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(72) Inventor: **Verbraak, Peter**
1951 ME VELSEN NOORD (NL)

(74) Representative: **De Vries & Metman**
Overschiestraat 180
1062 XK Amsterdam (NL)

(71) Applicant: **Danieli Corus BV**
1951 ME Velsen Noord (NL)

(54) **Apparatus and method for conditioned removal of gases**

(57) An apparatus (1) is disclosed for the removal of gasses from electrolysis cells (3) by suction comprising a branch duct (5) for each electrolysis cell, a ductwork (4) connecting the branch ducts to a gas treatment centre (9), a central suction fan (11) providing a gas flow in the ducts, and a heat exchanger (15) arranged in the gas flow. The heat exchanger comprises one or more heat

exchanger elements (17) in at least one of the branch ducts and the ductwork. One or more of the heat exchanger elements are removably arranged in the at least one of the branch ducts and the ductwork and/or the heat exchanger comprises a plate heat exchanger (15) comprising one or more heat exchanger plates (17).

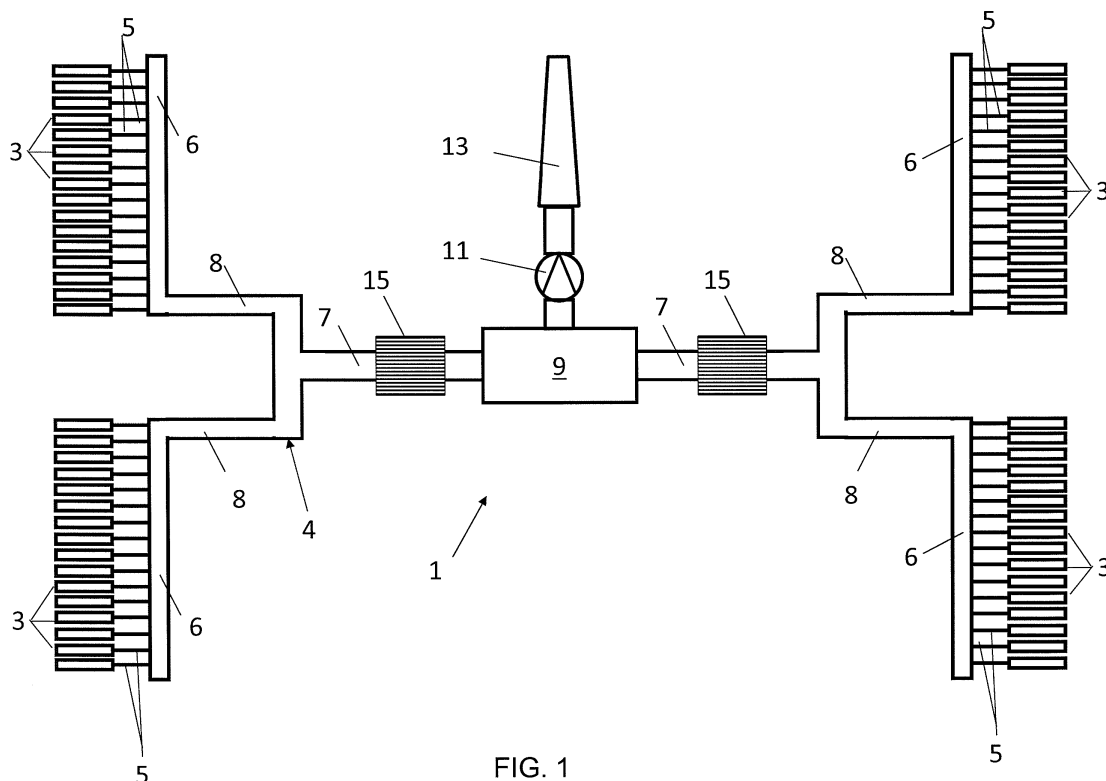


FIG. 1

Description

TECHNICAL FIELD

[0001] The present disclosure relates to an apparatus for the removal of gasses from electrolysis cells by suction comprising a branch duct for each electrolysis cell, a ductwork connecting the branch ducts to a gas treatment centre, a central suction fan providing a gas flow in the branch ducts and the ductwork and a heat exchanger.

BACKGROUND

[0002] During the electrolysis process in such apparatus gasses are produced that can be harmful for the environment and the working conditions in the pot room housing the electrolysis cells. Especially in the electrolysis process for production of aluminium harmful gasses containing fluorides and fluoride particles are emitted. The last decades major improvements have been implemented to reduce the emission of both fluoride particles and gasses containing fluorides. The emission of the fluoride particles now is at an acceptable level due to an efficient adsorption system in the gas treatment system. However, improvements in operation control are sought after.

[0003] A system as aforementioned is known from EP 2 407 228 and from El Hani Bouhabila et al, "An innovative compact heat exchanger solution for an aluminium off-gas cooling and heat recovery", Light Metals 2013:793-797 (The Minerals, Metals & Materials Society, 2013). Such systems enable control over the temperature of the gas entering gas treatment centre. However, such systems require a large number of complex heat exchangers, arranged at specific places. According to EP 2 407 228, the heat exchanger should further be arranged in an upwards gas flow to reduce collection of dust and scaling on the heat exchanger proper.

[0004] It is a desire to provide an improvements to a system of the aforementioned type with regard to one or more of reduction of formation and collection of dust and/or scaling, reduction of costs and/or simplifying maintenance.

SUMMARY

[0005] Inter alia in view of the above, herewith an apparatus of the aforementioned kind is provided according to the appended claims.

[0006] In an aspect, one or more of the heat exchanger elements are removably arranged in the at least one of the branch ducts and the ductwork, in particular being removable on-line, i.e. with the apparatus otherwise functional and possibly in operation, e.g. being accessible from outside the respective duct(s). This facilitates control and/or maintenance of the apparatus, e.g. for cleaning and/or repair. It is known that heat exchangers in a flue gas flow, in particular heat exchangers around which

turbulence tends to occur, suffer from scaling which may be very hard to remove. Further, several removal techniques such as blasting may easily damage the heat exchanger and thus require particular for prevention is required. Moreover, if cleaning is imperfect, residues may provide starting points for accelerated recreation of scaling deposits. It has been considered that removal of the heat exchanger facilitates access to the heat exchanger and therewith renders maintenance and cleaning more easy and effective and in fact a possibly complexer construction of the apparatus may well be outweighed by the improved maintenance access and resultant up time and durability of the apparatus. If the heat exchanger can be removed while the apparatus is on-line, significant improvements regarding uptime can be achieved.

