

SHEATHED HEATER

This invention relates to a sheathed heater,
5 and more particularly to an improvement of a
sheathed heater for use at a higher temperature
atmosphere.

The conventional sheathed heater to be connected
10 across a single-phase power source, as shown in
Fig. 1, comprises a metal pipe 1, such as a stainless
steel pipe, a core of porcelain insulator 2 made
of magnesia or the like and arranged at the center
of the metal pipe 1, a pair of lead pins 3a, 3b
15 having base portions which are inserted into small
holes formed in and passing through said core of
porcelain insulator 2, an internal heater coil 4
wound around said core of porcelain insulator 2,
and a thermal and electrical insulation material
20 5 of magnesia or the like filled in a space formed
between the metal pipe 1 and the core of porcelain
insulator 2, both ends of said internal heater coil
4 being electrically connected to said pair of lead
pins 3a, 3b, respectively. Such sheathed heater is
25 reduced in diameter by a subsequent swaging process.

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In such conventional sheathed heater, however, if the length thereof is too long the sheathed heater tends to bend when it is subjected to said swaging process. Accordingly, it was contemplated to divide axially the core of porcelain insulator 2 into two or more core pieces, for example, into three core pieces 2a~2c, and a planar spacer 6 of magnesia or the like is inserted between adjacent two core pieces, as shown in Fig. 2.

Further, in the conventional sheathed heater, the heater coil 4 has a limitation in length due to the diameter of the heater coil wire and a value of voltage applied thereto. Accordingly, said heater coil 4 is also divided into three heater coil segments 4a ~ 4c, each wound around each core piece 2a~2c, and a voltage of the single-phase power source is applied by said lead pins 3a, 3b to the both ends of each heater coil segment 4a, 4b or 4c. Specifically, as shown in Fig. 2, one end A1, A2 or A3 of the heater coil segment 4a, 4b or 4c is connected to one of said lead pins 3a, 3b at one end of each core pieces 2a, 2b or 2c, and the other end B1, B2 or B3 of each heater coil segment 4a, 4b or 4c is connected to the other of said lead pins 3a, 3b at the other end of each core piece



2a, 2b or 2c.

Fig. 3 shows a conventional sheathed heater to be connected across a three-phase power source.

5 It is publicly know that in the sheathed heater the insulation ability of the thermal and electrical insulation material 5 and the spacer 6 of magnesia or the like is lowered if the temperature is increased more than about 800 °C. However, in the sheathed heater as shown in Fig. 2 or Fig. 3, a
10 gap formed between the adjacent core pieces becomes non-heated portion, so that it should be made small, such as about 2 to 3 mm in order to equalize the temperature distribution. If this is the case, a voltage, such as 100 V is applied between said gap,
15 so that an abnormal current flows through said gap to heat this portion, thereby causing the service life of the sheathed heater to be shortened.

20 An object of the present invention is to reduce an abnormal current flowing through a gap formed between adjacent core pieces.

The above object can be attained by a sheathed heater characterized in that each internal heater coil segment is wound around each core piece
25 arranged axially, which is covered by a cylindrical



metal sheath through a thermal and electrical insulation material, and adjacent ends of adjacent internal heater coil segments are connected to the same lead pin, or lead pins of the same electric potential.

The above object can also be attained by a sheathed heater comprising a cylindrical metal sheath, a plurality of rod shaped core pieces of porcelain insulator arranged side by side in said cylindrical metal sheath, a thermal and electrical insulation material filled in a space formed between said metal sheath and core pieces, internal heater coil segments each wound around each of said core pieces, and a plurality of lead pins each inserted into said core pieces, characterized in that adjacent ends of adjacent internal heater coil segments are connected to the same lead pin, or lead pins of the same electric potential.

The above object can also be attained by a sheathed heater comprising a cylindrical metal sheath, a plurality of rod shaped core pieces of porcelain insulator arranged side by side in said cylindrical metal sheath, spacers of thermal and electrical insulation

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material each inserted between adjacent core
pieces, a thermal and electrical insulation
material filled in a space formed between said
metal sheath and core pieces, internal heater coil
5 segments each wound around each of said core pieces,
and a plurality of lead pins each inserted into
said core pieces and spacers, characterized
in the adjacent ends of adjacent internal heater
coil segments are connected to the same lead pin,
10 or lead pins of the same electric potential.

Fig. 1 is a sectional view of a conventional
sheathed heater to be connected across a single-phase
electric power source;

15 Fig. 2 is a sectional view of an another
conventional sheathed heater to be connected
across a single-phase electric power source;

Fig. 3 is a sectional view of an other
conventional sheathed heater to be connected
20 across a three-phase electric power source;

Fig. 4 is a sectional view of a sheathed heater
to be connected across a single-phase electric power
source according to an embodiment of the present
invention;

25 Fig. 5 is a sectional view of a sheathed heater

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to be connected across a three-phase electric power source according to the other embodiment of the present invention; and

5 Fig. 6 is a sectional view taken along a line 6-6 in Fig. 5.

Now, an embodiment of this invention will be described by referring to Figs. 4 to 6.

10 In a sheathed heater to be connected across a single-phase electric power source according to an embodiment of the present invention, as shown in Fig. 4, one end A1 of a first internal heating coil segment 4a wound around a first core piece 2a is electrically connected to one lead pin 3a at one end of said
15 first core piece 2a, whereas the other end B1 of said first internal heater coil segment 4a is electrically connected to the other lead pin 3b at the other end of said first core piece 2a. An end A2 of a second internal heating coil segment 4b
20 wound around a second core piece 2b adjacent to said first core piece 2a is electrically connected to said other lead pin 3b at one end of said second core piece 2b, whereas, the other end B2 of said second internal heating coil element 4b is
25 electrically connected to said one lead pin 3a at



the other end of said second core piece 2b.

Similarly, an end of A3 of a third internal heating coil segment 4c wound around a third core piece 2c adjacent to said second core piece 2b is electrically connected to said one lead pin 3a at one end of said third core piece 2c, whereas, the other end B3 of said third internal heating coil segment 4c is electrically connected to said other lead pin 3b at the other end of said third core piece 2c.

Figs. 5 and 6 show a sheathed heater to be connected across a three-phase electric power source according to the other embodiment of the present invention.

