A. J. E. MUNTERS.

APPARATUS FOR COOLING OR HEATING FLUIDS.

APPLICATION FILED SEPT. 17, 1914.

1,197,944.

Patented Sept. 12, 1916.

3 SHEETS—SHEET 1.

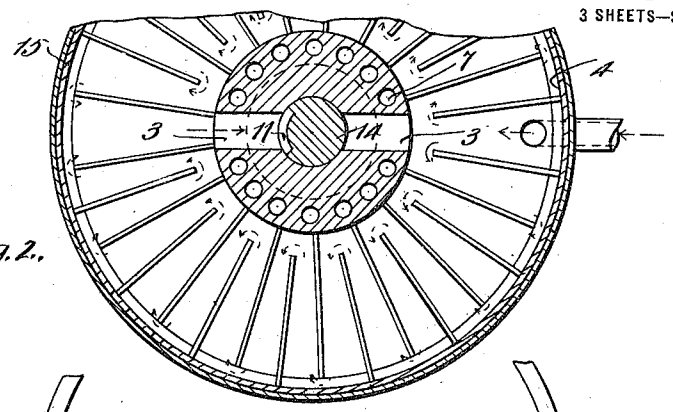


Fig. 2.

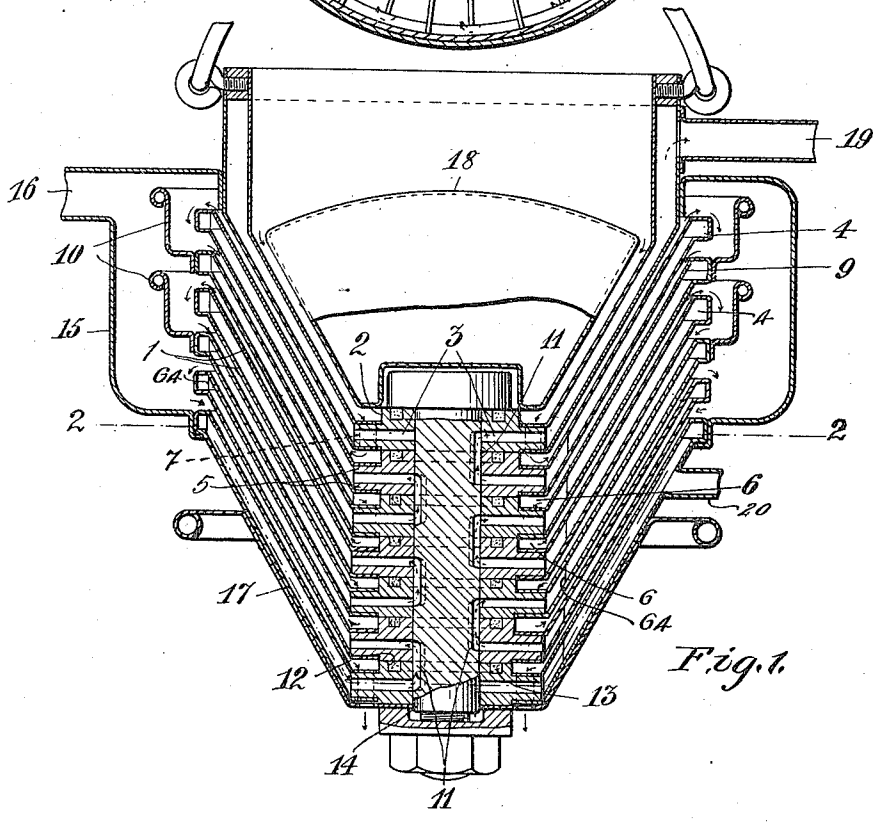


Fig. 1.

