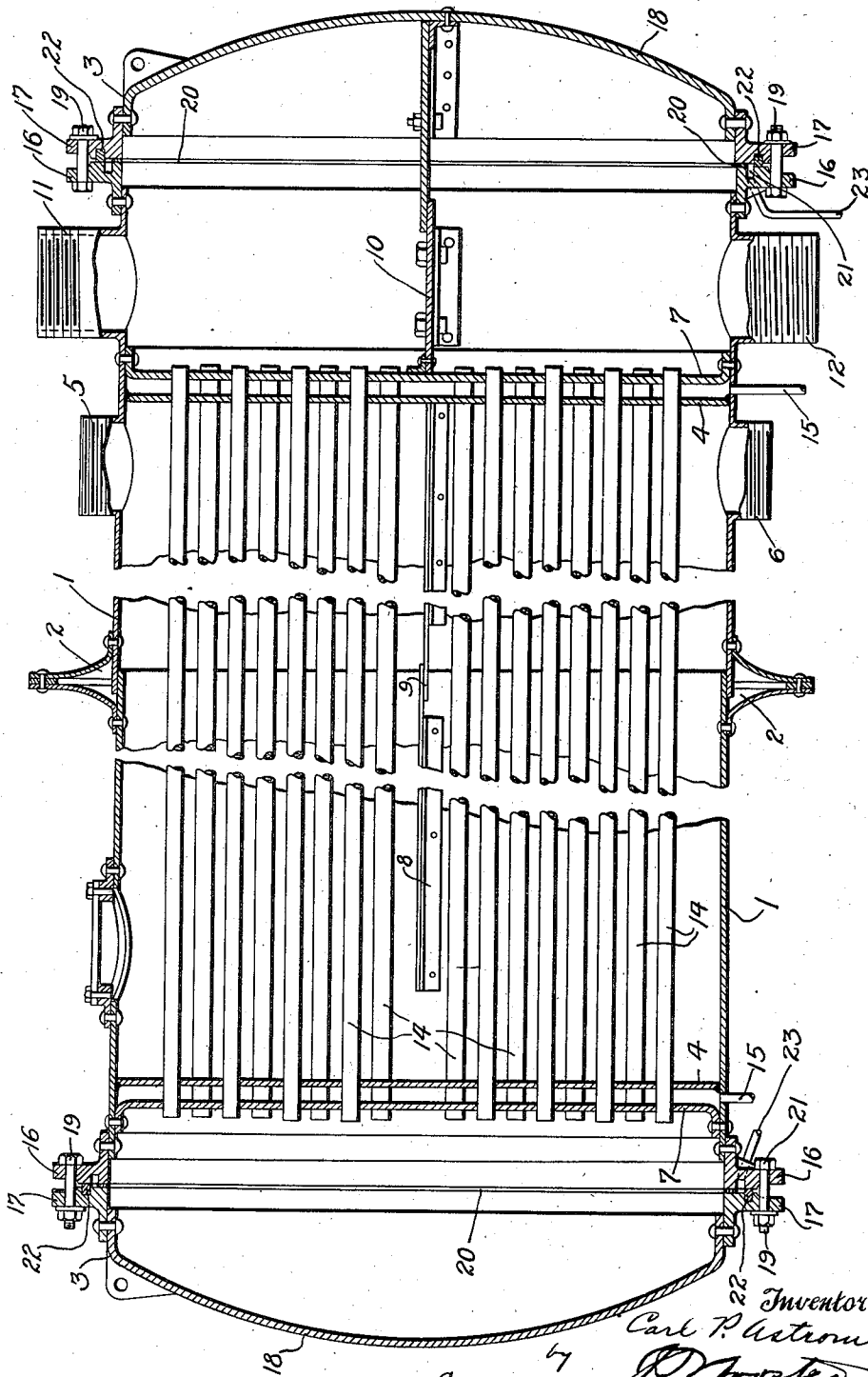


Dec. 19 1922.

1,439,283

C. P. ASTROM.
HEAT EXCHANGER.
FILED JUNE 10, 1920.



Attorney

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UNITED STATES PATENT OFFICE.

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HEAT EXCHANGER.

Application filed June 10, 1920. Serial No. 387,891.

To all whom it may concern:

Be it known that I, CARL P. ASTROM, a citizen of the United States, and a resident of East Orange, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Heat Exchangers, of which the following is a specification.

This invention relates to heat exchangers particularly devices used for heating a relatively cool fluid by heat derived from a hot liquid requiring to be cooled.

Such devices are used, for example, in oil refineries wherein hot oil from stills has to be cooled below flashing temperature and cold oil has to be raised in temperature to increase its fluidity for pumping, or to be preheated before entering a still.