In this embodiment, a first to three small holes separated in the circumferential direction from one another are formed in and passing through each of first to three core pieces 2a to 2c of porcelain insulator, and a first to three lead pins 3a to 3c are inserted into said first to three small holes, respectively. As like as said first embodiment, one end A1 of a first internal heating coil segment 4a wound around said first core piece 2a is electrically connected to said first lead pin 3a at one end of said first core piece 2a, the

other end B1 of said first internal heater coil segment 4a is electrically connected to said second lead pin 3b at the other end of said first core piece 2a, an end A2 of a second internal heating
5 coil segment 4b wound around said second core piece 2b adjacent to said first core piece 2a is electrically connected to said second lead pin 3b at one end of said second core piece 2b, and the other end B2 of said second internal heating coil element
10 4b is electrically connected to said third lead pin 3c at the other end of said second core piece 2b.

Similarly, an end of A3 of a third internal heating coil segment 4c wound around said third core piece 2c adjacent to said second core piece 2b is
15 electrically connected to said third lead pin 3c at one end of said third core piece 2c, whereas, the other end B3 of said third internal heating coil segment 4c is electrically connected to said first lead pin 3a at the other end of said third core
20 piece 2c.

Said first to three lead pins are electrically connected across a three-phase electric power source, respectively.

25 As stated above, in the present invention,

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no voltage difference are formed between the adjacent ends of the internal heating coil segments adjacent to each other, such as B1-A2, B2-A3, because these are electrically connected to the same lead pin, or
5 lead pins of the same electric potential.

Accordingly, the abnormal current is prevented from flowing between said adjacent lead pins, so that the service life of the sheathed heater can be prolonged.

While the invention has been particularly shown
10 and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by
15 the appended claims.

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CLAIMS:

1. A sheathed heater comprising a cylindrical metal sheath (1), a plurality of rod shaped core pieces (2a~2c) of porcelain insulator arranged side by side in said cylindrical metal sheath (1), a thermal and electrical insulation material (5) filled in a space formed between said metal sheath (1) and core pieces (2a ~ 2c), internal heater coil segments (4a ~ 4c) each wound around each of said core pieces (2a ~ 2c), and a plurality of lead pins (3a, 3b) each inserted into said core pieces (2a ~ 2c), characterized in that adjacent ends of adjacent internal heater coil segments (4a ~ 4c) are connected to the same lead pin, or lead pins (3a, 3b) of the same electric potential.

2. A sheathed heater comprising a cylindrical metal sheath (1), a plurality of rod shaped core pieces (2a~2c) of porcelain insulator arranged side by side in said cylindrical metal sheath (1), spacers (6) of thermal electrical and insulation material each inserted between adjacent core pieces (2a~2c), a thermal and electrical insulation material (5) filled in a space formed between said metal sheath (1) and core pieces (2a~2c), internal heater coil segments (4a ~ 4c) each





wound around each of said core pieces (2a ~ 2c),
and a plurality of lead pins (3a, 3b) each inserted
into said core pieces (2a ~ 2c) and spacers (6),
characterized in that adjacent ends of adjacent
5 internal heater coil segments (4a ~ 4c) are
connected to the same lead pin, or lead pins
(3a, 3b) of the same electric potential.

3. The sheathed heater according to claim 1
or 2, wherein said lead pins (3a, 3b) are two in
10 number which are separated to each other, and said
internal heater coil segment (4a~ 4c) is connected
across a single-phase electric power source.

4. The sheathed heater according to claim 1
or 2, wherein said lead pins (3a~ 3c) are three in
15 number which are separated from one another and said
internal heater coil segment (4a~ 4c) is connected
across a three-phase electric power source.

5. The sheathed heater according to claim 4,
wherein said three lead pins (3a~ 3c) are separated
20 from one another in the circumferential direction.

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ABSTRACT:

SHEATHED HEATER

A sheathed heater comprising at least two core
pieces (2a, 2b) of porcelain insulator separated to
each other in the axial direction of said core
piece (2a, 2b), at least two lead pins (3a, 3b)
separated to each other and inserted into the core
pieces (2a, 2b) axially, at least two internal
heater coil segments (4a, 4b) wound around the
at least two core pieces (2a, 2b), respectively,
and a cylindrical metal sheath (1) into which the
core pieces (2a, 2b) and the internal heater coil
segments (4a, 4b) are inserted through a thermal and
electrical insulation material (5), wherein adjacent
ends of adjacent internal heater coil segments (4a,
4b) are electrically connected to the same lead pin,
or lead pins (3a, 3b) of the same electric potential.

FIGURE NO. 4

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FIG. 1
PRIOR ART

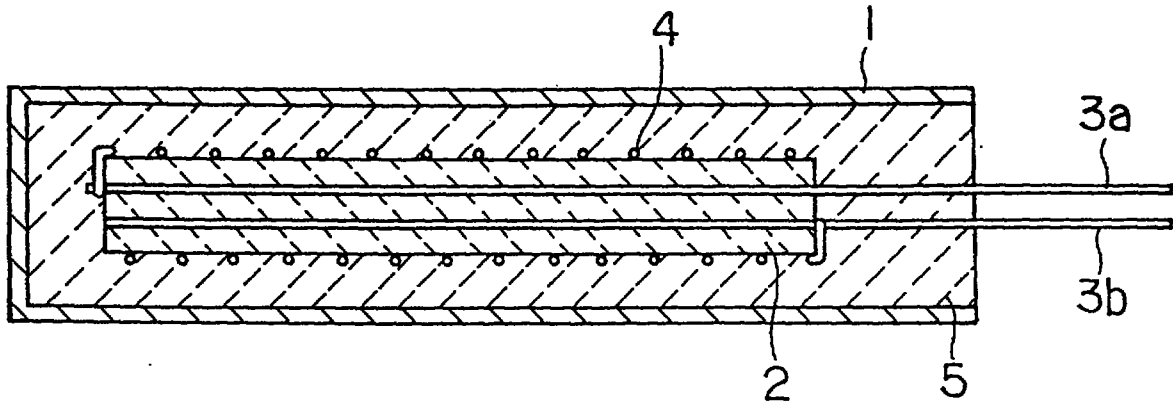
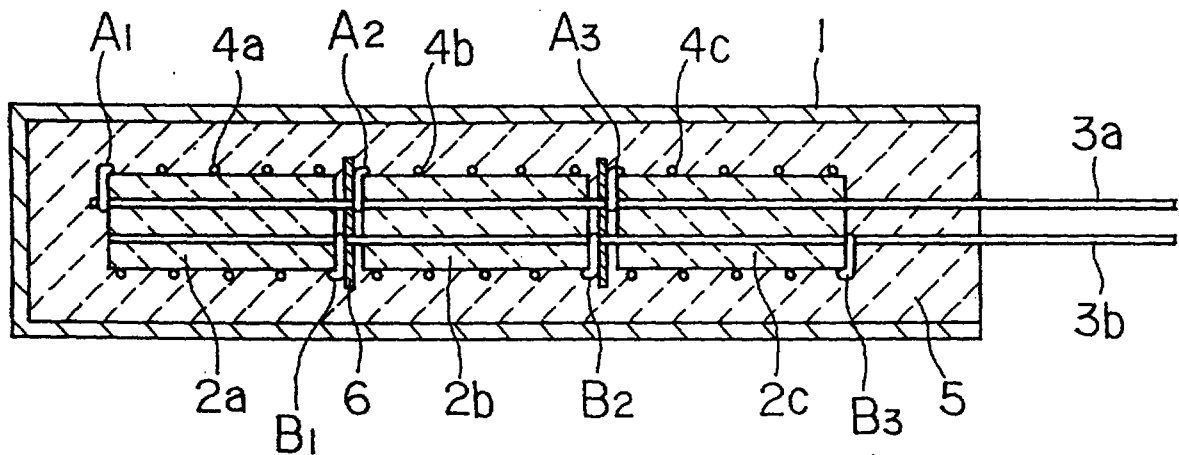