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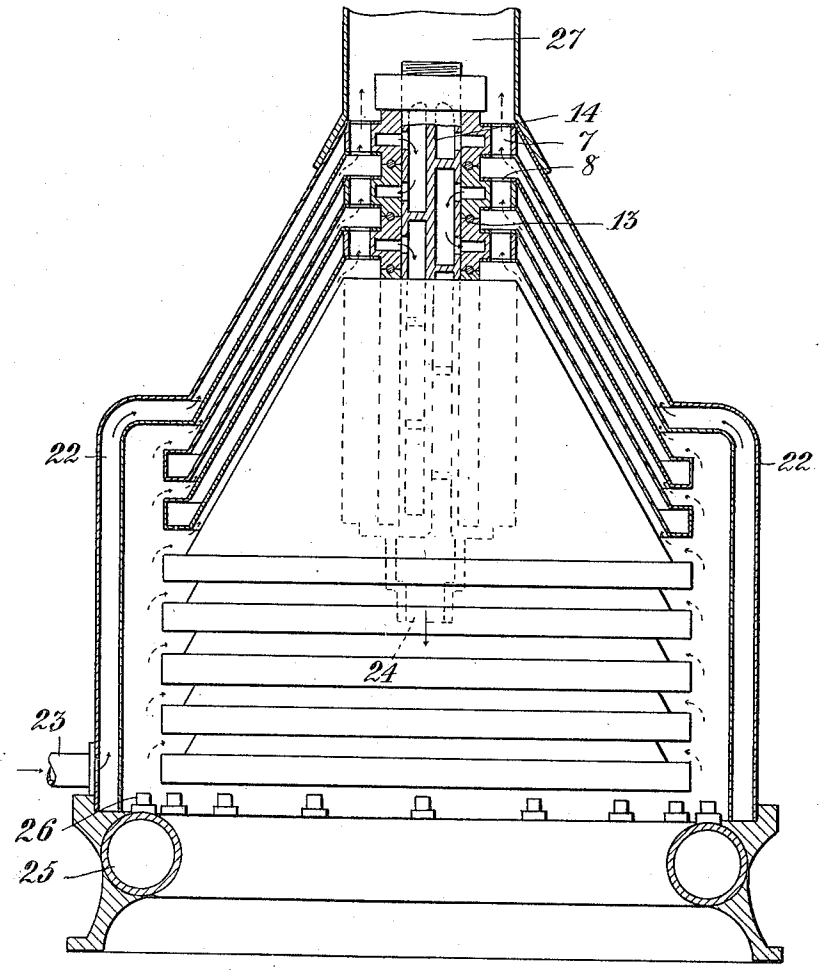
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3 SHEETS—SHEET 2.

Fig. 3.



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3 SHEETS—SHEET 3.

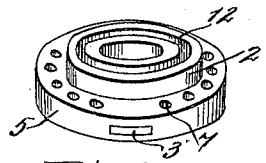


Fig. 5.

Fig. 4.

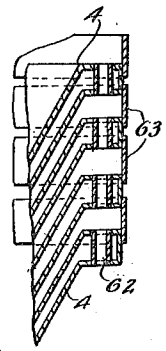
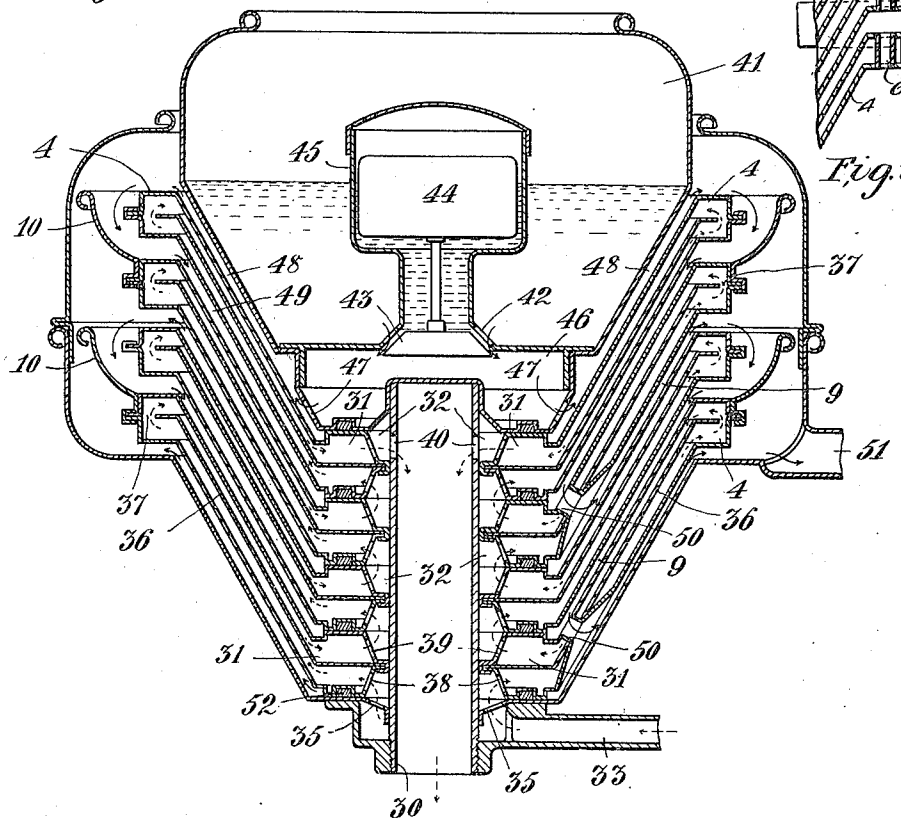


Fig. 6.



