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(71) Applicant: **Sundsvall Energi AB**
962 23 Sundsvall (SE)

(72) Inventor: **Ullberg, Sören**
Stöde 860 13 (SE)

(74) Representative: **Engdahl, Stefan**
P.O. Box 45086
104 30 Stockholm (SE)

(54) **Heat exchanger**

(57) A plate heat exchanger (44) with a symmetrical or asymmetrical plate design in one or more stages and for one or more circuits for use in preparing heat and/or hot water in buildings, which heat exchanger is adapted to transfer heat from a primary fluid circuit to at least one secondary fluid circuit. The heat exchanger includes a number of stacked plates provided with a pattern defining channels (48) for flows of said fluids is provided with at least one port for the primary fluid's and the secondary fluid's inflow and outflow, respectively. At least one port configuration of the heat exchanger and at least one, to the port, associated attachment means are arranged at least partly with a coaxial arrangement for a fluid.

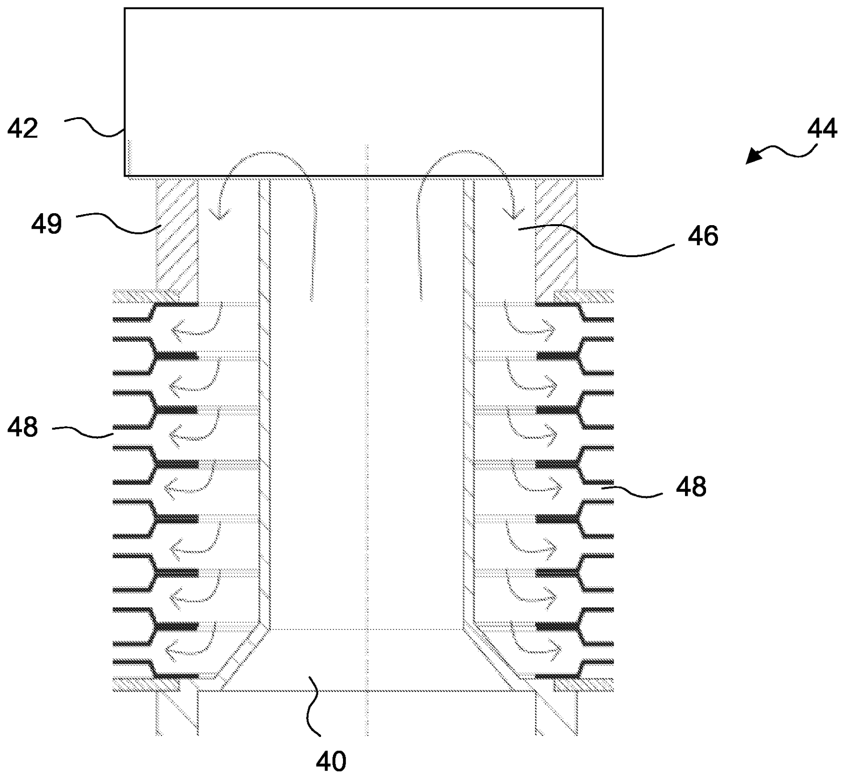

Fig. 3

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Description

TECHNICAL FIELD

[0001] The present invention relates to the field of rationally produced heat exchangers for generating heat and/or hot water in premises comprising at least one heat exchanger. More specifically, the invention relates to a brazed plate heat exchanger arranged to produce domestic hot water and/or hot water for a heating system from hot water obtained from an external hot water source such as a district heating system.

STATE OF THE ART

[0002] Compact heat exchangers, such as brazed plate heat exchangers, are used both for cooling and heating. In general design, manufacturing technics and methods for producing heat exchangers of the above-mentioned type are well-known in the art and a discussion and description of such methods will therefore be omitted.

[0003] The heat exchangers are, as a rule, connected to a pipe system, in which a medium flows which is to be heated/cooled, and another pipe system in which a heating/cooling medium flows. Furthermore, there are arranged in the pipe system, i. a. temperature- and flow-transducers, circulation pumps and i.a. flow control valves to control the heating/cooling. Every inlet and outlet port, usually arranged in the corners, of the heat exchanger is connected in a conventional manner by means of pipes and pipe-fittings to the secondary and primary systems. This altogether usually increases the volume of the heat transferring device and constitute a large volume in relation to the small size of the plate heat exchanger.

[0004] There is a pronounced need for cost-effectively produced, small, compact, service-friendly heat exchangers that also easily can be arranged in the form of functional integrated modules arranged in capacity stages having few couplings and thus small risk of leakage, and which need very little supervision and maintenance. It is also advantageous if they can be quickly and rationally installed and replaced especially in smaller premises, where it would be advantageous to be able to remove the complete units.

[0005] The above also applies to stations that connect premises to district heating systems that usually contains two heat exchangers, either coupled in parallel, or in so called two-stage, for simultaneous production of domestic hot water and hot water to a water carrying system for heating the premises. The system for heating the premises may comprise radiators, convectors, air-batteries and/or heating circuits, such as floor circuits.

[0006] More specifically, in the area of heating stations for simultaneous production of domestic hot water and hot water for a water carrying system generally, and in particular, for smaller premises, there is a pronounced need for rational, cost effective production of compact units having an integrated system regarding functionality and auxiliary equipment, whereby the number of working moments, both in production at the factory and on the premises can be reduced, especially manual moments, and thereby even costs, and also whereby there is a reduction of the number of joints between the different components included and thus reduction of the risk of leakage. Furthermore a properly designed compact unit for a small plant having a high level of integrated functions allows the production, service, upgrading etc. to take place in a factory environment, whereby modern technology in the field may be exploited to the full to produce a more cost effective, and with regard to capacity adaptation, very flexible equipment.

[0007] It would be an advantage if as much as possible of a heat exchanger mentioned above could be produced as an adaptable base unit prepared for use as a complete heat transferring device unit in an effective and rational manner with respect to costs and time-consumption. It would also be an advantage if such small, compact, service-friendly heat exchangers could be produced in this effective and rational manner with respect to costs and time-consumption with the ordinary few pressing tools and machinery and from the relatively simple and cheap base material and rational processing normally at hand to producers of plate heat exchangers, for example, brazed plate heat exchangers. Furthermore, it would be an advantage if such a heat exchanger could be arranged such that necessary external equipment of the heat exchanger to become a complete unit, such as equipment for controlling and monitoring and so on the thermal process in the heat exchanger, could be connected to the heat exchanger in a simple, rational and space efficient way.

[0008] EP 1080329 discloses a heat transferring device, for transferring heat between a primary fluid and at least one secondary fluid obtained from an external source, whereby the secondary fluid is tempered before being supplied to a consumer. The device comprises a heat exchanger and a connection block having inner channels. The heat exchangers have inlets and outlets for the inflow, outflow, respectively, of the primary fluid and the secondary fluid. The intelligent connection block has: a plurality of main connections for connecting the external primary fluid source and the consumer, for the inflow and outflow to and from the device, respectively, of the primary fluid and the secondary fluid; a plurality of sub-connections for connecting to the inlets and outlets of the heat exchanger for the inflow and outflow of the fluids to and from the heat exchanger respectively, whereby the inner channels join together the main- and sub-connections; flow distribution for distributing an incoming flow and/or flow accumulating means to bring together at least two outgoing flows; and integrated means for controlling and monitoring the thermal process in the heat exchanger. The heat transferring device according to EP 1080329 solves many of the above-mentioned problems but does not however present a satisfying solution in all aspects. For example, a large number of expensive pressing tools are required at the manufacturing. Moreover, another disadvantage that is difficult to master is undesired and uncontrolled heat transfer between the fluids in the elongated channels in the intelligent connection block. In addition, the differences in length between the plates of the heat exchanger and the plates of the intelligent connection block may also be a great problem to overcome in the manufacturing process.

[0009] Thus, there is a need of an improved compact heat exchanger that can be manufactured in an efficient way with respect to costs and time consumption and that, which in addition to not taking up much space and being flexible, in an easy and efficient way can be connected to equipment for controlling and monitoring the thermal process in the heat exchanger. It would be advantageous if the functionality of the block could be integrated in the normal set of heat exchanger plates, only one or two, in order to reduce the need of expensible pressing tools to a minimum. It would also, certain cases, be advantageous if the connections of the heat exchanger for the external systems in the same time could be maintained within a smaller area or space at the end surface of the heat exchanger.

BRIEF DESCRIPTION OF THE INVENTION

[0010] An object of the invention is to develop the above mentioned type of compact plate heat exchanger for use in preparing heat and/or hot water in buildings, for transferring heat between a primary fluid obtained from an external source and at least one secondary fluid.

[0011] Another object of the present invention is to provide a plate heat exchanger that can be manufactured in an efficient way with respect to costs and time consumption.

[0012] A further object of the present invention is to disclose a compact plate heat exchanger, which in addition to not taking up much space and being flexible, in an easy and efficient way can be connected to, and vice versa, equipment or means for controlling, monitoring, and measuring etc. of the thermal processes taking place in the heat exchanger or equipment or means for processing, etc. the fluids. Such equipment or means will hereinafter be denoted as process means.

[0013] These and other objects are achieved according to the present invention by providing a heat exchanger having the features defined in the independent claims. Preferred embodiments of the invention are characterized by the dependent claims.

[0014] In the context of this application, the term "stroke" refers to a continous channel portion in a heat exchanger where the heat transfer between two media takes place when the media flows through the channel portion. In order to achieve the requested heat transfer, two or more strokes may be, after being divided from the channel portion, interconnected in a flow sense of meaning, and thereby also thermically, and operating in series with each other.

[0015] For the purpose of clarity, the term "stage" (which may be the same as "stroke") refers to a heat exchangning process wherein a supply for new media is arranged before or after a channel portion. For example, in a two stage process is a first stage heat exchanger or in a channel portion in the heat exchanger arranged as a pre-heater where cold water is pre-heated and where the heating medium is after-cooled and a second stage heat exchanger or in a channel portion in the heat exchanger arranged as an after-heater where the pre-heated cold water is fully heated and the heating medium is pre-cooled.