FIG. 2
PRIOR ART



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FIG. 3
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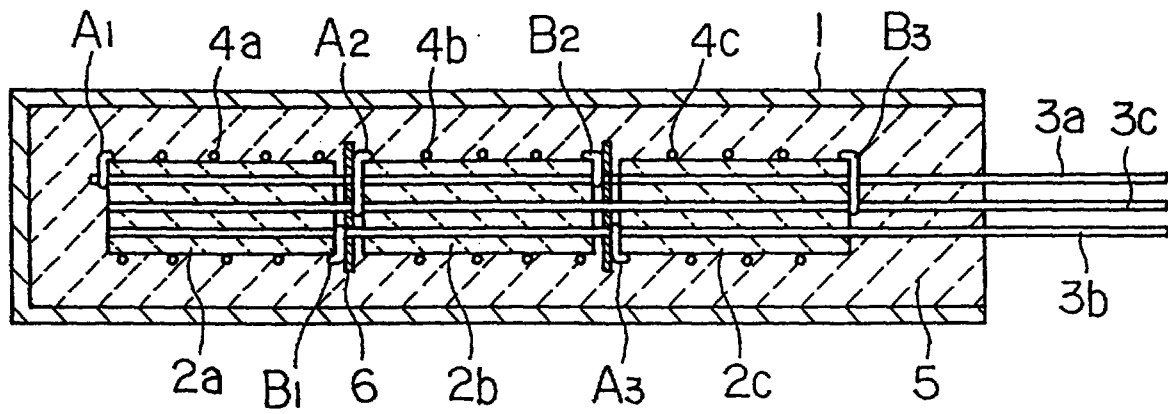
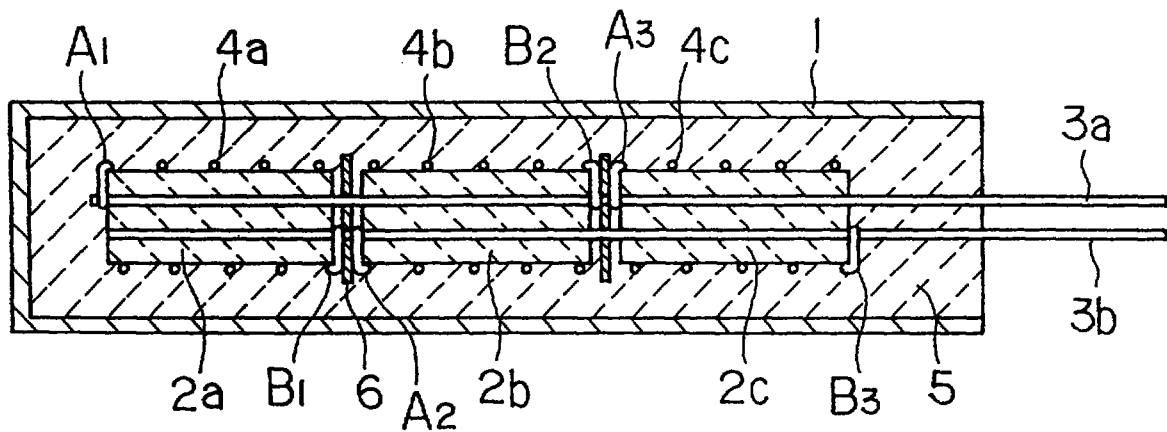
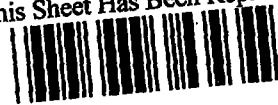


FIG. 4



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FIG.5

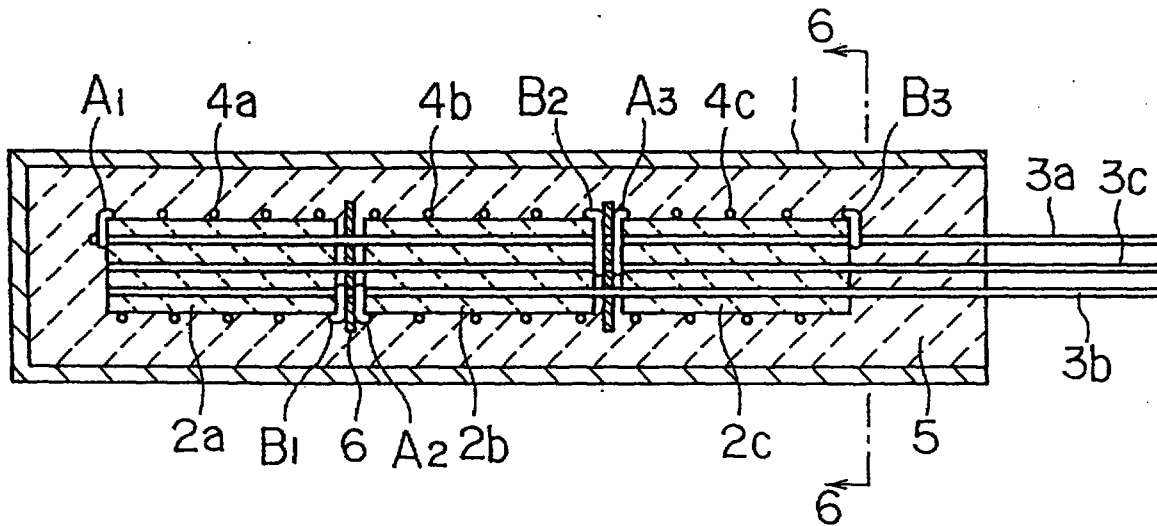
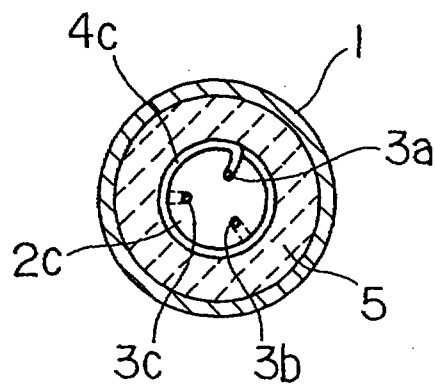


