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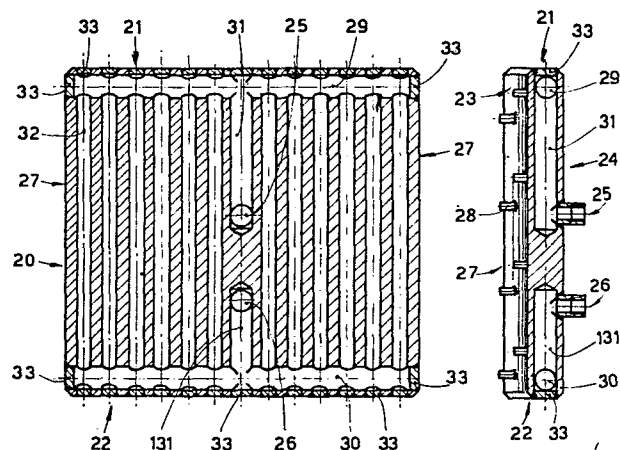
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⑤ **Cooling panel for electric arc furnaces.**

⑦ This invention concerns a cooling plate for electric arc furnaces either for obtaining the ring situated higher than the bath or for obtaining the furnace cover, whereby the inner side may comprise supports and anchorage means for the refractory material and inlet and outlet attachments for the cooling liquid, the panel being obtained with any desired thick plate cut to a desired, preferential profile (21—22—27), and a coordinated plurality of channels (29—30—32—37) substantially contained within the thickness of said plate being obtained by processing with a tool, whereby the plate is shaped as wished and consists of any desired, but advantageously metallic, material.



1 Description of the invention entitled

COOLING PANEL FOR ELECTRIC ARC FURNACES

in the name of IMPIANTI INDUSTRIALI S.p.A. at Osoppo

Submitted on

under No.

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The subject of this invention is a cooling panel for electric arc furnaces; to be more exact, the subject of this invention is a cooling panel of the type employed to cool the upper band of the wall of the electric arc furnace or to cool the cover of said furnace.

Some rings are formed with box-wise elements within which the cooling water circulates. Of the same type is the down-gate described in patent CH 221354, according to which said down-gate has its sides and beam part made of a box-wise metal structure, and the water circulates within them.

The integral ring envisaged in DE AS 2631982 to cool the upper band of the wall of the furnace also has a box-wise structure, and according to that patent said element has a refractory lining arranged for its inner surface.

French patent No. 1514515 has, instead, two integral box-wise rings, located one above the other, to cool the upper band of the furnace wall and a like structure to cool the furnace cover. In this patent the box-wise elements are connected to the refractory walls with some anchorage means and have in their hollow insides some pipes in which the

1 cooling water circulates.

Patent DE AS 2659827 has two box-wise cooling rings, both alike, arranged one above the other. In this case said rings are made in segments connected together and have some protrusions extending into the refractory lining to increase the heat-carrying capacity.

Patent US 3829595 (FR 73.02455) envisages the use of two rings situated one above the other and made in segments with solid metal blocks connected together; some vertical pipes are visualised within these blocks for the passage of cooling water. Said blocks have a refractory lining and refractory bricks on their inner surface.

German utility model GM 76I6608 envisages, instead, a furnace in which are foreseen three cooling zones disposed symmetrically around the upper band of the furnace wall; each zone comprises a plurality of metal cooling blocks provided with internal pipes in coils for the passage of cooling water; the inner surface of the blocks is equipped with metal protrusions, whilst the outer surface is covered with a metal plate that encloses said cooling pipes.

A like solution is envisaged by patent US 3849587 wherein the zones chosen for the cooling are provided with box-wise elements cooled with water, or else there are metal blocks equipped with internal pipes fused to the inside of said blocks.

Patents US 3743752, US 3777043 and GB II93527 also foresee the installation of box-wise cooling elements to be applied at points where the temperature is very high.

Other rings consist of segmented cooling elements in which a cast iron or copper block encloses a channel in coils wherein the water circulates, as in patent US 3843I06, the whole being obtained by casting and the coiled channel protruding partially to correspond with the connecting curves.

1. In other cases said coiled channel is not enclosed in
nor fused to the refractory material nor to the cast iron
or copper block as in US 3843106, but is envisaged as being
on the outside of the furnace and of its cover, as in patent
5 FR 873.478, or else said coiled channel is also wound around
the electrodes at the inlet for said electrodes as in patent
FR 1238713. Another lay-out is visualised in patent FR 1155723,
which foresees an electric arc furnace consisting of two co-
axial jackets located one inside the other and separated from
10 each other by a space; the inner jacket is cooled with gas
flowing through said space, whereas the outer jacket is cooled
with water coming in at the bottom and going out at the top.
The annular cavity of the outer jacket has some vertical
channels extending throughout practically all the length of
15 the furnace, and these channels consist of a corrugated
metal-foil element fixed between the internal walls of said
circular cavity.

There are also other types of rings, but all of them
are complex to make and are not very reliable owing to the
20 thermal stresses which they undergo periodically and conti-
nuously and which bring about a lessening of the life of the
refractory material and thus of the furnace itself.

This lessening of the life increases the cost and the
time needed to ready the walls and cover of the furnace.

25 This invention tends to overcome this problem by the
provision of a new cooling panel intended for the construct-
ion of the cooling ring or furnace cover. The invention com-
bines easy manufacture with a safe structure able to absorb
any thermal or mechanical shock, and also offers an extremely
30 simple structure to be constructed.

According to the invention a panel of thick plate is
cut according to whatever preferential shape is wished. Ac-
cording to the circumstances involved, the panel is bent

beforehand or after the successive operations. A plurality of internal channels is made with a tool, and they are connected together with manifolds. As said, the panels are shaped according to the circumstances in question so as to assume a partially cylindrical conformation or a partially truncated-cone conformation before or after the machining has been carried out, or else before or after the closure of the inlets of the connecting pipes. If wished, the manifolds or transit channels may be made at the ends or in an intermediate position by machining the exposed outer surface with a tool and then closing it thereafter with strip or with sheet sealed to the panel by welding. Next, the inlet and outlet attachments are arranged in any desired suitable position on the outer surface of the panel so as to correspond with the manifolds.

