected to the terminal lug 14 and which establishes the connection for protective grounding. The connection between the terminal lug 14 and the protective ground wire 16 is established by a crimped crimping sleeve 17 in this example. This crimped connection can be prepared much more reliably, especially because of the greater similarity of the dimensions of the terminal lug 14 and the protective ground wire 16, than a crimped connection to the jacket pipe 11 consisting of metal.

[0024] Figure 3 shows a cartridge type heater 20 with a jacket pipe 21 consisting of metal and with an electric heating element, which is arranged within the jacket pipe 21 consisting of metal, and therefore only the electric supply lines 22, 23 thereof, which lead into the interior space of the jacket pipe 21 consisting of metal, are visible. A terminal lug 24, which is connected in one piece to the jacket pipe 21 consisting of metal, is arranged at the end of the jacket pipe 21 consisting of metal, which said end faces the supply lines 22, 23.

[0025] The terminal lug 24 has a section 24a, which projects over the edge 21a of the jacket pipe 21 consisting of metal. Further, the terminal lug 24 has a section 24b, in which it is formed by a section of the edge area 21b of the jacket pipe 21 consisting of metal, which said section is separated by recesses 25a, 25b passing through the pipe wall of the jacket pipe 21 consisting of metal from a section 21c of the jacket pipe 21 consisting of metal, which said section 21c is located adjacent in the circumferential direction, and from a section 21d of the jacket pipe 21 consisting of metal, which said section 21d is located adjacent against the circumferential direction. The terminal lug 24 is configured as a male part of a flat connection.

[0026] Figure 3 shows, furthermore, a protective ground wire 26, which has a flat plug 27 at its end facing the cartridge type heater 20. As is indicated by the arrow in Figure 3, the connection for protective grounding can thus be established in a simple and reliable manner by pushing the flat plug 27 over the terminal lug 24 configured as a male part of the flat connection. It is, of course, equally possible to transpose the roles of the male and female parts of the flat connection when configuring the terminal lug over the edge of the pipe wall of the jacket pipe consisting of metal in a T-shaped manner and then transforming it.

[0027] Figure 4 shows another cartridge type heater 30 for low voltage or protective voltage with a jacket pipe 31 consisting of metal and with an electric heating element 32, which is arranged within the jacket pipe 31 consisting of metal and is therefore indicated by broken line. The electric heating element 32 is connected at one of its ends, the end 32a, to an electric supply line 33 leading into the interior space of the jacket pipe 31 consisting of metal, the section of said supply line extending in the interior space of the jacket pipe 31 consisting of metal being likewise indicated by broken line. This connection may be established, for example, by welding, crimping or pressing.

[0028] The other end 32b of the electric heating element 32 is electrically connected, e.g., likewise welded, crimped or pressed, to the jacket pipe 31 consisting of metal. The jacket pipe 31 consisting of metal is consequently used in the cartridge type heater 30 as a return conductor.

[0029] A terminal lug 34, which is made integrally in one piece with the jacket pipe 31

consisting of metal and is formed by a material section that projects over the edge 31a of the jacket pipe 31 consisting of metal, is arranged at the end of the jacket pipe 31 consisting of metal, which said end faces the supply line 33. As an alternative, the terminal lug 34 could also be defined by incising two grooves, each of which passes through the wall of the jacket pipe consisting of metal and starts from the edge of the jacket pipe consisting of metal, so that the terminal lug would have no section projecting over the edge of the jacket pipe consisting of metal.

[0030] Figure 4 shows, further, a second supply line 36, which has a female flat plug 37 at its end facing the cartridge type heater 30. Like in the cartridge type heater 20 shown in Figure 3, the connection to the second supply line 36 can be established in a simple and reliable manner in the cartridge type heater 30 as well by the flat plug 37 being pushed over the terminal lug 34 configured as a male part of the flat connection. It is, of course, also possible, in principle, to transpose the roles of the male and female parts of the flat connection in this case as well.