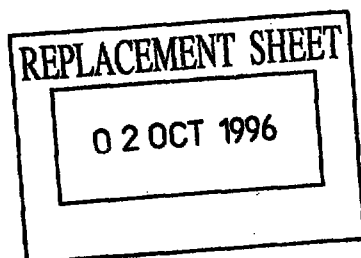
FIG.6



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SHEATHED HEATER

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5 This invention relates to a sheathed heater,
and more particularly to an improvement of a
sheathed heater for use at a higher temperature
atmosphere.

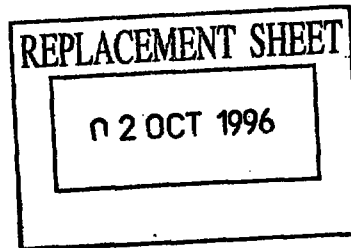
10 The conventional sheathed heater to be connected
across a single-phase power source, as shown in
Fig. 1, comprises a metal pipe 1, such as a stainless
steel pipe, a core of porcelain insulator 2 made
of magnesia or the like and arranged at the center
of the metal pipe 1, a pair of lead pins 3a, 3b
15 having base portions which are inserted into small
holes formed in and passing through said core of
porcelain insulator 2, an internal heater coil 4
wound around said core of porcelain insulator 2,
and a thermal and electrical insulation material
20 5 of magnesia or the like filled in a space formed
between the metal pipe 1 and the core of porcelain
insulator 2, both ends of said internal heater coil
4 being electrically connected to said pair of lead
pins 3a, 3b, respectively. Such sheathed heater is
25 reduced in diameter by a subsequent swaging process.

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In such conventional sheathed heater, however, if the length thereof is too long the sheathed heater tends to bend when it is subjected to said swaging process. Accordingly, it was contemplated to divide axially the core of porcelain insulator 2 into two or more core pieces, for example, into three core pieces 2a~2c, and a planar spacer 6 of magnesia or the like is inserted between adjacent two core pieces, as shown in Fig. 2.

Further, in the conventional sheathed heater, the heater coil 4 has a limitation in length due to the diameter of the heater coil wire and a value of voltage applied thereto. Accordingly, said heater coil 4 is also divided into three heater coil segments 4a ~ 4c, each wound around each core piece 2a~2c, and a voltage of the single-phase power source is applied by said lead pins 3a, 3b to the both ends of each heater coil segment 4a, 4b or 4c. Specifically, as shown in Fig. 2, one end A1, A2 or A3 of the heater coil segment 4a, 4b or 4c is connected to one of said lead pins 3a, 3b at one end of each core pieces 2a, 2b or 2c, and the other end B1, B2 or B3 of each heater coil segment 4a, 4b or 4c is connected to the other of said lead pins 3a, 3b at the other end of each core piece



2a, 2b or 2c.

Fig. 3 shows a conventional sheathed heater to be connected across a three-phase power source.

5 It is publicly known that in the sheathed heater the insulation ability of the thermal and electrical insulation material 5 and the spacer 6 of magnesia or the like is lowered if the temperature is increased more than about 800 °C. However, in the sheathed heater as shown in Fig. 2 or Fig. 3, a
10 gap formed between the adjacent core pieces becomes non-heated portion, so that it should be made small, such as about 2 to 3 mm in order to equalize the temperature distribution. If this is the case, a voltage, such as 100 V is applied between said gap,
15 so that an abnormal current flows through said gap to heat this portion, thereby causing the service life of the sheathed heater to be shortened.

20 An object of the present invention is to reduce an abnormal current flowing through a gap formed between adjacent core pieces.

The above object can be attained by a sheathed heater characterized in that each internal heater coil segment is wound around each core piece
25 arranged axially, which is covered by a cylindrical

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metal sheath through a thermal and electrical insulation material, and adjacent ends of adjacent internal heater coil segments are connected to the same lead pin, or lead pins of the same electric potential.

5 The above object can also be attained by a sheathed heater comprising a cylindrical metal sheath, a plurality of rod shaped core pieces of porcelain insulator arranged side by side in
10 said cylindrical metal sheath, a thermal and electrical insulation material filled in a space formed between said metal sheath and core pieces, internal heater coil segments each wound around each of said core pieces, and a plurality of lead
15 pins each inserted into said core pieces, characterized in that adjacent ends of adjacent internal heater coil segments are connected to the same lead pin, or lead pins of the same electric potential.

20 The above object can also be attained by a sheathed heater comprising a cylindrical metal sheath, a plurality of rod shaped core pieces of porcelain insulator arranged side by side in said cylindrical metal sheath,
25 spacers of thermal and electrical insulation

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material each inserted between adjacent core
pieces, a thermal and electrical insulation
material filled in a space formed between said
metal sheath and core pieces, internal heater coil
5 segments each wound around each of said core pieces,
and a plurality of lead pins each inserted into
said core pieces and spacers, characterized
in the adjacent ends of adjacent internal heater
coil segments are connected to the same lead pin,
10 or lead pins of the same electric potential.

Fig. 1 is a sectional view of a conventional
sheathed heater to be connected across a single-phase
electric power source;

15 Fig. 2 is a sectional view of an another
conventional sheathed heater to be connected
across a single-phase electric power source;

Fig. 3 is a sectional view of an other
conventional sheathed heater to be connected
20 across a three-phase electric power source;

Fig. 4 is a sectional view of a sheathed heater
to be connected across a single-phase electric power
source according to an embodiment of the present
invention;

25 Fig. 5 is a sectional view of a sheathed heater

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to be connected across a three-phase electric power source according to the other embodiment of the present invention; and

Fig. 6 is a sectional view taken along a line 6-6 in Fig. 5.

