

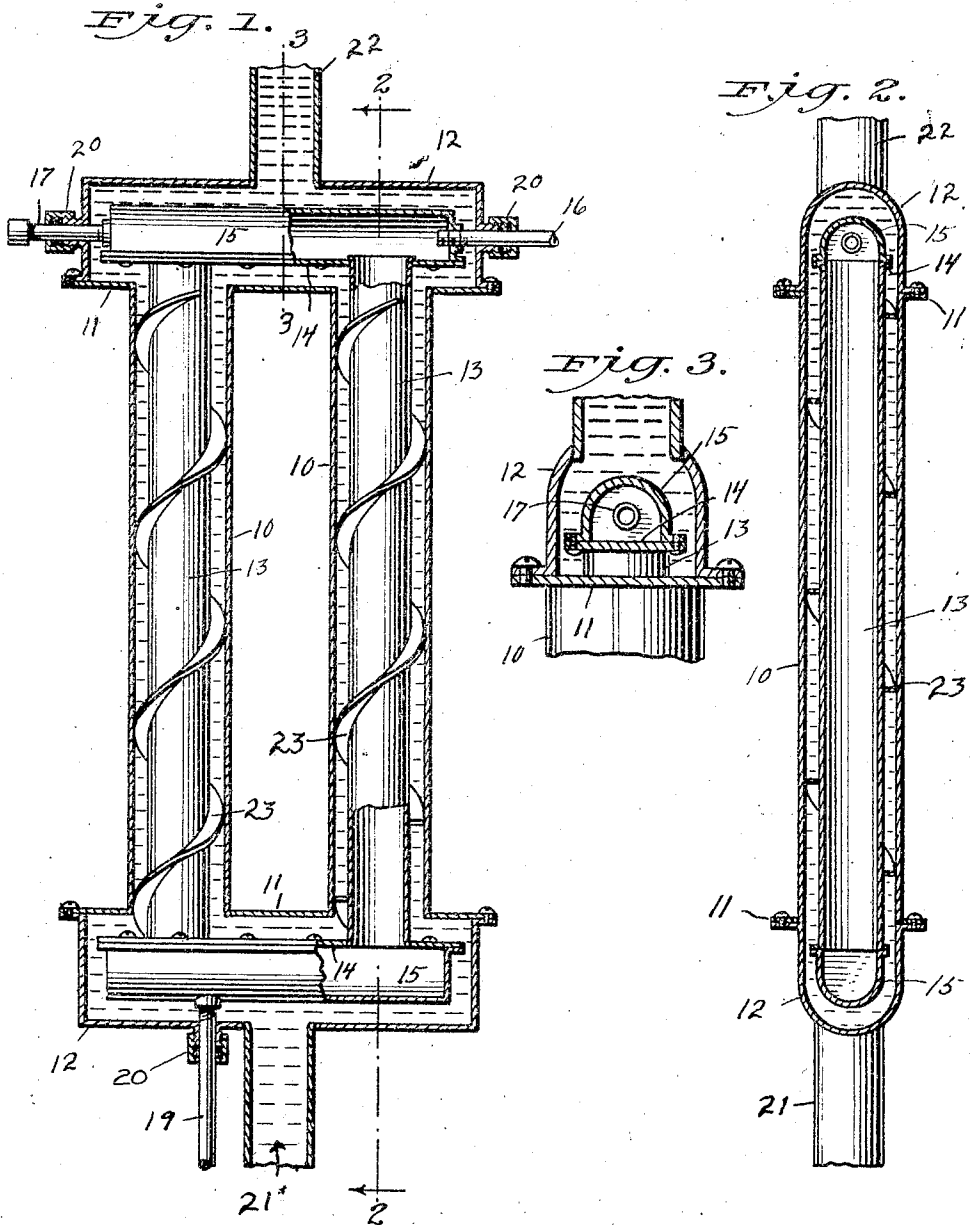
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HEAT INTERCHANGER

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UNITED STATES PATENT OFFICE.

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HEAT INTERCHANGER.

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To all whom it may concern:

Be it known that I, NORRIS H. FROST, a citizen of the United States, and resident of West Hoboken, in the county of Hudson and State of New Jersey, have invented certain new and useful Improvements in Heat Interchangers, of which the following is a specification.

This invention is a counter current heat interchanger particularly adapted for heating a moving body of liquid on its way to a delivery point, such as a body of liquid passing from supply tank or storage tank to a portable tank. One object of the invention is to provide heating apparatus which will rapidly heat the liquid as needed during its passage to a delivery outlet, and thereby obviate the necessity of continuously maintaining a large body of liquid at a high temperature.

