

12 **EUROPEAN PATENT APPLICATION**

21 Application number: 82830070.7

51 Int. Cl.³: **F 27 D 1/18**

22 Date of filing: 24.03.82

30 Priority: 14.04.81 IT 8336081

43 Date of publication of application:
27.10.82 Bulletin 82/43

84 Designated Contracting States:
AT BE DE FR GB SE

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54 **Cooled crown for electric furnaces.**

57 This invention concerns a cooled crown (20) for electric furnaces which consists of a plurality of tubular elements and comprises in mutual cooperation and coordination:

- a carrying structure (21) consisting of at least one outer, tubular, perimetric element (24) and of an inner, tubular element (25), whereby the two elements (24-25) are connected hydraulically to each other by appropriate tubular risers (46),
- a plurality of panels (22) to cool the crown, whereby said cooling panels (22) consist substantially of two primary manifolds (26-27) and of a plurality of tubes (28),
- a cap (23) consisting of supporting means which circulate fluid (50),
- and a possible cooling coil (33) which cooperates with the inner tubular element (25).

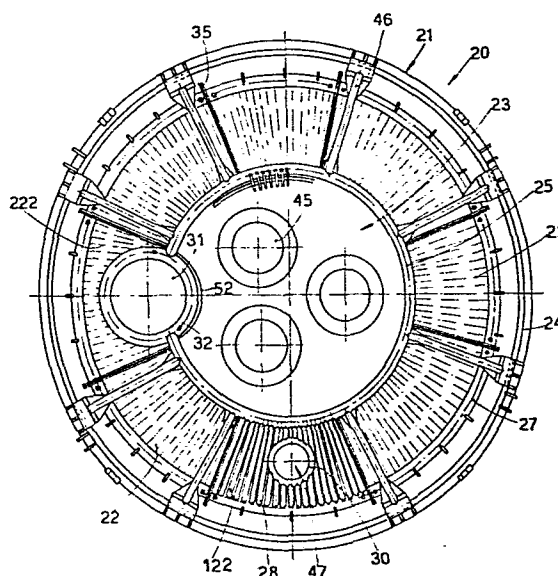


fig. 1

1. Description of the invention entitled:

. "COOLED CROWN FOR ELECTRIC FURNACES"

. in the name of DANIELI ENGINEERING S.p.A. at Buttrio

. submitted on

under No.

5 .

. This invention concerns a cooled crown for electric
. furnaces. To be more exact, this invention concerns a crown
. cooled by circulation of water under pressure, said crown
10. being suitable for being installed on electric furnaces
. with or without any additional holes.

. Many types of cooled crowns are known; some of them
. are concerned mainly with the cooling of the area surround-
. ing the electrode, as is the case, for instance, in Russian
15. patent 400787.

. Other types provide tubular elements arranged in a cir-
. cle, as is the case, for example, in patent US 4021603.

. Yet others include a lay-out of substantially parallel
. tubes, as is the case in patent US 4132852, for instance.

20. Instead, patent US 4216348 envisages tubes arranged
. substantially like a spider's web, while Russian patent
. 617671 sets forth a crown with an intermediate chamber suit-
. able for an irregular circulation of water.

. Such lay-outs involve many shortcomings either because
25. they do not permit a controlled expansion of the components

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1. or because they do not make possible an even cooling of the
surface or because they do not allow the component spaces
to be modular.

Furthermore, the lay-outs proposed do not enable energy
5. consumption to be kept low; they are costly and involve very
long construction and installation times.

Moreover, the known systems make it necessary to dis-
mantle or indeed to replace the whole crown when the central
ring bearing the electrodes has to be replaced.

10. Owing to all these shortcomings and to yet others, as
will be seen hereinafter in the description, the author has
studied, embodied and experimented with a new crown cooled
by circulation of water under pressure, said circulation be-
ing obtained owing to a special and characteristic lay-out
15. of a composite plurality of conduits.

This new type of crown provides many advantages conse-
quent upon the specific pre-set purposes.

One advantage is a considerable reduction in the con-
sumption of refractory material, which leads to an appreci-
20. able lessening of the operating costs.

Another advantage is the increase in the life span of
the middle part of the crown, the outcome of this being a
yet greater productivity of the furnace.

A further advantage is the increase in productivity
25. following on the drastic reduction in down times.

Another advantage again is the ability to re-use the
water for other purposes too, as it is possible to regulate
the heat exchange within preferential selected values.

The invention, therefore, leads to a restraining of
30. energy consumption in that refractory material is envisaged
as being positioned between one tube and another. Moreover,
the invention enables construction and installation times to
be reduced with a noteworthy working safety.

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1. Furthermore, the invention permits easy replacement of elements in case of a breakdown in one or more of said elements.

It is also an advantage that the invention enables the elements themselves to be readily repaired.

Besides, the various panels are suspended and upheld by an independent carrying frame which weighs on the perimeter of the furnace itself, and this fact increases the safety of the overall whole since, amongst other things, the panels are not stressed by dynamic forces.

It is also a considerable advantage that the central ring bearing refractory material can be changed without any need to change the crown itself, and this leads to an appreciable lessening of down times and a great increase in productivity.

The invention visualizes a supporting structure which has at least one outer supporting element having a substantially annular shape and consisting advantageously of a conduit for fluids, said outer element lying directly on the perimeter of the electric furnace and cooperating with a tubular element which has a circular or, more generically, polygonal shape and which is located within said outer element in a higher position.