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UNITED STATES PATENT OFFICE.

ANDERS JOHAN ERICSSON MUNTERS, OF STOCKSUND, SWEDEN.

APPARATUS FOR COOLING OR HEATING FLUIDS.

1,197,944. Specification of Letters Patent. Patented Sept. 12, 1916.

Application filed September 17, 1914. Serial No. 862,218.

To all whom it may concern:

Be it known that I, ANDERS JOHAN ERICSSON MUNTERS, engineer, a subject of the King of Sweden, and a citizen of Sweden, residing at Stocksund, in the Kingdom of Sweden, have invented certain new and useful Improvements in Apparatus for Cooling or Heating Fluids, of which the following is a specification.

The present invention relates to an apparatus for cooling or heating fluids.

The object of the invention is to obtain the highest possible efficiency *i. e.*, to make the transfer of heat as great as possible in relation to the size and weight of the apparatus.

Four embodiments of the invention are shown in the accompanying drawings:

Figure 1 shows the preferred form of the apparatus in vertical section. Fig. 2 is a sectional view of an element and its connection with the shaft on the line 2—2 in Fig. 1. Figs. 3 and 4 are vertical sectional views of two modifications. Fig. 5 shows a shaft ring in detail. Fig. 6 shows a vertical section of a part of a fourth modification.

The main part of the apparatus consists of an outer vessel or casing (made in one or more parts), a centrally arranged shaft tube or the like, and a number of heating or cooling elements.

As shown in Fig. 1 the elements are conical or funnel shaped and arranged one above the other, and separated by spaces of a predetermined size. Each element consists of a ring 2 to which is secured two plates 1. The lower ends of these plates are bent inwardly and attached to the ring 2 so that the plates are spaced apart. The outer edges of the plates are soldered or welded together so that the space 4 between them is closed at the outer or upper edge. The spaces 9 between the elements, on the contrary, are open toward the outside. The elements are nested together and held in position by a shaft 14 which passes through the central opening of each ring, each ring being provided with two radial channels 3, located opposite each other. The inner spaces 4 of the elements communicate with each other at the inner periphery of the plates by means of said channels 3 and other channels 11, provided in the shaft 14. As clearly shown on the drawing, the channels are alternately arranged on opposite sides of the central shaft. The rings are each provided with an annular rib 5 (Figs. 1 and 5) at the periphery, spaces 6 being formed between these ribs. On the upper and lower side of these ribs the inner edges of the plates are connected in a suitable manner, for instance, by soldering. Each second ring is provided with a series of vertical holes 7, in its flange, except in that part thereof, where the said radial channels 3 are arranged as clearly shown in Figs. 2 and 5, and the plates attached to these flanges are provided with corresponding holes, opposite to the holes 7 in the flanges. These holes in the plates and ribs 5 allow communication between the spaces 9 at the inner periphery of the same. The communication between the spaces 9 at their outer periphery is established by means of flanges or the like 10, *i. e.*, for each pair of spaces 9 one flange 10 is provided which is arranged in such a manner that, at the outer periphery, its bottom forms a continuation of the bottom of the lower one of the two adjacent spaces 9, while the upper end of the flange 10, lies at a somewhat higher point than the outer edge of the upper wall of the upper one of the two spaces 9. On the upper side of the rings 2 are provided grooves 12, containing packings 13 of rubber, soft metal, asbestos or the like. The shaft 14 is formed as a screw bolt, the lower end of the shaft being threaded and provided with a nut, while the upper end of the shaft is provided with a head 21. By tightening the nut the rings 2 on the shaft are pressed together so that an absolutely tight engagement is effected between the same.

In the form of the invention shown in Fig. 1, an outer, preferably cylindrical, casing 15 surrounds the upper ends of all of the elements, so that a certain space is formed between it and said elements. This outer casing 15 serves to collect any liquid, which flows over the edges of the flanges 10. At the upper end of the casing 15 there is arranged an opening 16 through which the interior of the casing is always in communication with the atmosphere.

