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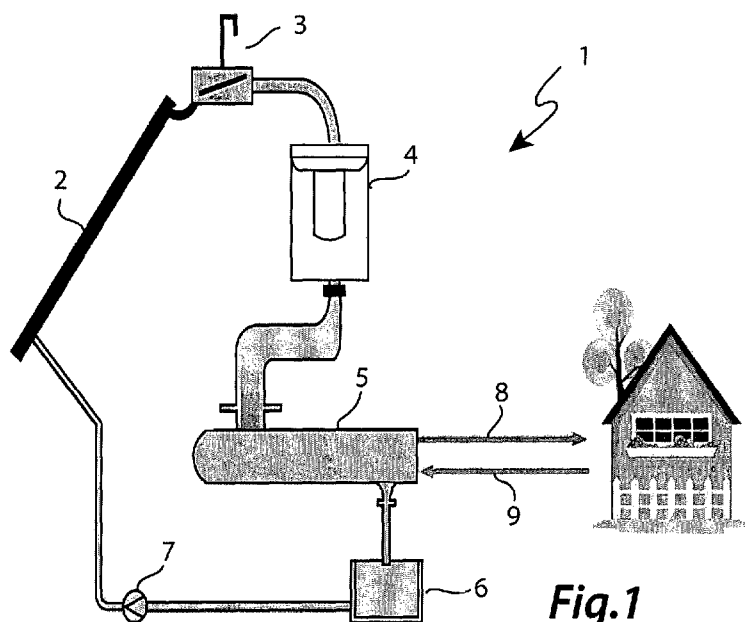
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(54) Title: THERMAL CO-GENERATION PLANT

**Fig.1**

(57) Abstract: The present invention relates to a thermal co-generation plant (1), within which, a fluid flows along a closed circuit, said plant comprising, in series, an evaporator (2), for heating said fluid, a valve (3), at the outlet of said evaporator (2), for adjusting pressure of fluid within said evaporator (2), a turbine (4), within which said fluid expands, generating electric power, a condenser (5), from which fluid exiting from said turbine (4) is entered into a closed circuit, hot water generation plant, a tank (6), for collecting cooled fluid from said hot water generation plant and to send the same to the evaporator (2), and a circulation pump (7), sending fluid at a liquid state, to said evaporator (2), said fluid having a boiling point of about 35°-40°.

THERMAL CO-GENERATION PLANT

The present invention relates to a thermal co-generation plant.

5 More specifically, the invention concerns a thermal co-generation plant supplied by a low boiling point fluid, heated by an evaporator.

10 Still more specifically, the invention concerns a thermal co-generation plant comprising a turbine realized in such a way to ensure a perfect sealing, thus preventing any loss of processed fluid, and to permit optimizing fan action.

15 As it is well known, fluid is heated in a thermal plant by sun irradiation. Once fluid, in most cases a water/glycol mixture, reaches a set temperature, a pump is activated, bringing the same through a heat exchanger, that in most cases is directly inserted within a hot water reservoir, i.e. a boiler. Heat exchanger cede power contained within fluid to water, which is cooler than fluid. Thus, water contained within reservoir is heated and at the same time said fluid is cooled. Cooled fluid is again supplied to the manifold or solar plant, and then to cycle starts again.

20 Known solutions has disadvantage of having low efficiency and not to ensure a perfect sealing.

Object of the present invention is that of obtaining a thermal plant that can exploit fluid with the highest efficiency.

25 Another object of the present invention is that of providing an optimum sealing, so as to prevent possible leakages of fluid from the circuit, thus lowering costs.

30 It is object of the present invention a thermal co-generation plant, within which, a fluid flows along a closed circuit, said plant comprising, in series, an evaporator, for heating said fluid, a valve, at the outlet of said evaporator, for adjusting pressure of fluid within said evaporator, a turbine, within which said fluid expands, generating electric power, a condenser, from which fluid exiting from said turbine is entered into a closed circuit, hot water generation plant, a tank, for collecting cooled fluid from said hot water generation plant and to send the same to the evaporator, and a circulation pump, sending fluid at a liquid state, to
35 said evaporator, said fluid having a boiling point of about 35°-40°.