According to the invention the path of the circulating water can be highly varied within the limits allowed by the making of the channels with a tool, whether it be done by drilling (for instance, with a straight-flute drill) or by milling or with a shaping or milling machine for plate, for example.

One purpose of this invention is to envisage a cooling panel which can be machined from plate of a suitable thickness available commercially; said plate must be capable of being worked readily with a tool so as to hold inside itself the cooling channels in a quantity enough for the purpose.

Another purpose of this invention is to visualise a cooling panel with internal channels for the cooling water formed as desired, which can be increased in number and volume, in the zones of higher temperature.

Yet another purpose is to envisage a cooling panel which has a low cost and can be readily and economically replaced or adjusted if found faulty. Again, a purpose is to obtain a

1 cooling panel from thick plate with one or more conduits or
manifolds made, perhaps at least partly, in its exposed sur-
face and then closed superficially.

It is an advantageous fact that the panel of this invention
5 does not require auxiliary lining pipes, thus enabling a
large reduction to be made in both costs and and weight. It
is also an advantageous fact that the cooling channels can
be located very near the surface, unlike panels made by cast-
ing, which need greater minimum thicknesses. This also en-
10 ables a greater power of cooling and heat dispersion to be
obtained. Another advantageous fact is that the panel forms
a more uniform and efficient block to absorb heat.

Yet another advantage is the ability offered by this invent-
ion to envisage a watertight cooling panel made of resilient
15 and homogeneous material with no risks of leakage in the cool-
ing water circuit, while it is also an advantage to be able
to instal adequate supports for the refractory material.
The foregoing purposes and advantages together with yet
others are attained with a cooling panel intended to constit-
20 ute the cooling ring or the furnace cover for electric arc
furnaces; said panel can be connected to other similar panels
to constitute together the required containing and cooling
structure.

The invention is therefore realized with a cooling panel to
25 be used with arc furnaces either to obtain the ring lying
above the bath or to obtain the furnace cover; the inner
side of the panel may comprise some supports and anchorage
means for the refractory material, while the outer side may
have attachments for the delivery and discharge of the cool-
30 ing fluid; the panel is characterized by the fact that it is
made of any desired thick plate and cut to a desired prefer-
ential profile, a coordinated plurality of channels substant-
ially contained within the thickness of said plate being

made by processing with a tool, and the plate being shaped as wished and consisting of any desired but advantageously metallic material.

Let us now see a preferential solution of the invention with the aid of the attached tables, which are given as non-restrictive examples. In the figures we have the following:-

- Fig. I shows a circumferential panel with substantially central inlet and outlet attachments;
- Fig. 2 shows a straightened, lengthwise, upright section of the panel of Fig. I;
- Fig. 3 shows a crosswise, upright section of the panel of Fig. I along the axis of the attachments;
- Fig. 4 shows a lengthwise, upright section of a variant of the panel of Fig. I;
- Fig. 5 shows a lengthwise, upright section of another variant of the panel of Fig. I;
- Fig. 6 shows a crosswise, upright section of the panel of Fig. 5;
- Fig. 7 shows a cutaway panel for a furnace cover;
- Fig. 8 shows a cutaway panel for a furnace cover with a hole provided;
- Figs. 9 a-b-c- show a possible section of the hole of Fig. 8;
- Fig. 10 shows a variant of the panel of Fig. 7;
- Fig. 11 shows a variant of the panel of Fig. 8;
- Fig. 12-13 show a head manifold made in the exposed outer surface and then closed;
- Fig. 14 shows diagrammatically a possible installation.
- The same parts in the figures bear the same reference numbers.

In the figures we have as follows; 20 is generically a panel for the side of the furnace, while 120 is a panel for the top thereof; the side panel is shaped advantageously as a segment of the circumference, whereas the top panel fits

a section of the furnace cover; the top panel may comprise some holes (for the entry of the electrodes, the outlet for fumes, the introduction of inoculants, etc.), which may be positioned in the middle of the panel (as per the examples of Figs. 8 and II) or at its side or in any other desired position without affecting the purposes of the invention; thus the side panel may include holes for controls and access to suit the usages and requirements; 21 and 22 are respectively the upper and lower sides; said sides, as also the lateral sides 27, may include special profiles or shapings so as to facilitate connections, installation, airtight seal, etc.; 23 is the inner face and may comprise some suitable means 28 of any desired shape and type which can improve and facilitate the installation of the refractory material; 24 is the outer face, from which there protrude advantageously the connecting pipes or attachments 25 and 26 for connection to the delivery or discharge of cooling liquid; 25 and 26 are the inlet and outlet attachments, or viceversa, which serve respectively to feed and discharge the cooling liquid employed; 28 are the anchorages or anchorage means which serve to facilitate the installation and retaining of the refractory material; said anchorage means can be welded, screwed or inserted into appropriate holes and clamped there, for instance, with nuts on the face 24; 29 - I29 - 229 are channels acting as an upper manifold; 30 - I30 - 230 are channels acting as a lower manifold (the definition of upper and lower manifold here being merely illustrative); 31 and I31 are possible tracts to connect one or both of the attachments to the channels 29 and 30 acting as manifolds; 32 are the conduits which convey the cooling liquid coming from the manifolds; 33 are plugs which are fixed to give a watertight seal at the ends, in the sides and, possibly, in the faces by blocking the channels 29, 30 and 32; the plugs 33 can be.

1 screwed, welded or inserted under pressure and can cooperate
or not with watertight packings; 34 are the inside plugs
which are inserted, for instance, into the manifolds to di-
vide them into sections and to modify the circulation of li-
5 quid as wished; 35 is the cover of the channel made in the
exposed surface and then closed; said cover may be wholly or
partially embedded or be fixed on the outside; 36 is a pos-
sible hole in the panels; it serves for very varied uses and
may have very varied shapes and sections; it can lie in any.
10 desired position in the panel and thus may be situated in-
differently in the middle, in an intermediate position or
near the edge or may be formed in the edge so as to corres-
pond with the neighbouring panel as well; 37 is the annular
manifold channel and can be made in different ways as shown.
15 in Figs. 9a, 9b and 9c; 38 is the closure for the channel
37 and is such as to permit the cooling liquid to circulate
around the hole 36 but not to run out; 39 is the shaft of
the electric furnace; 40 are the electrodes; 41 are examples
of delivery means while 42 are examples of discharge means,
20 but both of them could be inverted; said outer manifolds 41
and 42 are shown connected in a ring but in actual fact can
be connected as wished.