[0016] Furthermore, as used herein, the term "circuit" refers to an open or closed circulation and/or flow system for fluid where the heat exchanger is included and where a first medium emit heat and a second media at the same time absorb heat from the first medium in at least one heat exchangning process. In a heat exchange process, the term "circuit" normally refers to the meduim being heated, for example, a "hot water circuit".

[0017] Moreover, as used herein, the term "port" refers to an area in a plate heat exchanger that is delimited by, normally, circular die pressed areas in the patters in which the material has been punched off in the plates of the heat exchanger, wherein a stoppage for one medium and a hole or apperture arrangement for the heat exchangning medium is created, in which hole arrangement the heat exchanging medium can flow into or out of the heat exchangning passages and normally, but not necessarily, into and out of the heat exchanger.

[0018] In particular, there is provided a plate heat exchanger with a symmetrical or asymmetrical plate design in one or more stroke/stages and for one or more circuits for use in preparing heat and/or hot water in buildings, which heat exchanger is adapted to transfer heat from a primary fluid circuit to at least one secondary fluid circuit. The heat exchanger includes a number of stacked plates provided with a pattern defining channels for flows of said fluids and is provided with at least one port for the primary fluid's and the secondary fluid's inflow and outflow, respectively. The heat exchanger is characterized in that at least one port configuration of said heat exchanger and at least one, to said port, associated attachment means are arranged at least partly with a coaxial channel arrangement for a fluid.

[0019] According to an aspect of the present invention, there is provided a method for manufacturing a brazed plate heat exchanger with a symmetrical or an asymmetrical plate design in one or more strokes/stages and for one or more circuits for use in preparing heat and/or hot water in buildings, the heat exchanger being adapted to transfer heat from a primary fluid circuit to at least one secondary fluid circuit, wherein the heat exchanger includes a number of stacked plates provided with a pattern defining channels for flows of the fluids and wherein the heat exchanger is provided with at least one port for the primary fluid's and the secondary fluid's inflow and outflow, respectively, including step of arranging at least one port configuration of the heat exchanger and at least one, to the port, associated attachment means at least partly with a coaxial channel arrangement for a fluid.

[0020] The present invention provides several advantages in comparison to the prior art. For example, the heat exchanger according to the present invention can be manufactured in an efficient way with respect to costs and time consumption due to the fact that it can be manufactured by means of only one or two sets of pressing tools for pressing the plates of the heat exchanger device. Only one set of pressing tools is required in case of a heat exchanger built by means of symmetrical plates and two sets of pressing tools are required in case of a heat exchanger built by means of asymmetrical plates.

[0021] In one embodiment of the present invention, the attachment means is arranged at the surface of the heat exchanger.

[0022] According to embodiments of the present invention, the coaxial port arrangement is adapted to conduct the fluid into and/or out of the process means.

[0023] Furthermore, the process means may be associated with the coaxially arranged port channels as an integrated part of the heat exchanger.

[0024] According to another embodiment, the process means may be associated with the coaxially arranged port channels as a joined part of the heat exchanger.

[0025] In yet another embodiment of the present invention, the at least one port configuration comprises co-axially arranged channels, each co-axially arranged channel being adapted to conduct the primary or at least one secondary fluid into and/or out of the heat exchanger.

[0026] In a further embodiment of the present invention, each co-axially arranged port channel comprises an inner channel and an outer channel, the inner channel and the outer channel, respectively, being adapted to conduct a fluid in counter-currently directions relative to each other.

[0027] Moreover, two or more coaxially arranged port channels may be arranged to communicate with each other via heat exchange passages between adjacent plates. Accordingly, an inner channel of a first co-axially arranged channel may communicate with an inner channel or an outer channel of at least one second co-axially arranged channel and/or an outer channel of a first co-axially arranged channel may communicate with an inner channel or an outer channel of at least one second co-axially arranged channel.

[0028] According to the present invention, the co-axially arranged port channels are connectable to the process means via the attachment means. In other words, the co-axially arranged channels that conducts the primary and secondary fluids into and out of the device are connectable, at the turning points (i.e. at their ends outside the heat exchanger), to the process means. Such process means may be arranged, in principle, directly on the end piece of the heat exchanger in communication with a port with co-axially arranged channels.

[0029] In further embodiments, one medium or two media may be conducted into and/or out of the heat exchanger by means of a port with coaxially arranged channels. Thus, the flows in the port channels may be either counter-currently to each other or may be concurrently or parallel.

[0030] According to the present invention, great flexibility when adapting capacity is achieved, in that configuration, design and dimensioning of the co-axial port channels may easily be adapted, and when needed, adjusted for variable or modified capacity needs between units. The heat exchanger is built up of an eligible number of channel-forming plates and may also comprise isolating intermediate layers and at least two end pieces.

[0031] The primary fluid can be an arbitrary heating medium but according to an embodiment the external primary fluid source is a district heating plant which supplies a primary fluid in the form of hot water to a heating sub-station in a smaller building for producing domestic hot water and hot water for the building's heating system. Such a heating sub-station may comprise:

- a first heat transferring circuit in the form of a plate heat exchanger according to claim 1 arranged for producing domestic hot water, whereby cold water is heated with hot water from a district heating network; and/or
- a second heat transferring circuit, partly integrated in the first circuits plate heat exchanger, arranged for producing circulating domistic hot water; and/or
- a third or more heat transferring circuit in the form of a plate heat exchanger according to claim 1 for producing hot water to a circulation circuit for water-carried heating;
- controlling means for the thermal processes, flow distributing means for the inlets and outlets of the district heating water and the secondary circtuis, in and out of, respectively, the heat exchangers, distribution means for refilling of the heat exchanged circulation circuit.

[0032] If each of the heat exchangers is of two stroke/stage type being designed with two flow directions and with co-axial turning ports in one end and inlet and outlet ports in the other end of the heat exchanger, the above mentioned first, second and third circuits can all be built-in in an one and only heat exchanger package. Furthermore, such a heating station according to the present invention preferably also comprises integral temperature sensors, flow transducers and energy meters as well as means to draw off one or several of the fluids, at least the primary fluid. Preferably, the means for controlling and monitoring the thermal processes in the heat exchanger, such as valves, flow transducer for the energy meter, circulation pumps and the like, as well as valves for refilling the circuits and safety valves or similar means for ensuring the circulation and desired pressure in the circuits may be connected to the co-axial port channels of the heat exchangers. By such means, and particularly the station including three circuits, a rationally produced, compact modular heating sub-station having few and reliable assembly joints with a high degree of functional integration and system planning can be achieved.

[0033] The features that characterize the invention, both as to organization to methods of operation, together with further objects and advantages thereof, will be better understood from the following description used in conjunction with accompanying drawings. It is to be expressly understood that the drawings is for the purpose of illustration and is not intended as a definition of the limits of the invention. These and other objects attained, and advantages offered, by the present invention will become fully apparent as the description that now follows is read in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0034] In the following detailed description, reference will be made to the accompanying drawings, of which:

Fig. 1 is an example of a schematic diagram illustrating a system environment in which a heat exchanger package with two circuits according to the present invention may be implemented.

Fig. 2 is an example illustrating a partly cross-sectional view of a heat exchanger package according to an embodiment of the present invention.

Fig. 3 schematically shows a cross-sectional view of a coaxial port arrangement of the heat exchanger according to the present invention.

Fig. 4 schematically shows a cross-sectional view of another coaxial port arrangement of the heat exchanger according to the present invention.

Fig. 5 schematically shows a cross-sectional view of a further coaxial port arrangement of the heat exchanger according to the present invention.

Fig. 6 schematically shows a cross-sectional view of yet another coaxial port arrangement of the heat exchanger according to the present invention.

Fig. 7 schematically shows another embodiment of a coaxial port arrangement in accordance with the present invention in cross-section.

Fig. 8 is a section along the line I-I of Fig. 7 showing a coaxial port configuration of the heat exchanger according to the present invention.

Fig. 9 is a section along the line II-II of Fig. 7 showing a coaxial port configuration of the heat exchanger according to the present invention.

Fig. 10 is a section along the line III-III of Fig. 7 showing a coaxial port configuration of the heat exchanger according to the present invention.

Fig. 11 is a section along the line IV-IV of Fig. 7 showing a coaxial port configuration of the heat exchanger according to the present invention.

Fig. 12a schematically shows another embodiment of the bottom of the coaxial port arrangement Fig. 7 in accordance with the present invention in cross-section.

Fig. 12b is a section along the line V-V of Fig. 12a showing a coaxial port configuration of the heat exchanger according to the present invention.

Figs. 13a-16b show further embodiments of a coaxial port arrangement in accordance with the present invention in cross-section.

DETAILED DESCRIPTION OF THE INVENTION

[0035] The descriptions of embodiments of a heat exchanger according to the present invention are mainly directed at a heat exchanger that can be used for central heating in a smaller building. However, the device and use of it is not limited to this and a number of suitable applications will appear to be just as interesting and obvious to a man skilled in the art, based on the description in its entirety and on the following description of embodiments in particular.

[0036] Fig. 1 is an example of a schematic diagram illustrating a system environment in which a heat exchanger package including two circuits according to the present invention may be implemented. As the man skilled within the art realizes the system environment described hereinafter is only for illustrative purposes, and should therefore not be regarded as limiting the use of the invention to such a system environment, and there are of course a number of other conceivable system configurations in which the invention may be utilized.

[0037] The system comprises a coupling block 1, a heat exchanger 3 comprising two circuits, a hot water circuit 9 and a radiator circuit 10, a first consumer 4, for instance a radiator system, a second consumer 5, for instance a domestic hot water system, and an external hot water source 6, such as a district heating system. The hot water circuit 9 in Fig. 1 is, for example, a water heating circuit 9, supplied with cold water 7 which is heated with the hot water from the district heating system 6, which passes through the circuit 9 in opposite direction to the cold water. A corresponding heat exchangning process takes place in the circuit 10. The heat exchanger 3 comprises inlet ports for the cold water and outlet ports for the heated domestic hot water, inlet mutual ports for incoming hot water and mutual outlet ports for the return of the hot water, and inlet and outlet ports for the radiator circuit 10. Some of these ports is preferably coaxially arranged ports as will be described below. Dependent upon outer connecting systems, such as a coupling block 1, these inlet and outlet ports may be arranged assembled at the end on the side of the gable surface turned away from the heat exchanger, such as is illustrated in Fig. 1, or on the opposite gable surface or be more spread out on any of the two gable surfaces.