Furthermore, according to the invention, said heat exchange hot water generation plant can further comprise a first duct, connecting

said condenser with a user, for transmitting hot vapor arriving from turbine, and a second return duct of said cooled fluid from user to condenser.

Still according to the invention, said fluid can be Solkatherm[®] SES36 fluid.

5 Furthermore, according to the invention, said turbine can comprise a housing, provided with inlet and outlet for fluid crossing said turbine, a distributor, substantially close to said inlet, and a fan, provided with a plurality of blades, said distributor providing a number of passage holes corresponding to the number of said blades, said plurality of fluid
10 passage holes being shaped and addressed in such a way to always distribute the fluid on said fan blades.

Still according to the invention, said turbine can have every part realized so as to be liquid-tight.

15 Always according to the invention, said plant can provide a plurality of turbines in parallel each other.

Finally, said evaporator can be a solar evaporator, particularly, said evaporator can be a thermal solar panel comprising a plurality of cap collectors, placed side-by-side each other, each one having, in its upper central portion a seat for housing a tube, within which said fluid flows.

20 The invention will be now described, for illustrative, but not limitative, purposes with particular reference to its preferred embodiments, and to the figures of the enclosed drawings, wherein:

figure 1 shows a scheme of the thermal co-generation plant according to the invention;

25 figure 2 is a perspective view of an embodiment of solar evaporator according to the invention;

figure 3 is a front section view of solar evaporator of figure 2;

figure 4 is a front section view of a particular of figure 3;

30 figure 5 is a front illustrative view of a turbine according to the invention;

figure 6 is a lateral view of a first embodiment of distributor of turbine of figure 5;

figure 7 is a top view of distributor of figure 6;

figure 8 is a bottom view of distributor of figure 6;

35 figure 9 is a section view of distributor of figure 6, taken along line IX-IX of figure 8;

figure 10 is a lateral view of a second embodiment of distributor of turbine of figure 5;

figure 11 is a top view of distributor of figure 10;

figure 12 is a bottom view of distributor of figure 10;

5 figure 13 is a section view of distributor of figure 10, taken along line XIII-XIII of figure 8;

figure 14 is a front view of a fan of turbine of figure 5;

figure 15 is a top view of fan of figure 14;

figure 16 is a section view taken along line XVI-XVI of figure 15;

10 and

figure 17 is a section view taken along line XVII-XVII of figure 15.

15 Making reference to figure 1, it is observed a closed circuit thermal co-generation plant 1, comprising an evaporator 2, particularly a solar evaporator, an adjustment valve 3, a turbine 4, a condenser 5, a tank 6 for collecting condensate, and a circulation pump 7.

A fluid flows within thermal co-generation plant 1, having a low boiling point of about 40°C; particularly, said fluid can be of the Solkatherm® SES36 type.

20 Fluid, circulating within plant 1, in correspondence of solar evaporator 2, is heated thanks to sun irradiation and reaches gaseous state at a temperature of about 35°C – 45°C.

25 Adjustment valve 3, connected with solar evaporator 2, permits passage of vapor only when a pressure of about 12 bar is reached within evaporator 2. Vapor, that at this pressure reaches a temperature of about 110°C, enters within turbine 4, connected to the adjustment valve 2, that, by power produced by passage of vapor, generates electric power, e.g. for supplying a domestic user, or for entering electric power into the public network.

30 Vapor exiting from turbine 4 at a temperature of about 60°C, enters within condenser 5, directly connected with said turbine 4.

Hot fluid is sent into a first duct 8, taking hot fluid, to be exploited to heat a domestic user.

35 Said fluid, once cooled, is sent through a second duct 9, and it is again entered within condenser 5. Cooled fluid from condenser 5 is collected within a tank 6, from which it is again pumped to solar evaporator 2, by circulation pump 7.

In the embodiment shown in figures 2 – 4, it is made reference to a solar evaporator 2 which is a thermal solar panel, but in further embodiments, solar evaporator can be another type of evaporator.

5 Solar evaporator 2, i.e. thermal solar panel, comprises a plurality of calotte collectors 21, parallel and side-by-side each other, each collector 21 having, in its upper central portion, a seat for housing a tube 22, within which plant 1 fluid flows.