The lower part of the apparatus is in-

closed by a casing 17. In Figs. 3 and 4 a single casing is shown inclosing the entire apparatus.

The uppermost element serves as a funnel for filling the liquid to be heated or cooled in the apparatus. In this funnel there is arranged a float gage or a fixed distributer 18. The uppermost element is provided with an upwardly projecting extension, which is provided with an outlet 19 for the heating and cooling medium.

The peripherical flanges 10 may be made integral with the corresponding element plate and said flanges 10 may be omitted if, for instance, as shown in Fig. 6, the spaces between the elements are closed at their outer periphery by means of rings 63 and communicate with each other by means of tubes or the like 62, passing through the element near the periphery thereof. Each ring may be attached to one of the adjacent elements.

The apparatus operates in the following manner: The fluid to be cooled or heated, is introduced over the distributer 18, flows down between this latter and the uppermost element and further through the holes at the inner edges of the upper element plates and the holes in the intermediate (uppermost) ring 2, to the uppermost spaces 9. The fluid rises in this space, flows over the upper wall of the next element, and is led by the uppermost peripherical flange 10 to the second space 9, and so on, so that the fluid finally passes through the holes at the inner edge of the lowermost element plates and corresponding holes in the intermediate ring 2 down into the receiving vessel (not shown), as indicated by the arrows, shown in full lines in Fig. 1. The fluid thus flows alternately upward and downward in the spaces 9 between the elements.

The cooling or heating fluid admitted through the inlet 20 to the lowermost element, is forced to circulate in this latter in a circular zig-zag path by means of guiding organs 64 (see Figs. 1 and 2) which are radially arranged in the element, and the fluid passes further through a radial channel 3 in the lowermost ring 2 (on the left hand side of Figs. 1 and 2), then through channel 11 and the channel 3 in the next ring above into the second element. From this element the fluid passes through the channel 3 (on the right hand side of Fig. 1) in the second ring (counted from below) the channel 11 in the shaft and the channel 3 in the third ring into the third element, and so on until the interior of the uppermost element is reached. From this latter element the fluid flows out through the outlet 19. The path of the heating and cooling fluid is indicated by the dotted arrows in Fig. 1.

The embodiment shown in Fig. 3 is especially adapted for heating water or other liquids by means of hot gases or for cooling gases by means of liquids. In this embodiment the narrowing ends of the conical elements are turned upward and the elements are surrounded by a double wall casing 22, the liquid being admitted to the space between the inner and outer wall of the casing through the inlet 23 at the lower end of the said casing. From said space the liquid passes to the uppermost element and so on through all the elements to the outlet 24, as indicated by the full lined arrows, shown in Fig. 3. The heating gas is admitted from a device placed below the elements, said device consisting of an annular tube 25 for receiving a combustible gas or liquid, provided with a number of upwardly directed burner nozzles 26. The combustion gases pass upward surrounding the elements and escape at the upper end of the apparatus through the outlet 27. In this embodiment all the rings 3 are provided with vertical holes 7 and the inner edges of all plates with corresponding holes 8, so that the gases of combustion may pass as indicated by the dotted arrows in Fig. 3. Also in this embodiment the heating gases may be forced to pass in a zig-zag path by such arrangements as indicated with reference to Fig. 1.

Referring to the modification shown in Fig. 4, this is of about the same type as that shown in Fig. 1. The elements 4 in this embodiment are arranged around a tubular shaft 30 and are at their inner periphery provided with enlargements 31 and between said enlargements and the outside of the tube 30 there are formed annular spaces 32, through which the enlargements communicate with each other and with the interior of the shaft as will be explained more particularly below. Each element is provided with a partition 36, the inner edge of which is fixed between the inner edges of the two plates of which the elements are composed. The outer edge of the partition, on the contrary, does not reach to the outer wall of the element, a passage 37 thus being left between said edge and wall so as to establish communication between the two compartments formed in the element by the partition 36. The cooling or heating fluid is admitted through the inlet tube 33, arranged at the lower end of the outer casing 34. From this inlet the fluid passes to the lowermost one of the annular spaces 32 between the enlargements 31 and the tubular shaft 30, through openings 35 in the wall of the said space. From this space the fluid passes to the lower compartment of the lowermost element, through openings 38 in the wall of the enlargement 31, rises along the underside of the partition 36 and passes through the passage 37 to the upper compartment of the same element. Then the fluid passes

