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TILTING INDUCTION FURNACE WITH LEADS EXTENDING THROUGH A TRUNNION

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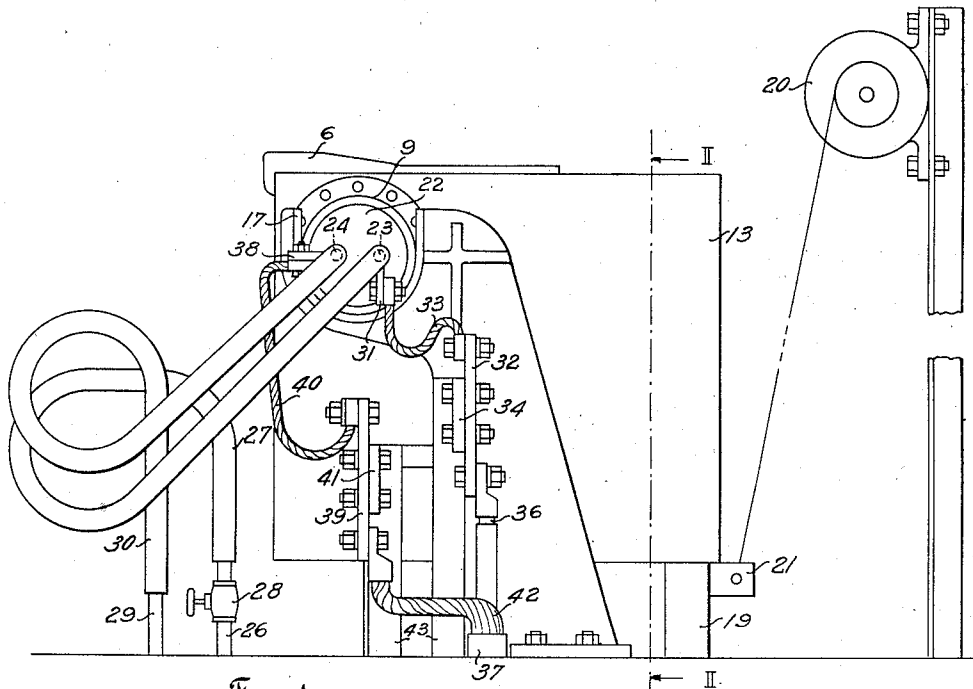


Fig. 1

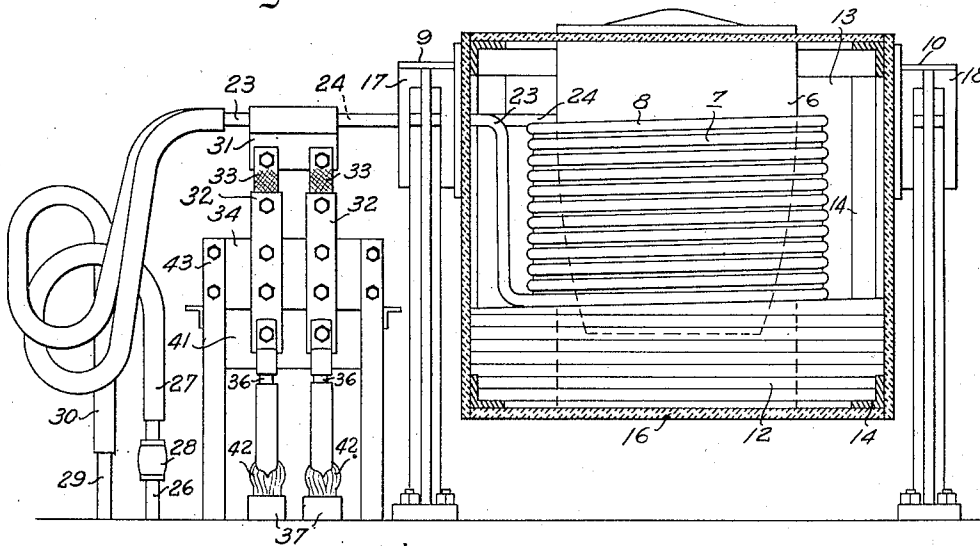


Fig. 2

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TILTING INDUCTION FURNACE WITH LEADS
EXTENDING THROUGH A TRUNNIONPaul C. Vogel, Waukesha, Wis., assignor to Allis-
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3 Claims. (Cl. 13—27)

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This invention relates in general to improve-
ments in electric heating devices and more par-
ticularly to a lead arrangement for induction
furnaces of the trunnion supported tilting type.