The method of working is evident. The liquid enters
through 25 or 26 and, after having passed through the mani-
25 folds 29 and 30, the conduit 32 and the possible tracts 31
and I31, leaves through 26 or 25.

The method of obtaining the panels 20 - I20 is like-
wise evident, and the sequence of the phases indicated can
vary, one being carried out earlier or later than the others
30 to suit the means employed.

Having cut the panel 20 - I20 according to the peri-
pheral, geometric sizes required, steps are taken to make
the channels 29, 30 and 32 and, perhaps, 37.

1. Said channels can be made wholly or partially with a drill and bit (for instance, with a so-called straight-flute drill for long bores), or with a milling cutter or a rotating tool (for instance, for the channels 37 of Figs. 9a and 9b), or again with a shaping machine (or milling machine) for plate.

The plugs 33 or closures 35 - 38 are then fixed with any desired means such as welding, screwing, pressure, etc.

Fig. 5, in fact, shows the case of a panel wherein a head channel is obtained by milling (shown as an example of a non-through channel), while the other channel 129 serves to connect the various conduits 32 and, perhaps, 31 without said conduits being thereafter plugged as per the examples of Fig. 4 and other solutions.

15. The conduits 32 can obviously be vertical or horizontal or follow any desired slope.

Fig. 7 shows an example wherein the manifold 30 was made from the beginning as a non-through channel, and the conduits 32 are also not through channels. Moreover, Fig. 7 shows a conduit 32 made, for instance, by milling.

The conduits 32 can lie in any direction in the panel 120.

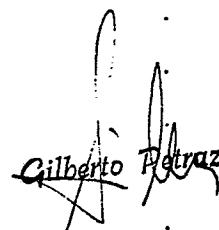
Figs. 9 show some possible types of collars both for the cooling of the edge of the electrode and for connecting the third or fourth hole.

We have described some variants here, but others are possible for a technician in this field, just as it is possible to introduce integrating and/or replacing modifications or variants without departing thereby from the scope of the idea of the solution.

Thus the proportions and/or sizes can be changed, and other types of courses can be realized; it is possible to make channels wholly by drilling, or partly by drilling and

partly by working on the exposed surface and then closing the channel, or all the channels can be made in the open exposed surface and then closed; it is possible to make the manifolds 29 - 30 horizontal, almost horizontal, vertical or almost vertical or, in general, in any desired direction; it is possible to make the conduits 32 meet the manifolds 29 - 30 at any desired angle; the whole course can consist of one single conduit, and so on. These and other variants are all possible for a technician in this field.

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Gilberto Petraz

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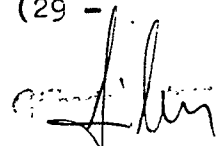
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C L A I M S

- 1 I. Cooling panel for electric arc furnaces, either to form the ring situated higher than the bath or to form the furnace cover, whereby the inner side and, advantageously, the outer side comprise supports and anchorage means for the refractory material and also inlet and outlet attachments for the cooling liquid, being characterized by the fact that it is made of any desired thick plate cut to a desired, preferential profile (21 - 22 - 27), wherein a coordinated plurality of channels (29 - 30 - 32 - 37) substantially contained within the thickness of said plate is obtained by processing with a tool and wherein the plate is shaped as wished and consists of any desired, but advantageously metallic, material.
2. Cooling panel for electric arc furnaces, as in Claim I, characterized by the fact that the channels (29 - 30 - 32 - 37) are oriented and connected as wished, whereby at least some of the channels are plugged (33) at their ends so as to form a closed circuit.
3. Cooling panel for electric arc furnaces, as in Claims I and 2, characterized by the fact that the plugs (33) are welded.
4. Cooling panel for electric arc furnaces, as in Claims I and 2, characterized by the fact that the plugs (33) are screwed.
5. Cooling panel for electric arc furnaces, as in Claims I and 2, characterized by the fact that the plugs (33) are forced into position under pressure.
6. Cooling panel for electric arc furnaces, as in Claim I and in one or another of the Claims thereafter, characterized by the fact that the manifolds (29 - 30 - 37) are connected to at least one conduit (32).
7. Cooling panel for electric arc furnaces, as in Claim I and in one or another of the Claims thereafter, characterized by the fact that at least part of the manifolds (29 -



1 30 - 37) are obtained from the open exposed surface (Figs. .
I2 - I3) and have watertight closure elements (35 - 38).

8. Cooling panel for electric arc furnaces, as in Claim I.
and in one or another of the Claims thereafter, character-
5 ized by the fact that at least part of the conduits (32) are
obtained from the open exposed surface (Figs. I2 - I3) and
have watertight closure elements (35 - 38).

9. Cooling panel for electric arc furnaces, as in Claim I.
and in one or another of the Claims thereafter, character-
10 ized by the fact that the manifolds (29 - 30 - 37) and con-
duits (32) are positioned in the panel (20 - I20) as desired.

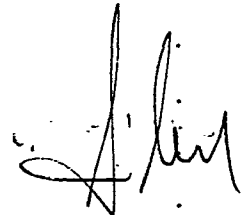
10. Cooling panel for electric arc furnaces, as in Claim I.
and in one or another of the Claims thereafter, character-
ized by the fact that there is at least one connecting tract
15 (31 - I3I) in the panel (20 - I20).