[0038] The cold water enters the heat exchanger 3 by means of a first main connection and is lead to the hot water heater's 9 inlet ports for domestic water of the water heater's 9 secondary fluid, and into and through the water heater 9 where it is heated by district heating water which passes the water heater 9 in counter flow to the domestic water. The cold water is lead in a first stroke/stage 12 leading upwards in Fig. 1 and then via a second stroke/stage 11 leading downwards, which strokes/stages may include one or several passages. The heated domestic water, the domestic hot tapwater, then leaves the water heater 9 and the heat exchanger 3 via a second main connection and is lead to the consumer system 5 having one or several drain cocks or taps for domestic hot water. The external primary fluid circuit 6, which in the embodiment according to Fig. 1 consists of a hot water circuit 6, may, for example, be a district heating water circuit. District heating water 6a is supplied to the device via a third mutual main connection and is lead to the heat exchanger 3 and the water heater's 9 inlet port for district heating water, primary fluid, through the water heater 9. Then it leaves the heat exchanger 3 via a fourth mutual main connection and returns as district heating water return 6b. In a corresponding process taking place in the radiator circuit 10, return water from the radiator system 4 enters the heat exchanger 3 via a fifth main connection and is lead to the radiator circuit's 10 inlet ports for return water of the radiator circuit's secondary fluid, and into and through the radiator circuit 10 where it is heated by district heating water which passes the radiator circuit 10 in counter flow to the domestic water. The return water is lead in a first stroke 14 leading upwards in Fig. 1 and then via a second stroke 13 leading downwards, which strokes may include one or several passages. The heated radiator water then leaves the water heater 3 via a sixth main connection and is lead further on to the radiator system 4. The district heating water serving the radiator circuit 10 enters and leaves the device 3 och 10 through the mentioned third and fourth mutual main connections.

[0039] Furthermore, Fig. 1 shows some, but not all, of the requisite process means 8a-8e which all are at least partly attatched with a coaxial channel arrangement. For example, a flow transducer 8a, a control valve 8b, and a pump 8c. The valve 8b may be arranged to regulate the throghflow of the primary water of the water heater 9 based on the throghflow of the domistic tapwater. This throghflow of the domistic tapwater is monitored by means of a flow transducer 8a, the flow transducer 8a being associated with the valve 8b. Water is lead to the the pump 8c via coaxially arranged ports (see for example Fig. 2) from the first stroke 14 of the radiator circuit 10 and is fed back into the second stroke 13. A ventilation port 15 may also be arranged at the heat exchanger 3. As the skilled man within the art easily realizes, there are a number of other controlling, monitoring, or measuring units that may be connected to the device 3 such as several types of valves, temperature sensors for reading the temperature of the water supplied to the hot water system 5, for reading the temperature of the incoming district heating water 6a etc.

[0040] Obviously this assembly of a heat exchanger according to the invention may be used for other purposes requiring the production of heating and cooling media.

[0041] Turning now to Fig. 2, an example of a cross-sectional view of the embodiment of the heat exchanger package in accordance with Fig. 1, complemented with a hot water circulation circuit, will be described. As can be seen, a cross-sectional view of a plate heat exchanger 30 for use in preparing heat and hot water in buildings, for transferring heat between a primary fluid obtained from an external source and two secondary fluids, whereby the secondary fluids is tempered before being supplied to the consumer, is shown. The heat exchanger device 30 comprises a number of ports including ten coaxially arranged ports, in this view only seven 32a-32g are shown and of which four 32c,d,e and g are shown in cross-section. The shown ports 32j-32m, may be arranged as inlet ports and outlet ports for the secondary fluid's inflow and outflow, respectively. The ports for the primary fluid's inflow and outflow, and some other ports, may lies this side of the cross section line and therefore are not visible. Furthermore, the co-axially arranged ports 32a-32c and 32e-32g may also be adapted to conduct the primary and secondary fluids into and out of the device 30 at the turning points of the strokes/stages. Attachment means are associated with each port. Adapted process means (see for example Fig. 5) can be connected to the heat exchanger via the attachment means.

[0042] According to embodiments of the present invention, each co-axially arranged port 32a-32g may comprise a respective inner channel 33a-33g and an outer channel 34a-34g. Thereby, the inner channel 33a-33g of a co-axial port 32a-32g may conduct a primary or secondary fluid into the device and the outer channel 34a-34g of the co-axial port 32a-32g may conduct the fluid out of the device. Furthermore, two or more coaxially arranged channels can be interconnected to each other via heat exchange passages between two adjacent plates 31. The heat passages may be arranged in one or several strokes.

[0043] In an example of an embodiment of the present invention, the coaxial port 32a may be arranged for ventilation of the primary circuit, the port 32b may be arranged for ventilation of the hot water circulation circuit, the port 32c may be arranged for ventilation of a secondary circuit, the port 32e may be connected to a flow transducer for hot water, the port 32f may be connected to a primary control valve, the port 32g may be connected to a circulation pump for the radiator circuit, the port 32d may be arranged for refill of the radiator circuit from the hot water circuit, the port 32h may be connected to a safety pressure valve for the radiator circuit, the port 32i may be connected to safety pressure valve for the hot water circuit, the port 32j may be arranged as an inlet port for cold water for a tap water circuit, the port 32k may be arranged as an outlet port for a tap water circuit, the port 321 may be arranged as an inlet port for a tap water circulation circuit, the port 32m and the port 32n may be arranged as inlet port and outlet port, respectively, for the radiator circuit.

[0044] Turning now to Figs. 3-6, cross-sectional views of the principle of different port arrangements with coaxial channels of the heat exchanger according to the present invention are shown. The direction of the fluid flows are indicated with arrows.

[0045] In Fig. 3, the basic principle, the coaxial port arrangement is arranged as a through bore or hole, i.e. the inner and outer channel 40 and 46, respectively, are extended through the heat exchanger. As can be seen in Fig. 3, a fluid, primary or secondary, is conducted through an inner channel 40 to a process means 42. For example, a flow transducer, a pump, or a control valve. Then, the fluid is conducted back into the heat exchanger 44 via an outer channel 46 and further on in heat exchange passages 48. Thus the flows in the inner channel 40 and the outer channel 46 will pass through the port arrangement counter-currently relative to each other. In this embodiment, the process means 42 is arranged at a guide socket or a stud 49. Alternatively, the process means 42 may be arranged directly at the ports. In embodiments, the process means 42 may be associated with coaxially arranged ports as integrated parts of the heat exchanger. Alternatively, the process means 42 may be associated with coaxially arranged ports as joined parts of the heat exchanger.

[0046] Referring to Fig. 4, an embodiment of a port arrangement according to the present invention with a divided coaxial channel configuration is shown in cross-section. In Fig. 4, the coaxial port arrangement is arranged as a through arrangement, i.e. the inner and outer channel 50 and 52, respectively, are extended through the heat exchanger. As can be seen, a fluid, primary or secondary, is conducted through an inner channel 50 to a process means 42. For example, a flow transducer, a pump, or a control valve. Then, the fluid is conducted back into the heat exchanger 44 via the outer channel 52 and further on in heat exchange passages 54 in an upper stroke. Thus, the flows in the inner channel 50 and the outer channel 52 will pass through the port arrangement counter-currently relative to each other. In this embodiment, the fluid is also conducted by the inner channel 50 directly into heat exchange passages 56 of a lower stroke separated from the heat exchange passages receiving the fluid from the process means 42 by a partition element 58 attached to wall elements 59 of the inner channel 50, which partition element preferably is a part of a plate. Hence, the fluid conducted by the inner channel 50 is divided in one flow to the process means 42 and one flow to the heat exchange passages 56. In this embodiment, the process means 42 is arranged at a guide socket or a stud 49. Alternatively, the process means 42 may be arranged directly at the port.

[0047] With reference now to Fig. 5, another embodiment of a port arrangement according to the present invention is shown in cross-section. In Fig. 5, the coaxial port arrangement is arranged as a single-ended arrangement, i.e. the inner and outer channel 60 and 62, respectively, are not extended entirely through the heat exchanger. As can be seen, a fluid, primary or secondary, is conducted from heat exchange passages 64 through an outer channel 62 to a process means 42. For example, a flow transducer, a pump, or a control valve. Then, the fluid is conducted back into the heat exchanger 44 via an inner channel 60 and further on in heat exchange passages 66. Thus the flows in the inner channel 60 and the outer channel 62 will pass through the port arrangement counter-currently relative to each other. A partition element 68 attached to wall elements 69 of the inner channel 60 separates the fluid conducted to the process means 42 from the fluid flowing out from the process means 42, which partition element preferably is a part of a plate. In this embodiment, the process means 42 is arranged at a guide socket or a stud 49. Alternatively, the process means 42 may be arranged directly at the port.

[0048] Referring to Fig. 6, another embodiment of a port arrangement according to the present invention is shown in cross-section. In Fig. 6, the coaxial port arrangement is arranged as a single-ended arrangement, i.e. the inner and outer channel 70 and 72, respectively, are not extended entirely through the heat exchanger. As can be seen, a fluid, primary or secondary, is conducted from heat exchange passages 74 through an outer channel 72 to a process means 42 in an upper stroke. For example, a flow transducer, a pump, or a control valve. Then, the fluid is conducted back into the heat exchanger 44 via an inner channel 70 and further on in heat exchange passages 76 in a lower stroke. Thus the flows in the inner channel 70 and the outer channel 72 will pass through the port arrangement counter-currently relative to each other. A partition element 78 attached to wall elements 79 of the inner channel 70 separates the fluid conducted to the process means 42 from the fluid flowing out from the process means 42, which partition element preferably is a part of a plate. In this embodiment, the process means 42 is arranged at a guide socket or a stud 49. Alternatively, the process means 42 may be arranged directly at the port. As can be seen, the channels in the lowest stroke are blocked or closed off by means of a plate element 77. A number of closed-off or sealed-off channels 71, and 73 are also shown.