Now, an embodiment of this invention will be described by referring to Figs. 4 to 6.

In a sheathed heater to be connected across a single-phase electric power source according to an embodiment of the present invention, as shown in Fig. 4, one end A1 of a first internal heating coil segment 4a wound around a first core piece 2a is electrically connected to one lead pin 3a at one end of said first core piece 2a, whereas the other end B1 of said first internal heater coil segment 4a is electrically connected to the other lead pin 3b at the other end of said first core piece 2a. An end A2 of a second internal heating coil segment 4b wound around a second core piece 2b adjacent to said first core piece 2a is electrically connected to said other lead pin 3b at one end of said second core piece 2b, whereas, the other end B2 of said second internal heating coil element 4b is electrically connected to said one lead pin 3a at

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the other end of said second core piece 2b.

Similarly, an end of A3 of a third internal heating coil segment 4c wound around a third core piece 2c adjacent to said second core piece 2b is electrically connected to said one lead pin 3a at one end of said third core piece 2c, whereas, the other end B3 of said third internal heating coil segment 4c is electrically connected to said other lead pin 3b at the other end of said third core piece 2c.

Figs. 5 and 6 show a sheathed heater to be connected across a three-phase electric power source according to the other embodiment of the present invention.

In this embodiment, a first to three small holes separated in the circumferential direction from one another are formed in and passing through each of first to three core pieces 2a to 2c of porcelain insulator, and a first to three lead pins 3a to 3c are inserted into said first to three small holes, respectively. As like as said first embodiment, one end A1 of a first internal heating coil segment 4a wound around said first core piece 2a is electrically connected to said first lead pin 3a at one end of said first core piece 2a, the

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other end B1 of said first internal heater coil segment 4a is electrically connected to said second lead pin 3b at the other end of said first core piece 2a, an end A2 of a second internal heating coil segment 4b wound around said second core piece 2b adjacent to said first core piece 2a is electrically connected to said second lead pin 3b at one end of said second core piece 2b, and the other end B2 of said second internal heating coil element 4b is electrically connected to said third lead pin 3c at the other end of said second core piece 2b.

Similarly, an end of A3 of a third internal heating coil segment 4c wound around said third core piece 2c adjacent to said second core piece 2b is electrically connected to said third lead pin 3c at one end of said third core piece 2c, whereas, the other end B3 of said third internal heating coil segment 4c is electrically connected to said first lead pin 3a at the other end of said third core piece 2c.

Said first to three lead pins are electrically connected across a three-phase electric power source, respectively.

As stated above, in the present invention,

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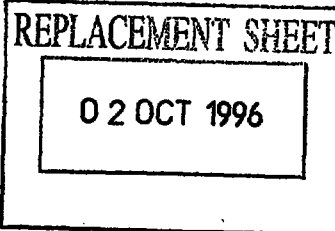
no voltage difference are formed between the adjacent ends of the internal heating coil segments adjacent to each other, such as B1-A2, B2-A3, because these are electrically connected to the same lead pin, or
5 lead pins of the same electric potential.

Accordingly, the abnormal current is prevented from flowing between said adjacent lead pins, so that the service life of the sheathed heater can be prolonged.

While the invention has been particularly shown
10 and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by
15 the appended claims:

20

25



CLAIMS:

1. A sheathed heater comprising a cylindrical metal sheath (1), a plurality of rod shaped core pieces (2a~2c) of porcelain insulator arranged side by side in said cylindrical metal sheath (1), a thermal and electrical insulation material (5) filled in a space formed between said metal sheath (1) and core pieces (2a ~ 2c), internal heater coil segments (4a ~ 4c) each wound around each of said core pieces (2a ~ 2c), and a plurality of lead pins (3a, 3b) each inserted into said core pieces (2a ~ 2c), characterized in that adjacent ends of adjacent internal heater coil segments (4a ~ 4c) are connected to the same lead pin, or lead pins (3a, 3b) of the same electric potential.

2. A sheathed heater comprising a cylindrical metal sheath (1), a plurality of rod shaped core pieces (2a~2c) of porcelain insulator arranged side by side in said cylindrical metal sheath (1), spacers (6) of thermal electrical and insulation material each inserted between adjacent core pieces (2a~2c), a thermal and electrical insulation material (5) filled in a space formed between said metal sheath (1) and core pieces (2a~2c), internal heater coil segments (4a ~ 4c) each

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REPLACEMENT SHEET

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wound around each of said core pieces (2a ~ 2c),
and a plurality of lead pins (3a, 3b) each inserted
into said core pieces (2a ~ 2c) and spacers (6),
characterized in that adjacent ends of adjacent
5 internal heater coil segments (4a ~ 4c) are
connected to the same lead pin, or lead pins
(3a, 3b) of the same electric potential.

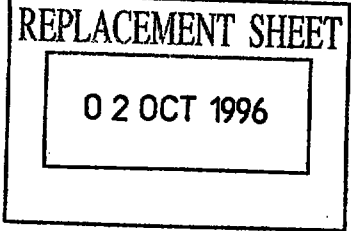
3. The sheathed heater according to claim 1
or 2, wherein said lead pins (3a, 3b) are two in
10 number which are separated to each other, and said
internal heater coil segment (4a~4c) is connected
across a single-phase electric power source.

4. The sheathed heater according to claim 1
or 2, wherein said lead pins (3a~3c) are three in
15 number which are separated from one another and said
internal heater coil segment (4a~4c) is connected
across a three-phase electric power source.

5. The sheathed heater according to claim 4,
wherein said three lead pins (3a~3c) are separated
20 from one another in the circumferential direction.

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ABSTRACT:

SHEATHED HEATER

5 A sheathed heater comprising at least two core
pieces (2a, 2b) of porcelain insulator separated to
each other in the axial direction of said core
piece (2a, 2b), at least two lead pins (3a, 3b)
separated to each other and inserted into the core
pieces (2a, 2b) axially, at least two internal
heater coil segments (4a, 4b) wound around the
10 at least two core pieces (2a, 2b), respectively,
and a cylindrical metal sheath (1) into which the
core pieces (2a, 2b) and the internal heater coil
segments (4a, 4b) are inserted through a thermal and
electrical insulation material (5), wherein adjacent
15 ends of adjacent internal heater coil segments (4a,
4b) are electrically connected to the same lead pin,
or lead pins (3a, 3b) of the same electric potential.