Induction furnaces and other electric heating
devices which are mounted on trunnions are
generally provided with flexible leads for con-
necting the heating conductor of the device
with a suitable source of electric current. When
the conductor or some other element of the de-
vice requires artificial cooling, flexible insulat-
ing hose sections are generally provided in ad-
dition for connecting the cooling circuit with a
supply of water or other cooling fluid and with
a drain. These flexible leads and hose sections
are generally attached at some point of the de-
vice which has a substantial displacement during
tilting of the device and they must therefore be
relatively long. They thus become cumber-
some, interfere with the movement of the device
and are in the way of the operator.

It is therefore preferable to provide the device
with hollow trunnions of such diameter that
the leads and cooling connections of the device
may be drawn therethrough, whereby the move-
ment of the flexible portions of the current and
water connections is considerably reduced. The
connections may then be made shorter, with a
lesser degree of flexibility, and may be so located
as not to interfere with the movement of the
device.

The connections may be completed in what-
ever manner is found most expedient in each
particular instance. For example, the preferred
arrangement comprises rigid conductive pipe sec-
tions disposed side by side within the trunnion
for conducting both the current and the cooling
fluid. The leads are connected to fixed termi-
nals through flexible electrical connections and
are connected with a source of cooling fluid and,
if desired, with a drain through sections of in-
sulating flexible hose.

The pipe sections disposed within the trun-
nion may also be severally connected to the fixed
terminals through flexible conductive hose, each
of which serves both for the supply of current
and for the supply of cooling fluid, or through
flexible electric conductors encased in the flex-
ible hose serving for the flow of cooling fluid.
The flexible conductors are then fluid cooled and
may be made of smaller cross section than in the
absence of artificial cooling means.

The trunnion may also enclose fixed conduc-
tive pipes arranged in side by side or coaxial re-
lation and rigidly connected to the fixed current

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terminals as well as to the source of cooling
fluid. The pipes may then be connected to the
terminals of the trunnion supported device
through any of the above mentioned types of
flexible connections.

It is therefore an object of the present inven-
tion to provide an electric heating device of the
tilting type with flexible electric current and
cooling connections which do not interfere with
the tilting movement of the device.

Another object of the present invention is to
provide an electric heating device of the tilting
type in which flexible electric current and cool-
ing connections have the least movement upon
tilting of the device.

Another object of the present invention is to
provide an electric heating device of the tilting
type having common rigid electric current and
cooling connections and separate flexible electric
current and cooling connections.

Objects and advantages other than those above
set forth will be apparent from a consideration
of the following description when read in con-
nection with the accompanying drawing, in
which:

Fig. 1 is a view in side elevation of a trunnion
supported induction melting furnace provided
with a preferred embodiment of current and cool-
ing connections extending through a trunnion
thereof; and

Fig. 2 is a view in cross section through line
II—II of the embodiment illustrated in Fig. 1.

Referring more particularly to the drawing by
characters of reference, the induction furnace
comprises a crucible 6 of graphite or ceramic
material associated with an inductor coil 7. The
inductor is a solenoid wound from an elongated
conductor of a metal of high conductivity such
as copper with interposition of suitable electric
insulation between adjacent turns thereof. The
conductor may be of solid cross section if it does
not require artificial cooling, or may consist of
a pipe 8 wound alone or in parallel with other
conductive elements when the inductor is to be
traversed by a flow of cooling water or other
cooling fluid. Inductor 7 is mounted on a pair
of hollow trunnions 9, 10 in any suitable known
manner to permit tilting crucible 6 when it is
desired to pour molten metal therefrom. For
example, inductor 7 may be laid on a hollow
frame 12 built of asbestos lumber disposed in a
casing 13 comprising a structural frame 14 and
a covering of asbestos lumber 16. Crucible 6 is
set within inductor 7 and the space therebetween

is filled with tamped refractory material (not shown).

Trunnions 9, 10 are fastened to frame 14 of casing 13 and are supported in a pair of overhanging bearings 17, 18 within which they are free to rotate. Downward tilting of casing 13 with respect to bearings 17, 18 is limited by suitable feet 19 provided on frame 14. The casing may be tilted upward for pouring metal from crucible 6 by means of a hoist 20 suitably located with respect thereto and having its cable attached to a suitable lug 21 provided on frame 14.