[0007] The position of the heat exchanger facilitates access and, in particular when arranged in the main duct, the heat exchanger affects substantially the entire gas flow equally, facilitating process control and gas flow properties control, such as providing predictable turbulence and/or content of dust and/or other contaminants entrained in the gas flow. Arrangement of the heat exchanger in other parts of the ductwork facilitates localised control of the gas flow, benefitting overall process parameters.

[0008] Preferably, at least part of the heat exchanger is removable from at least one of the branch ducts and the ductwork on a lateral side thereof, e.g. by being slid out of the respective duct. This greatly facilitates removal of the heat exchanger (part) for inspection, maintenance and/or repair. The removable part may be removable per individual heat exchanger element and/or in one or more assemblies of plural heat exchanger elements. In an embodiment wherein plural parts of the heat exchanger are removable individually, the heat exchanger configuration with respect to the number and/or positions of heat exchanger plates may be adapted to varying process conditions.

[0009] In an embodiment, one or more of the heat exchanger elements are attached to a removable duct wall part. In particular, in use the elements may be supported by the wall part in the respective duct and preferably the duct is substantially closed off, e.g. sealed, by the duct wall part. Thus, the heat exchanger element(s) and duct wall part may be removed or inserted as a whole and relative positions between the heat exchanger element(s) and the duct wall are well defined. In a particular embodiment, the one or more heat exchanger elements are suspended from the wall part into the respective portion of the duct, which facilitates arranging the heat exchanger element(s) into the duct by hanging it/them into the duct. Closing off the duct prevents leaking of air into the duct and/or leaking of gas out of it.

[0010] An embodiment may comprise an apparatus for removing the removable part of the heat exchanger from the respective duct portion of the branch ducts and/or the ductwork and possibly transporting the element outside and away from the respective duct portion to a further

location, e.g. a - preferably movable- crane or other lifting or hoisting arrangement. This facilitates removal and transport of the respective heat exchanger part. In case of an elevated duct, part of the heat exchanger may be removable downwards and the support may be formed to lift the heat exchanger part up into the duct.

[0011] In an embodiment a lateral side of the duct at a position of at least part of the heat exchanger may be provided with one or more doors or hatches granting access to the interior of the duct, e.g. for inspection, maintenance and/or repair of a heat exchanger part without having to remove the heat exchanger part. Such doors or hatches may also serve for removal of scale fallen from the duct wall and/or heat exchanger.

[0012] In another aspect, the presently provided apparatus the heat exchanger comprises a plate heat exchanger comprising one or more heat exchanger plates in at least one of the branch ducts and the ductwork. Preferably the ductwork comprises a main duct connected to the gas treatment centre and the heat exchanger is arranged the main duct.

[0013] A heat exchanger plate comprises a generally plate-like body of a highly heat conductive material such as a metal extending into the duct and being coupled with a coolant header having one or more coolant channels for conducting heat away from or towards the heat exchanger plate with the coolant. In particular, the plate-like body is generally flat, being significantly larger in two perpendicular directions (length, width) than in a third direction (thickness) perpendicular to the other two directions, defining a general plane. Thus, a generally flat object is provided that, when arranged in a gas flow with a large size extending in the gas flow direction, can provide a large surface for (thermal) contact with the gas at a low drag. Note that, although such shape may be used, the plate need not be plane in the strict Cartesian sense and it may be curved in one or more directions so as to provide a shell-like shape.

[0014] A plate heat exchanger provides a large heat exchanging contact surface in relation to the number of connections to other, differently shaped parts, in particular one or more coolant headers, in comparison with a tube heat exchanger or, in particular, a tube bundle wherein each tube needs a connection to a manifold. Further, the aerodynamic properties of the heat exchanger may be controlled better than with a tube heat exchanger; in particular, turbulence may be more predictable and/or reduced, so that settling of dust and/or scale may be reduced or prevented, while the location of such settling / scaling may be predicted more accurately and appropriate measures may be taken. Moreover, a plate heat exchanger may be cleaned more easily than a tube (bundle) heat exchanger.

[0015] In a preferred embodiment, one or more heat exchanger plates comprise a plate-like body and one or more coolant channel portions integral with it and in particular being arranged adjacent each other in and/or on the plate-like body in at least one of the branch ducts and

the ductwork. The coolant channels may have various shapes and in they may be arranged in the direction of the plane in a serpentine pattern. Suitable construction types comprise one or more tubes fixed onto a plate, e.g. by soldering, welding, clamping etc., and/or a number of plate portions attached to each other and structured such that one or more enclosed coolant channels are provided between the attached plate portions, e.g. so-called "coil sheets". Such structuring may be provided by a distribution of spot welds and/or rivets etc., but ribs, corrugations, and/or further structures may also be provided, possibly in combination. This enables a large thermal contact between the gas and the coolant in the duct and it may improve aerodynamic properties like reducing drag.

[0016] Preferably the heat exchanger plates are generally devoid of protrusions like ribs, fins etc. extending into the gas flow, which are customary in traditional heat exchangers, so as to reduce drag. One or more plates may be formed aerodynamically, e.g. wing or foil-like.

[0017] The heat exchanger may comprise plural heat exchanger elements of different construction and/or one or more dummy elements, preferably arranged on an upstream side of the heat exchanger with respect to (the direction of) the gas flow. This facilitates accommodating different conditions in the gas flow.

[0018] Up to now, heat exchangers had generally identical constructions throughout. However, it has been found that the gas flow conditions may vary significantly along the interaction zone of the gas flow and the heat exchanger, e.g. with respect to gas flow velocity, content of dust and/or other entrained matter and/or turbulence. Providing a heat exchanger with heat exchanger elements, e.g. plates, of different construction and/or one or more dummy elements, in particular dummy plates, can significantly improve robustness of the apparatus and the heat transfer process alike.

[0019] In particular the construction difference may relate to the build quality with respect to overall shape (e.g. one or more tubes and/or plates), wall thickness, coating, overall size etc. As an example, a first element may have a plate shape and comprise a plurality of coolant channels and/or one or more coolant channels of significant lengths undulating in or on the heat exchanger plate body, whereas a second plate shaped element comprises significantly less cooling ducts or cooling duct length, e.g. a single U-shaped coolant channel and being otherwise massive but of equal shape as the first plate. A dummy element may be an element of generally similar shape as one or more heat exchanger elements of the heat exchanger, but without (connection to) a coolant channel. Such relatively robust heat exchanger elements and/or dummy elements may be used at positions in the heat exchanger that are subject to significantly abrasive gas flow portions and/or portions within the apparatus suffering from elevated scaling. Such positions will occur on an upstream side of the heat exchanger with respect to the gas flow direction.