Said tubular element is supported by a plurality of tubular risers connecting the circumferential tubular element with the outer hollow supporting ring so as to permit hydraulic continuity in the circulation of the cooled fluid.

The circumferential tubular element can perhaps include one or more auxiliary circumferential elements cooperating with a possible hole for charging operations carried out through the crown itself or for other work.

Panels to cool the crown are fitted below said supporting structure so that they are located substantially between

1. said supporting structure itself and the inside of the furnace.

Said panels to cool the crown consist of two tubular elements connected to each other by a plurality of other tubular elements arranged substantially radially and having the advantage of a section possessing an inverted oval development.

A cap consisting of elements with the shape of an inverted "L" are supported on the tubular element.

10. Said elements with the shape of an inverted "L" can be a plurality of spokes resting on the circumferential tubular element and bearing one or more rows of cooling tubes.

To said spokes is anchored the cap which serves to carry the refractory material that positions and insulates the electrodes.

An appropriate ring for circulation of fluid can be envisaged instead of the plurality of spokes with cooling tubes.

Also, one or more cooling rings can be envisaged as being around the electrodes.

The invention therefore consists substantially of a plurality of parts having well defined functions: a supporting structure consisting of a substantially annular outer element and of an inner element, said elements being connected to each other hydraulically with appropriate risers, whereby said supporting structure sustains on its lower side a plurality of panels to cool the crown which can be either normal or of a specialized kind, and whereby on the tubular element is borne a cap which has on its periphery supporting means for circulation of fluid which serve to anchor and position the refractory material connected to the electrodes.

The tubular element can include an auxiliary circumferential element; if so, said auxiliary circumferential element

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1. will comprise cooling coil means able to invest the depth of
the refractory material itself.

The invention is therefore embodied in a cooled crown
for electric furnaces, whereby the cooled crown is composed
5. of a plurality of tubular elements and is characterized by
comprising in mutual cooperation and coordination:

- a carrying structure consisting of at least one outer, tu-
bular, perimetric element and an inner tubular element,
said two elements being connected to each other hydraulic-
10. ally by tubular risers,
- a plurality of panels to cool the crown, whereby said cool-
ing panels can be normal or of a specialized kind and con-
sist advantageously of two primary manifolds disposed sub-
stantially concentrically and of a plurality of tubes
15. which are positioned radially and have a substantially
elliptic section with an inverted axis,
- a cap consisting of supporting means which circulate fluid
- and possible cooling coil means which cooperate with the
inner tubular element.

20. By referring to the attached tables, which have been
given as non-restrictive examples, let us now see a prefer-
ential lay-out of the invention and an embodying variant.

In the tables we have as follows: -

Fig. I gives from above a view of a cooled crown according
25. to the invention;

Fig. 2 shows the solution of Fig. I according to a vertical
diametral section;

Fig. 3 shows a section of a detail of the cooled crown;

Fig. 4 shows a modular cooling panel of a non-specialized
30. kind;

Figs. 5, 6 & 7 show specific sections as they are embodied in
the modular panels of Fig. 4;

Fig. 8 shows from above a view of a different embodiment

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1. of the cooled crown of the invention;
Fig. 9 gives a vertical, diametral section of the solution
of Fig. 8;

Fig. 10 shows a detail of the front view of a crosswise
5. section of a cooled panel.

In the attached figures the same parts or parts performing the same functions bear the same reference numbers.

Figs. 1 and 2 show an embodiment of the cooled crown 20
of the invention. Said cooled crown 20 consists substantially
10. ly of a carrying structure 21 able to bear a plurality of
cooling panels 22 and of an arch or cap 23 positioned on the
middle of the cooled crown 20.

Said carrying structure 21 consists, in this instance,
of an outer, tubular, perimetric element 24 having a circum-
15. ferential shape and of an inner, tubular element 25 also
having a circumferential shape, whereby the two elements 24
and 25 are connected to each other hydraulically with a plu-
rality of tubular risers 46.

Said tubular risers 46 are arranged substantially radi-
20. ally between the tubular elements 24 and 25 so as to form
therewith 24-25, in this example, a circular crown, whereby
said circular crown, and substantially the whole cooled crown
20, can be flat or dome-shaped or be disposed in a series
of suspended surfaces.

25. Said carrying structure 21 bears the cooling panels 22
by means of welded elements or elements which can be disman-
tled or by means of known means.

Said cooling panels 22, which are divided between spe-
cialized panels and normal panels, depending on how they are
30. to be employed, have in the example of Figs. 1 and 3 a form
consisting substantially of sectors of a circular crown and
are able, when connected to each other, to occupy a zone
which is conformed like a circular crown and is at least

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1 partially lower than the zone occupied by the carrying struc-
ture 21.

The cooling panels 22 normally used consist of two pri-
mary manifolds 26-27, which in this instance are conformed
5 like an arc of a circumference and are positioned concentri-
cally, and of a plurality of tubes 28 connecting the two
primary manifolds 26-27 together radially and having at their
opposite ends substantially elliptic sections with inverted
principal axes.

10 This special shape of the tubes 28 enables the cooling
fluid to be distributed evenly over the enveloping surface
divided into sectors of circular crown and occupied by each
cooling panel 22, as shown in Figs. 1 and 4.

The cooled crown also includes a cooling panel 122 of
15 a specialized kind for the charging of materials into the
electric furnace, said panel 122 being substantially like
those 22 normally employed.

