May 8, 1923

1,454,053

R. C. JONES

OIL COOLER

Filed Feb. 18, 1920

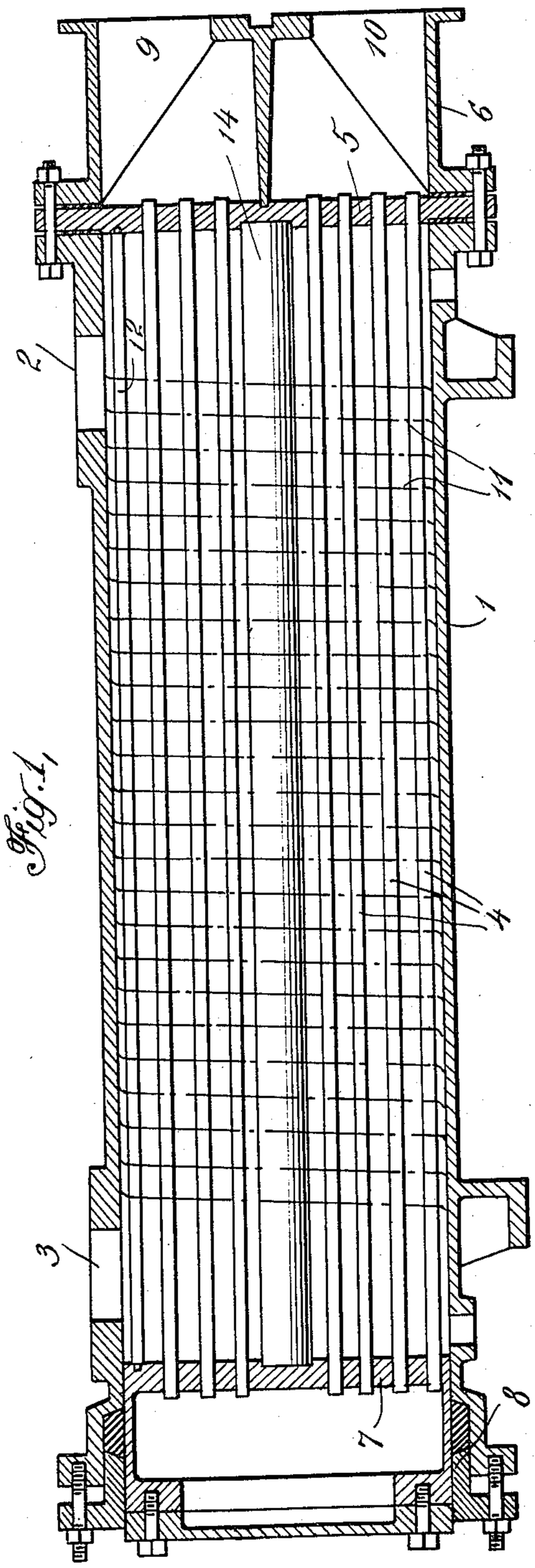


Fig. 1.

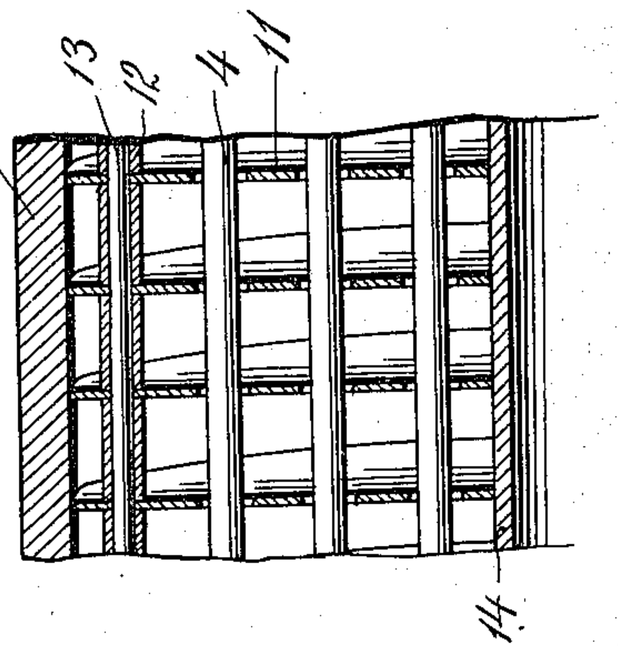


Fig. 4.

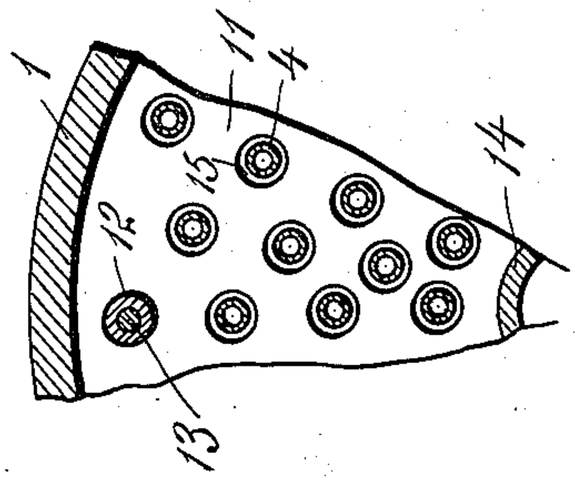


Fig. 3.

