

Oct. 5, 1926.

1,601,874

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HEAT EXCHANGER

Filed June 10, 1925

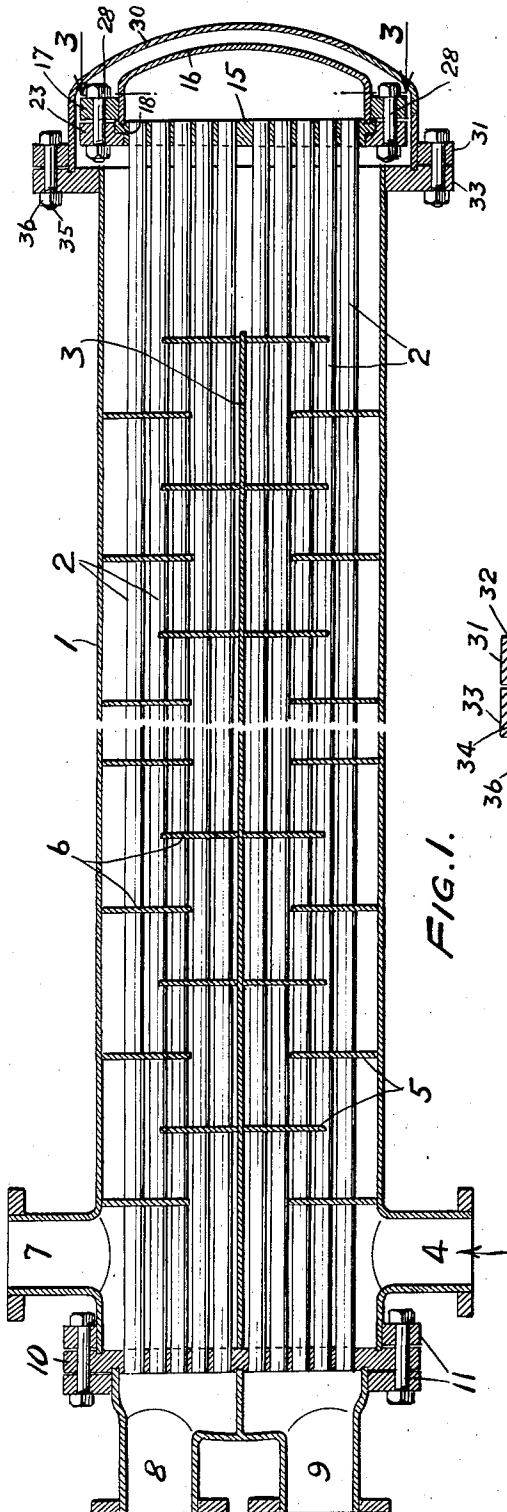


FIG. 1.

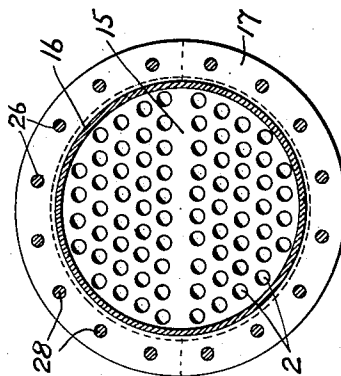


FIG. 3.

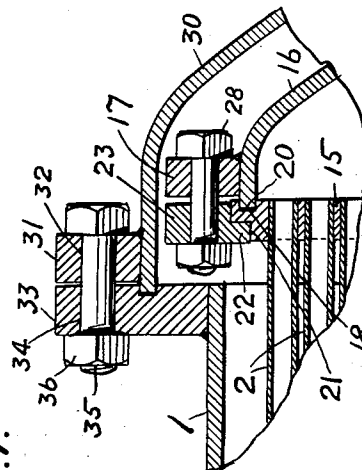


FIG. 4.