[0049] Turning now to Figs. 7-14, another embodiments of a coaxial port arrangement, made directly by shaping and punching of the heat exchanger plates, in accordance with the present invention are shown in cross-section. A primary fluid has been designated by the letter P, a first secondary fluid has been designated by a letter Y and Z, and a second secondary fluid has been designated by a letter X. The letters Y and Z designating the first secondary fluid indicate that the fluid has changed state after being processed in some way in a process means 42. Accordingly, the letter Y may designate a fluid flow entering the process means 42 via an outer channel 80 and the letter Z may designate a fluid flow leaving the process means 42, or vice versa via an inner channel 82. As the skilled man easily realizes, the number and shape of the "spokes", for example 88a-88c in Fig. 8, as well as the hole or aperture arrangements, for example 80 in Fig. 8, are arbitrary as long as the functions of supporting the coaxially arranged ports, stabilizing the heat exchanger, especilly during the brazing moment, are withheld and the fluids are allowed to flow freely.

[0050] Figs. 8-11 are a sections along the lines I-I, II-II, III-III, and IV-IV, respectively, of Fig. 7 showing the coaxial port arrangement according to the present invention. The areas marked with white and a letter indicate open spaces where a fluid may flow and the grey areas indicate brazed areas of plate parts.

[0051] In figs 8-10, the outer channel 80 is designed with supporting elements 88a-88i in form of a "spoke wheel" with three spokes. As the skilled man easily realizes, the number of "spokes" are arbitrary as long as the functions of supporting the coaxially arranged ports, stabilizing the heat exchanger and allowing the fluids to flow freely are withheld. The areas marked with reference numerals 83, 84, 85, and 86, respectively, indicate inclined parts of the plates.

[0052] In Figs. 12a and 12b, an alternative design of the bottom of the coaxial port arrangement at section IV-IV in Fig. 7 are shown. Fig. 12b shows the section V-V in Fig. 12a and as can be seen, the coaxial arrangement is provided with three supporting elements 90a-90c or "spoke elements".

[0053] Hereinafter, with reference to Figs. 13a-13b, 14a-14b, 15a-15b, and 16a-16b, a further number of embodiments of the present invention will be discussed briefly in order to underline the large number of possible ways of constructing coaxially arranged ports in accordance with the present invention. As the skilled man realizes, these embodiment are only examples and thus there exist a number of other conceivable ways of contructing such coaxially arranged ports.

[0054] With reference to Figs. 13a-13b, further embodiments of the present invention will be discussed. According to this embodiment, the coaxial port arrangement comprising an inner channel 100 and an outer channel 102 is formed by bended parts 104 of the plates, which may be attached to each other by means of brazing. In Fig. 13b, an alternative embodiment is shown, where the channels 100 and 102 are formed by a single plate part 106 except at the attachment points where the plate parts may be attached to each other by means of brazing.

[0055] Referring now to Figs. 14a-14b, yet other embodiments of the present invention will be discussed. According to this embodiment, the coaxial port arrangement comprising an inner channel 200 and an outer channel 202 is formed by bended parts 204 and 206 of the plates, which may be attached to each other by means of brazing. In Fig. 14b, an alternative embodiment is shown.

[0056] Turning now to Figs. 15a-15b, still other embodiments of the present invention will be discussed. According to this embodiment, the coaxial port arrangement comprising an inner channel 300 and an outer channel 302 is formed by tube-like element 304, 306 having a substantial circular cross section. Of course, as the skilled man realizes, the shape of the element 304, 306 may have other forms, for example, it may be square-like or hexagonal. The element 304, 306 may be attached to a plate or a number of plates by means of brazing.

[0057] With reference now to Figs. 16a-16b, further embodiments of the present invention will be discussed. According to this embodiment, the coaxial port arrangement comprising an inner channel 400 and an outer channel 402 is formed by tube-like element 404, 406 having a substantial circular cross section. The tube-like element 404, 406 may be attached after the brazing moment by means of a o-ring or packing ring 408 in two different types of brazed-in washers 410 placed in and adapted to spaces between plates at the port.

[0058] Although specific embodiments have been shown and described herein for purposes of illustration and exemplification, it is understood by those of ordinary skill within the art that the specific embodiments shown and described may be substituted for wide variety of alternative and/or equivalents implementations without departing from the scope of the invention. Those of ordinary skill will readily appreciate that the present invention could be implemented in a wide variety of embodiments. This application is intended to cover any adaptations or variations of the preferred embodiments discussed herein. Consequently, the present invention is defined by the wording of the appended claims and equivalents thereof and the invention is not to be regarded as limited to only the structural or functional described in the embodiments, but to the attached claims.

Claims

1. A brazed plate heat exchanger with a symmetrical or asymmetrical plate design in one or more strokes/stages and for one or more circuits for use in preparing heat and/or hot water in buildings, said heat exchanger being adapted to transfer heat from a primary fluid circuit to at least one secondary fluid circuit, wherein said heat exchanger includes a number of stacked plates provided with a pattern defining channels for flows of said fluids and wherein said

heat exchanger is provided with at least one port for the primary fluid's and/or the secondary fluid's inflow and/or outflow, respectively, **characterised in that** at least one port configuration of said heat exchanger and that at least one, to said port, associated attachment means are arranged at least partly with a coaxial channel arrangement for a fluid.

2. The plate heat exchanger according to claim 1, wherein said attachment means is arranged at the surface of the heat exchanger.

3. The plate heat exchanger according to claim 1 or 2, wherein said coaxial arrangement is adapted to conduct said fluid into and/or out of process means.

4. The plate heat exchanger according to claim 3, wherein said process means is associated with the coaxially arranged port as an integrated part of said heat exchanger.

5. The plate heat exchanger according to claim 3 or 4, wherein said process means is associated with the coaxially arranged port as a joined part of said heat exchanger.

6. The plate heat exchanger according to any one of preceding claims, wherein said at least one port configuration comprises co-axially arranged channels, each co-axially arranged channel being adapted to conduct the primary or at least one secondary fluid into and/or out of said heat exchanger.

7. The plate heat exchanger according to claim 6, wherein each co-axially arranged channel comprises an inner channel and an outer channel, said inner channel and said outer channel, respectively, being adapted to conduct a fluid in counter-currently directions relative to each other or in parallel flow directions.

8. The plate heat exchanger according to claim 6 or 7, wherein two or more coaxially arranged channels communicates with each other via heat exchange passages between adjacent plates.

9. The plate heat exchanger according to claim 8, wherein an inner channel of a first co-axially arranged channel communicates with an inner channel or an outer channel of at least one second co-axially arranged channel.

10. The plate heat exchanger according to claim 9, wherein an outer channel of a first co-axially arranged channel communicates with an inner channel or an outer channel of at least one second co-axially arranged channel.

11. The plate heat exchanger according to any one of preceding claims 6-10, wherein said co-axially arranged channels are connectable to process means.

12. Use of a brazed plate heat exchanger according to any one of preceding claims 1-11 in preparing heat and/or hot water in buildings.

13. Use of a brazed plate heat exchanger according to any one of preceding claims 1-11 for producing domestic hot water and/or hot water for a heating system from hot water obtained from an external hot water source such as a district heating system.

14. Method for manufacturing a brazed plate heat exchanger with a symmetrical or an asymmetrical plate design in one or more strokes/stages and for one or more circuits for use in preparing heat and/or hot water in buildings, said heat exchanger being adapted to transfer heat from a primary fluid circuit to at least one secondary fluid circuit, wherein said heat exchanger includes a number of stacked plates provided with a pattern defining channels for flows of said fluids and wherein said heat exchanger is provided with at least one port for the primary fluid's and/or the secondary fluid's inflow and/or outflow, respectively, **characterised in** by the step of arranging at least one port configuration of said heat exchanger and at least one, to said port, associated attachment means at least partly with a coaxial channel arrangement for a fluid.

15. The method according to claim 14, further comprising the step of:

arranging said attachment means at the surface of the heat exchanger.

16. The method according to claim 14 or 15, further comprising the step of:

adapting said coaxial arrangement to conduct said fluid into and/or out of process means.

17. The method according to claim 16, further comprising the step of:

associating said process means with the coaxially arranged port as an integrated part of said heat exchanger.

18. The method according to claim 16 or 17, further comprising the step of:

associating said process means with the coaxially arranged port as a joined part of said heat exchanger.

19. The method according to any one of preceding claims 14-18, wherein said at least one port configuration comprises co-axially arranged channels, further comprising the step of:

adapting each co-axially arranged channel to conduct the primary or at least one secondary fluid into and/or out of said heat exchanger.

20. The method according to claim 19, wherein each co-axially arranged channel comprises an inner channel and an outer channel, further comprising the step of:

adapting said inner channel and said outer channel, respectively, to conduct a fluid in counter-currently directions relative to each other or in parallel flow directions.

21. The method according to claim 19 or 20, further comprising the step of:

arranging two or more coaxially arranged channels to communicate with each other via heat exchange passages between adjacent plates.

22. The method according to claim 21, further comprising the step of:

arranging an inner channel of a first co-axially arranged channel to communicate with an inner channel or an outer channel of at least one second co-axially arranged channel.

23. The method according to claim 22, further comprising the step of:

arranging an outer channel of a first co-axially arranged channel to communicate with an inner channel or an outer channel of at least one second co-axially arranged channel.

24. The method according to any one of preceding claims 19-23, wherein said co-axially arranged channels are connectable to process means.