through other openings 39 in the enlargement wall to the next annular space 32 and so on, until the fluids flow out from the uppermost annular space 32 to the interior of the tubular shaft 30 through openings 40 in said shaft. The fluid to be heated or cooled is admitted to the receiving funnel 41, provided with valve openings 42 at its bottom, said openings coacting with a valve body 43, connected with a float gage 44, which is surrounded by a casing 45. From the receiving funnel the fluid to be heated and cooled is passed through the said valve to a chamber 46, and from this chamber the fluid passes through openings 47 to the space 48 between the receiving funnel and the uppermost element 4. The communication between the said space 48 and the space 49 between the two uppermost elements as well as between two adjacent spaces 9 is accomplished at the outer periphery by means of edge plates 10 in the same manner as shown in Fig. 1. At the inner periphery, the communication between the spaces 9 is accomplished by means of short tubes 50 extending through the intermediate elements. 51 indicates the outlet for the fluid which has been cooled or heated. The path for the cooling or heating fluid is indicated by dotted arrows, while the path for the fluid to be cooled or heated is indicated by arrows, shown in full lines.

It will easily be understood that the float gage valve acts as a regulator which controls the admission of the fluid to be cooled or heated to the apparatus. When the apparatus is filled with the fluid the same rises in the casing 45, causing the float gage to rise and close the valve. As the fluid escapes through the outlet the valve is opened, allowing fluid from the receiving funnel to enter between the elements. The enlargements at the inner edges of the elements engage each other closely, packing rings 52 being inserted between the same.

Claims:

1. Apparatus for heating or cooling fluids characterized by a plurality of hollow elements, arranged one above the other so as to form spaces between themselves and to form a central vertical space, an outer casing, surrounding said elements, outlets and inlets in said casing for the cooling or heating fluid and for the fluid to be cooled and heated, the elements being closed at their outer periphery, but communicating with each other at their inner periphery, the spaces between the elements communicating with each other both at the outer and the inner periphery, the passages between the spaces between the elements at the outer periphery being formed by annular curved flanges.

2. Apparatus for heating or cooling fluids characterized by a plurality of hollow elements, arranged one above the other so as to form spaces between themselves and to form a central vertical space, an outer casing surrounding said elements, outlets and inlets in said casing for the cooling or heating fluid and for the fluid to be cooled or heated, the elements being closed at their outer periphery but communicating with each other at their inner periphery the spaces between the elements communicating with each other both at the outer and inner periphery, the elements having enlargements at their inner periphery, said enlargements engaging each other closely.

3. Apparatus for heating or cooling fluids, characterized by a plurality of hollow elements, arranged one above the other so as to form spaces between themselves and to form a central vertical space, an outer casing, surrounding said elements, outlets and inlets in said casing for the cooling or heating fluid and for the fluid to be cooled or heated, the elements being closed at their outer periphery but communicating with each other at their inner periphery, the spaces between the elements communicating with each other at the outer and the inner periphery, a tube being inserted in the said central vertical space, annular chambers being formed between the inner edge wall of the elements and the said tube, each of such chambers forming a passage between the inner edges of two adjacent elements.

4. Apparatus for heating or cooling fluids characterized by a plurality of hollow elements, arranged one above the other so as to form spaces between themselves and to form a central vertical space, an outer casing surrounding said elements, outlets and inlets in said casing for the cooling or heating fluid and for the fluid to be cooled and heated, the elements being closed at their outer periphery but communicating with each other at their inner periphery, the spaces between the elements communicating with each other both at the outer and inner periphery, the passages between the spaces between the elements at the outer periphery being formed by annular curved flanges, the spaces between the elements communicating with each other near the inner periphery by means of short tubes passing through the elements.

5. Apparatus for heating or cooling fluids characterized by a plurality of hollow elements arranged one above the other so as to form spaces between themselves and to form a central vertical space enabling the elements to be mounted on a central shaft, passages establishing communication between the elements, and passages establishing communication between the spaces between the elements, an outer casing sur-

rounding said elements, outlets and inlets in said casing for the cooling or heating fluid and for the fluid to be cooled and heated, a receiving funnel above the elements, a valve in said funnel, the valve body being connected with a float surrounded by a housing, the arrangement being such that the float gage rises and closes the valve opening as the level of the fluid rises in the outer casing and vice versa.

In testimony whereof I have affixed my signature in presence of two witnesses.

ANDERS JOHAN ERICSSON MUNTERS.

Witnesses:

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E. W. ABRAHAMSON.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."