FIGURE NO:4

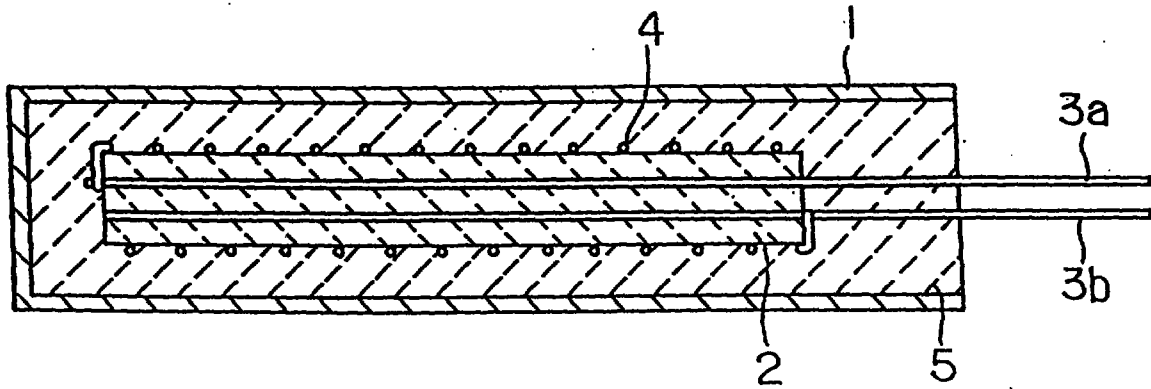
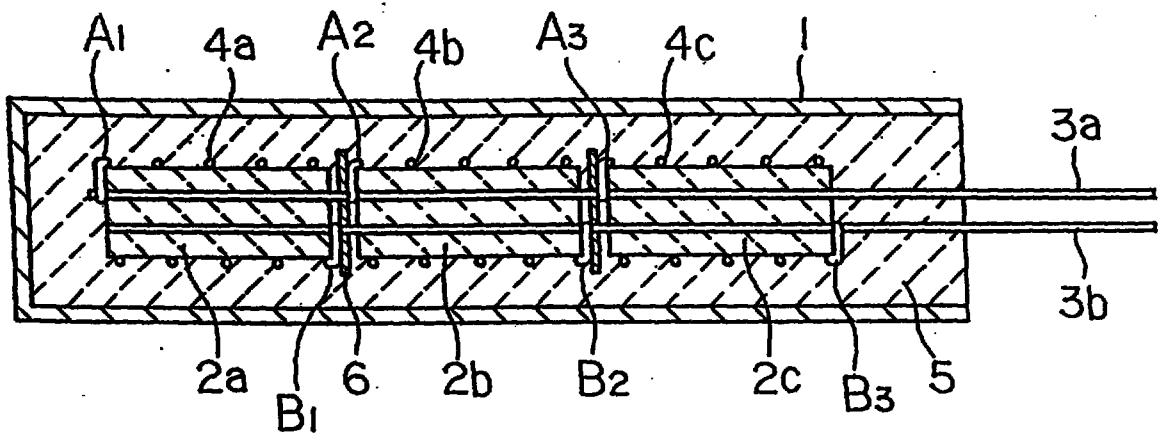
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FIG. 1
PRIOR ARTFIG. 2
PRIOR ART

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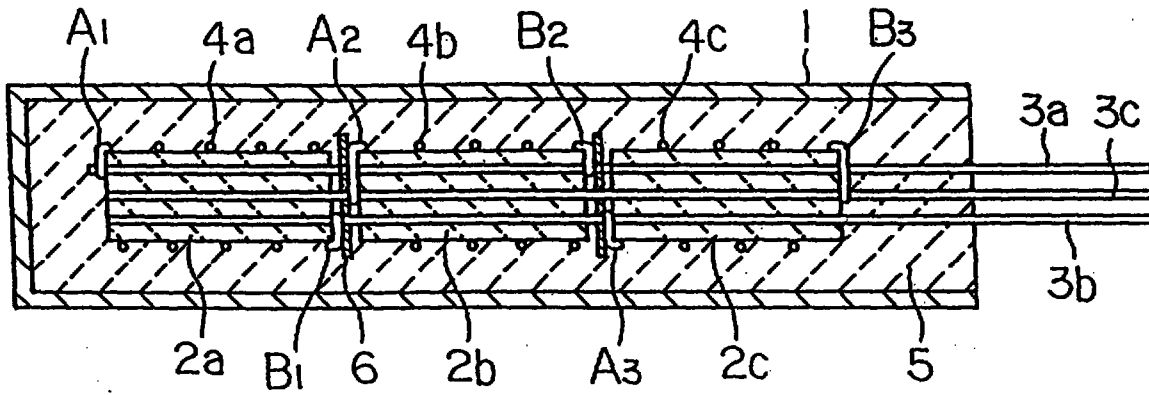
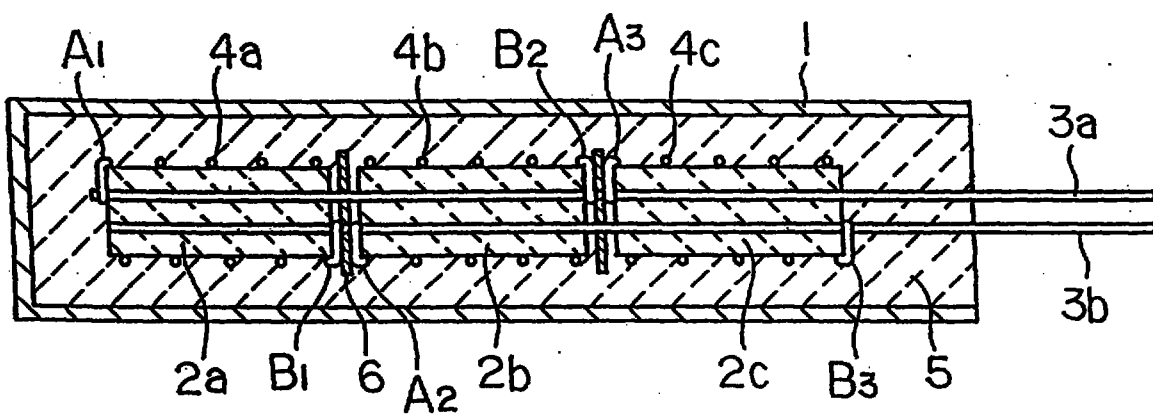
FIG. 3
PRIOR ART