[0020] In an embodiment, one or more heat exchanger

elements and/or dummy elements, when applicable, may be formed for promotion of scaling and/or deposit of material entrained in the gas flow, such as solid matter and/or matter that solidifies at the normal operating temperature of the respective element. This may be done by providing cavities, ridges and/or turbulence-promoting portions in or on the heat exchanger elements, which may otherwise be formed turbulence-reducing or -preventing. Thus, deposition and scaling on target places is induced and promoted, preventing deposition and scaling in other, possibly more delicate, places. Providing sacrificial heat exchanger elements or dummy elements therefore protects delicate parts and improves overall behaviour and reliability of the apparatus. Moreover, by inducing deposition and/or scaling on the heat exchanger, fouling and wear of filters in the gas treatment centre and/or other downstream portions of the apparatus, with respect to the gas flow, are reduced or prevented.

[0021] The combination of promotion of deposition and/or scaling with removable heat exchanger parts facilitates provision of a further dust- and other contaminant collection instance in the apparatus, improving recovery and possibly sorting of such matter.

[0022] Also least one of the heat exchanger elements and/or dummy elements may comprise a dust- and/or scaling repellent coating. This assist preventing deposition of dust in unwanted locations. The combination of scaling/deposition promoting portions and dust allows controlled localisation of scaling, dust collection and the like in the apparatus.

[0023] The apparatus may comprise a main suction duct connected to the gas treatment centre, wherein at least part of the heat exchanger is preferably arranged in the main suction duct. This allows affecting, in particular cooling, the gas from plural, if not all, electrolysis cells.

[0024] In an embodiment, the heat exchanger is configured to establish a downstream gas temperature in a range of 90-150 degrees Celsius, in particular 100-130 degrees Celsius, more in particular 100-120 degrees Celsius. Such temperatures spare the material of bag filters commonly used in gas cleaning sections of a gas cleaning centre for cleaning electrolysis gases such as produced in electrolysis of aluminium. It has been considered, moreover, that operating temperatures in the range of 100-120 degrees Celsius are optimal for fluoride adsorption at lower temperatures, effectiveness of filtering dust may be improved. Electrolysis processes for manufacturing of aluminium tend to produce (fluoride-containing) gases at temperatures of about 80-100 degrees Celsius in colder climates, whereas in hot climates the gas temperatures of the same processes may be up to about 180-200 degrees Celsius. The present apparatus is useful for thermal conditioning of the gas in either case, be it cooling or heating the gas. Note that in the latter case (heating) the word "coolant" in this text should be understood to comprise any suitable fluid operating medium for transferring heat from or to the heat exchanger

element(s), i.e. being either for cooling or rather for heating the heat exchanger element(s).

[0025] In an embodiment, the heat exchanger is a first heat exchanger comprising an operating medium for absorbing and transporting heat from or to the first heat exchanger, the first heat exchanger being coupled with a second heat exchanger comprised in the apparatus for cooling or heating the operating medium, wherein preferably the second heat exchanger is arranged for exchanging heat with a cold reservoir most preferably the environment, in particular losing heat to the environment. E.g., the second heat exchanger may comprise a series of open-air heat exchangers, possibly comprising forced air devices such as ventilators. The coolant may be fed through the first and second heat exchangers via forced flowing, e.g. comprising a compressor in a closed circuit. The second heat exchanger may comprise a second operating medium. In an embodiment, at least one of the first and second heat exchangers comprises a heat pipe arrangement, wherein the respective coolant is evaporated at one side and condenses at another side and a flow of the coolant is provided by gravity due to density differences between the evaporated coolant and the condensed coolant.

[0026] Suitable coolants comprise glycol, other hydrocarbons and/or water.

[0027] In an embodiment at least part of the heat exchanger is arranged as a counterflow heat exchanger. This improves heat exchange between the gas and the heat exchanger.

[0028] In an embodiment, at least part of the heat exchanger is arranged for providing a predetermined temperature distribution with respect to the gas flow direction, wherein in particular part of the heat exchanger is arranged as a co-flowing heat exchanger and another part of the heat exchanger is arranged as a counterflow heat exchanger. Thus, a cold zone and/or a hot zone in the gas flow may be provided. A cold zone may promote solidification and/or deposition of matter entrained in the gas flow. Thus, specific portions of the heat exchanger may be dedicated for dust collection, scaling, etc. so that other portions may be spared from such effects.

[0029] In a variant of such embodiment, a first portion of the heat exchanger is arranged on an upstream side of the gas flow and serves for cooling the gas flow from an initial, relatively high, temperature to an intermediate, relatively low, temperature, preferably in a counterflow arrangement, and a second portion of the heat exchanger is arranged downstream of the first heat exchanger portion with respect to the gas flow and serves for heating the gas from the intermediate temperature to an end temperature in between the initial and intermediate temperatures, preferably in a co-flowing arrangement, with a single coolant flow circuit and/or wherein the coolant exit temperature of the first heat exchanger corresponds to the coolant entry temperature of the second heat exchanger portion. Thus, condensation of contaminants may be promoted energy efficiently since heat that has

been drawn off the incoming gas to cool it to a condensation temperature for the targeted contaminant(s) is returned to the gas to heat the gas so as to provide a gas flow after the heat exchanger of a desired temperature but without the target contaminants.

[0030] The present apparatus is particularly suitable for electrolytic production of aluminium, especially for such production using a Hault-Heroult-process.

[0031] In view of the above, herewith a heat exchanger is provided for an apparatus as disclosed herein, comprising a plurality of plate heat exchanger plates and at least one dummy plate.

[0032] Preferably, in any heat exchanger disclosed herein, the heat exchanger plates are decouplable from each other, e.g. for inspection, maintenance, repair and/or exchange.

BRIEF DESCRIPTION OF THE DRAWINGS

[0033] The above-described aspects will hereafter be more explained with further details and benefits with reference to the drawings showing exemplary embodiments.

Fig. 1 shows an apparatus for the removal of gasses from electrolysis cells;

Fig. 2A-2C show side, top and front views of a heat exchanger in a gas duct of an apparatus according to Fig. 1;

Fig. 3 shows removal of a heat exchanger part from the duct in an arrangement according to Figs. 2A-2C;

Fig. 4 shows an embodiment of a heat exchanger plate;

Fig. 5 shows an assembly with plural heat exchanger plates;

Fig. 6 shows another embodiment of a heat exchanger in a gas duct of an apparatus according to Fig. 1;

Fig. 7 is a schematic of a heat exchanging system for use in the apparatus according to Fig. 1;

Fig. 8 is a schematic of another heat exchanging system for use in the apparatus according to Fig. 1.