10 Making particularly reference to figure 4, it is observed that calotte-shape of collector 21 permits concentrating heat produced by sun irradiation toward central part of collector, thus in correspondence of tube 22, to obtain an optimum heating of fluid.

15 Observing now figures 5 – 15, it is shown a turbine according to the invention, generically indicated by reference number 4, realized in such a way to ensure a perfect sealing, thus preventing every loss of processed fluid, and to permit an optimum action of fan.

Turbine 4 according to the invention provides a housing 42, within which a distributor 410, specifically shown in figures 6-9 and 10-13, and a fan 420 are provided.

20 The two embodiments of distributor 410 of turbine 4 according to the invention shown in figures 6-9 and 10-13 are substantially the same, the only difference being their sizes, so that only distributor shown in figure 6-9 will be described in greater detail, and to indicate the one of figures 10 – 13 the same numeral references of figures 6 – 9 being used.

25 As it is shown in the figures, distributor 410, provided in turbine 4 according to the invention in correspondence of fluid inlet side, has a plurality of holes 411, corresponding to the number of blades provided in fan 420, that will be described in greater detail with reference to figures 14 – 17.

30 From section of figure 9 (section IX-IX of figure 8) or of figure 13 (section XIII-XIII of figure 8), it is observed that holes 411 are realized inclined through distributor 410.

35 Inclination and shape of holes 411 is realized in such a way that said fluid enters within turbine 4 according to the invention is addressed on blades (not shown in these figures) of fan 420, so as to ensure a continuous action on same blades, without any interruption, thus ensuring a high efficiency of turbine 4 according to the invention.

Outside, said distributor 410 has a plurality of holes 412 for fixing, by a flange, to said turbine 4 housing 42.

5 Observing now figures 14 – 17 of the enclosed drawings, it is shown a fan 420 of turbine 4 according to the invention, so sized to be used in a turbine 4 providing a distributor 410 as shown in figures 6 – 9.

Fan 420 provides eighteen blades 421, corresponding to holes 411 of figure 9, and inclined in such a way to steadily receive thrust of fluid flow entering within turbine 4 according to the invention through holes 411 of distributor 410.

10 Thus, fluid expanded through fan 420 of turbine 4 exits from the same through turbine 4 outlet (see figure 5), without any leakage of fluid, and that can be thus sent along a closed circuit.

Electric power generated by turbine 4 according to the invention can be entered within public network, stored or used in private facilities.

15 A plurality of said turbines 4, in parallel, can be provided in said plant 1.

Present invention thus permits realizing a co-generation plant that can produce both thermal power and electric power, with a high efficiency and low costs.

20 Furthermore, another advantage of the present invention is that of preventing leakages from plant, that would increase costs and lower plant efficiency.

25 The present invention has been described with reference to preferred embodiments, but it is to be understood that variations and/or modifications can be introduced by those skilled in the art without departing from the relevant scope as defined in the enclosed claims.

CLAIMS

1. Thermal co-generation plant (1), within which, a fluid flows
5 along a closed circuit, said plant comprising, in series, an evaporator (2),
for heating said fluid, a valve (3), at the outlet of said evaporator (2), for
adjusting pressure of fluid within said evaporator (2), a turbine (4), within
which said fluid expands, generating electric power, a condenser (5), from
10 which fluid exiting from said turbine (4) is entered into a closed circuit, hot
water generation plant, a tank (6), for collecting cooled fluid from said hot
water generation plant and to send the same to the evaporator (2), and a
circulation pump (7), sending fluid at a liquid state, to said evaporator (2),
said fluid having a boiling point of about 35°-40°.

2. Plant (1) according to claim 1, characterized in that said heat
15 exchange hot water generation plant can further comprise a first duct (8),
connecting said condenser (5) with a user, for transmitting hot vapor
arriving from turbine (4), and a second return duct (9) of said cooled fluid
from user to condenser (5).

3. Plant (1) according to one of the preceding claims,
20 characterized in that said fluid is Solkatherm® SES36 fluid.

4. Plant (1) according to one of the preceding claims,
characterized in that said adjustment valve (3) opens at a temperature of
about 12 bar.