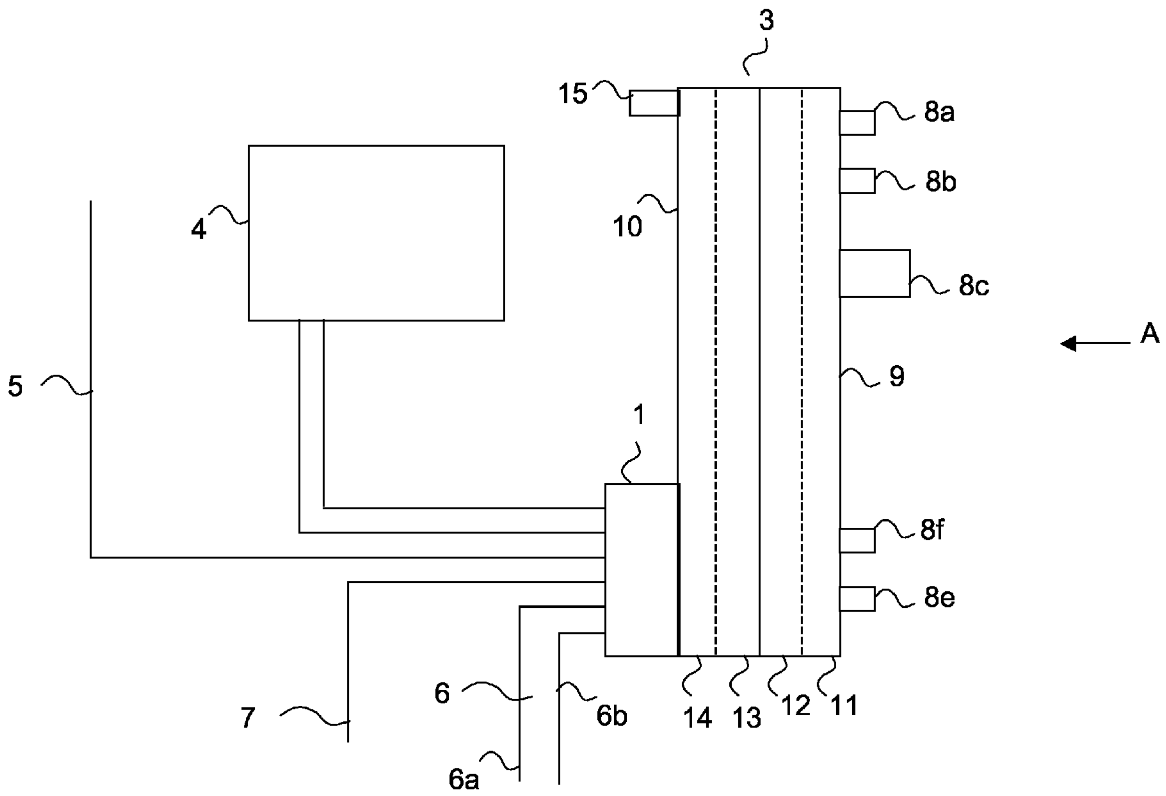

Fig. 1

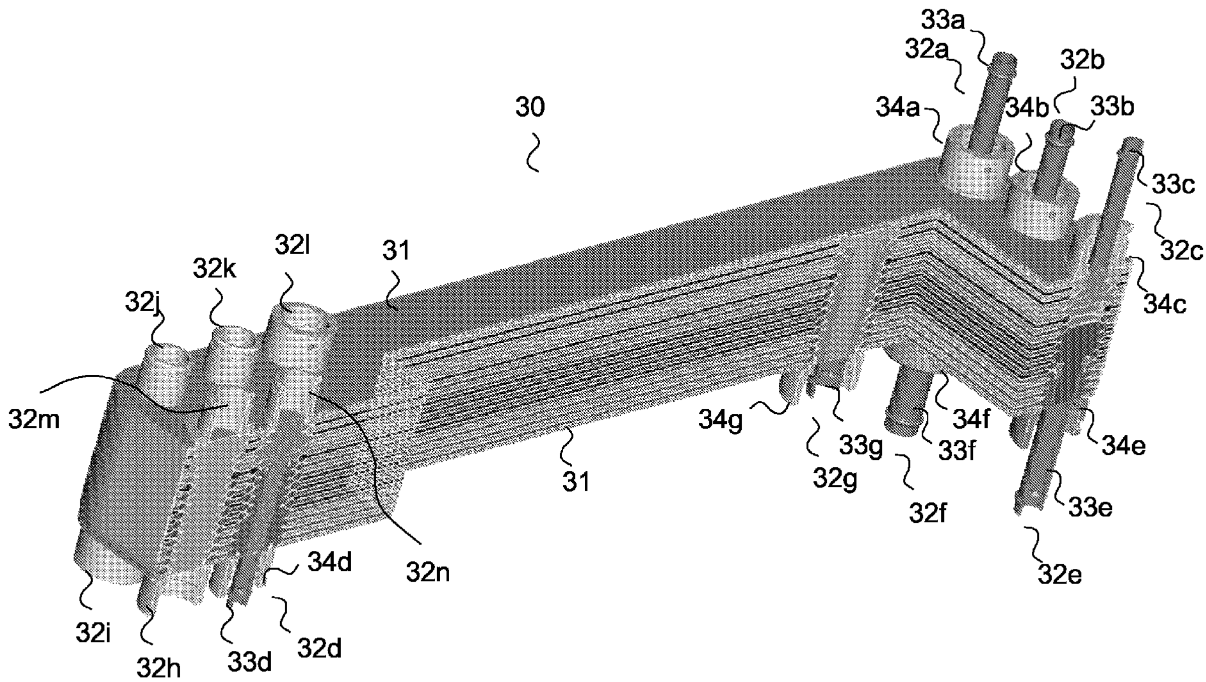
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Fig. 2