At least one variant is possible which consists of the
charging intake 47 delimited by a conduit 30, which has a
20 toroidal shape and is connected hydraulically to at least
part of the tubes 28 and is disposed in the middle thereof
28.

Another panel 222 of a specialized kind has an aspirat-
ion outlet 29 for fumes which is delimited by a conduit 52
25 of toroidal shape connected hydraulically to the inner mani-
fold 26 and to at least part of the tubes 28.

Moreover, it is visualized that above the said outlet
29 there is a second outlet 31 delimited by a conduit 32,
which is connected hydraulically to the carrying structure
30 21 and, to be more exact, to the inner, tubular, circumfer-
ential element 25.

Cooling coil means 33 are arranged to pass through the
two outlets 29 and 31 so as to get better dispersion of the

1. heat radiated by the fumes leaving the electric furnace at .
a very high temperature.

. It is possible to exchange the specific uses to which .
. the two outlets 29 and 47 are put.

5. Furthermore, the cooling panels 22 are at least partial-
ly sunk in a structure of refractory material 34, whereby .
said structure of refractory material 34 is put between the .
tubes 28 and also substantially around them 28 so as to en-
wrap them, and whereby said structure 34 is supported by .
10 said tubes 28 by virtue of the special inverted-ellipse .
shape of the latter, as shown in Fig.10.

. Said cooling panels 22, being thus constituted, are .
welded together so as to form a modular structure conformed,
in this instance, like a circular crown.

15. In substance said panels 22 comprise end joints 35 sha-
ped so as to make possible an easy mutual connection and an .
easy separation whenever a possible replacement of said panels
22 may be required.

. Fig.5 shows a detail of the connection of the tubes 28.
20 to the manifold 27 and of the connection of said manifold 27
to the conduit 36 delivering or taking away the cooling fluid.
The same kind of connection can be envisaged as existing be-
tween the tubes 28 and manifold 26.

. Figs.6 and 7 show means 37 for bleeding off the air and
25 any steam forming in the tubes owing to the high temperature
of the fluid circulating.

. In particular, being lighter than the cooling fluid, the
air tends to gather in the high part of the manifold 26, which
in its turn is usually positioned at a level higher than the
30 remainder of the pipes in the panel 22.

. As the turbulence alone of said cooling fluid is not .
enough to discharge said steam, said means 37 are employed .
to bleed off the air and steam and consist substantially of.

perhaps
1. tubular elements/conformed elbow-wise, of which the intake
is turned towards that part of the inner surface of the mani-
fold 26 which is located at the highest level thereof, as
shown in Fig.6.

5. Said Fig.6 also shows a delivery hole 38 able to faci-
litate the passage of air but to keep to a minimum the pass-
age of cooling fluid.

To allow the air to reach the discharge conduits or
bleeder tube 37 there is comprised in said manifold 26 a
10. communicating passage 41 of small dimensions or at any rate,
of dimensions such as to let the air filter through prefer-
entially; any cooling liquid will pass through in very small
quantities. only.

So as to enable the cooling fluid to circulate inside
15. the tubes of the panel 22 in a desired way, the manifolds
26-27 can be divided by partition walls 40 into separate
neighbouring sectors 39, as shown diagrammatically in Figs,
4 and 7.

It is possible, therefore, to arrange said bleeder
20. means 37 along the manifold 26 in a desired number so as to
enable the air and steam to be drawn off from said manifold
26.

As said earlier, so as to lessen still further the for-
mation of bubbles or pockets of steam or air inside said
25. manifold 26, some through holes 41 are visualized as being
machined through the uppermost part of the partition walls
40 so that the neighbouring sectors 39 can communicate with
each other. This assists the circulation of the air and the
withdrawal of the latter through the bleeder means 37.

30. Bleeder means 37 the same as or like those described
just now can also be envisaged in the inner tubular element
25.

Fig.3 shows a lengthwise section of a tubular riser 26,

1. which in this instance is conformed so as to permit a two-
way circulation of cooling fluid.

It can also be visualized that said cooling fluid circulates in only one direction inside each tubular riser 26.

5. Indeed, in both cases it is possible to envisage the creation of hydraulically separated neighbouring sectors inside the tubular elements 24-25 so as to pre-set the path of the cooling fluid therewithin 24-25.

Figs. I, 2 and 3 show the cap 23 disposed so as to shut
10. the top of the cooled crown 20.

In particular, said cap 23 is upheld by the carrying structure 21 and is located on the inner, tubular element 25. Owing to this lay-out the cap 23 can be readily exchanged when so needed.

15. The cap 23 consists substantially of supporting means 50 which circulate fluid and comprise a plurality of spoke elements 42 arranged radially and conformed, for instance, like an inverted "L", whereby said spokes 42 rest on or are located on the inner, hollow, tubular element 25 and bear
20. one or more rows of cooling tubes 43.

To said supporting means 50 which circulate fluid there is anchored the refractory material 44 which serves to position and insulate the electrodes, whereby said electrodes can be inserted in suitable through holes 45 machined in
25. said cap 23.

Instead of the plurality of spokes 42 with cooling tubes 43 it is possible to visualize a supporting-structure ring which circulates fluid.

Moreover, one or more cooling rings can be visualized
30. as being around the electrodes.

According to a variant of the embodiment of the invention the cooled crown 20 can also be as shown in Figs, 8 and
9.

1. In particular, said cooled crown 20 of Figs.8 and 9
has a carrying structure 21 of which the perimetric tubular
element 24 consists here of two tubular units I24-224, where-
by each of said tubular units I24-224 has cooling fluid
5. running through it in a given direction.