5. Plant (1) according to one of the preceding claims,
25 characterized in that said turbine (4) comprises a housing (42), provided
with inlet and outlet for fluid crossing said turbine (4), a distributor (410),
substantially close to said inlet, and a fan (420), provided with a plurality of
blades (421), said distributor providing a number of passage holes (411)
corresponding to the number of said blades (421), said plurality of fluid
30 passage holes (411) being shaped and addressed in such a way to always
distribute the fluid on said fan (420) blades (421).

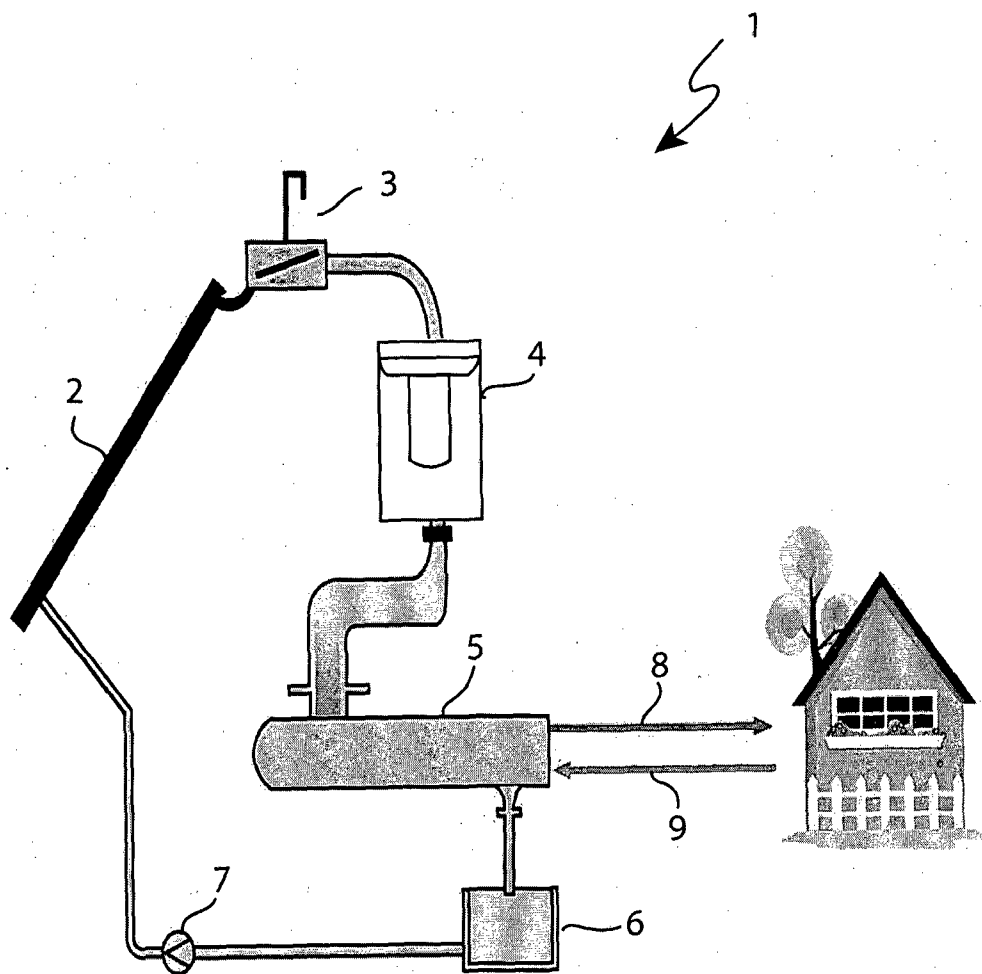
6. Plant (1) according to claim 5, characterized in that said
turbine (4) has every part realized so as to be liquid-tight.

7. Plant (1) according to one of the preceding claims,
35 characterized in that said plant provides a plurality of turbines (4) in
parallel each other.