DETAILED DESCRIPTION OF EMBODIMENTS

[0034] It is noted that the drawings are schematic, not necessarily to scale and that details that are not required for understanding the present disclosure may have been omitted. The terms "upward", "downward", "below", "above", and the like relate to the embodiments as oriented in the drawings, unless otherwise specified. Further, like elements are denoted by like reference signs.

[0035] Fig. 1 shows an apparatus 1 for the removal of gasses from electrolysis cells 3 by suction comprising a branch duct 5 for each electrolysis cell connected to a ductwork 4, having a manifold 6, a main duct 7 connecting the branch ducts 5 via the manifold 6 and here via optional group ducts 8, to a gas treatment centre 9, a central suction fan 11 providing a gas flow in the ducts and a stack

13 for venting exhaust gases. Here, the electrolysis cells 3 are grouped. In practice, the apparatus may comprise tens to hundreds of electrolysis cells 3 arranged in more or fewer groups of electrolysis cells 3 with the ducts 5-8 suitably arranged accordingly.

[0036] In the main ducts 7, here each main duct 7, a plate heat exchanger 15 is arranged, comprising heat exchanger plates extending into the gas flow, as explained below. It should be noted that the heat exchanger may be arranged in other locations as well, in particular in one or more group ducts 8. It is noted that due to the suction, the gas pressure inside the ducts will be lower than the atmospheric pressure outside of the ducts.

[0037] In a typical apparatus, the electrolysis cells 3, or "pots", are operated for electrolytic production of aluminium from alumina (aluminium oxide) according to a Hault-Heroult process. Such process produces hot gases containing fluorides that are sucked from the cells 3 to the gas treatment centre 9 under the influence of the central suction fan 11. Additional suction ductwork such as for boosted suction when opening an electrolysis cell 3 may be provided. Such additional suction ductwork may also comprise a heat exchanger as presently described.

[0038] Figs. 2A-2C show as a detail of an apparatus according to Fig. 1 an embodiment of the heat exchanger 15 in the duct 7. The heat exchanger 15 is a plate heat exchanger comprising heat exchanger plates 17 in a lumen 19 of the duct 7, which here has a generally rectangular shape. Here, the plates 17 are generally flat and plane extending in two perpendicular directions significantly more than in the third direction perpendicular to both former directions. The plates have a generally rectangular shape but other shapes are conceivable.

[0039] In the shown embodiment, the heat exchanger plates 17 each comprise one or more coolant channels, being interconnected in series (open arrows) in the gas flow direction (black arrows). Adjacent heat exchanger plates 17 in a direction perpendicular to the gas flow may be interconnected as well, in particular in parallel with respect to the coolant channels. However, individual connection to a coolant circuit of one or more (sets of) heat exchanger plates 17 is also possible.

[0040] In the present embodiment as shown in Figs. 2A-2B, the coolant flows from right to left (Fig. 2A), whereas the gas flows oppositely from left to right. In case hot gas flows into the portion of the duct 7 comprising the heat exchanger 15, and the coolant has a lower temperature than the gas, cooled gas will exit (the duct portion comprising) the heat exchanger 15 and a counterflow heat exchanging arrangement is provided. If the operating medium ("coolant") flows in the same direction as the gas flow, a co-flowing heat exchanger arrangement is provided.

[0041] Fig. 3 is a view similar to that of Fig. 2A part of an embodiment of an apparatus according to Fig. 1 with a heat exchanger 15 and further comprising a crane 21 comprising a hoisting device 23 movable along a mono-rail 25 or another conveyor for removing the plates 17

from the duct 7 and, in this case, transporting them away. In the shown embodiment, the plates 17 are removable from the duct 7 on a lateral side of the duct 7 and in lateral direction, here, generally in vertical direction. The plates 17 comprise an optional flange 27 and the duct 7 has a wall 29 with slots (not shown) accommodating the plates 17, so that the plates 17 can be inserted into and removed from the duct 7 by the crane 21 through the according slots. When inserted into the duct 7, (the flanges 27 of) the plates 17 rest on the duct wall 29. The flanges 27 preferably close off the respective slots, thus effectively forming part of the duct wall. Fastening arrangements e.g. bolts, clamps etc. may be provided. Doors, hatches, valves etc. may be provided to close off one or more slots from which heat exchanger plates 17 have been removed at least partly, preferably fully. Thus, the geometry and/or size of the heat exchanger can be adapted to suit particular operation conditions of the apparatus, e.g. the number of electrolysis cells in use, a process temperature and/or an outside temperature, composition of the gas etc. However, in case of sufficiently strong suction by the suction fan 11 and sufficiently small slots (and associated heat exchanger plates 17 or assemblies of interconnected heat exchanger plates), open slots in the duct wall 29 from which heat exchanger plates 17 have been removed may not significantly affect the gas flow in the duct work (5-8) and not lead to leaking of gas from the duct 7 so that doors and the like for closing off slots need not be provided. This significantly facilitates operation and reduction of costs of the apparatus, in particular with regard to on-line removal of heat exchanger plates 17. This also reduces the number of interconnections between (coolant channels of) individual plates 17.

[0042] Instead of individual heat exchanger plates 17, assemblies of interconnected heat exchanger plates 17 may be made removable as a whole, e.g. as an integrated cassette.

[0043] It is to be noted that in other embodiments of the apparatus as described with particular reference to Fig. 3 the heat exchanger may be of different construction and not comprise heat exchanger plates, but of which one or more heat exchanger elements can still be removed from the respective duct, preferably on and towards a lateral side of the respective duct. E.g., one or more heat exchanger tubes or entire cassettes of tube bundles may be removed from the duct for adaptation of the heat exchanger and/or for inspection, maintenance, repair etc.

[0044] Figs. 4 is a side view of an embodiment of a heat exchanger plate 17 in mid-cross section. The plate 17 has a single coolant channel 31 in a serpentine pattern between connection ports 33 for flowing a fluid operating medium (coolant) through (the coolant channel 31 of) the plate 17.

[0045] Fig. 5 is a front view (cf. Fig. 2C) of an assembly 35 of plural heat exchanger plates 17 that are fixed together, forming an integrated cassette, and of which the respective coolant channels 31 are interconnected

through a manifold 37. Thus, plural heat exchanger plates 17 may be removed from and inserted into the duct 7 in one operation. The number of slots in the duct wall 29 may be reduced compared to arrangements with (manipulation of) single heat exchanger plate 17.