[0031] Figure 5 shows another embodiment of a cartridge type heater 40 with a jacket pipe 41 consisting of metal and with an electric heating element, which is arranged within the jacket pipe 41 consisting of metal, and therefore only the electric supply lines 42, 43 thereof, which lead into the interior space of the jacket pipe 41 consisting of metal, are visible. The cartridge type heater 40 differs from the cartridge type heaters 10, 20, 30 in respect to the configuration of the jacket pipe 41 consisting of metal, especially the flat, oval cross section thereof, as a result of which it shall be illustrated by an example that the exact cross-sectional

shape of the jacket pipe 41 consisting of metal is not important.

[0032] Further, the cartridge type heater 40 also differs from the cartridge type heaters 10, 20, 30 in that it has a terminal lug 44, which is arranged centrally in a section of the wall surface of the jacket pipe 41 consisting of metal and which is at an angle of $>0^\circ$, namely, approximately
5 at right angles in the example being shown, to the wall surface of the jacket pipe 41 consisting of metal.

[0033] Thus, the terminal lug 44 projects from the wall surface of the jacket pipe 41 consisting of metal in this example. The terminal lug 44 is configured as a male part of a flat connection here. Further, Figure 5 shows a protective ground wire 46, which has a female flat
10 plug 47 at its end facing the cartridge type heater 40. Like in Figure 3, the connection for protective grounding can be established in a simple and reliable manner here as well by the flat plug 47 being pushed over the terminal lug 44 configured as a male part of the flat connection.

[0034] While specific embodiments of the invention have been shown and described in detail to illustrate the application of the principles of the invention, it will be understood that the
15 invention may be embodied otherwise without departing from such principles.

WHAT IS CLAIMED IS:

1. A cartridge type heater comprising:
a jacket pipe comprising metal;
an electric heating element arranged within said jacket pipe;
a terminal lug connected in one piece to said jacket pipe.

2. A cartridge type heater in accordance with claim 1, wherein said terminal lug is provided at one end of said jacket pipe.

3. A cartridge type heater in accordance with claim 2, wherein said terminal lug comprises at least one section, which projects over an edge of said jacket pipe.

4. A cartridge type heater in accordance with claim 2, wherein said terminal lug has at least one terminal lug section, said at least one terminal lug section being formed by an edge area section of an edge area of said jacket pipe, said at least one terminal lug section being separated from a first jacket pipe section of said jacket pipe and a second jacket pipe section of said jacket pipe by recesses, said recesses passing through a pipe wall of said jacket pipe, said first jacket pipe section being located adjacent to one of said recesses in a circumferential direction, said second jacket pipe section being located adjacent to another one of said recesses against the circumferential direction.

5. A cartridge type heater in accordance with claim 1, wherein said terminal lug is

arranged centrally in a section of a wall surface of said jacket pipe.

6. A cartridge type heater in accordance with claim 1, wherein at least a terminal-side end section of said terminal lug is formed as one of a flat plug and a round plug.

7. A cartridge type heater in accordance with claim 3, wherein said terminal lug has another terminal lug section, said another terminal lug section being formed by an edge area section of an edge area of said jacket pipe, said another terminal lug section being separated from a first jacket pipe section of said jacket pipe and a second jacket pipe section of said jacket pipe by recesses, said recesses passing through a pipe wall of said jacket pipe, said first jacket pipe section being located adjacent to one of said recesses in a circumferential direction, said second jacket pipe section being located adjacent to another one of said recesses against the circumferential direction.

8. A cartridge type heater comprising:
a metal jacket pipe comprising a metal jacket interior space;
an electric heating element arranged in said metal jacket interior space;
a lug integrally connected to said metal jacket pipe, said lug defining a connector for connecting said metal jacket pipe to a ground wire.

9. A cartridge type heater in accordance with claim 8, wherein said metal jacket pipe comprises at least one end, said lug being integrally connected to said metal jacket pipe at said at

least one end.