Fig.8 also shows the openings 48-49-I48-I49 for the
inflow and outflow of the cooling fluid into and out of
the tubular units I24-224.

The substantial differences of the embodying variant
10. as compared to the preceding lay-out consist of the substant-
ially triangular shape of the new tubular element 25 and,
correspondingly, of the cap 23 as well as of the different
positioning of the aspiration outlet 29 for fumes and of
the charging inlet 47.

15. In particular, said aspiration outlet 29 is positioned
inside the corresponding specialized panel 222 and does not
affect the cap 23.

Therefore the conduit 32 is not included which in the
preceding case delimited the outlet 29 at its upper part
20. and which was connected hydraulically to the tubular element
25.

The cooled crown 20 comprises supporting means 51 able
to permit ready handling for a possible displacement of said
cooled crown 20.

25. Moreover, in the variant shown in Figs.8 and 9 the in-
let 47 is machined in the cap 23.

We have described here a preferential embodiment of
this invention together with one variant, but other variants
are possible for a technician in this field.

30. Thus the proportions, shapes and sizes can be varied..
In particular, it can be envisaged that the cap 23 has a
polygonal shape or that the tubular element 25 is conformed
correspondingly or is polygonal; it can also be visualized.

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1. that the element 24 has perimetric developments of a differ-
ent shape, for instance, elliptic, polygonal, etc.

It is also possible to foresee that the engagement or
connection of the tubes 28 with the manifolds 26-27 is dif-
5. ferent from that shown in Fig.5; in particular, it can be
envisaged that their 26-27-28 lengthwise axes do not inter-
sect as in said Fig.5 but are awry.

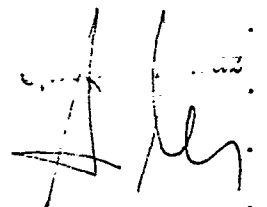
It is also possible to visualize any desired path of
flow of the cooling fluid in the tubes of the cooled crown
10. 20.

Moreover, the use of special valves instead of the
bleeder means 37 can be envisaged.

It is possible to visualize cooling panels 22 consist-
ing of one or more circumferential tubes and of tubes branch-
15. ing off from the latter and returning thereto after invert-
ing their own direction.

These and other variants are all possible for a technic-
ian in this field without departing thereby from the scope
of the idea of the solution.

20 .



25 .

30 .

C L A I M S

1. I. Cooled crown (20) for electric furnaces, whereby
the cooled crown consists of a plurality of tubular elements
5 and is characterized by comprising in mutual cooperation and
coordination:

- a carrying structure (21) consisting of at least one outer,
tubular, perimetric element (24) and of an inner, tubular
element (25), whereby the two elements (24-25) are connect-
10 ed hydraulically to each other by suitable tubular risers.
(46),
- a plurality of panels (22) to cool the crown, whereby said
cooling panels (22) consist substantially of two primary
manifolds (26-27) and a plurality of tubes (28),
- 15 - a cap (23) consisting of supporting means (50) which cir-
culate fluid,
- and a possible cooling coil (33) cooperating with the inner,
tubular element (25).

2. Cooled crown (20) for electric furnaces, as in Claim
20 I, characterized by the fact that the panels (22) to cool
the crown are panels (122-222) of a specialized kind.

3. Cooled crown (20) for electric furnaces, as in Claim
I, characterized by the fact that the panels (22) to cool
the crown are normal panels (22).

25 4. Cooled crown (20) for electric furnaces, as in Claim
I and in Claim 2 or 3, characterized by the fact that at
least one of the primary manifolds (26-27) of the cooling
panels (22) is substantially concentric with the outer, tubu-
lar, perimetric element (24).

30 5. Cooled crown (20) for electric furnaces, as in Claim
I and in Claim 2 or 3, characterized by the fact that the
primary manifolds (26-27) of the cooling panels (22) are
substantially concentric.

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1. 6. Cooled crown (20) for electric furnaces, as in Claim
.I and in Claim 2 or 3, characterized by the fact that the
.tubular elements (26-27) constituting a cooling panel (22)
.have substantially the same lengthwise form as the part of
5. the hollow tubular elements (24-25) cooperating with them.

. 7. Cooled crown (20) for electric furnaces, as in Claim
.I and in one or another of the Claims thereafter up to Claim
.6 inclusive, characterized by the fact that the tubes (28)
.of the cooling panels (22) have a substantially elliptic
10. section with an inverted axis.

. 8. Cooled crown (20) for electric furnaces, as in Claim
.I and in one or another of the Claims thereafter up to Claim
.6 inclusive, characterized by the fact that the tubes (28)
.of the cooling panels (22) have a substantially round sect-
15. ion.

. 9. Cooled crown (20) for electric furnaces, as in Claim
.I and in one or another of the Claims thereafter up to Claim
.8 inclusive, characterized by the fact that the tubes (28)
.of the cooling panels (22) are arranged substantially radi-
20. ally.

. 10. Cooled crown (20) for electric furnaces, as in Claim
.I and in one or another of the Claims thereafter up to Claim
.8 inclusive, characterized by the fact that the tubes (28)
.of the cooling panels (22) are arranged substantially in
25. loops (II-I2-I3).

. II. Cooled crown (20) for electric furnaces, as in Claim
.I and in one or another of the Claims thereafter, character-
.ized by the fact that the cooling panels (22) have on their
.outside a structure of refractory material (34) (Fig.3).