[0046] Fig. 6 shows, as in Fig. 2B, another embodiment of a heat exchanger 15 in a duct 7 of an apparatus of the type of Fig. 1. Different from the embodiment of Figs. 2A-2C, this heat exchanger 15 comprises dummy plates 39 in addition to heat exchanger plates 17. The dummy plates 39 are arranged on an upstream side of the heat exchanger 15 with respect to the gas flow (white arrows), where the gas flow will contain most entrained dust and other contaminants. Thus, the dummy plates 39 protect the heat exchanger plates 17 arranged downstream of them from wear. In some embodiments, it may appear that heat exchanger plates 17 further downstream may suffer from wear and/or deposition of contaminants more than plates further upstream. In such cases one or more of the affected plates 17 may be formed more robust than adjacent plates 17 and/or be exchanged for dummy plates 39. Embodiments with removable heat exchanger plates as presented herein facilitate optimisation of the geometry of the heat exchanger, also on line in case process parameters change in one or more electrolysis cells 3 or elsewhere in the apparatus 1.

[0047] Here, all plates are shown with rectangular shapes, but more aerodynamically shaped plates may be provided.

[0048] Fig. 7 is a scheme of part of an embodiment of an apparatus as disclosed herein otherwise. Fig. 7 shows an arrangement wherein the plate heat exchanger 15, arranged for thermal conditioning of gas with a first temperature $G(T_1)$ to gas with a second, different, temperature $G(T_2)$ using exchange of heat with an operating medium (coolant) flowing in a closed loop 41. The medium is reconditioned to a default temperature in a second heat exchanger 43, e.g. for exchange to environmental temperature. Here, an optional storage tank 45 for storing and possibly replenishing and/or refreshing an amount of the medium via suitable system 47 (not shown) and an optional pump 49 for propelling the medium are provided as well. At least the pump 49 may be arranged in another position in the arrangement.

[0049] Fig. 8 shows a simplified apparatus 1, wherein coolant from the first heat exchanger 15 is evaporated in the first heat exchanger 15, the resulting vapour rises through a conduit 51 to the second heat exchanger 43 in which the coolant is condensed to a liquid phase. The resultant liquid flows back through the conduit 51 by gravity to the first heat exchanger 15 to start the cycle anew. Such heat pipe operation principle obviates compressors and/or other active flow-generating devices and it may reduce numbers of conduits for establishing a coolant flow (pipes, hoses, etc.).

[0050] The disclosure is not restricted to the above described embodiments which can be varied in a number of ways within the scope of the claims. For instance, the

shapes, numbers, positions and/or relative positions of heat exchanger elements and/or dummy elements such as plates may be varied.

[0051] Elements and aspects discussed for or in relation with a particular embodiment may be suitably combined with elements and aspects of other embodiments, unless explicitly stated otherwise.

Claims

1. An apparatus (1) for the removal of gasses from electrolysis cells (3) by suction comprising a branch duct (5) for each electrolysis cell, a ductwork (4) connecting the branch ducts to a gas treatment centre (9), a central suction fan (11) providing a gas flow in the branch ducts and the ductwork, and a heat exchanger (15) arranged in the gas flow, wherein the heat exchanger comprises one or more heat exchanger elements (17) in at least one of the branch ducts and the ductwork, and wherein one or more of the heat exchanger elements are removably arranged in the at least one of the branch ducts and the ductwork, in particular being removable on-line.
2. The apparatus according to claim 1, wherein one or more of the heat exchanger elements (17) are removable from at least one of the branch ducts and the ductwork on a lateral side thereof.
3. The apparatus according to any preceding claim, wherein one or more of the heat exchanger elements (17) are attached to a removable duct wall part (27), such that in particular in use the one or more elements are supported by, e.g. suspended from, the wall part in the duct and wherein preferably the duct is substantially closed off, e.g. sealed, by the duct wall part.
4. The apparatus according to any preceding claim, comprising an apparatus (21) for removing and possibly transporting the removable part of the heat exchanger from the at least one of the branch ducts and the ductwork.
5. An apparatus (1) for the removal of gasses from electrolysis cells (3) by suction, in particular an apparatus according to any preceding claim, comprising a branch duct (5) for each electrolysis cell, a ductwork (4) connecting the branch ducts to a gas treatment centre (9), a central suction fan (11) providing a gas flow in the branch ducts and the ductwork, and a heat exchanger (15) arranged in the gas flow, wherein the heat exchanger comprises a plate heat exchanger (15) comprising one or more heat exchanger plates (17) in at least one of the branch ducts and the ductwork.
6. The apparatus according to claim 5, wherein one or more heat exchanger plates comprise a plate-like body and one or more coolant channel portions integral with it and in particular being arranged adjacent each other in and/or on the plate-like body in at least one of the branch ducts and the ductwork.
7. The apparatus according to any preceding claim, wherein the heat exchanger comprises plural heat exchanger elements of different construction and/or one or more dummy elements (39), preferably arranged on an upstream side of the heat exchanger with respect to a direction of the gas flow.
8. The apparatus according to any preceding claim, wherein at least one of the heat exchanger elements and/or dummy elements, where applicable, is formed for promotion of scaling and/or deposit of material entrained in the gas flow, and/or wherein at least one of the heat exchanger elements and/or dummy elements, where applicable, comprises a dust-and/or scaling- repellent coating.
9. The apparatus according to any preceding claim, wherein the duct work comprises a main suction duct (7) connected to the gas treatment centre (9) and at least part of the heat exchanger is arranged in the main suction duct.
10. The apparatus according to any preceding claim, wherein the heat exchanger is configured to establish a downstream gas temperature in a range of 90-150 degrees Celsius, in particular 100-130 degrees Celsius, more in particular 100-120 degrees Celsius.
11. The apparatus according to any preceding claim, wherein the heat exchanger (15) is a first heat exchanger comprising an operating medium for absorbing and transporting heat from or to the first heat exchanger, the first heat exchanger being coupled with a second heat exchanger (43) comprised in the apparatus for cooling or heating the operating medium, wherein preferably the second heat exchanger is arranged for exchanging heat with the environment.
12. The apparatus according to any preceding claim, wherein at least part of the heat exchanger (15) is arranged as a counterflow heat exchanger.
13. The apparatus according to any preceding claim, wherein at least part of the heat exchanger is arranged for providing a predetermined temperature distribution with respect to the gas flow direction, wherein in particular part of the heat exchanger is arranged as a co-flowing heat exchanger and another part of the heat exchanger is arranged as a coun-

terflow heat exchanger.