10. A cartridge type heater in accordance with claim 9, wherein said lug comprises at least one section, which projects over an edge of said metal jacket pipe.

11. A cartridge type heater in accordance with claim 9, wherein said lug has at least one lug section, said at least one lug section being defined by an edge area section of an edge area of said jacket pipe, said at least one lug section being separated from a first jacket pipe section of said metal jacket pipe and a second jacket pipe section of said metal jacket pipe by recesses, said
5 recesses passing through a pipe wall of said metal jacket pipe, said first jacket pipe section being located adjacent to one of said recesses in a circumferential direction, said second jacket pipe section being located adjacent to another one of said recesses against the circumferential direction.

12. A cartridge type heater in accordance with claim 8, wherein said lug is arranged centrally in a section of a wall surface of said metal jacket pipe.

13. A cartridge type heater in accordance with claim 8, wherein at least a terminal-side end section of said lug comprises one of a flat plug and a round plug.

14. A cartridge type heater in accordance with claim 10, wherein said lug has another lug section, said another lug section being formed by an edge area section of an edge area of said

metal jacket pipe, said another lug section being separated from a first jacket pipe section of said jacket pipe and a second jacket pipe section of said jacket pipe by recesses, said recesses passing
5 through a pipe wall of said jacket pipe, said first jacket pipe section being located adjacent to one of said recesses in a circumferential direction, said second jacket pipe section being located adjacent to another one of said recesses against the circumferential direction.

15. A cartridge type heater comprising:

a metal jacket comprising a metal jacket interior space and a metal jacket projection, said metal jacket projection being integrally connected to said metal jacket pipe, said metal jacket projection defining a means for connecting said metal jacket to a ground wire; and
5 an electric heating element arranged in said metal jacket interior space.

16. A cartridge type heater in accordance with claim 15, wherein said metal jacket projection is provided at one end of said metal jacket.

17. A cartridge type heater in accordance with claim 16, wherein said metal jacket comprises an end portion defining an edge area, said projection extending beyond said edge area to a position located at a spaced location from said edge area.

18. A cartridge type heater in accordance with claim 16, wherein said projection has at least one projection section, said at least one projection section being defined by an edge area section of an edge area of said metal jacket, said at least one projection section being separated

5 from a first metal jacket section of said metal jacket and a second metal jacket section of said metal jacket by recesses, said recesses passing through a wall of said metal jacket, said first metal jacket section being located adjacent to one of said recesses in a circumferential direction, said second metal jacket section being located adjacent to another one of said recesses against the circumferential direction.

19. A cartridge type heater in accordance with claim 15, wherein said projection is arranged centrally in a section of a wall surface of said metal jacket.

20. A cartridge type heater in accordance with claim 15, wherein said projection comprises at least a terminal-side end section, said terminal-side end section comprising one of a flat plug and a round plug.

ABSTRACT OF THE DISCLOSURE

A cartridge type heater (10, 20, 30, 40) with a jacket pipe (11, 21, 31, 41) including metal and with an electric heating element (32), which is arranged within the jacket pipe (11, 21, 31, 41). At least one terminal lug (14, 24, 34, 44) is connected in one piece to the jacket pipe (11, 21, 31, 41).

75523-1

APPENDIX:

List of Reference Numbers

10, 20, 30, 40	Cartridge type heater
11, 21, 31, 41	Jacket pipe
11a, 21a, 31a	Edge (of jacket pipe)
11b, 21b	Edge area (of jacket pipe)
11c, 11d, 21c, 21d	Section (of jacket pipe)
12, 13, 22, 23, 33, 36, 42, 43	Supply line
14, 24, 34, 44	Terminal lug
14a, 14b, 24a, 24b	Section (of terminal lug)
15a, 15b, 25a, 25b	Recess
16, 26, 46	Protective ground wire
17	Crimping sleeve
27, 37, 47	Flat plug
32	Electric heating element
32a, 32b	End (of electric heating element)