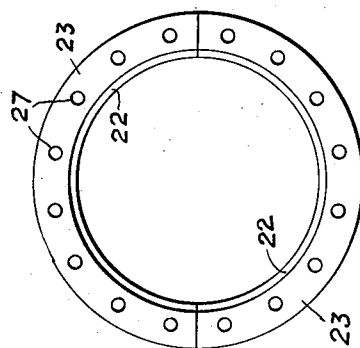


FIG. 2.

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UNITED STATES PATENT OFFICE.

KARL MUHLEISEN, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO SCHUTTE AND KOERTING COMPANY, OF PHILADELPHIA, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

HEAT EXCHANGER.

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My invention relates to heat exchangers of the character in which a relatively large number of tubes in the form of bundles are mounted within casings, the opposite ends of which tubes are permanently or rigidly secured within openings in tube-sheets located adjacent the opposite ends of said casings.

When heat exchangers of this character are employed for the purpose of cooling certain liquids, such as lubricating oils, which are caused to flow through the casing and to contact with or impinge upon the tubes therein the exterior surfaces of said tubes frequently become coated with a deposit rendering it desirable, if not necessary, that they be cleaned. It is desirable, therefore, that a construction be provided whereby the bundle of tubes may be withdrawn from the casing for that purpose; that is, for the purpose of cleaning the same or removing the deposit therefrom.

In constructions of this character one of the tube-sheets usually is rigidly connected to one end of the casing structure, while the other is movably mounted therein in order to permit freedom of expansion of the tubes without interference thereof with the casing.

The general object of the present invention is to provide a construction comprising novel means whereby the bundle of tubes within a casing may be readily removed therefrom.

It is also an object of the invention to provide a construction comprising novel means whereby a head forming a chamber may be detachably connected with the tube-sheet which is movably mounted within the casing.

To these and other ends my invention comprehends the construction of means as hereinafter described, particularly pointed out in the claims, and as illustrated in the drawing in which I have shown one form of mechanical embodiment thereof. However, it will be understood that the invention is susceptible of embodiment in means of other construction than that illustrated and that changes in the details of construction may be made within the scope of the claims without departing from the principle of the invention.

In the drawing:

Fig. 1 is a central longitudinal section of a construction of heat exchanger comprising means embodying my invention;

Fig. 2 is a plan view of one of the members or elements constituting a part of the structure embodying the invention;

Fig. 3 is a transverse sectional view taken on the line 3—3 of Fig. 1; and

Fig. 4 is an enlarged longitudinal sectional view showing a fragmentary portion of the structure embodying the invention.

Referring to the drawing:

1 designates a casing of any suitable construction provided with a plurality of tubes 2 mounted therein. These tubes are divided into two groups by a plate or diaphragm 3 extending longitudinally of the casing. The fluid to be cooled may enter the casing through an inlet 4. The fluid which enters the casing through the said inlet travels forwardly in the casing back and forth about the baffle plates 5. Such fluid passes around the outer or free edge of the plate or diaphragm 3 and returns in the opposite direction flowing in and out around the baffle plates 6. The fluid leaves the casing through the outlet 7. The cooling fluid enters the casing through an inlet 8 and flows through the tubes above the plate or diaphragm 3 and thence through the tubes below the said diaphragm and out through the outlet opening 9.

The ends of the tubes 2 at the left hand end of the structure are secured in openings through a fixed or stationary tube-sheet 10. The said tube-sheet is secured to the adjacent end of the casing 1 by means of flanges and bolts, designated as a whole by the reference numeral 11, in known manner.

The construction thus far referred to forms no part of my invention and will not be described further or more in detail.

The opposite ends of the tubes 2 are secured in openings through a movable or floating tube-sheet 15. In the construction as shown this tube-sheet is circular and is of a diameter less than the diameter of the casing 1, so that it may be withdrawn through the casing in case it should be desired to remove the bundle of tubes 2 therefrom for cleaning purposes.