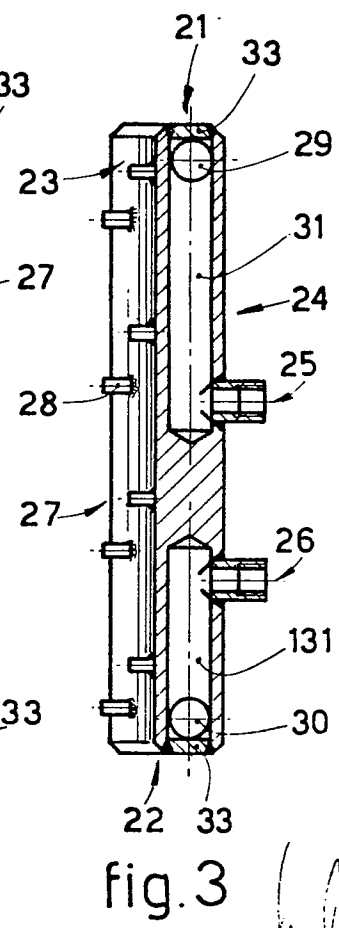
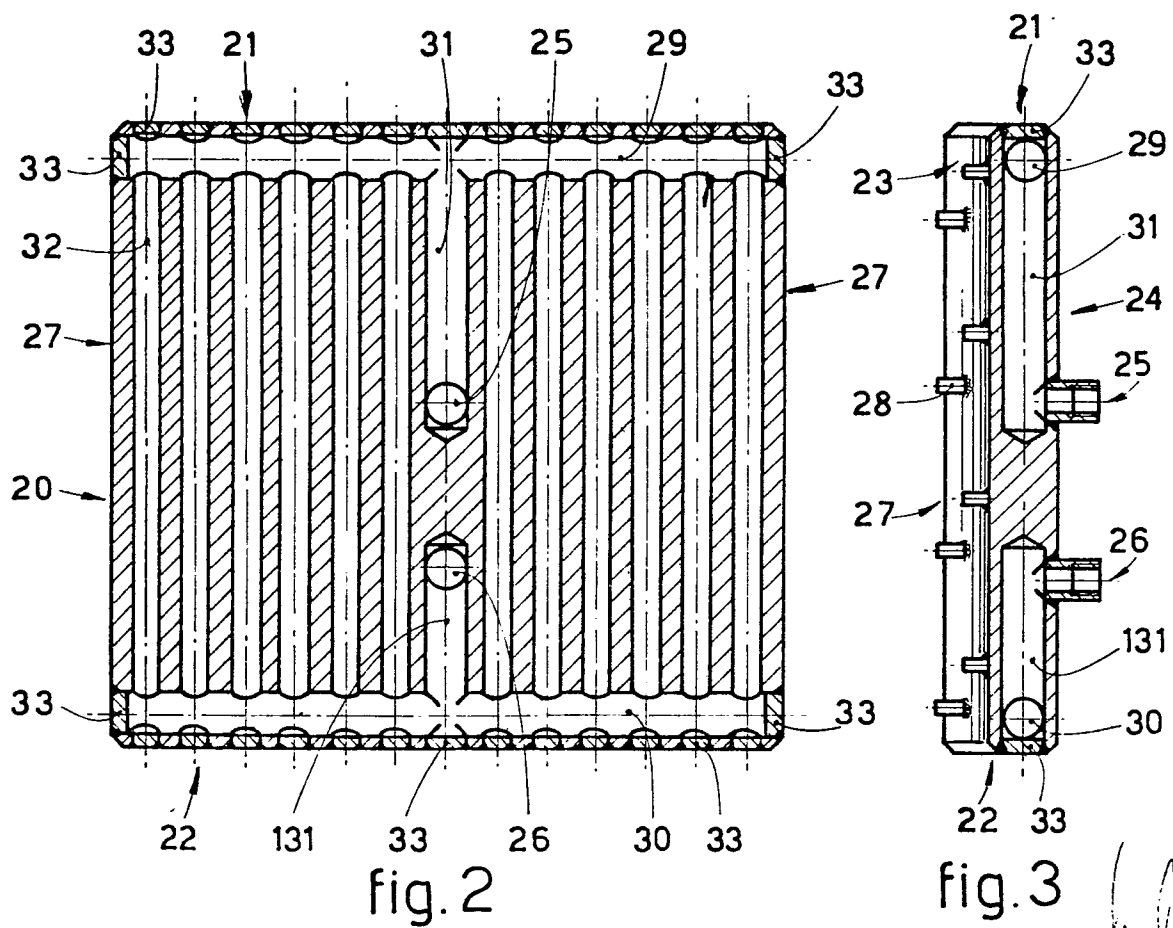
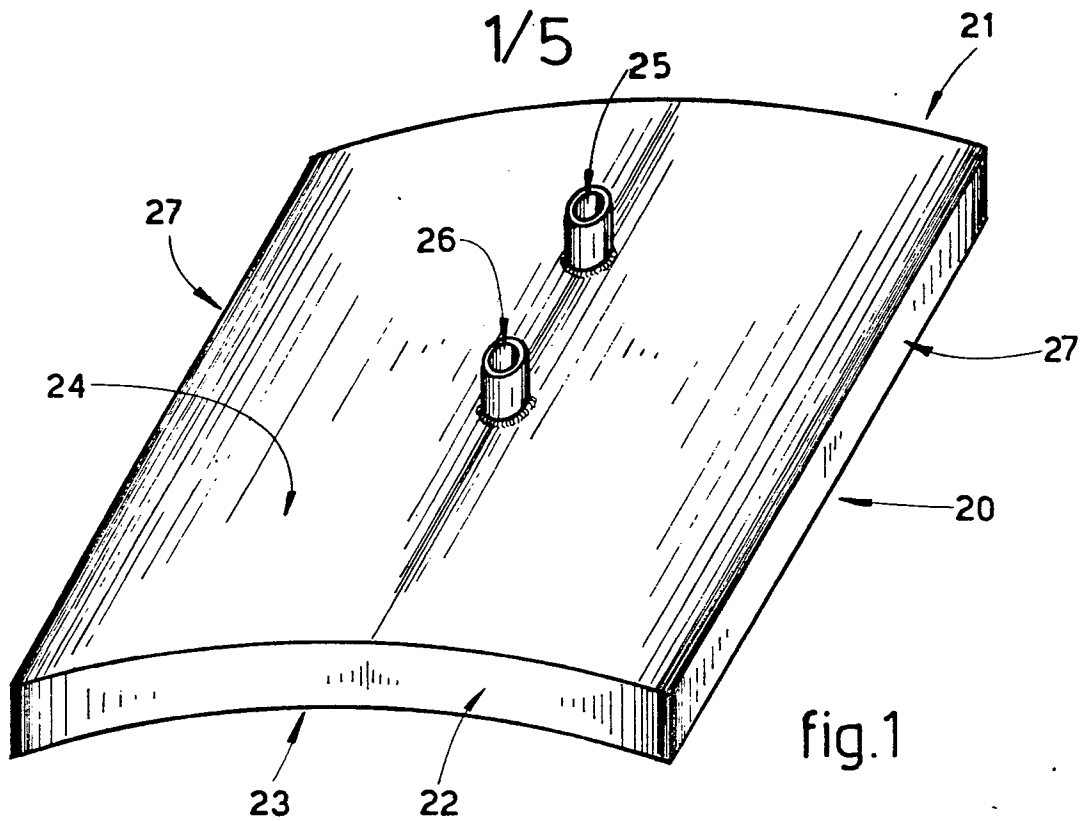
11. Cooling panel for electric arc furnaces, as in Claim I.
and in one or another of the Claims thereafter, character-
ized by the fact that the inlet and outlet attachments (25 -
26) are positioned as desired.