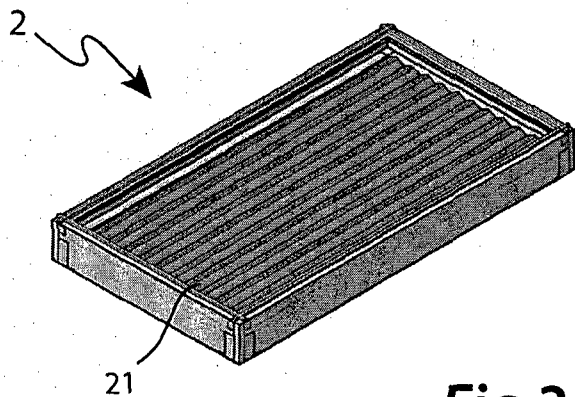
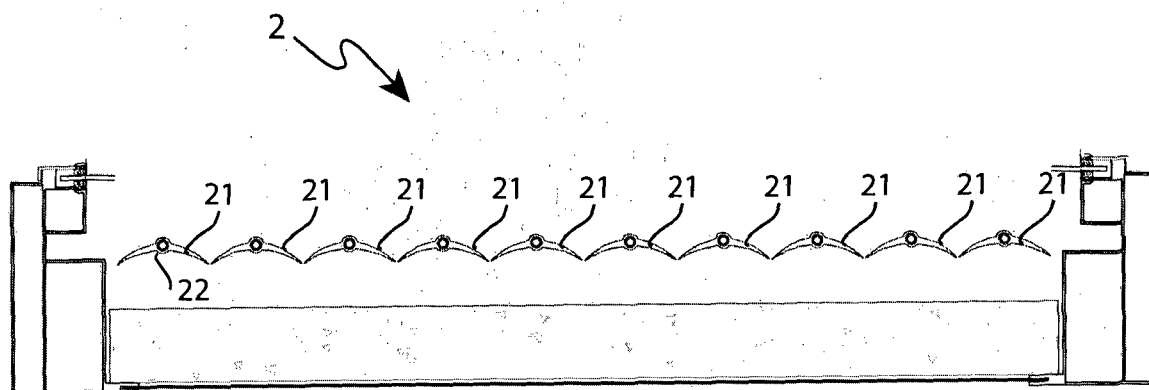
8. Plant (1) according to one of the preceding claims, characterized in that said evaporator (2) is a solar evaporator (2).

5 9. Plant (1) according to claim 8, characterized in that, said evaporator (2) is a thermal solar panel comprising a plurality of cap collectors (21), placed side-by-side each other, each one having, in its upper central portion a seat for housing a tube (22), within which said fluid flows.

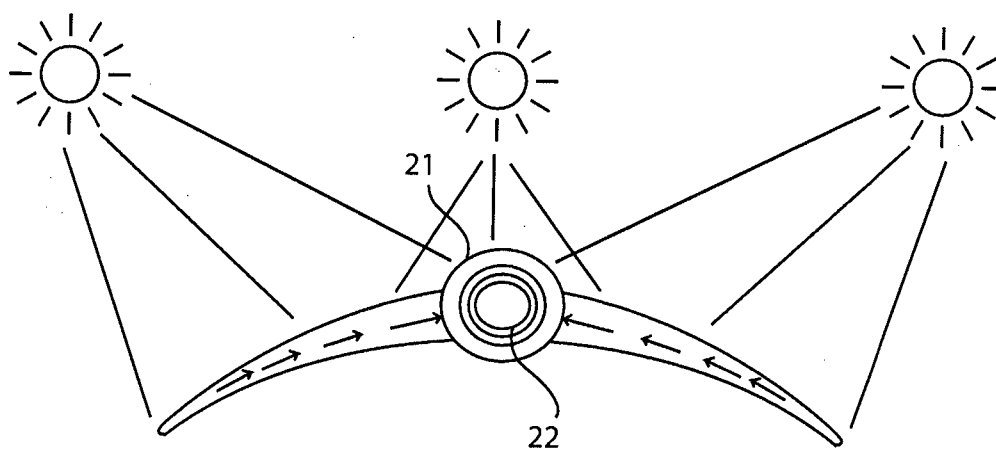
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**Fig.1**