30. 12. Cooled crown (20) for electric furnaces, as in Claim
.I and in one or another of the Claims thereafter, character-
.ized by the fact that the cooling panels (22) are at least
.partially sunk in a structure of refractory material (34).

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1. I3. Cooled crown (20) for electric furnaces, as in Claim
I and in one or another of the Claims thereafter, character-
ized by the fact that the tubes (28) of the cooling panels
(22) are at least partially sunk in a structure of refract-
5. ory material (34).

I4. Cooled crown (20) for electric furnaces, as in Claim
I and in one or another of the Claims thereafter up to Claim
I0 inclusive, characterized by the fact that the inner tub-
ular element (25) is substantially circular.

10 I5. Cooled crown (20) for electric furnaces, as in Claim
I and in one or another of the Claims thereafter up to Claim
I0 inclusive, characterized by the fact that the inner tub-
ular element (25) is substantially polygonal.

I6. Cooled crown (20) for electric furnaces, as in Claim
15. I and in one or another of the Claims thereafter, character-
ized by the fact that at least one cooling panel (22) of a
specialized kind cooperates with a conduit (32).

I7. Cooled crown (20) for electric furnaces, as in Claim
I and in one or another of the Claims thereafter, character-
20. ized by the fact that at least one cooling panel (22) of a
specialized kind cooperates with coil means (33).

I8. Cooled crown (20) for electric furnaces, as in Claim
I and in one or another of the Claims thereafter up to Claim
I4 inclusive, characterized by the fact that the cooling
25. panels (22) are positioned above the carrying structure (21).

I9. Cooled crown (20) for electric furnaces, as in Claim
I and in one or another of the Claims thereafter up to Claim
I4 inclusive, characterized by the fact that the cooling
panels (22) are positioned below the carrying structure (21).

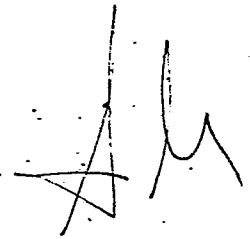
30. 20. Cooled crown (20) for electric furnaces, as in Claim
I and in one or another of the Claims thereafter, character-
ized by the fact that the cap (23) has a peripheral conform-
ation substantially the same as that of the tubular element

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1. (25).

21. Cooled crown (20) for electric furnaces, as in Claim I and in one or another of the Claims thereafter, characterized by the fact that the cap (23) includes at least one opening (47) for charging purposes or for discharging furnaces.

22. Cooled crown (20) for electric furnaces, as in Claim I and in one or another of the Claims thereafter, characterized by the fact that the cap (23) has supporting means (50) which circulate fluid.

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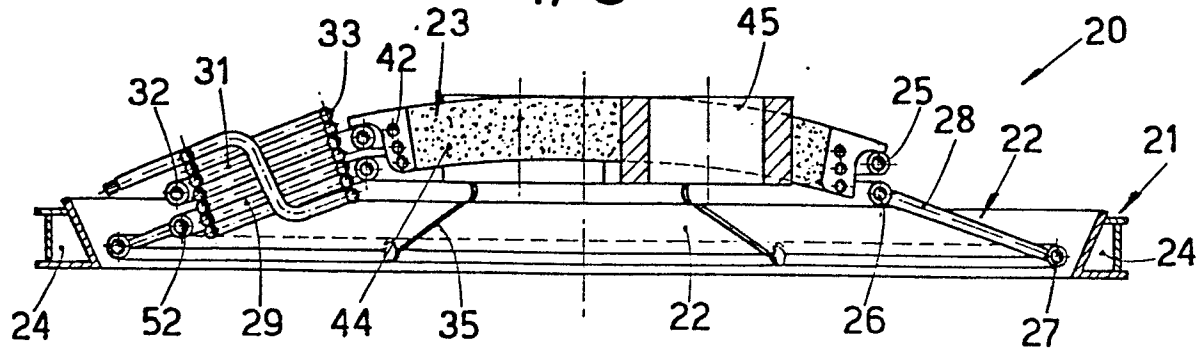