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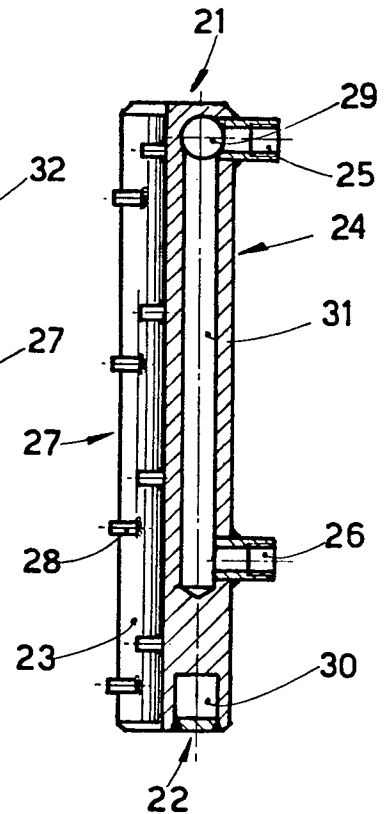
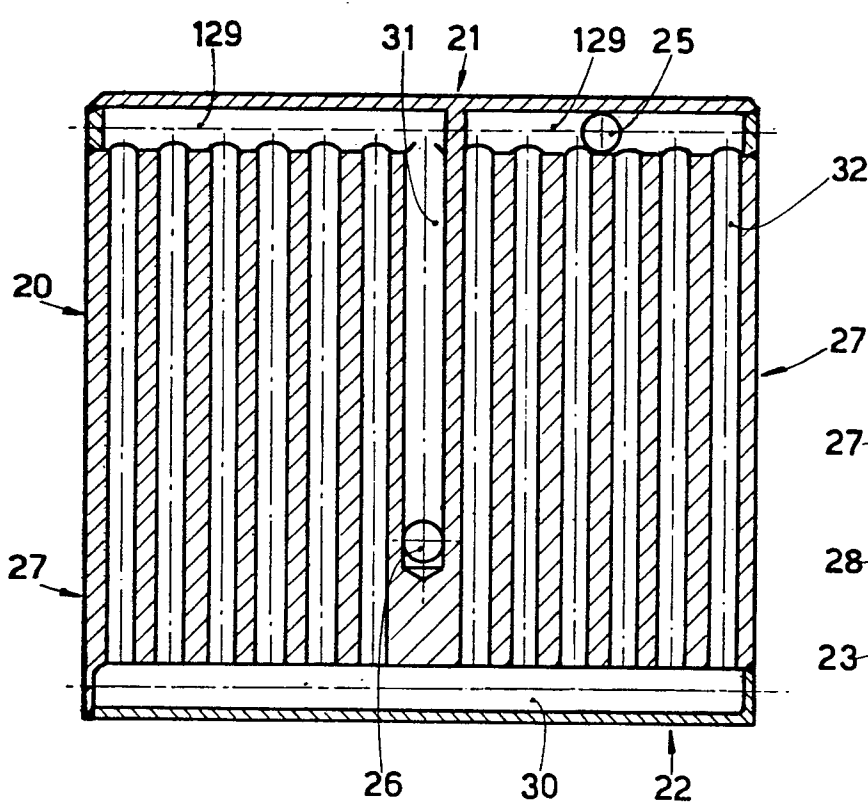
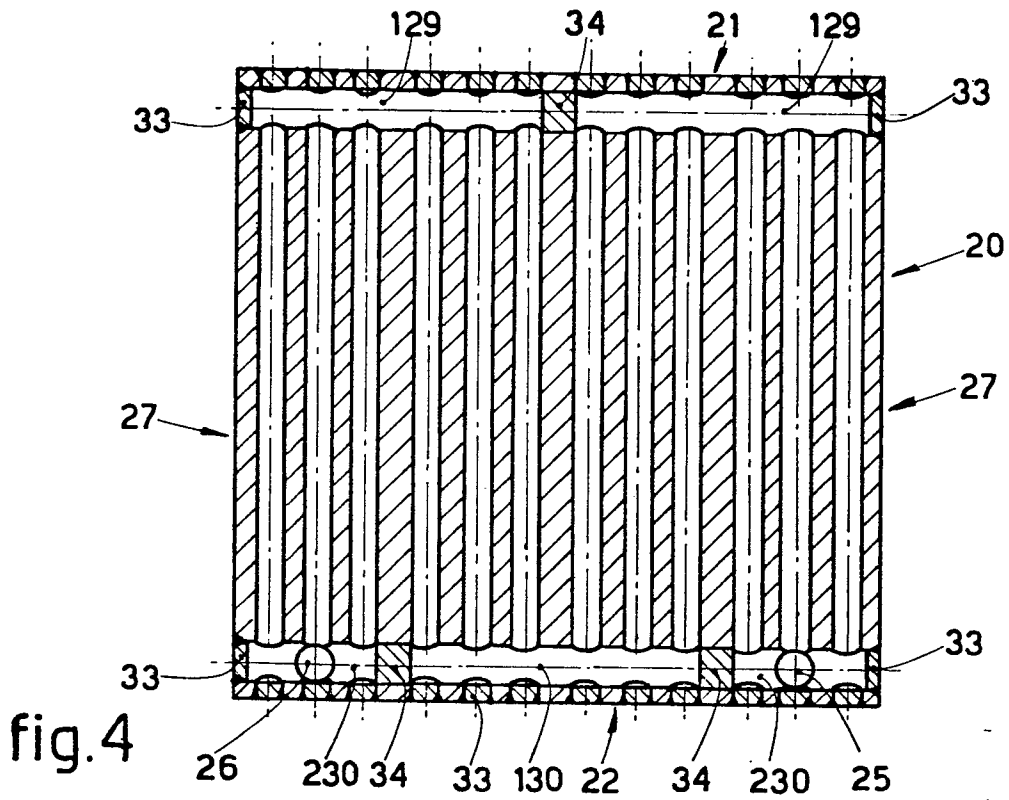