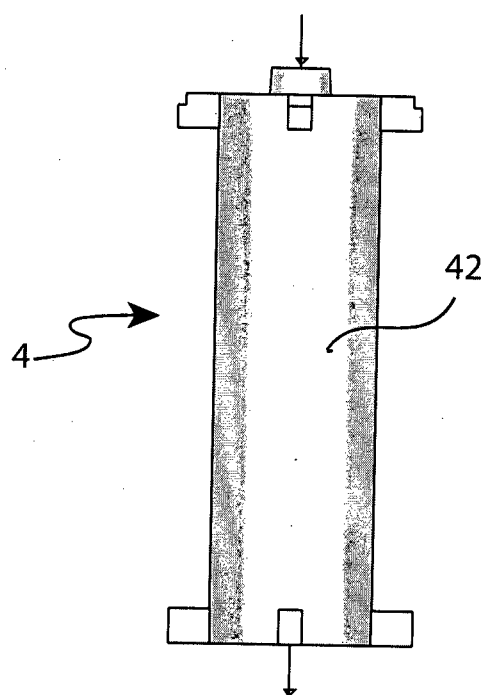
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Fig. 2Fig. 3

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**Fig.4**

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Fig.5

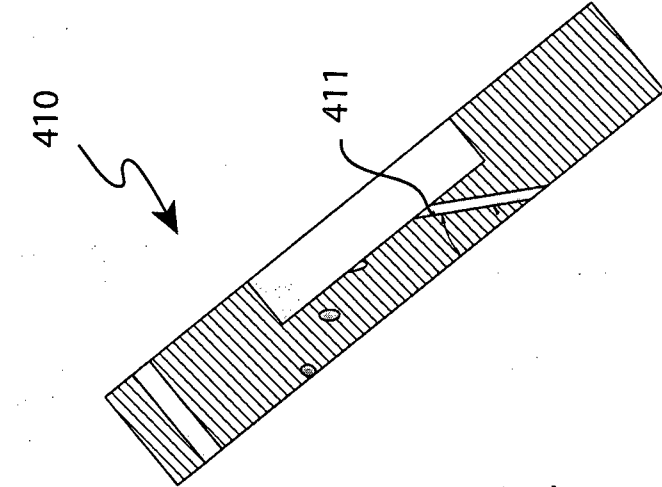


Fig. 9

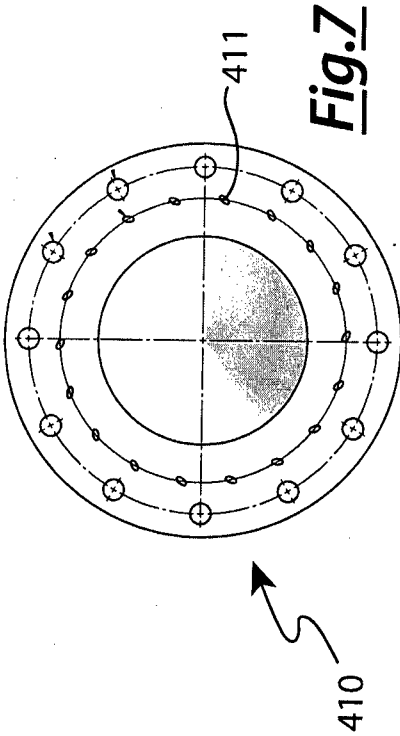


Fig. 7

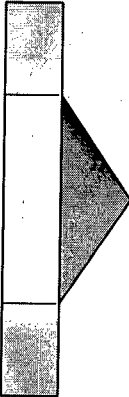


Fig. 6

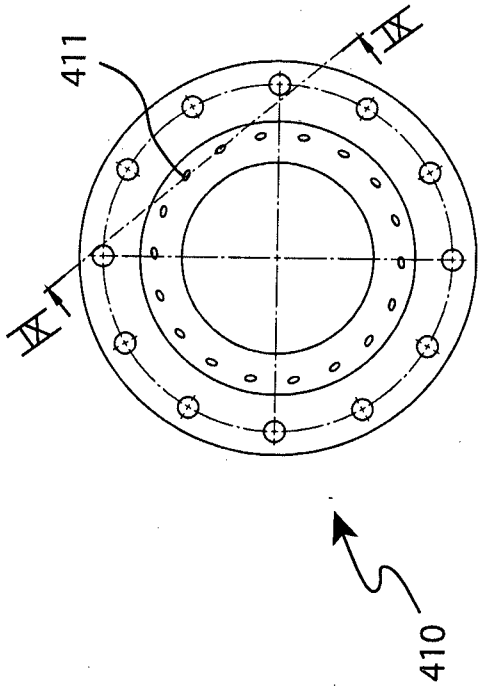
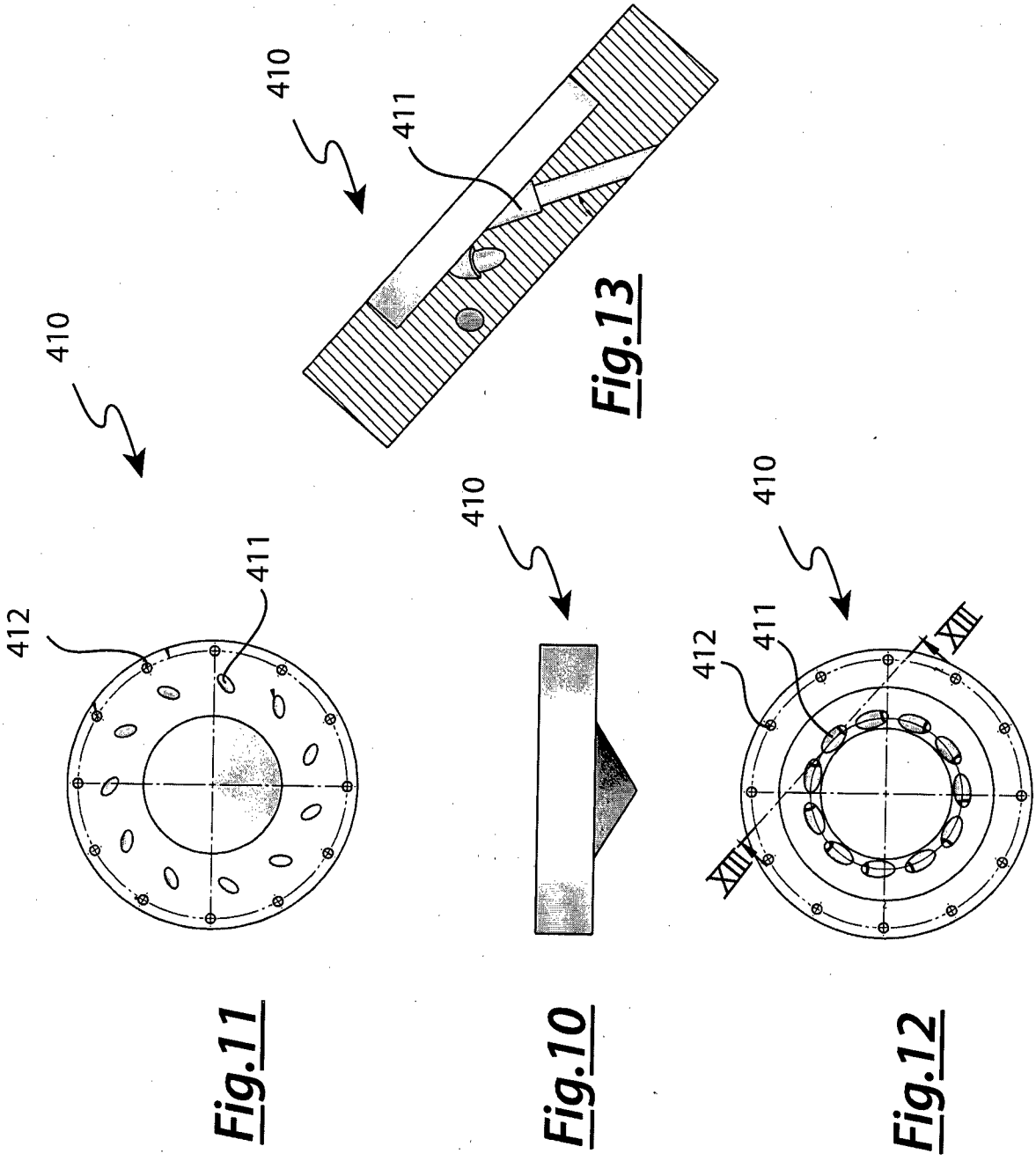
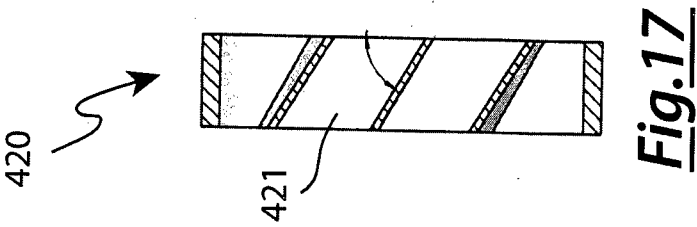