fig. 2

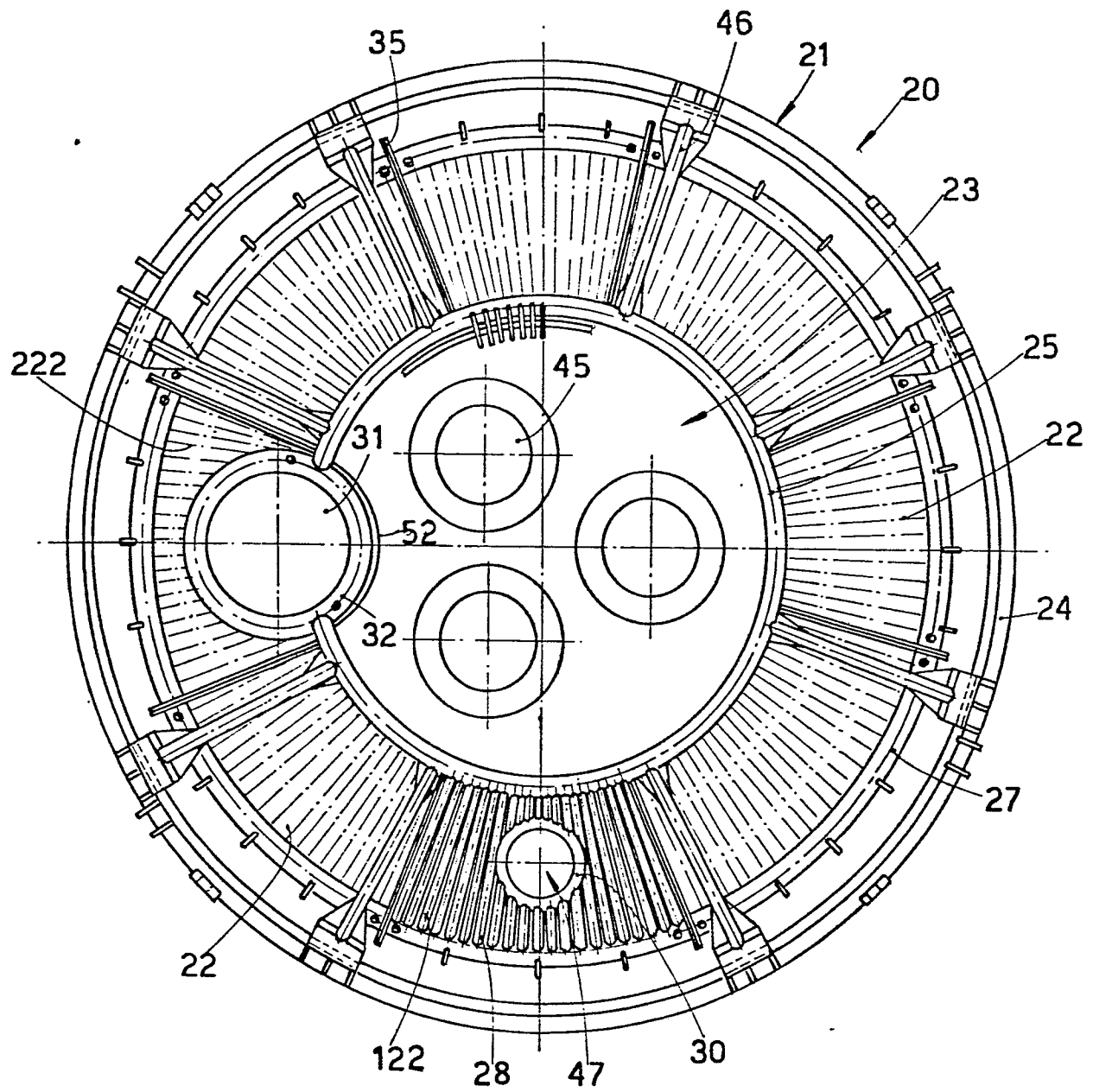
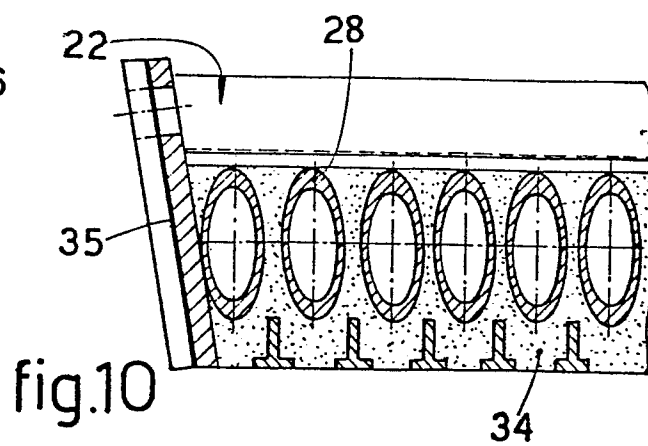
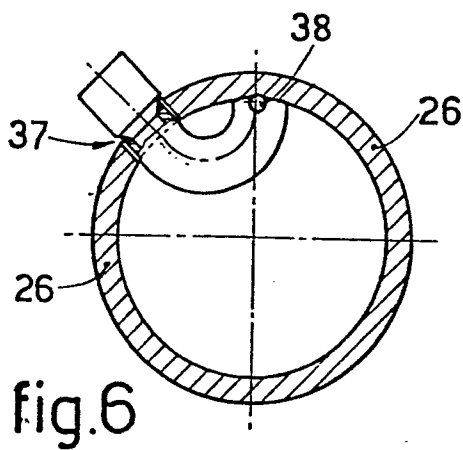
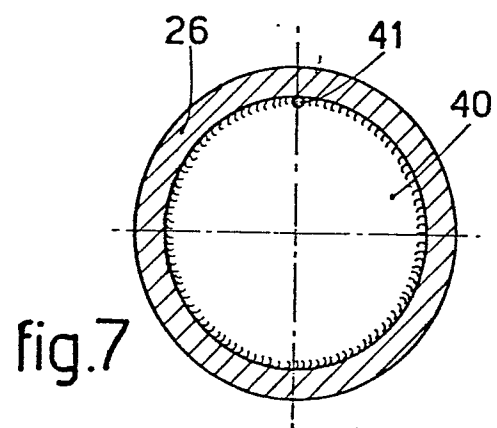
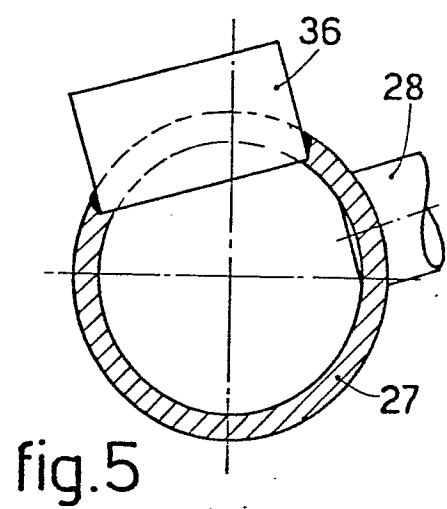
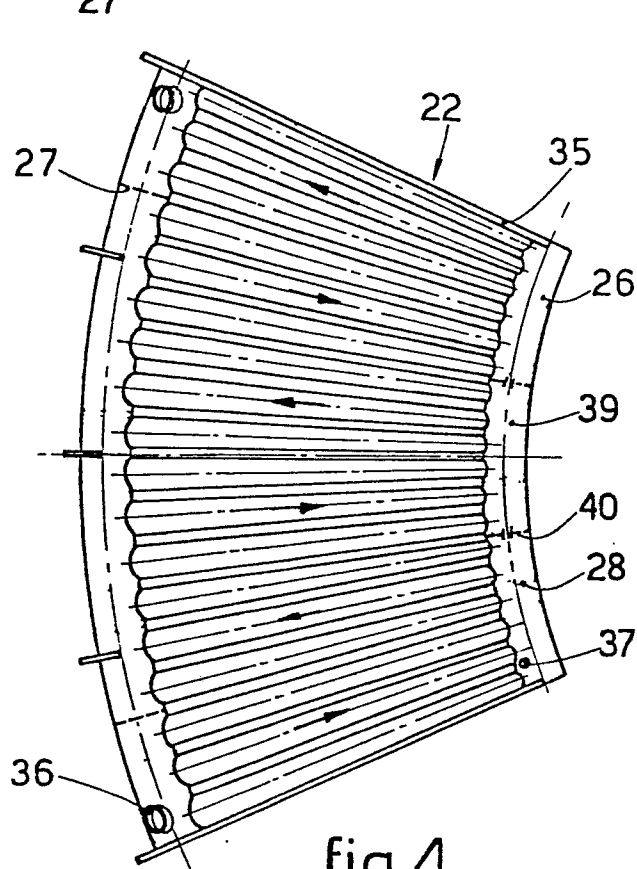
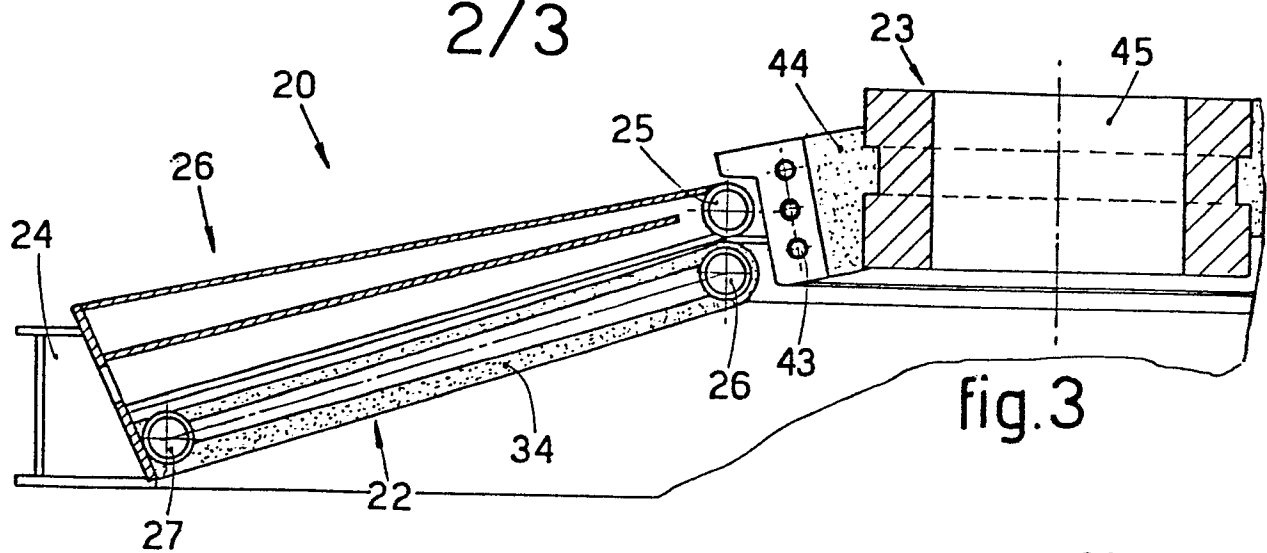