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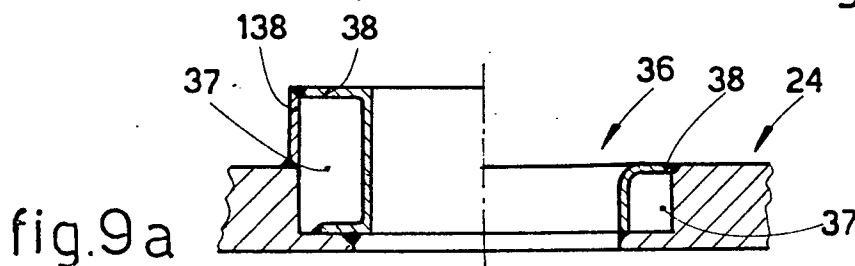
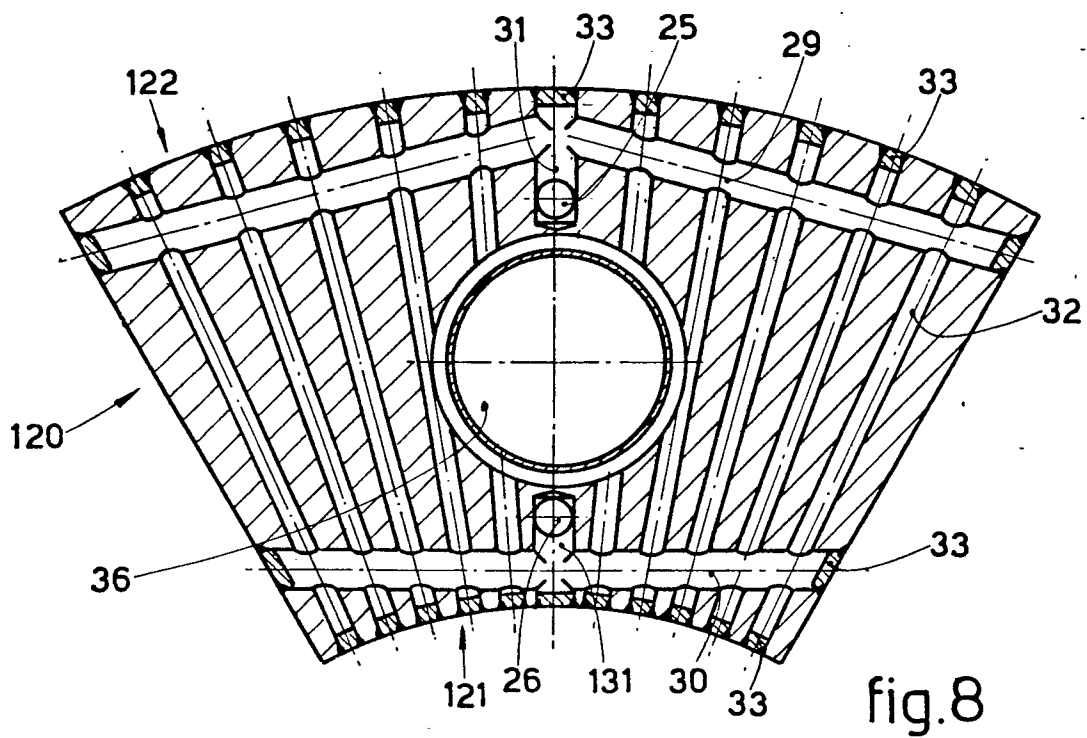
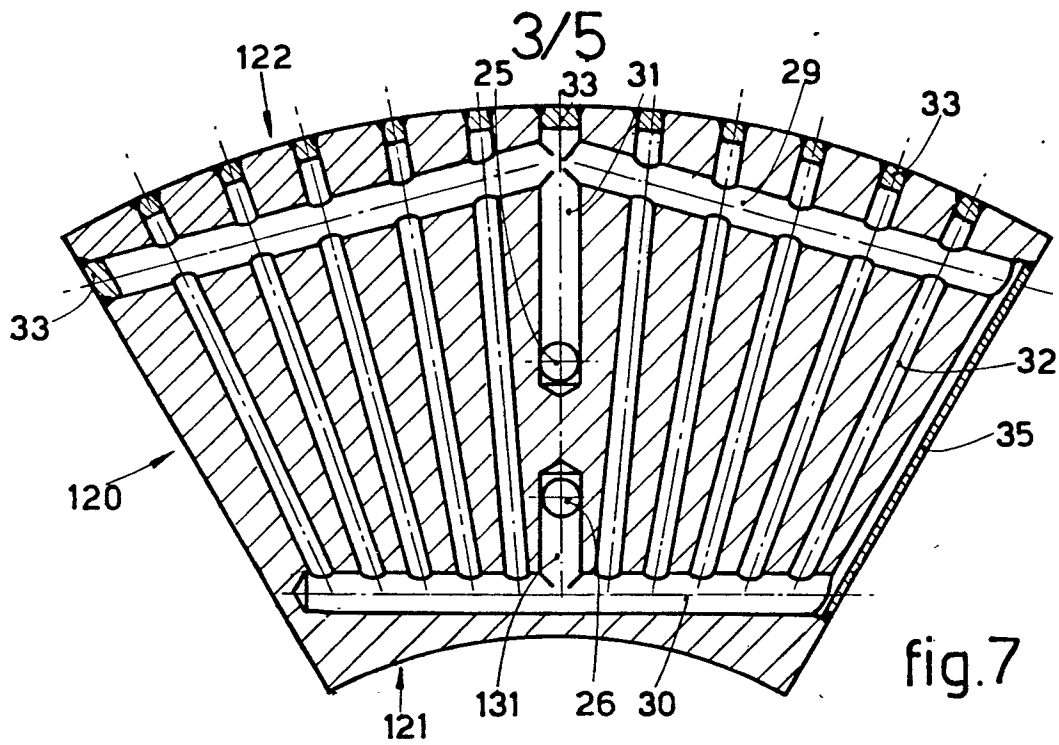