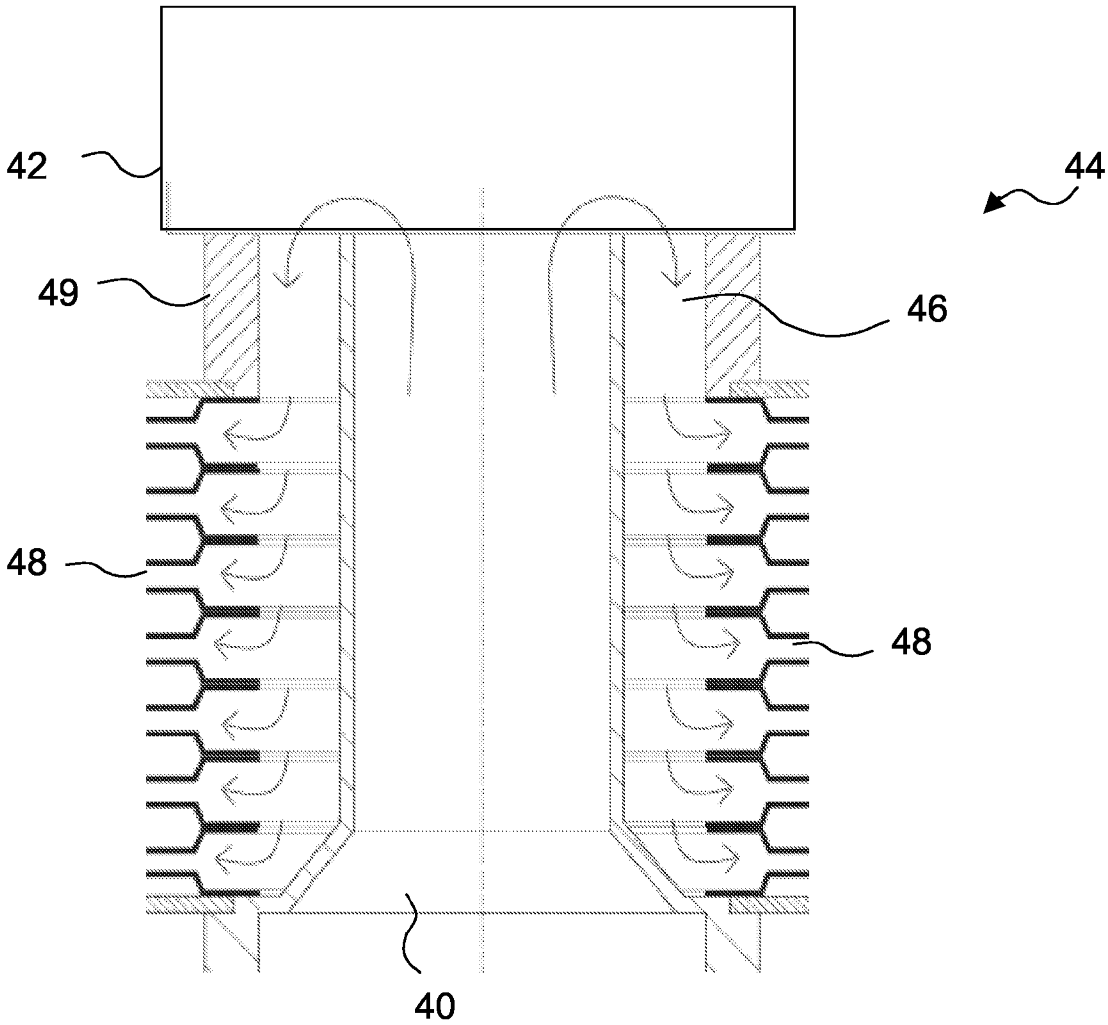

Fig. 3

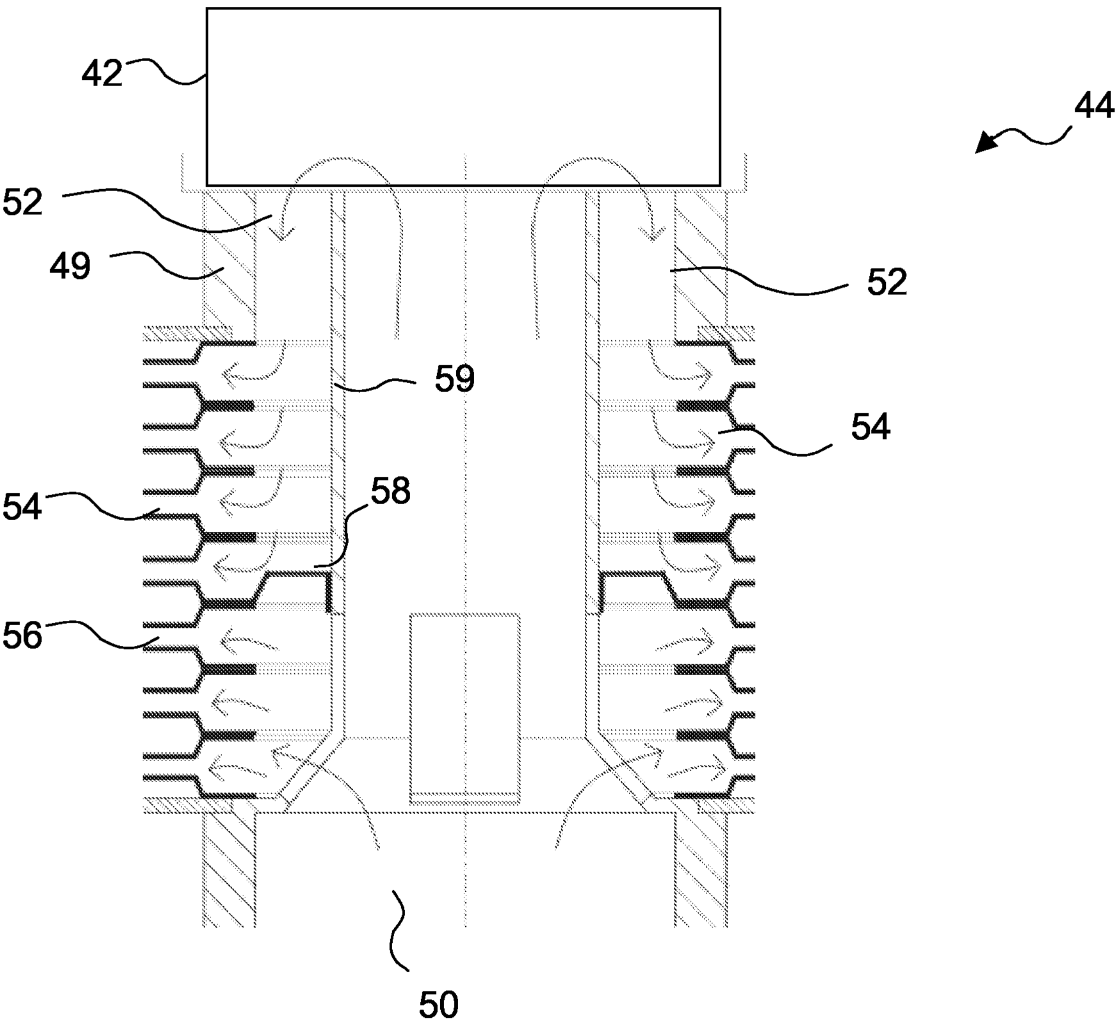

Fig. 4

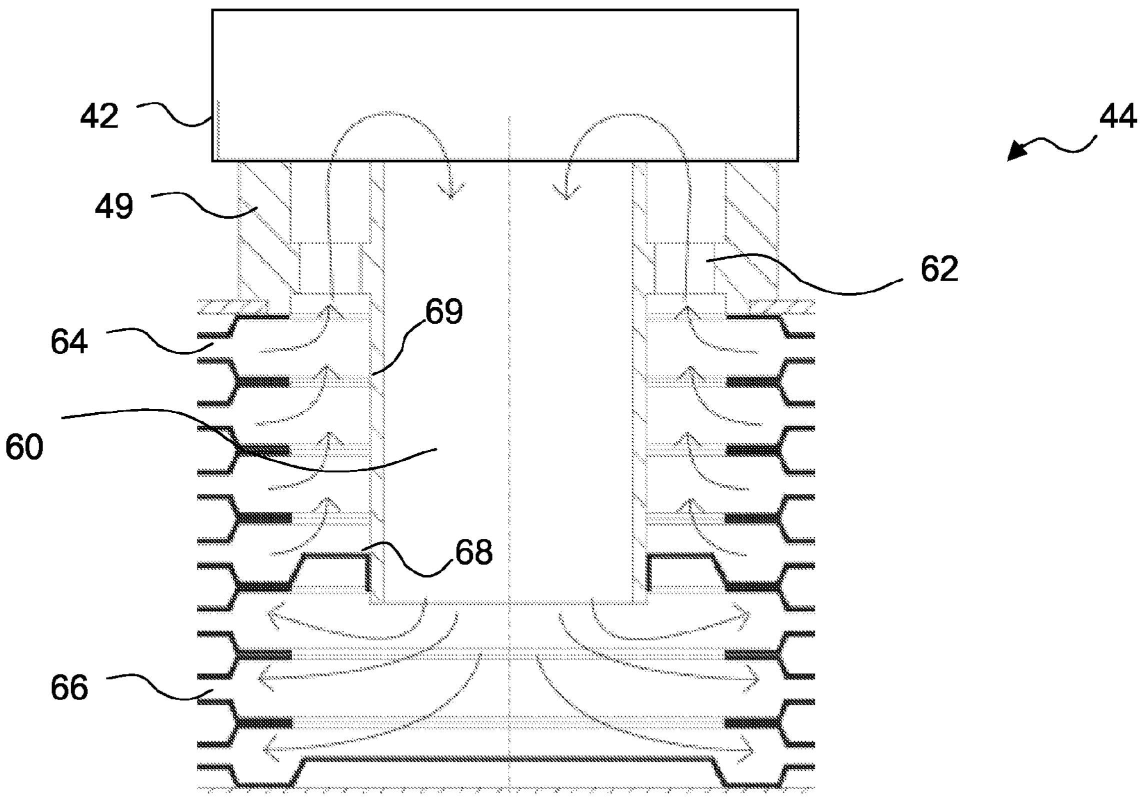

Fig. 5

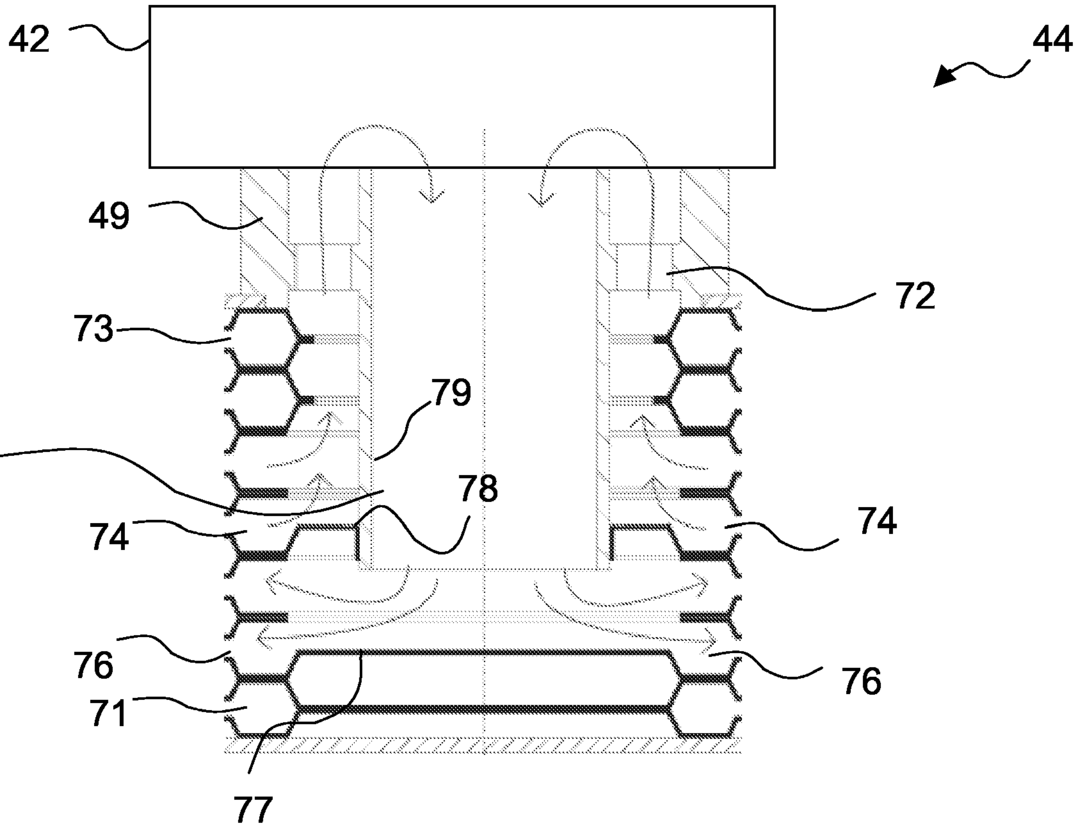

Fig. 6

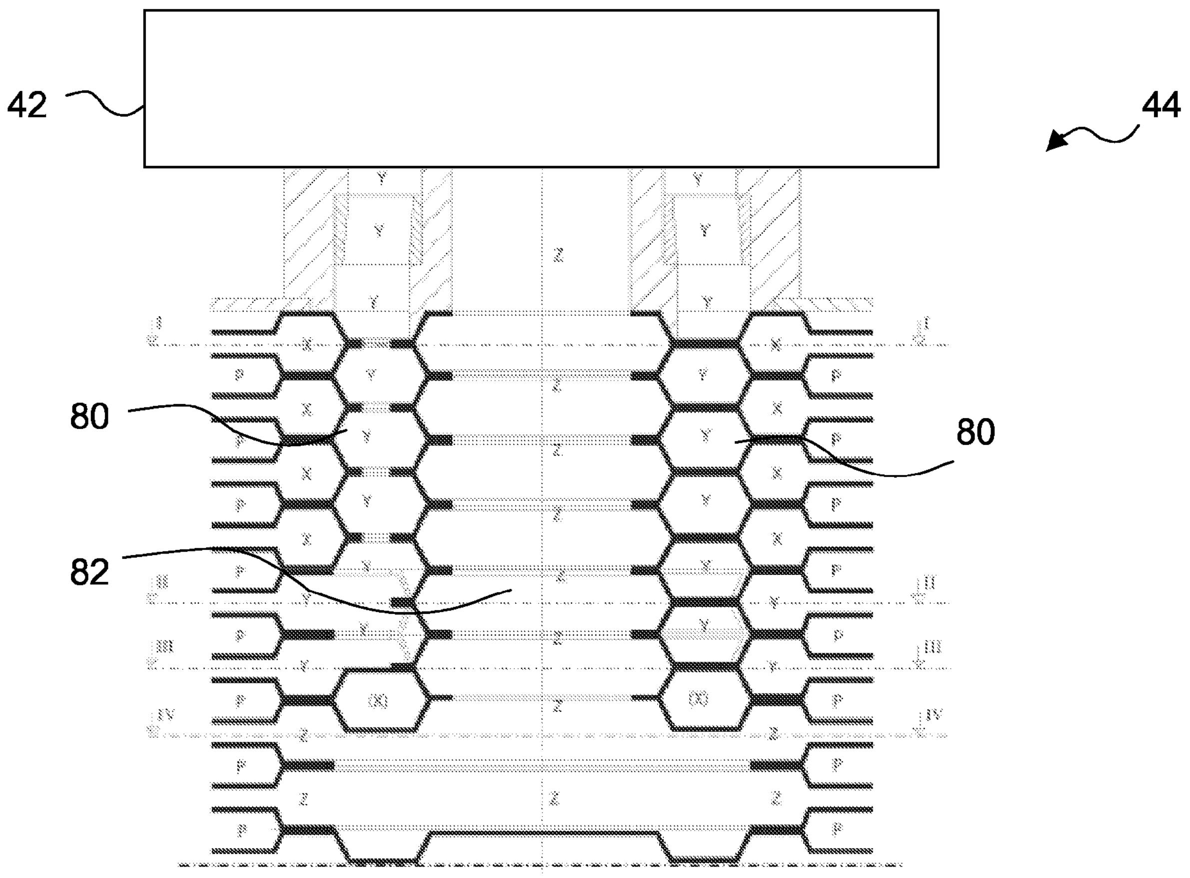

Fig. 7

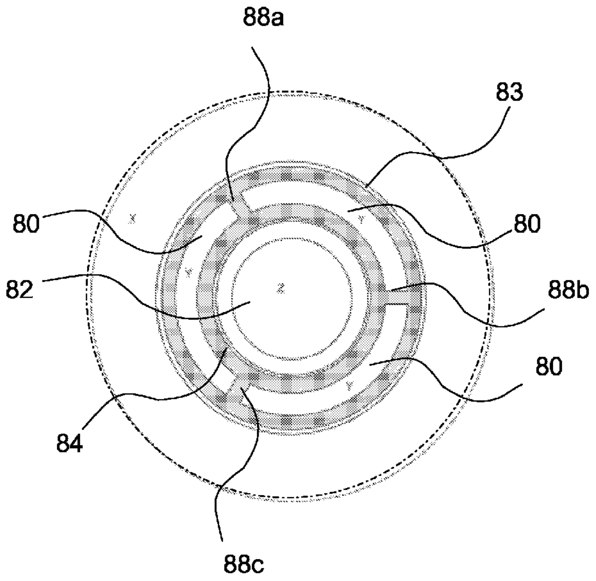

Fig. 8

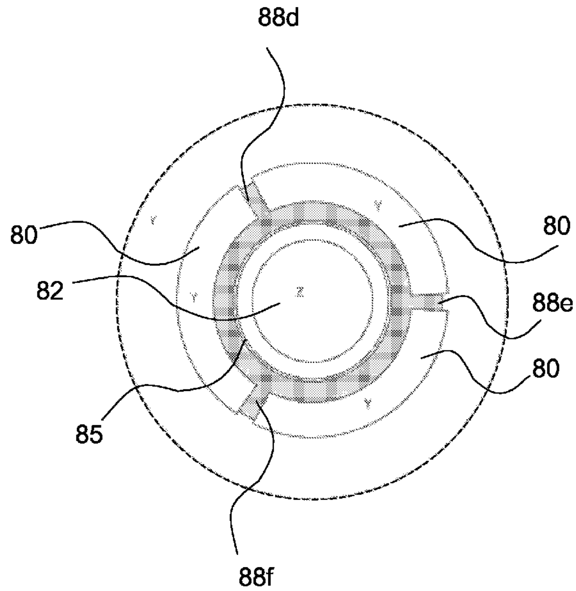

Fig. 9

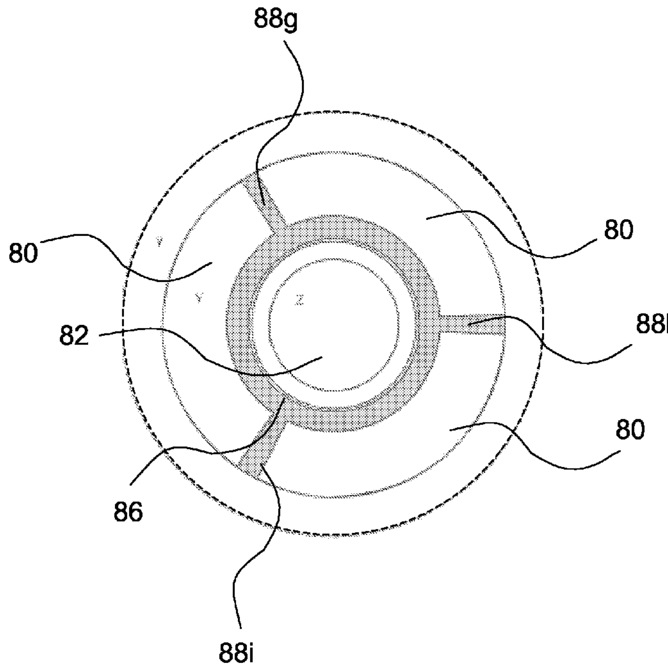

Fig. 10

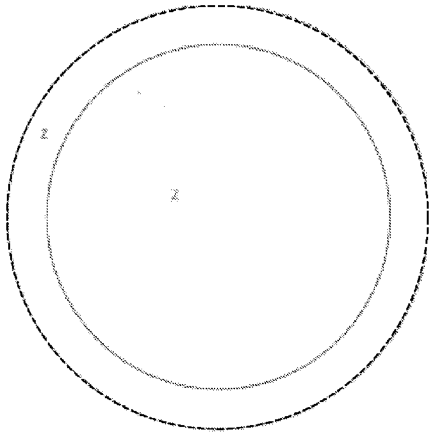

Fig. 11