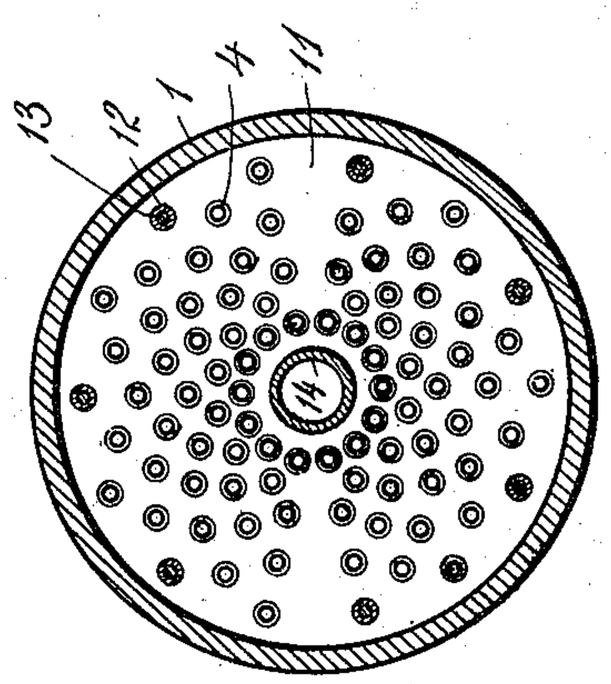


Fig. 2

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By his Attorneys

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# UNITED STATES PATENT OFFICE.

RUSSELL C. JONES, OF BRONXVILLE, NEW YORK, ASSIGNOR TO THE GRISCOM RUSSELL COMPANY, OF NEW YORK, N. Y., A CORPORATION OF DELAWARE.

## OIL COOLER.

Application filed February 18, 1920. Serial No. 359,607.

*To all whom it may concern:*

Be it known that I, RUSSELL C. JONES, a citizen of the United States, residing at Bronxville, in the county of Westchester, State of New York, have invented certain new and useful Improvements in Oil Coolers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in oil coolers, particularly of the type disclosed in the patent to R. C. Jones, No. 1,335,506, issued March 30, 1920.

The object of the present invention is to provide a heat exchanger and particularly a cooler of the type above mentioned in which the surfaces of the heat transferring tubes are scoured throughout their length so that there will be no accumulation of congealed oil at any point along the length of the tube. The scouring action takes place continuously during the operation of the apparatus and serves to maintain the heat transferring surfaces of the tubes at all times in condition for the most advantageous heat transfer.

Oil coolers of the kind described in my copending application above referred to consist essentially of a shell with inlet and outlet passages for the oil to be cooled, the shell containing a series of longitudinal tubes through which the cooling liquid is circulated. Supported within the shell is a series of baffle plates connected together to form a continuous helical passage from the inlet to the outlet passage of the shell, whereby in traversing the short length of the shell the oil is caused to pass again and again across the tubes containing the cooling liquid, thus providing in an apparatus of small dimensions a passage for the oil many times the length of the shell whereby an effective cooling of the oil is obtained. As constructed for actual commercial use the baffle plates are of sheet iron, each shaped to constitute a single turn of the screw and perforated for the passage of the tubes which are set close together in the shell. As originally constructed it was found that there was a tendency of the oil to congeal in the corners at the intersection of the tubes and the baffle plates, particularly on the far side of the tubes, in the direction of the flow of the oil, the congealed oil gradually accumulating in the shape of a fillet which rendered a considerable portion of the tube surface ineffective for the transfer of heat from the oil to the liquid.

It is the purpose of the present invention to prevent this accumulation of congealed oil, which purpose is secured essentially by providing a clearance between the baffles and the tubes sufficient to cause a slight short-circuiting of a portion of the oil along each tube from one section of the helical baffle to the next, the flow of the oil under pressure through the narrow passage around the tubes acting to scour the congealed oil off as rapidly as it forms, whereby the tubes are kept clean throughout their length.

In the accompanying drawings, I have illustrated my improvement applied to a cooler of the character disclosed in my said patent, and in said drawings,

Figure 1 is a longitudinal section of my improved oil cooler;

Fig. 2 is a transverse section through the central portion of my improved cooler; and

Figs. 3 and 4 are enlarged details showing the improved baffle construction.

Referring to the drawings, 1 indicates the shell through which the oil is circulated from the inlet passage 2 to the outlet passage 3.

The cooling liquid is circulated through tubes 4 supported at one end in the tube sheet 5 clamped against one end of the shell by a service header 6 and supported at the other end by a floating head or drum 7 which is mounted to slide longitudinally of the shell in a packed bearing 8 with the expansion and contraction of the tubes. The service header 6 is divided into inlet and outlet compartments by a transverse partition, whereby the cooling liquid passes from the inlet 9 through the tubes at the upper half of the bundle, thence through the floating head 7 to the outlet 10.