FIG. 4



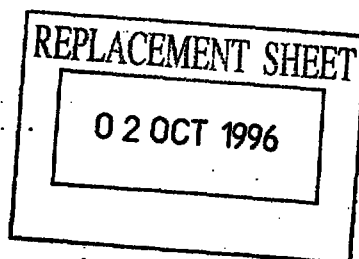


FIG. 5

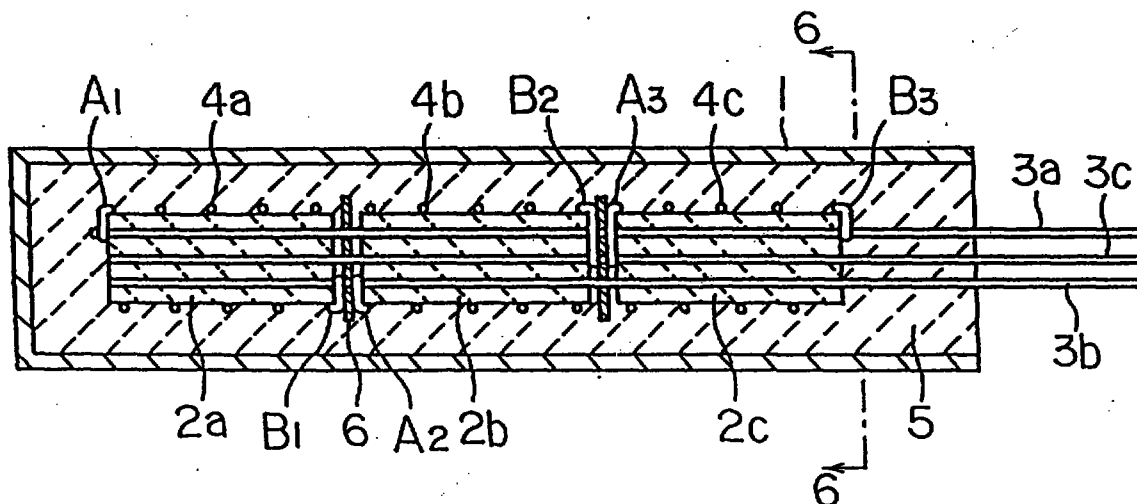
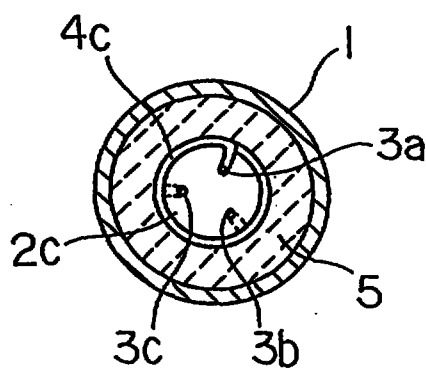
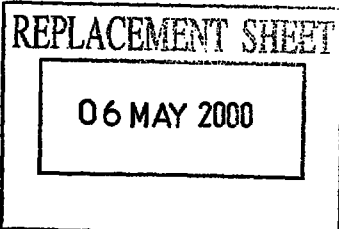


FIG. 6





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CLAIMS

REPLACEMENT SHEET		SG
1. Description: page 1 to page 1		
✓ 2. (a) : page 2 to page 12		
3. (b) : page 1 to page 1		
✓ 4. (c) : page 13 to page 1		

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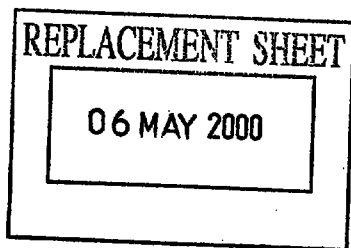
1. A sheathed heater comprising a cylindrical metal sheath (1), a plurality of rod shaped core pieces (2a-2c) of porcelain insulator arranged in separated end to end adjacent relationship in said cylindrical metal sheath (1), a thermal and electrical insulation material (5) filled in a space formed between said metal sheath (1) and core pieces (2a-2c), a plurality of internal heater coil segments (4a,4b,4c) each wound around a different one of said core pieces (2a,2b,2c) and having opposed terminals located at opposite ends of said core piece (2a,2b or 2c), and two lead pins (3a,3b) separated from each other and inserted into said core pieces (2a-2c), characterized in that one of said two lead pins (3a,3b) is connected to an upstream side terminal (A1) of a first coil segment (4a) and a downstream side terminal (B2) of a second coil segment (4b), and the other of said two lead pins (3a,3b) is connected to a downstream side terminal (B1) of the first coil segment (4a) and an upstream side terminal (A2) of the second coil segment (4b), and said two lead pins (3a,3b) are connected across a single-phase electric power source, so that said two coil segments (4a,4b) are connected in parallel to said power source.

20

2. A sheathed heater according to Claim 1 characterised in that one of said two lead pins (3a,3b) is connected to an upstream side terminal (A1) of the first coil segment (4a), a downstream side terminal (B2) of the second coil segment (4b), and an upstream side terminal (A3) of a third coil segment (4c), and the other of said two lead pins (3a,3b) is connected to a downstream side terminal (B1) of the first coil segment (4a), an upstream side terminal (A2) of the second coil segment (4b), and a downstream side terminal (B3) of the third coil segment (4c) and said two lead pins (3a,3b) are connected across a single-phase electric power



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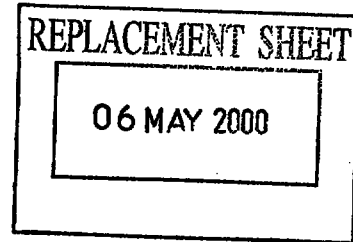


source, so that said three coil segments (4a-4c) are connected in parallel to said power source.

3. A sheathed heater comprising a cylindrical metal sheath (1), a
5 plurality of rod shaped core pieces (2a-2c) of porcelain insulator arranged
in separated end to end adjacent relationship in said cylindrical metal
sheath (1), a thermal and electrical insulation material (5) filled in a space
formed between said metal sheath (1) and core pieces (2a-2c), a plurality
10 of internal heater coil segments (4a,4b,4c) each wound around a different
one of said core pieces (2a,2b,2c) and having opposed terminals located at
opposite ends of said core piece (2a,2b or 2c), and three lead pins (3a-3c)
separated from each other and inserted into said core pieces (2a-2c),
characterized in that one (3a) of said three lead pins (3a-3c) is connected
15 to an upstream side terminal (A1) of a first coil segment (4a) and a
downstream side terminal (B3) of a third coil segment (4c), another (3b)
of said three lead pins (3a-3c) is connected to a downstream side terminal
(B1) of the first coil segment (4a) and an upstream side terminal (A2) of a
second coil segment (4b), the other (3c) of said three lead pins (3a-3c) is
connected to a downstream side terminal (B2) of the second coil segment
20 (4b) and an upstream side terminal (A3) of the third coil segment (4c), and
said three lead pins (3a-3c) are connected on the downstream side of the
plurality of core pieces across a three-phase electric power source.