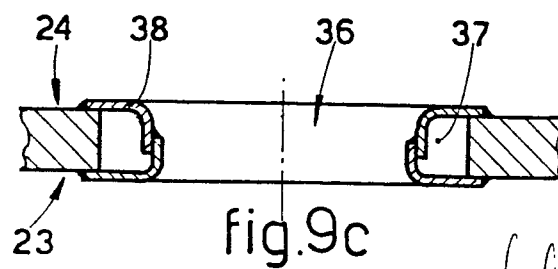
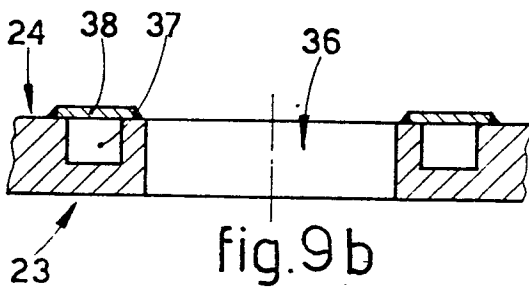
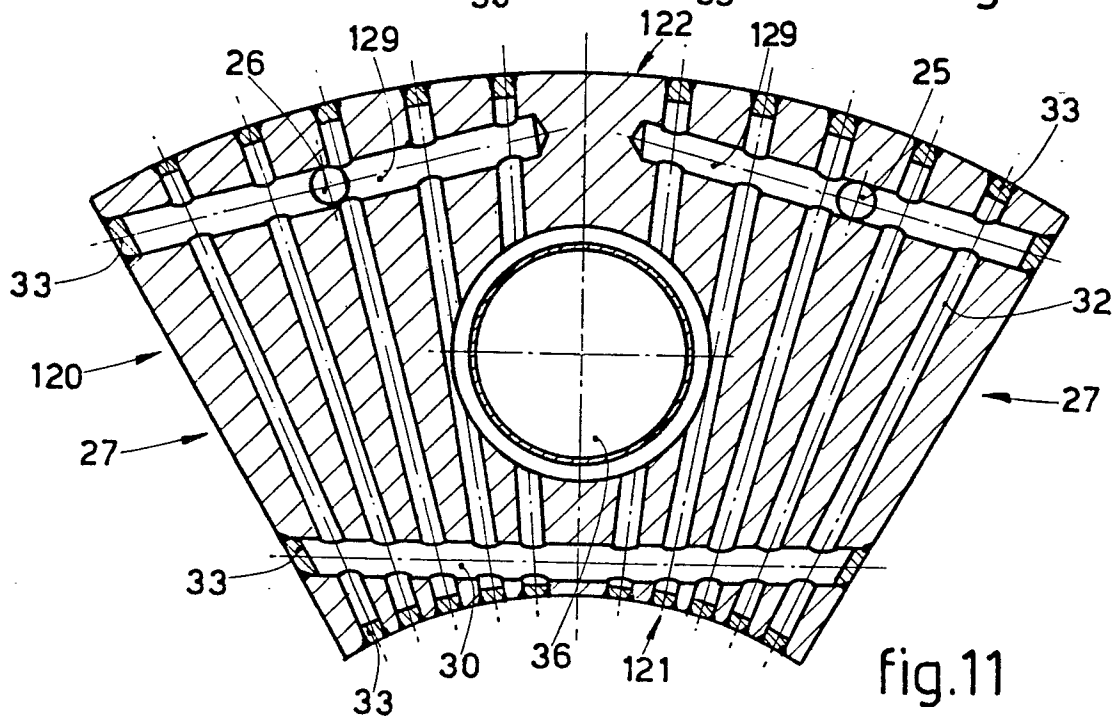
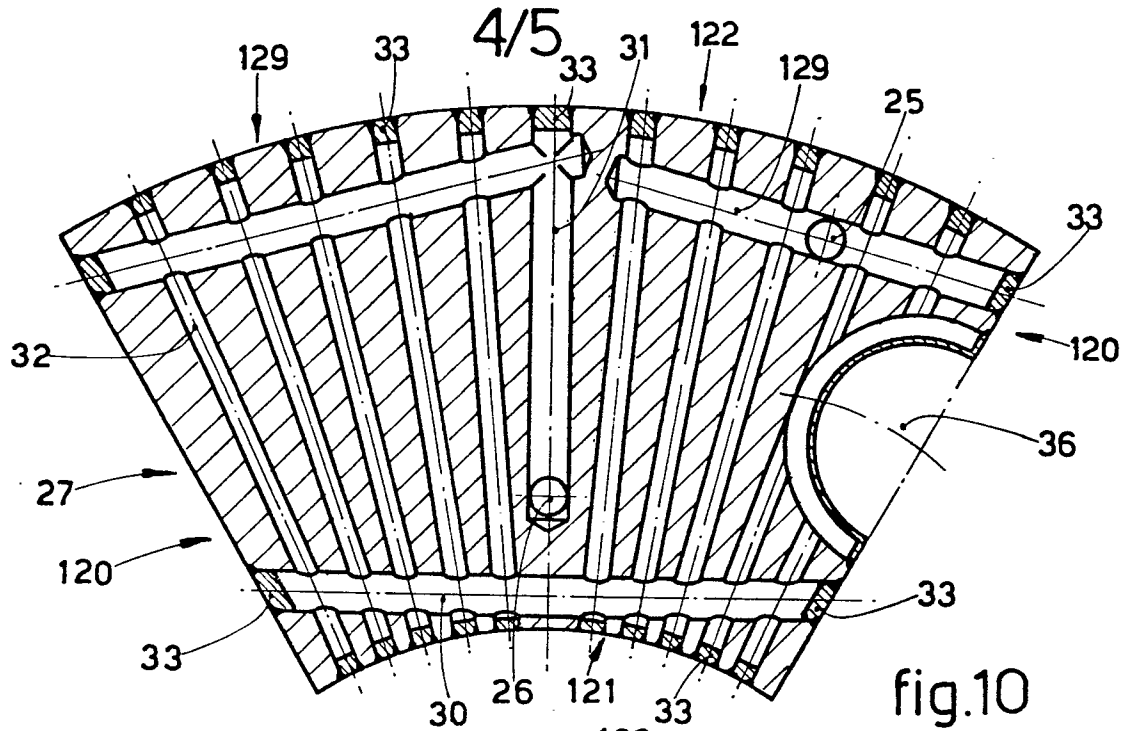
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L. H.