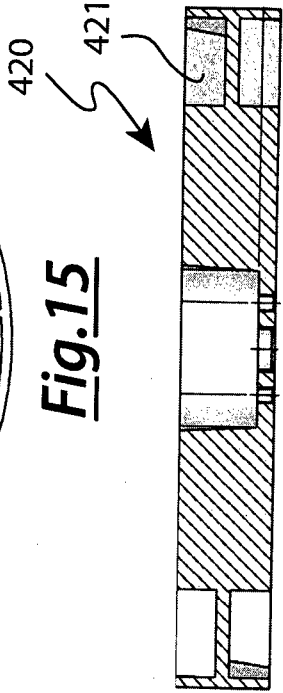
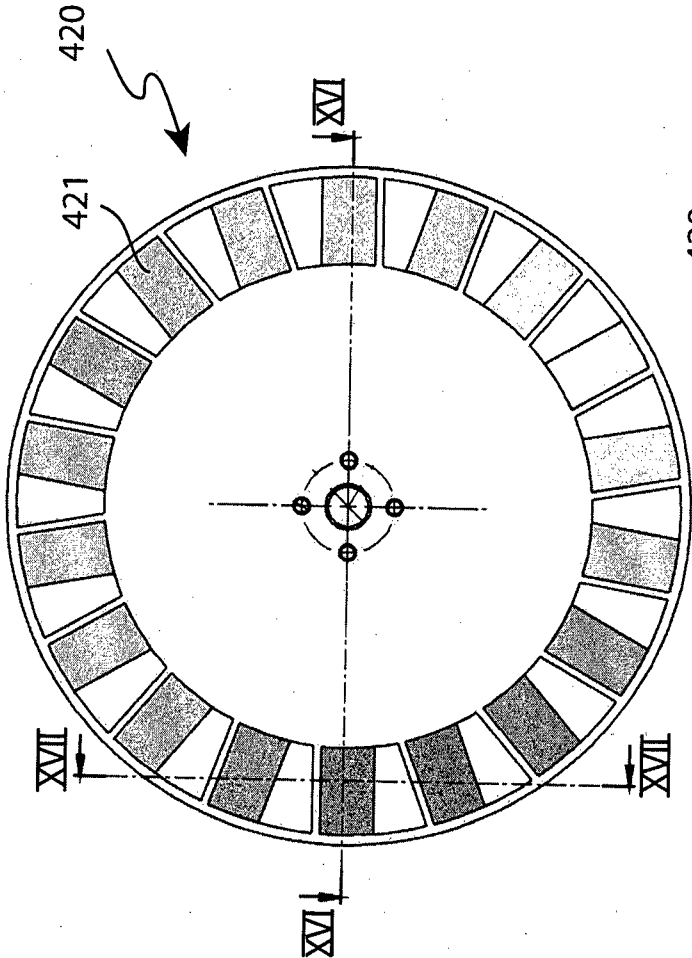
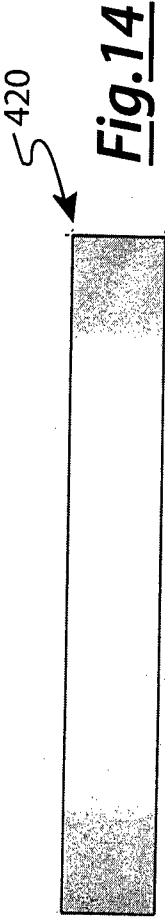


Fig. 8





INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER

INV. F25B27/00 F01K25/08 F03G6/06 F22B1/00
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F25B F01K F03G F22B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	WO 2010/145970 A2 (DEUTSCH ZENTR LUFT & RAUMFAHRT [DE]; FELDHOFF JAN FABIAN [DE]; ECK MAR) 23 December 2010 (2010-12-23) the whole document	9
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Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

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16/05/2012

Name and mailing address of the ISA/

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de Graaf, Jan Douwe

INTERNATIONAL SEARCH REPORT

International application No

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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Information on patent family members

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