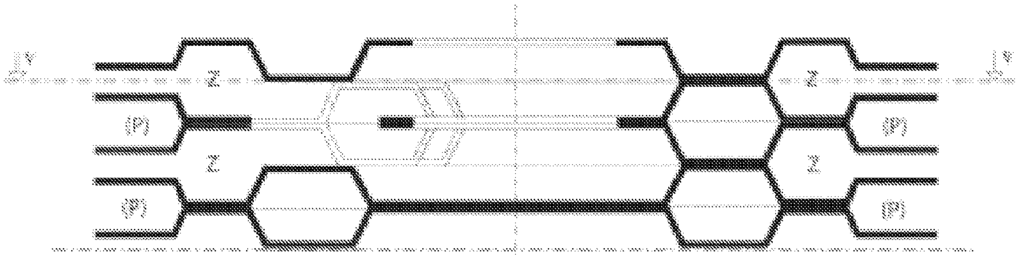

Fig. 12a

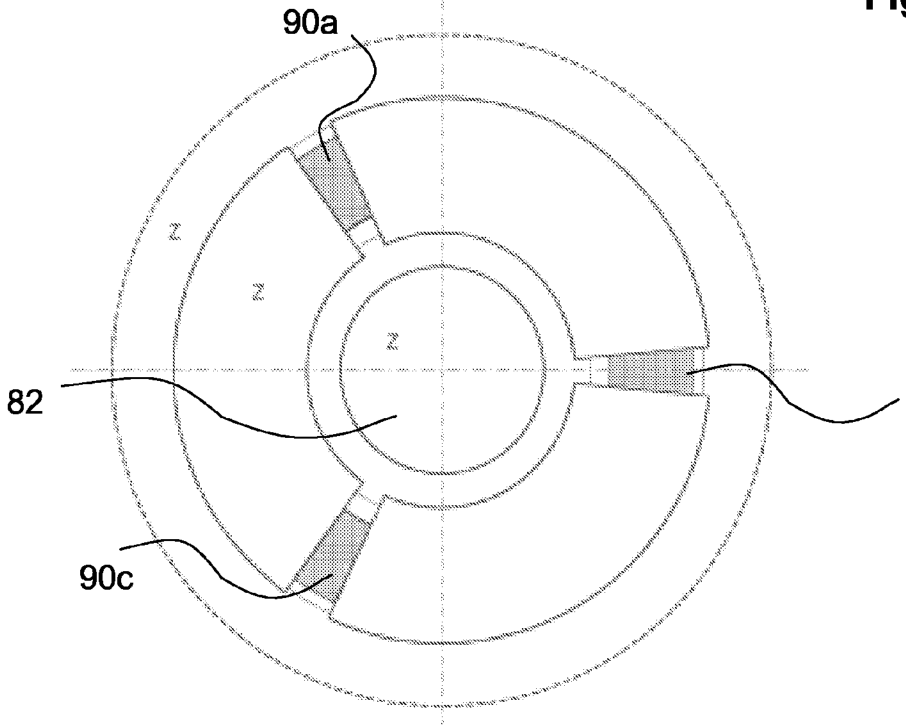

Fig. 12b

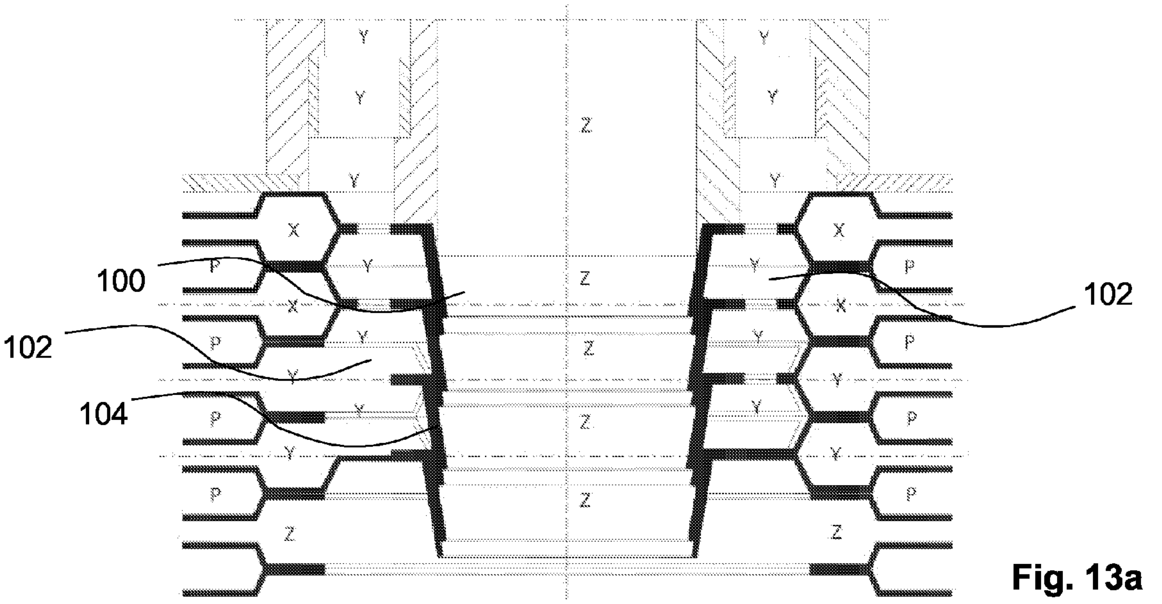

Fig. 13a

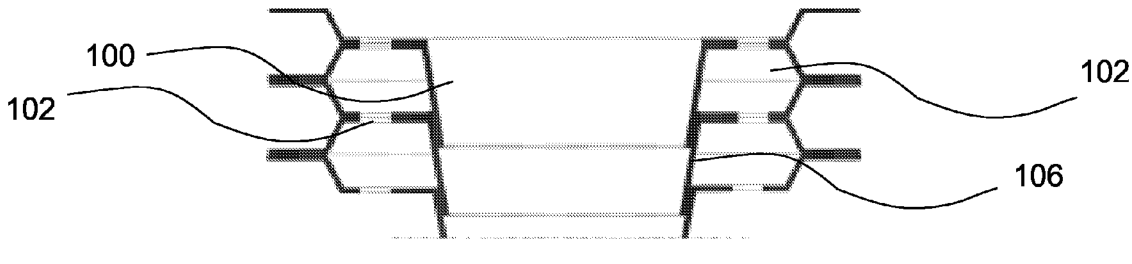

Fig. 13b

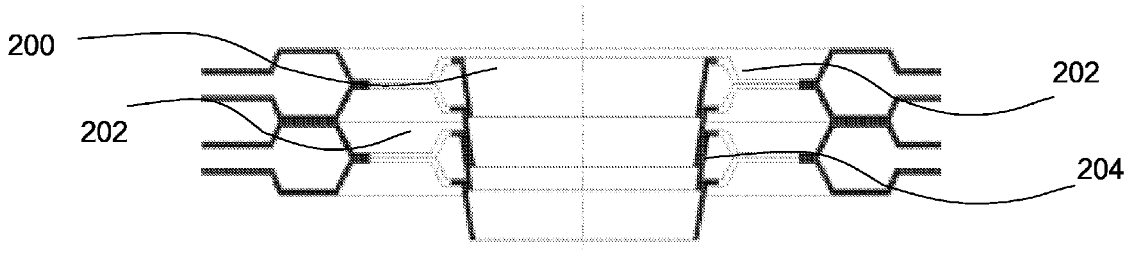

Fig. 14a

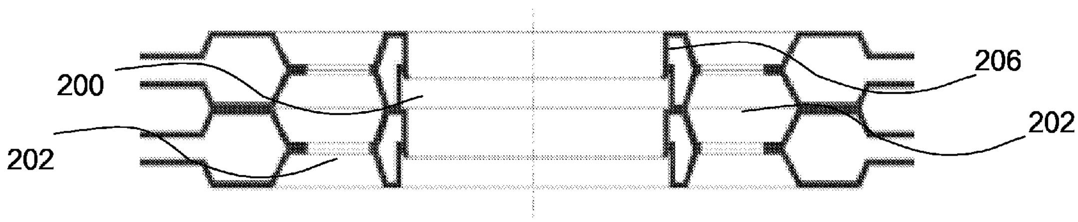

Fig. 14b

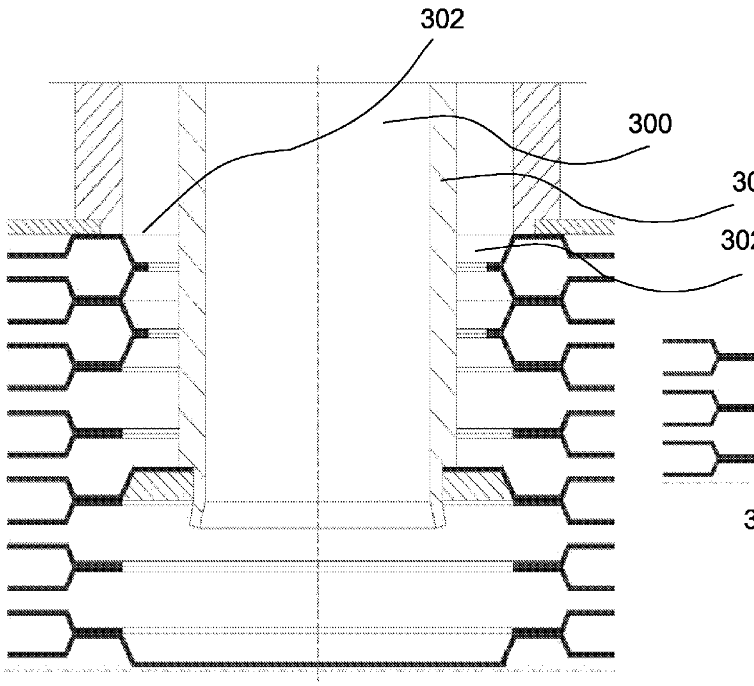

Fig. 15a

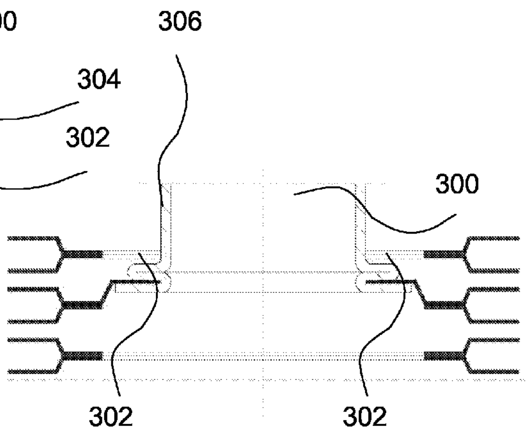

Fig. 15b

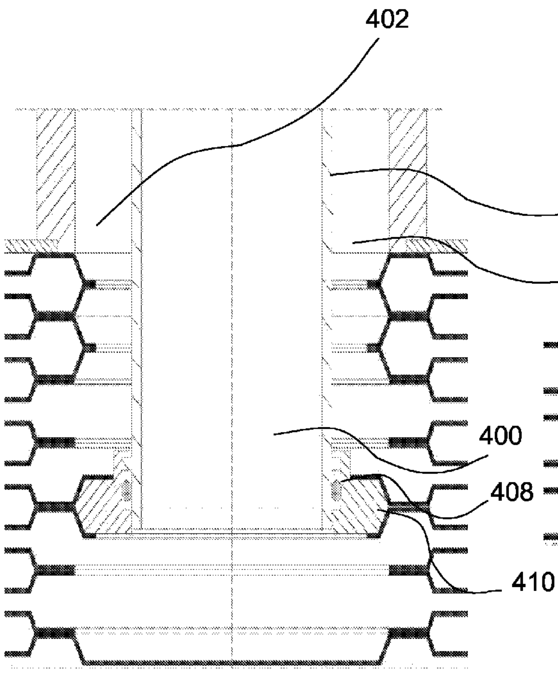