The oil is caused to flow transversely of the tubes through the shell by a spiral baffle made up of separate plates 11, each bent to form a single helix of the spiral with the edges of the adjacent helices aligned with each other and in some cases attached together by butt joints of usual design. The helices are preferably of low pitch so as to

provide a long narrow passage for the oil from the inlet to the outlet through which the oil may be forced with an appreciable velocity in order to prevent its congealing on the tubes. The separate baffle plates 11 are preferably maintained in properly spaced relation by short sleeves or thimbles 12 mounted on rods 13 arranged around the periphery of the tube bundle and abutting at their opposite ends against the tube sheet 4 and floating head 7, respectively. The baffle plates 11 are preferably cut out at the center to receive a rod 14 whose ends are supported in recesses in the tube sheet and header.

The apparatus so far described is the same as that disclosed in my patent referred to above. In the improved construction shown in the drawings, the baffle plates, instead of closely fitting the tubes at the points of intersection of the tubes and plates, have the holes for the passage of the tubes of larger diameter than the tubes, as shown particularly in Fig. 3 of the drawings, whereby there is provided an annular passage 15 through the baffles around each tube forming, as it were, a short-circuit from one turn of the helix to the adjacent turn. These short-circuiting passages serve several useful functions. In the first place, the most important, they prevent the accumulation of congealed oil at any point on the tube surface. The annular passage, while wide enough not to be stopped with sediment or oil film, is narrow enough to insure a rapid velocity of the oil through the passage forming, as it were, large numbers of cross currents of oil which extend well into the main current of oil, following the spiral path between the baffles. These cross currents keep the tube surfaced scoured clean on all sides, particularly at the intersection of the baffle plates where the main current of oil would otherwise be at low velocity. The cross currents also serve to keep the oil well agitated, thereby increasing the efficiency by constantly bringing fresh oil against the heat-absorbing surfaces of the tubes. The agitation of the oil through the cross currents also counteracts the tendency of the oil to acquire a higher velocity at the surface of the shell through the effect of centrifugal force and prevents the formation of pockets at the middle of the shell.

It will be understood that it is only the holes in the baffle plates for the passage of the tubes which are of enlarged diameter, the baffles fitting closely on the center rod 14 and also on the peripheral rods 13. These latter rods, instead of abutting against the flat faces of the tube sheet and head 7, may be set in sockets formed in the faces of the sheet and head wall, whereby the baffles will be maintained in fixed relation to the tubes so that the tubes will be centered in the enlarged holes through the baffles and the passage 15 kept open on all sides of the tubes.

While I have shown and described my improvement as applied to the oil cooler of my patent above mentioned, it is to be understood that the improvement may be applied with advantage to other forms of baffles, and the invention is not to be understood as limited to my prior structure, except in so far as recited in the appended claims.

I have described my invention as particularly applicable to a heat exchanger in which both heat transferring liquids are oils. It is evident, however, that the apparatus is equally applicable for effecting heat transfer between any two liquids either one of which is a liquid whose viscosity changes with temperature. The apparatus may be advantageously employed in effecting heat transfer between non-viscous liquids in cases where it is desired to scour the tubes clean of impurities or other substances which may be contained in the liquid.

I claim:

1. In an apparatus of the class described, the combination of a shell for the circulating liquid, means in said shell for causing a main current of said liquid to flow in a circuitous path, and means for causing secondary cross currents in said main current.

2. In an apparatus of the class described, the combination of a shell for the circulating liquid, tubes extending into said shell, baffle plates supported in said shell substantially transversely of said tubes and forming a continuous spiral path for said liquid, and holes in the baffles for the passage of the tubes, said holes being of larger diameter than the outside diameter of the tubes.

3. In an apparatus of the class described, the combination of a shell for the liquid to be treated, tubes in said shell for a second fluid, baffles in said shell arranged to cause a main current of said liquid to be treated in a circuitous path across said tubes, and means for causing auxiliary cross currents of said liquids along the tube surfaces.

4. In an apparatus of the class described, the combination of a shell for the fluid to be treated, tubes extending through said shell for a second fluid, said shell having inlet and outlet openings, baffles in said shell arranged to provide a circuitous passage from the inlet to the outlet opening, and passages through the said baffles for producing cross currents in the fluid in directions different from the main current along the baffles.

5. In an apparatus of the class described, the combination of a shell having inlet and outlet passages for the fluid to be treated, baffles arranged in said shell forming a continuous circuitous passage from inlet to outlet opening, tubes in said shell for the pas-

sage of the second fluid, said tubes projecting through said baffles and passages through said baffles around said tubes for producing cross currents in the fluid flowing through said passage from the inlet to the outlet of the shell.

6. In an apparatus of the class described, the combination of a shell, inlet and outlet openings for the fluid to be treated, a baffle in said shell forming a continuous spiral passage from the inlet to the outlet opening, tubes extending longitudinally of said shell and passing through said baffle in parallelism with the axis of the spiral and annular passages in said baffles at the intersection of the tubes and the baffles as and for the purpose set forth.

In testimony whereof I affix my signature.

RUSSELL C. JONES.