In order to prevent the cooling fluid which flows first through the tubes above the plate or diaphragm 3 and then backwardly or in return direction through the tubes below the said plate it is necessary to connect the cap or head 16 to the outer side of the tube-sheet 15, so as to form a

chamber into which the fluid from the first of the said tubes is discharged and from which it enters the second group of tubes below the plate or diaphragm 3. The cap or head 16 is of cup shape and is provided near its open end with a flange 17 which is secured thereto by welding, brazing, or otherwise. The edge of the said cap or head is adapted to fit within an annular groove 18 formed upon the outer side of the tube-sheet 15 adjacent its periphery. In order to prevent escape of fluid between the edge of the said cap or head and the bottom of the said groove the latter is provided with a packing 20 against which the said edge contacts.

The tube-sheet 15 is provided upon the inner side of its outer edge with an annular groove 21 within which is adapted to be seated arc-shaped projecting portions 22 formed upon the inner edges of a plurality of arc-shaped members 23. These projections are formed by cutting out portions of the inner edges of the said members 23 upon one side thereof.

In the construction as shown I have shown two members 23, but it will be understood that the number of these members may be increased if desired, and it is also to be understood that the ends of these members need not abut, as shown, but may be spaced from each other.

Both the flange 17, previously referred to, and the members 23 are provided with openings 26 and 27 which are adapted to be brought into registry for the reception of bolts 28 which are adapted to bind or connect the flange 17 and the parts 23 together and to clamp the edge of the cap or head 16 in the groove 18, previously referred to, and against the tube plate 15, or against the packing 20 in the said groove. The end of the casing 1 adjacent the tube-sheet 15 is adapted to be closed by a cap or head 30 which is of cup shape. The said cap is provided with a flange 31 near its open end, which flange is secured to the said cap or head by welding, brazing, or otherwise. The said flange is provided with openings 32 at intervals therein and is adapted to be located in juxta-position with respect to the flange 33 upon the adjacent end of the casing 1. The latter flange is provided with openings 34 at intervals therein. Bolts 35 are adapted to be inserted through the said openings. These bolts are provided with screw-threaded ends for the reception of nuts 36. By tightening these nuts the cap or head 30 may be clamped against the

flange 33 to close the adjacent end of the said casing.

In order to remove the members 23 together with the cap or head 16 the cap or head 30 is first removed. Thereafter the nuts upon the bolts 28 are removed, after which said bolts may be removed. Upon their removal the cap 16 may be removed and likewise the members 23. After these parts have been thus removed and the tube plate 10 disconnected from the opposite end of the casing 1 the bundle of tubes 2 may be withdrawn from the casing. Such withdrawal is permitted because the diameter of the tube-sheet 15 is less than the internal diameter of the casing 1.

The tubes having been withdrawn may be cleaned and thereafter re-inserted and the cap or head 16 re-assembled with the movable tube-sheet 15, after which the cap or head 30 may be replaced in position and secured to the flange 33.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

In a heat exchanger comprising a casing and a bundle of tubes therein, the combination of a movable tube-sheet having openings therethrough within which one end of each of the tubes of said bundle of tubes is permanently secured, the diameter of the said tube-sheet being less than the internal diameter of the said casing, the outer side of the outer edge portion of said tube-sheet being provided with an annular groove and the underside of the peripheral portion of the said tube-sheet being provided with a groove forming a shoulder, a cup shaped cap member having a laterally and outwardly extending flange located near its open end, the edge of the open end of said member being adapted to be seated in the groove in the outer side of the outer edge of the said tube-sheet, a plurality of members of arc-shape having grooves upon the upper sides of the inner peripheral portions thereof forming shoulders which are adapted to engage the shoulders upon the said tube-sheet, and means for detachably securing the said arc-shaped members to the said flange and clamping the said members and the said flange together to effect clamping of the cap member against the said tube-sheet.

In testimony that I claim the foregoing as my invention, I have hereunto signed my name this 5th day of June, A. D., 1925.

KARL MUHLEISEN.