Gilberto Petraz



Gilberto Retraz

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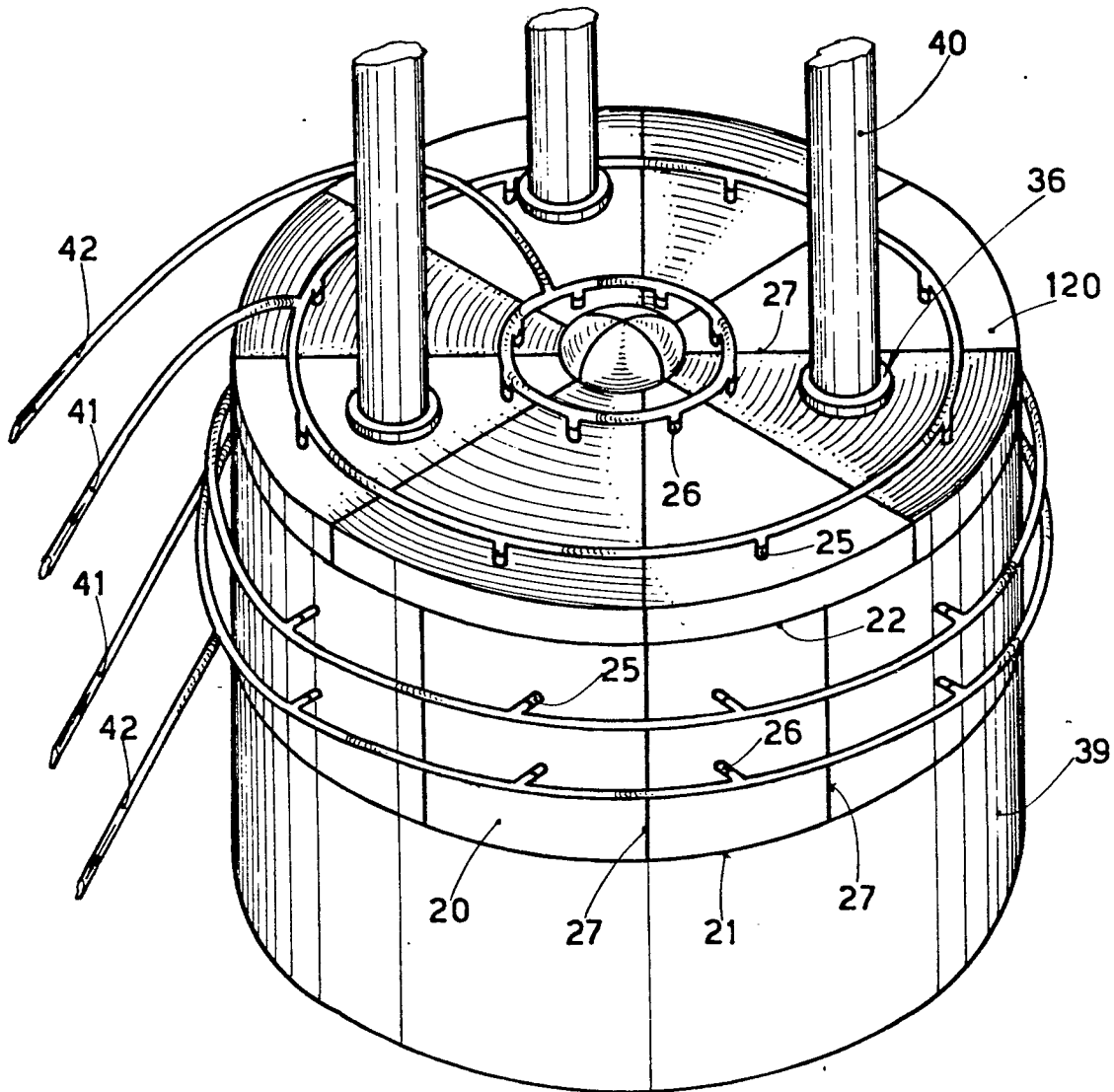


fig.14

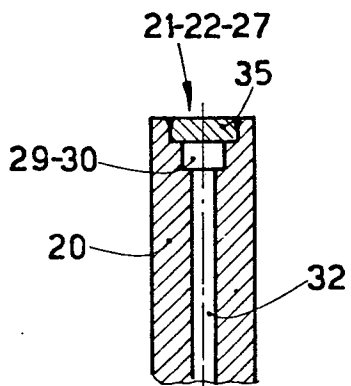


fig.12

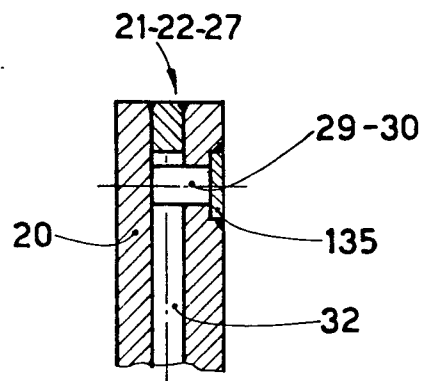


fig.13

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0029416



European Patent
Office

EUROPEAN SEARCH REPORT

Application number

EP 80 83 0091

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.3)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
	FR - A - 2 411 380 (SANYO SPECIAL STEEL) * figures 1-14; claims 1-8; page 8, lines 24-38 *	1	F 27 B 3/24 F 27 D 1/12
P	DE - A - 2 907 511 (KABEL- und METALLWERKE GUTEHOFFNUNGSHÜTTE) * figures 1-5; claims 1-15 *	1-11	
A	US - A - 3 940 552 (SUSUMU MIZUNO)		
A	US - A - 2 396 976 (G.A. WHITEHURST)		TECHNICAL FIELDS SEARCHED (Int. Cl.3)
A	US - A - 3 339 904 (E.R. RICHARDS)		F 27 B 3/24 F 27 B 1/24 C 21 B 7/10 F 27 D 1/12 F 27 D 9/00
			CATEGORY OF CITED DOCUMENTS
			X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons
			&: member of the same patent family, corresponding document
☒ The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		12.02.1981	ELSEN