Considerable pressure is used in handling oils under these conditions, and the object of this invention is to provide a single device for exchanging heat, capable of withstanding large difference in pressure and temperature, and so constructed as to minimize the dangers due to leakage. Heretofore, little or no attention has been paid to the prevention of leakage or waste due to leakage, but by this invention are provided arrangements for segregating and draining off leakage with decrease in fire hazard, and increase of cleanliness. There are two sources of leakage in a device of this kind, one being from the chambers formed by the end heads, and connected by tubes in spaced tube sheets, usually carrying the high pressure low temperature fluid, and the other the high temperature space between the tube sheets, which are subject to leakage from the high pressure side. It is objectionable to have one liquid contaminated by the other but it cannot well be avoided unless special precautions are taken. By this invention, double separated tube sheets are provided to form a leakage space which can be readily drained, and the tube sheet on the high temperature side is preferably welded to the shell and the other tube sheet riveted, so that by reason of the tubes going through both and being expanded on both, one is supported by the other. Leakage at the heads is prevented by an arrangement of separated annular packings forming a leakage space which can be readily drained. A plant having exchangers embodying this invention is

not only cleaner but safer than plants heretofore proposed.

In the accompanying drawing, the cylindrical shell 1 has an intermediate expansion joint 2, end heads 3, welded tube sheets 4, 4, forming a chamber intermediate the ends with inlet 5 and outlet 6, as for hot oil under low pressure, and riveted tube sheets 7, 7, flanged and riveted to the shell. The intermediate chamber has a baffle 8 with sliding joint 9, and the end chamber a cross baffle 10 between inlet 11 and outlet 12. Between the tube sheets 7, 4, 4, 7, are tubes 14 which connect opposite sides of baffle 10. The pair of tube sheets farthest from baffle 10, and baffle 8, may be omitted by using continuous return tubes.

By this construction is obtained an intermediate chamber having welded heads or tube sheets, which will ordinarily remain tight, and end chambers having riveted heads or tube sheets cooperating with the welded heads or tube sheets. Any leakage will only get to the space between the sheets, and drain off by pipes 15, without any chance of one liquid mixing with the other. Also, better support is obtained against pressure by using two tube sheets and expanding the tubes into each sheet, as I prefer doing.

The shell is preferably welded longitudinally, and each end provided with a casting 16, welded thereto, or riveted as shown. A cooperating casting 17 carries a head 18, similarly fastened, and castings 16, 17, are bolted together by bolts 19, with a ring packing 20 between. Outside the packing 20 is a groove 21, in one of the castings, as 16, and outside of this is a second ring packing 22. The groove 21 forms a drain for leakage, which runs into pipe 23.

This invention thus provides a heat exchanger of simple construction capable of handling large volumes of fluids with or without pressure, with mixture of the two prevented and leakage disposed of so as to provide a clean and safe installation. Where used for heavy cold oil under pressure of 150 pounds or more to be heated by hot oil from stills, with cooling of the latter below danger of flashing, this invention entirely overcomes difficulties heretofore experienced from leakage.

What I claim is:

1. In a heat exchanger, a shell, double

tube sheets adjacent each end carrying tubes connecting the ends of the shell, one of said tube sheets being riveted and the other welded to the shell.

5 2. In a heat exchanger, a shell, double tube sheets adjacent each end carrying tubes connecting the ends of the shell, one of said tube sheets being riveted and the other welded to the shell, and means for
10 draining the space between the tube sheets.

3. A heat exchanger comprising a shell, an inlet and an outlet from the shell, tubes for carrying fluid between the inlet and outlet, a tube sheet carrying said tubes,
15 a second tube sheet adjacent said first sheet and also carrying the tubes, one of said tube sheets being welded to the shell and the other being riveted thereto, means for draining the space between the sheets, and
20 an inlet and an outlet to the space in said shell outside the tubes for receiving another fluid.

4. A heat exchanger comprising an elongated shell carrying a pair of tube sheets
25 adjacent each end to form end chambers and an intermediate chamber, a plurality of tubes connecting said end chambers, each of said tubes being expanded into each of said tube sheets, an inlet and an outlet for said intermediate chamber, an inlet and an
30 outlet for said end chambers and having

communication with each other only through said tubes, and an expansion joint in the shell.

5. A heat exchanger comprising an elongated shell, a tube sheet adjacent each end thereof to form end chambers and an intermediate chamber, an inlet and an outlet for the end chambers, an inlet and an outlet for the intermediate chamber, an expansion joint in the shell, and a baffle between the intermediate chamber inlet and outlet, said baffle comprising two portions having a sliding joint therebetween and secured respectively to said shell on either
45 side of said expansion joint.

6. A heater exchanger comprising a shell, a pair of separated tube sheets adjacent each end of the shell dividing the latter into an intermediate chamber and
50 end chambers, means for draining the space between each pair of tube sheets, an inlet and an outlet for the intermediate chamber, an inlet and an outlet for the end chambers, a removable head at each end of the
55 shell, a packing between each head and the shell, and a drainage channel outside each packing.

Signed at New York city in the county of New York and State of New York this
60 9th day of June A. D. 1920.

CARL P. ASTROM.