fig. 1

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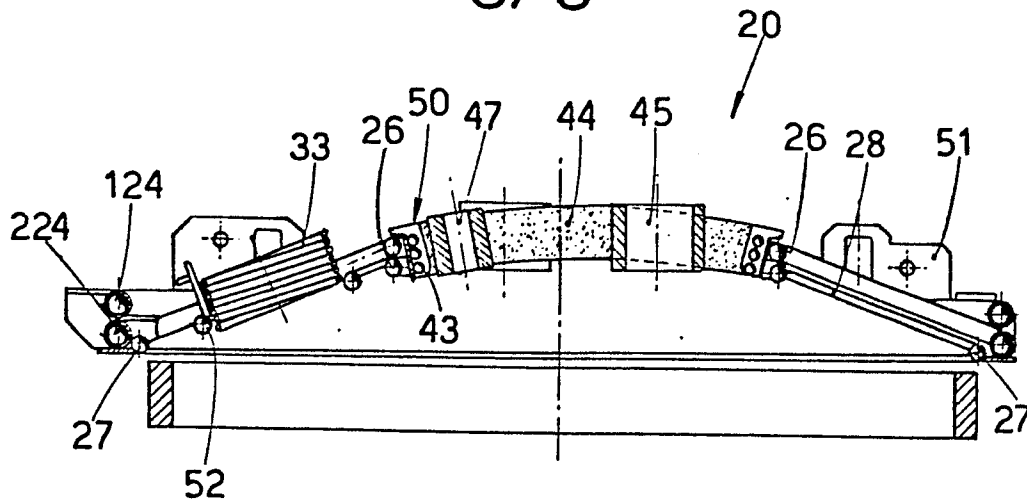