14. The apparatus according to any preceding claim,
wherein the apparatus is arranged for electrolytic
production of aluminium, in particular using a Hault-
Heroult-process. 5
15. Heat exchanger for an apparatus according to any
preceding claim, being a plate heat exchanger (15)
comprising a plurality of heat exchanger plates (17) 10
and at least one dummy plate (39).

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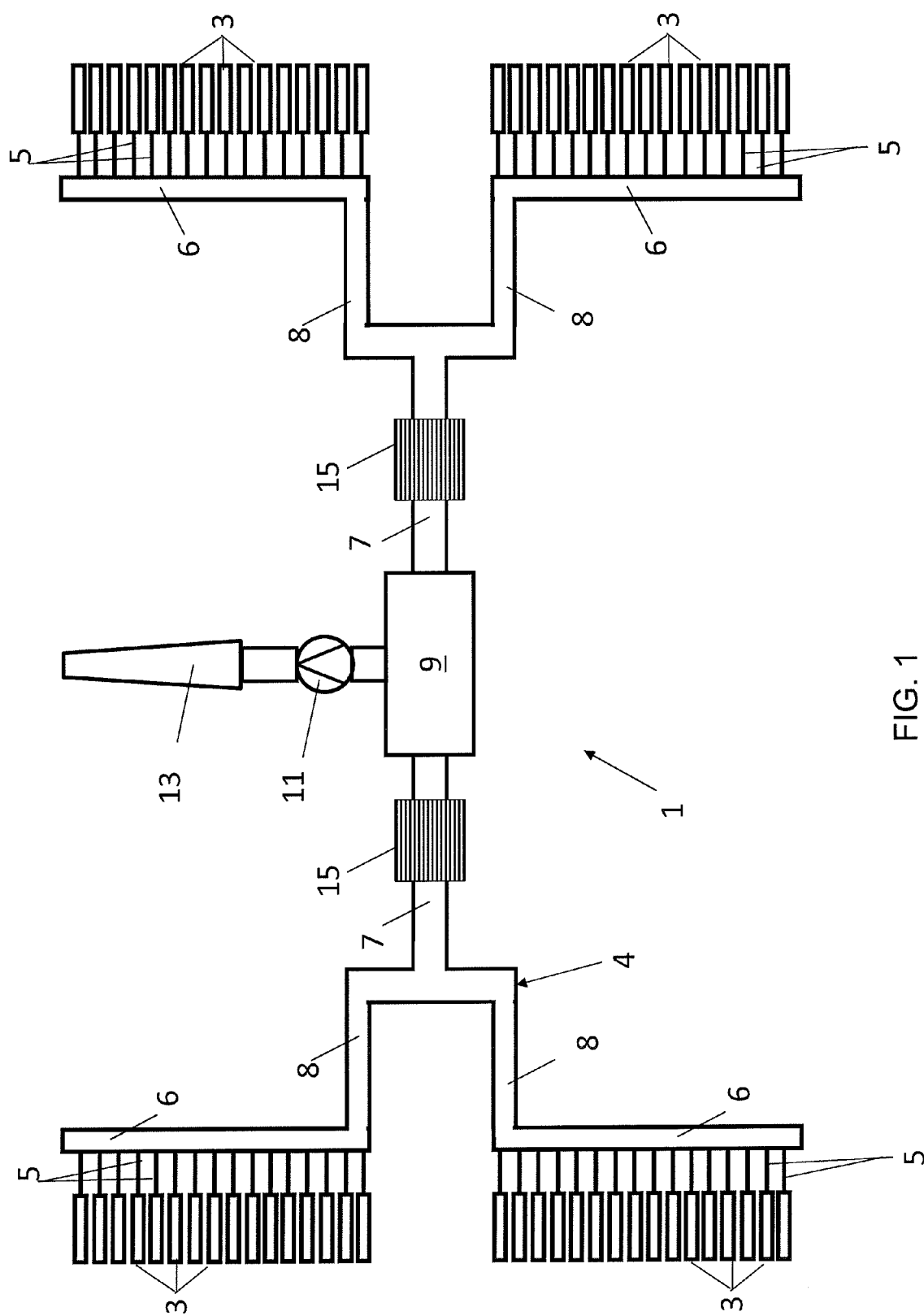
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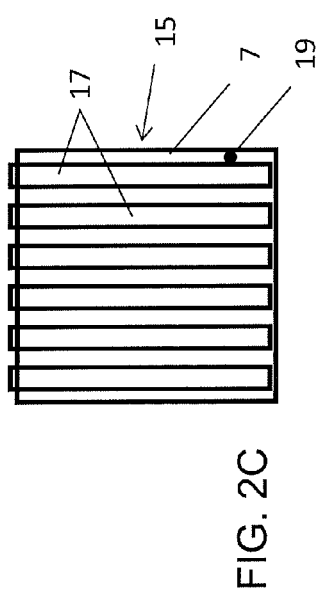
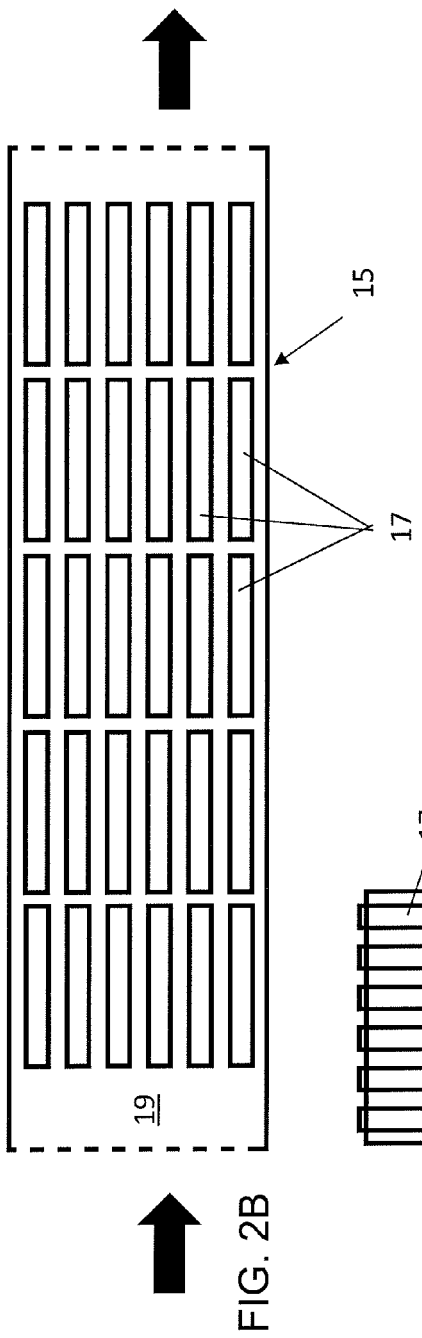
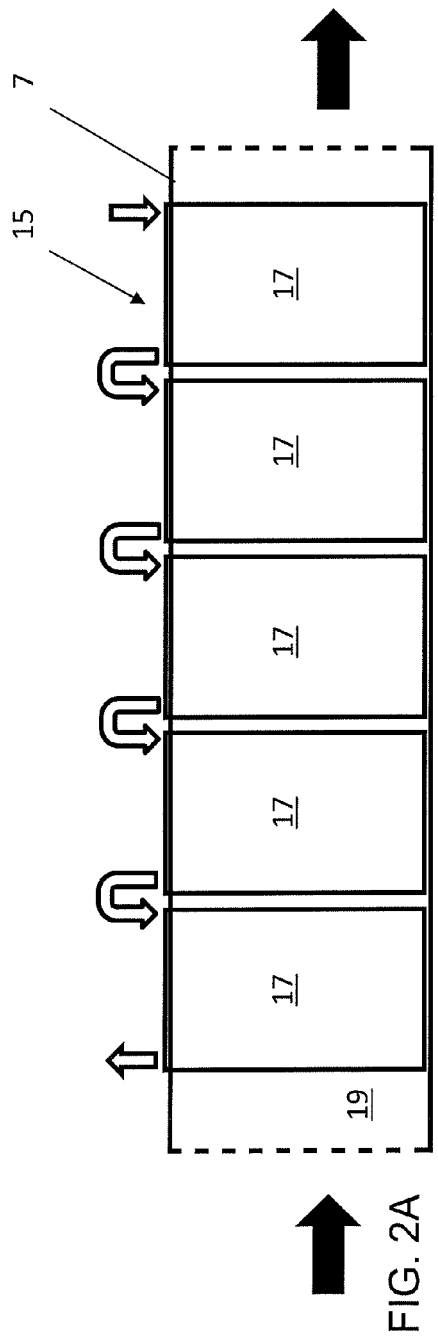
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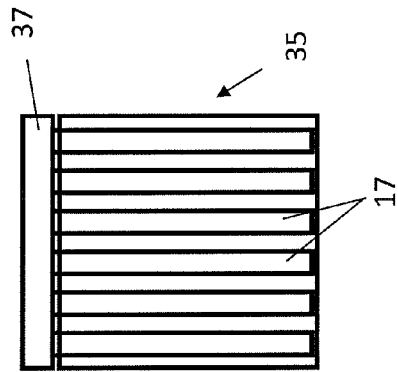