Trunnion 9 is provided with a plug 22 of suitable insulating material such as fabric reinforced synthetic resin forced into the trunnion. Plug 22 is provided with two passages parallel to the axis thereof for receiving metal pipes 23, 24 integral with pipe 8 or fastened thereto and serving as current leads as well as water flow connections for the inductor. Pipes 23, 24 are associated with stationary piping outlets disposed adjacent bearing 9. Pipe 23 for example is connected with a water supply pipe 26 through a section of flexible insulating hose 27 and a valve 28, and pipe 24 is connected with a drain pipe 29 through a second section of flexible insulating hose 30. Hose sections 27, 30 are made of any suitable flexible insulating material such as fabric reinforced rubber and are chosen of such length as to reduce the current leakage through the water contained therein to the desired extent.

Pipe 23 is provided with a terminal 31 brazed thereon and movable therewith and connected to one or more stationary terminals 32 through one or more flexible conductors 33. Each terminal 32 may consist of a copper bar bolted on a plate of insulating material 34 and connected with a suitable current generator (not shown) through the inner conductor 36 of a coaxial insulated cable 37. Pipe 24 is likewise provided with a terminal 38 movable therewith connected to stationary terminals 39 through flexible conductors 40. Terminals 39 are supported on a plate of insulation 41 and are connected with outer conductors 42 of coaxial cables 37. Insulation plates 34, 41 are mounted on a suitable framework 43 of which the outermost elements are assumed to be removed in Fig. 1 to clarify the drawing. During operation of the furnace the entire arrangement of connections of pipes 23, 24 with cables 37 and outlets 26, 29 is preferably covered with a hood (not shown) to prevent accidental contact of the operator therewith and to prevent damage thereto by metal spilt during pouring of the charge.

It will be apparent that with the above described arrangement the electrical and cooling water connections of inductor 7 are remote from the inductor so as not to interfere with the tilting thereof. The electrical connections of the inductor with cables 37 are adjacent each other, whereby the inductance of such connections is maintained at a minimum value. When the charge of crucible 6 is to be poured, casing 13 is lifted by means of hoist 20. Pipes 23, 24 rotate with a minimum radius and flexible conductors 33, 40 are subjected to a minimum of flexure and may therefore be made relatively short and compact. While the length of hose sections 27, 30 cannot be reduced below the value required to prevent excessive current leakage between the conductor terminals, the life of the hose sections is increased by the absence of excessive flexure thereof during tilting of the furnace.

Although but one embodiment of the present invention has been illustrated and described it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

It is claimed and desired to secure by Letters Patent:

1. An electric heating device comprising a bearing, a hollow trunnion rotatably supported on said bearing, a current conductor rigidly mounted on said hollow trunnion for tilting movement with respect to said bearing, current leads for said conductor extending through said hollow trunnion and through said bearing, stationary terminals disposed adjacent said bearing, and flexible conductors connecting said current leads with said terminals.

2. An electric heating device comprising a bearing, a hollow trunnion rotatably supported on said bearing, a metallic pipe rigidly mounted on said hollow trunnion for tilting movement with respect to said bearing, said pipe defining an electric circuit and forming a passage for the flow of a fluid, electrically conductive pipe sections extending side by side in insulated relation through said hollow trunnion and through said bearing for supplying electric current and fluid to said pipe, stationary terminals adjacent said bearing, flexible conductors connecting said pipe sections with said terminals, a stationary piping outlet adjacent said bearings, and a flexible insulating hose section connecting one of said pipe sections with said outlets.

3. An electric heating device comprising a bearing, a hollow trunnion rotatably supported on said bearing, a metallic pipe rigidly mounted on said hollow trunnion for limited tilting movement with respect to said bearing, said pipe defining an electric circuit and forming a passage for the flow of a fluid, electrically conductive pipe sections extending through said hollow trunnion and through said bearing for supplying electric current and fluid to said pipe, electrical insulation disposed within said hollow trunnion for supporting said pipe sections side by side in insulated relation with respect to each other and to said hollow trunnion, stationary terminals disposed side by side in a direction transverse to the axis of said trunnion adjacent said bearing, bare flexible conductors connecting said pipe sections with said terminals, said terminals being at different heights to prevent short circuits between said conductors during said tilting movement, stationary piping outlets adjacent said bearings, and flexible insulating hose section connecting said pipe sections with said outlets.

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