fig.9

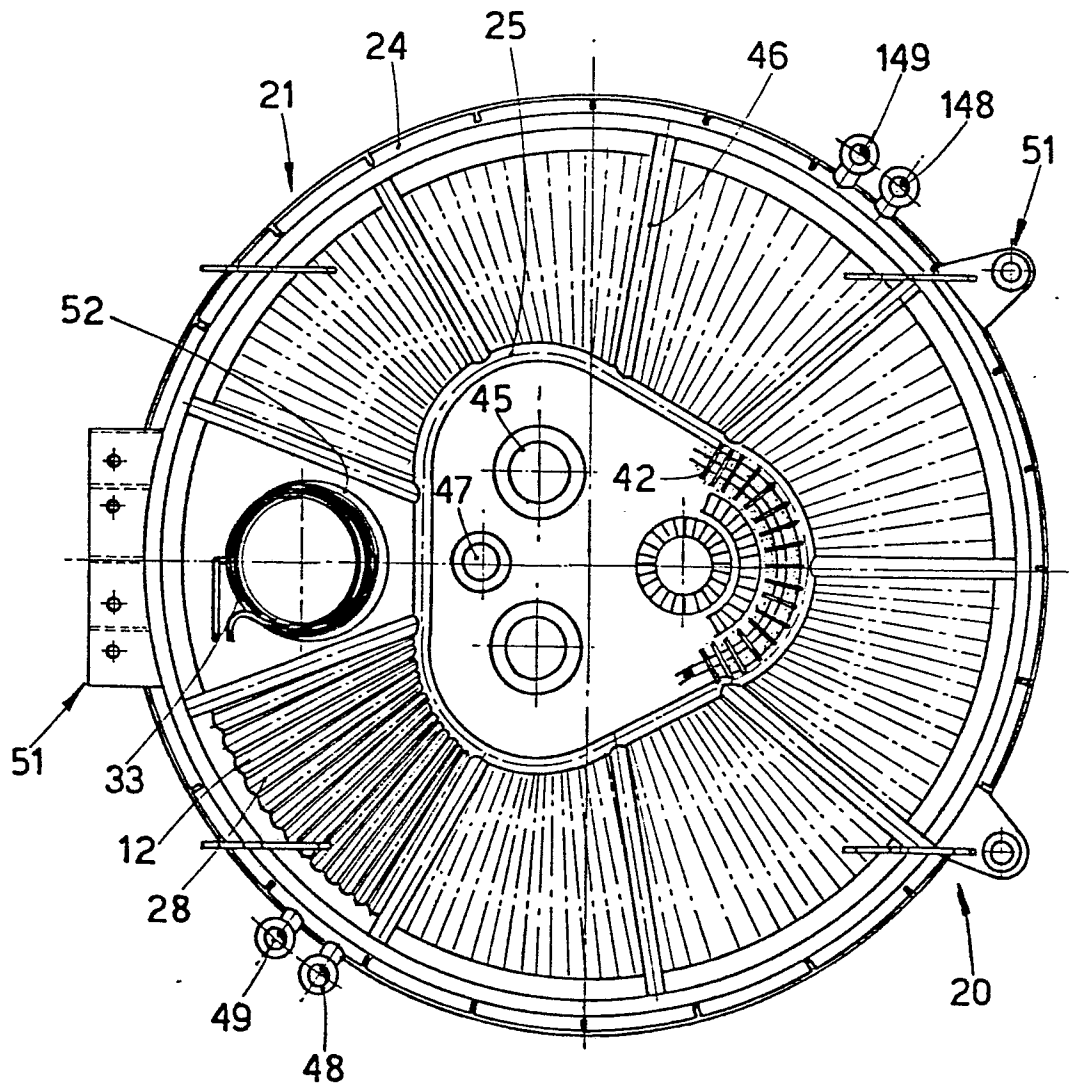


fig.8



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
X	FR-A-2 455 719 (SIDEPAL) *Figures 1-5b; claims 1-17*	1-6,8- 10,14- 17,20	F 27 D 1/18
Y	FR-A-2 404 818 (DEMAG) *Figure 6; page 9, lines 28-40*	1-5,8- 10	
Y	DE-C- 937 442 (DEMAG-ELEKTAOMETALLURGIE) *Figures 1-4; claims 1,2*	1	
A	FR-A-2 424 498 (F.KRUPP)		
A	US-A-3 967 048 (L.S.LONGENECKER)		TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
A	DE-A-2 805 263 (DAIDO TOKUSHUKO)		F 27 D
A	US-A-3 429 973 (F.H.N.CARTER)		
A,D	US-A-4 216 348 (J.P.GREENBERGER)		
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 22-07-1982	Examiner ELSEN D.B.A.
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
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