Fig. 16a

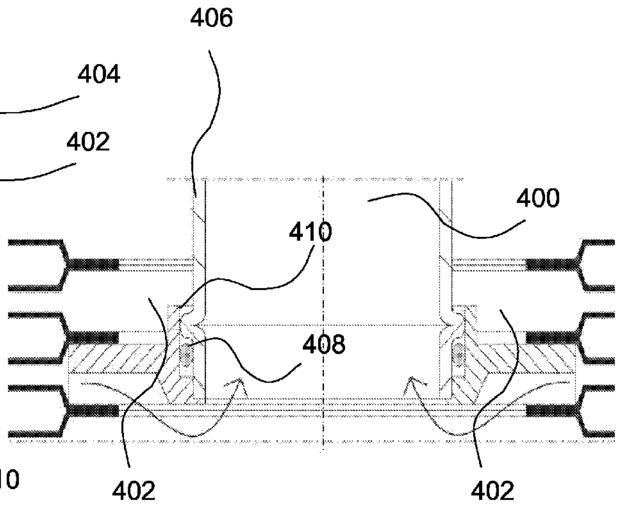

Fig. 16b

European Patent Office

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Application Number
EP 06 11 3007

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims

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Place of search	Date of completion of the search	Examiner
The Hague	2 October 2006	Mootz, Frank

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