4. A sheathed heater according to Claim 1 or Claim 2, further
25 comprising spacers (6) of thermal electrical and insulation material each
inserted between adjacent core pieces (2a-2c) and wherein said two lead
pins (3a,3b) are each inserted into said core pieces (2a-2c) and said
spacers (6).





5. A sheathed heater according to Claim 3, further comprising spacers (6) of thermal electrical and insulation material each inserted between adjacent core pieces (2a-2c) and wherein said three lead pins (3a,3b,3c) are each inserted into said core pieces (2a-2c) and said spacers (6).

5

6. The sheathed heater according to Claim 3 or Claim 5, wherein said three lead pins (3a-3c) are separated from one another in the circumferential direction.



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ABSTRACT:

SHEATHED HEATER

5 A sheathed heater comprising at least two core
pieces (2a, 2b) of porcelain insulator separated to
each other in the axial direction of said core
piece (2a, 2b), at least two lead pins (3a, 3b)
separated to each other and inserted into the core
pieces (2a, 2b) axially, at least two internal
heater coil segments (4a, 4b) wound around the
10 at least two core pieces (2a, 2b), respectively,
and a cylindrical metal sheath (1) into which the
core pieces (2a, 2b) and the internal heater coil
segments (4a, 4b) are inserted through a thermal and
electrical insulation material (5), wherein adjacent
15 ends of adjacent internal heater coil segments (4a,
4b) are electrically connected to the same lead pin,
or lead pins (3a, 3b) of the same electric potential.

Figure No. 4

REPLACEMENT SHEET

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REPLACEMENT SHEETS		SG
☒	Description : paged 3. to paged 3..	
☐	Claim(s) : paged to paged	
☐	Drawing(s) : paged to paged	
☐	Abstract : paged to paged	
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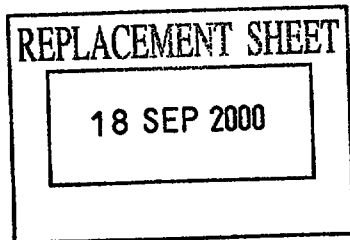
2a, 2b or 2c.

Fig. 3 shows a conventional sheathed heater to be connected across a three-phase power source.

5 It is publicly know that in the sheathed heater the insulation ability of the thermal and electrical insulation material 5 and the spacer 6 of magnesia or the like is lowered if the temperature is increased more than about 800°C. However, in the sheathed heater as shown in Fig. 2 or Fig. 3, a gap formed between the
10 adjacent core pieces becomes non-heated portion, so that it should be made small, such as about 2 to 3 mm in order to equalize the temperature distribution. If this is the case, a voltage, such as 100 V is applied between said gap, so that an abnormal current flows through said gap to heat this portion, thereby causing the service
15 life of the sheathed heater to be shortened.

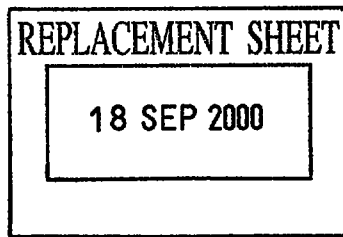
An object of the present invention is to reduce an abnormal current flowing through a gap formed between adjacent core pieces.

20 According to one aspect of the present invention, there is provided a sheathed heater comprising a cylindrical metal sheath (1), a plurality of rod shaped core pieces (2a-2c) of porcelain insulator arranged in separated end to end to adjacent relationship in said cylindrical metal sheath (1), a thermal and electrical
25 insulation material (5) filled in a space formed between said metal sheath (1) and core pieces (2a-2c), a plurality of internal heater oil segments (4a, 4b, 4c) each wound around a different one of said



core pieces (2a, 2b, 2c) and having opposed terminals located at opposite ends of said core piece (2a, 2b or 2c), and two lead pins (3a, 3b) separated from each other and inserted into said core pieces (2a-2c), characterized in that one of said two lead pins (3a-3b) is connected to an upstream side terminal (A1) of a first coil segment (4a) and a downstream side terminal (B2) of a second coil segment (4b), and the other of said two lead pins (3a, 3b) is connected to a downstream side terminal (B1) of the first coil segment (4a) and an upstream side terminal (A2) of the second coil segment (4b), and said two lead pins (3a, 3b) are connected across a single-phase electric power source, so that said two coil segments (4a, 4b) are connected in parallel to said power source.

According to a second aspect of the invention, there is provided a sheathed heater comprising a cylindrical metal sheath (1), a plurality of rod shaped core pieces (2a-2c) of porcelain insulator arranged in separated end to end adjacent relationship in said cylindrical metal sheath (1), a thermal and electrical insulation material (5) filled in a space formed between said metal sheath (1) and core pieces (2a-2c), a plurality of internal heater coil segments (4a, 4b, 4c) each wound around a different one of said core pieces (2a, 2b, 2c) and having opposed terminals located at opposite ends of said core piece (2a, 2b, 2c), and three lead pins (3a-3c) separated from each other and inserted into said core pieces (2a-2c), characterized in that one (3a) of said three lead pins (3a-3c) is connected to an upstream side terminal (A1) of a first coil segment (4a) and a downstream side terminal (B3) of a third coil segment



(4c), another (3b) of said three lead pins (3a-3c) is connected to a downstream side terminal (B1) of the first coil segment (4a) and an upstream side terminal (A2) of a second coil segment (4b), the other (3c) of said three lead pins (3a-3c) is connected to a downstream side terminal (B2) of the second coil segment (4b) and an upstream side terminal (A3) of the third coil segment (4c), and said three lead pins (3a-3c) are connected on the downstream side of the plurality of core pieces across a three-phase electric power source.

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Fig. 1 is a sectional view of a conventional sheathed heater to be connected across a single-phase electric power source;

Fig. 2 is a sectional view of an another conventional sheathed heater to be connected across a single-phase electric power source;

Fig. 3 is a sectional view of an other conventional sheathed heater to be connected across a three-phase electric power source;

Fig. 4 is a sectional view of a sheathed heater to be connected across a single-phase electric power source according to an embodiment of the present invention;

Fig. 5 is a sectional view of a sheathed heater