FIG. 5

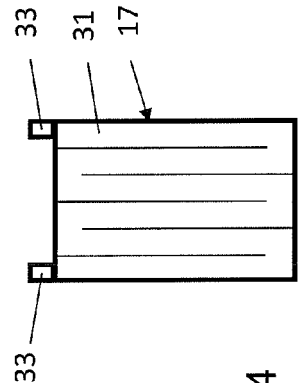


FIG. 4

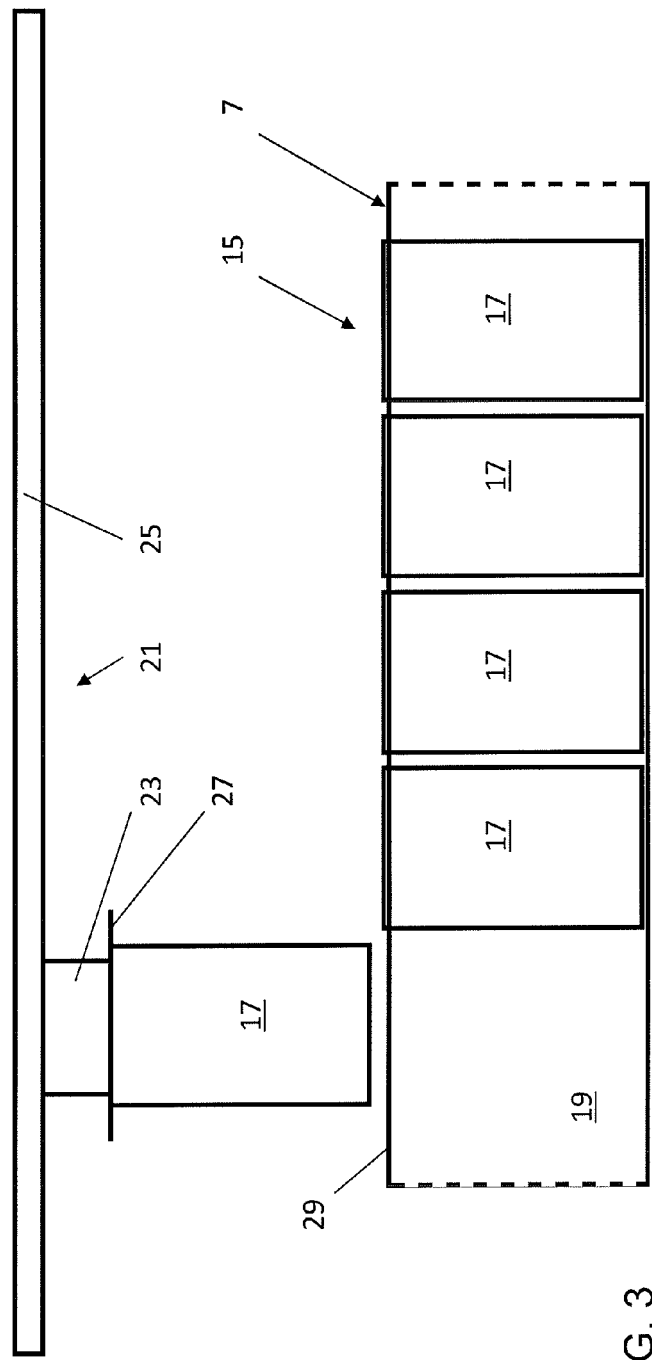


FIG. 3

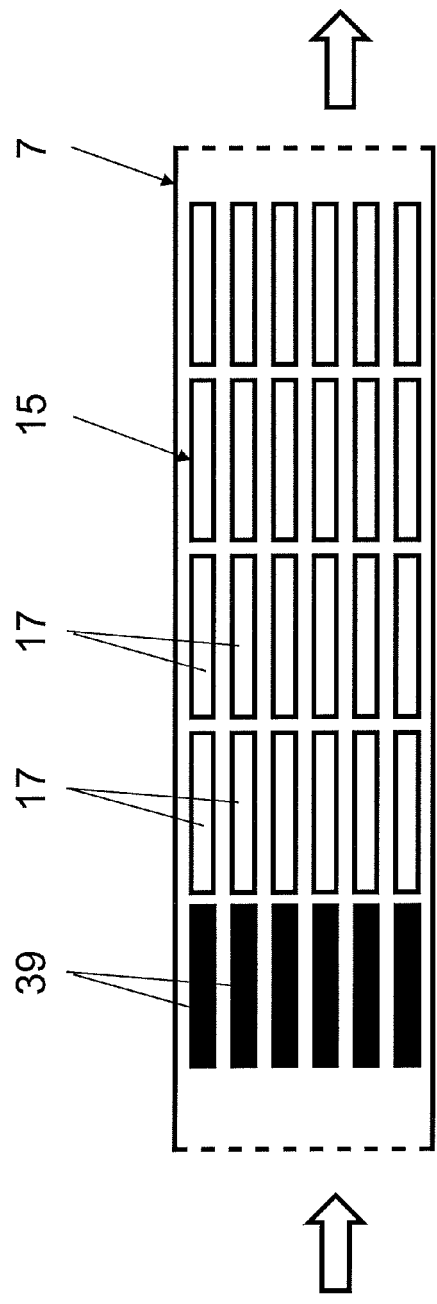


FIG. 6

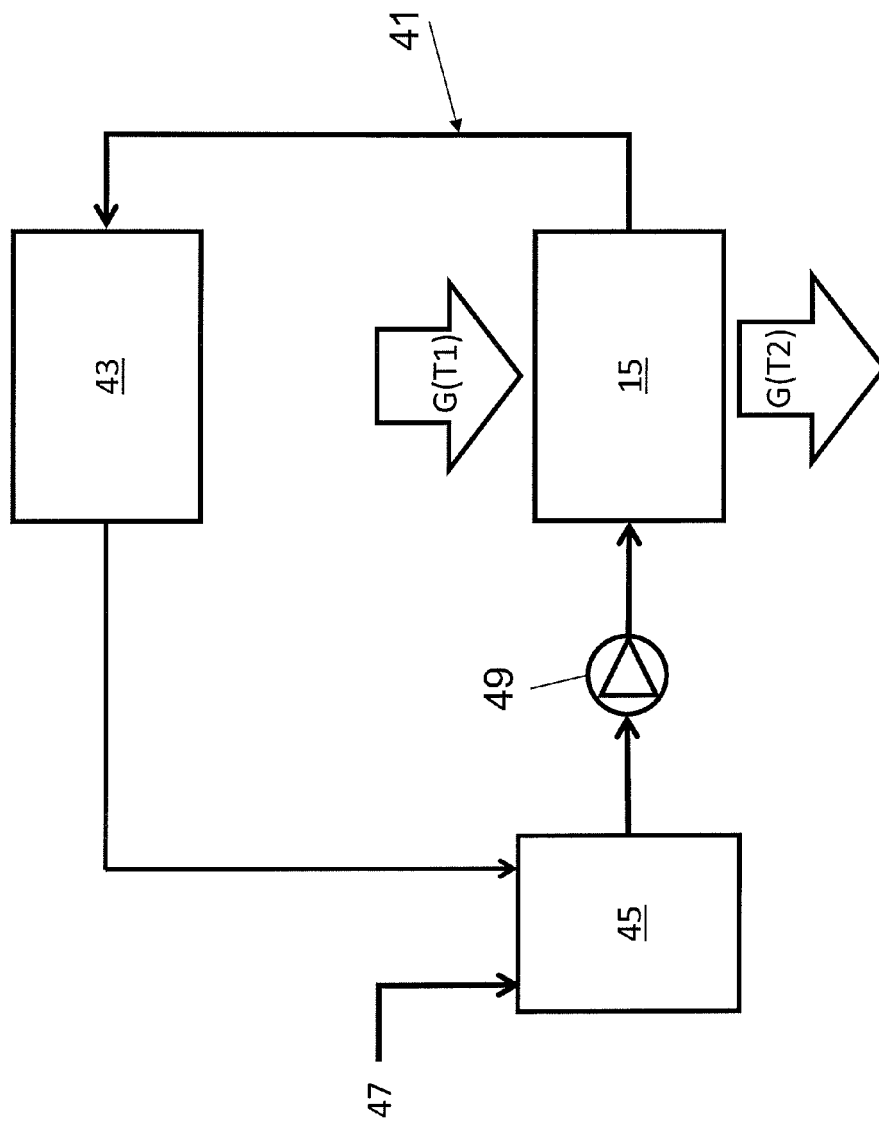


FIG. 7

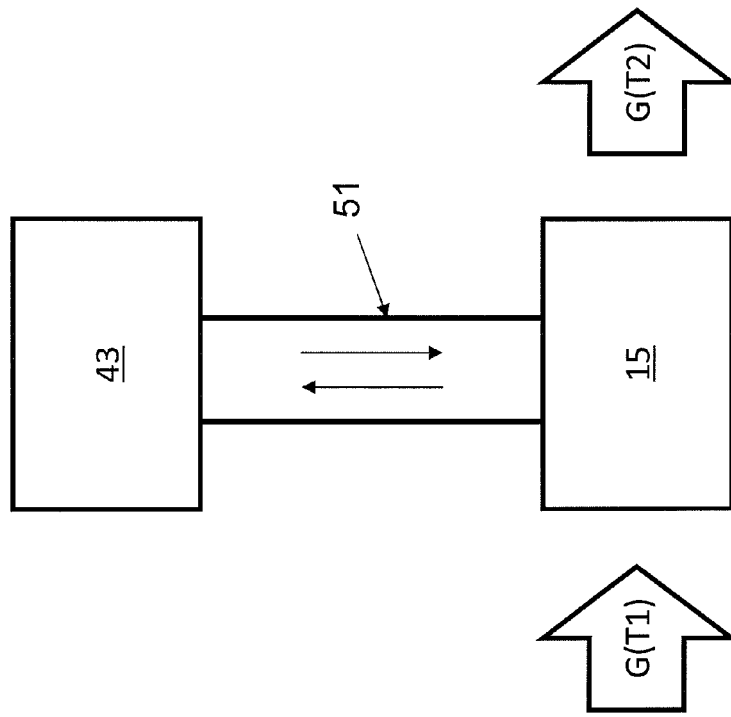


FIG. 8



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Place of search Munich		Date of completion of the search 11 March 2014	Examiner Cojuhovschi, Oana
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