As one important feature of my improved apparatus I employ two separate and complete units, each including headers and connecting pipes, and these are so designed and proportioned that one is entirely enclosed within the other. Thus there is no escape for the heat from the inner unit except to the fluid in the outer unit, and said fluid is caused to flow in a comparatively thin film between the units. As a further feature the two units are so designed that the inner unit is supported by its inlet and outlet pipes which are so mounted as to permit of expansion and contraction of the parts.

In the accompanying drawings:

Fig. 1 is a vertical section through an apparatus embodying my invention, and Figs. 2 and 3 are vertical sections on the lines 2—2 and 3—3 respectively of Fig. 1.

In the form illustrated, the outer unit includes a plurality of parallel pipes 10 which connect upper and lower headers. To facilitate assembly each header includes a wall or tube sheet 11 into which the ends of the pipes are expanded, rolled or otherwise secured, and a body or main part 12 which may be substantially semi-cylindrical in cross-section. The tube sheet and the body part are detachably secured together in any suitable manner, as for instance by bolts or screws in peripheral flanges. The inner header is substantially the same in design, although it differs in proportions.

The inner pipes 13 are disposed within the outer pipes, and are longer than the latter but of smaller diameter, so as to leave

thin annular passages therebetween. The inner headers are also formed each of two parts, namely a tube sheet 14 shorter and narrower than the tube sheets 11, and spaced a short distance therefrom, and a main or body part 15 approximately semi-cylindrical and shorter and smaller than the parts 12 of the outer headers. These parts 14 and 15 are detachably secured together, as for instance by screws or bolts. Thus the inner unit may be completely enclosed in the outer unit and a thin space for liquid to be heated will be provided around not only the inner tubes but also around the inner headers.

For supporting the inner unit and also for conducting the heating medium thereto, the upper inner header is provided with a pair of pipes 16 and 17 in alignment with each other and secured in threaded openings in the opposite end walls thereof. These project through stuffing boxes 20 in the end walls of the upper outer header and permit of endwise expansion of the inner header. The pipes thus serve as hangers and one pipe, for instance the pipe 16, may be connected to the steam supply, while the other, 17, may be capped or replaced with a supporting rod of the same size. The lower inner header is provided with an outlet or drain pipe 19 which preferably leads from the lower side thereof and extends at right angles to the pipes 16 and 17 and through a stuffing box 20. Endwise expansion or contraction of the inner pipes 13 is permitted by the sliding of the pipe 19 through its stuffing box. The lower inner header may expand endwise in each direction from this single drain pipe. Fluid to be heated may be conducted to and from the outer unit in any suitable manner, and preferably flows in the opposite direction to that of the heating medium. As shown the lower outer header has a supply pipe 21 entering the bottom wall and the upper outer header has an outlet pipe 22 leading from the top wall. It will be evident that full advantage is taken of the heat from the steam since both the headers and the steam tubes are entirely surrounded by the liquid to be heated. If desired, the path of the liquid to be heated may be lengthened and heat transference promoted by the use of spiral baffle plates 23, arranged in the space between the pipes 13 and the pipes 10. These baffle plates are preferably welded or

otherwise secured to the inner tubes so that they serve the double purpose of baffles and heat radiating fins.

The number of inner and outer pipes which are used to connect the upper and lower steam headers and liquid chambers may vary in different installations, but it is desirable that the cross-sectional area of the annular spaces between the pipes be substantially equal to the cross-sectional area of the inlet and outlet pipes 21 and 22.

I have mentioned headers as "upper" and "lower", but it will be quite obvious that the device need not necessarily be arranged in vertical position in order to be effective, and means other than steam pipes 16 and 17 might be utilized for properly supporting the heater unit in spaced relationship to the walls of the outer unit. It will be evident that rapid and efficient heat transference is obtained by passing the liquid in thin films around the steam headers and steam pipes. There being no connection of the inner and outer headers except the pipes 16, 17 and 19, differential expansion and contraction of the inner and outer members may occur without damage to either member.

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

1. A heat interchanger including an inner unit and an outer unit, each including a series of parallel pipes and a pair of headers, each header including a tube sheet and a semi-cylindrical body part, the pipes of the inner unit being smaller and longer than the pipes of the outer unit and disposed therein, and the headers of the inner unit being disposed within the headers of the outer unit and spaced from the walls thereof, a pair of hangers secured to the ends of one inner header and extending through the ends of the corresponding outer header and one hanger serving as a fluid supply pipe, an outlet pipe at right angles to the hangers and extending from the other inner header through the wall of its corresponding outer header, and stuffing boxes on the outer headers and through which said hangers and outlet pipe extend.

2. A heat interchanger including an inner unit and an outer unit, each including a

series of parallel pipes and a pair of headers, the pipes of the inner unit being smaller and longer than the pipes of the outer unit and disposed therein, and the headers of the inner unit being disposed within the headers of the outer unit and spaced from the walls thereof, and a pair of hangers secured to the ends of one inner header and extending through the ends of the corresponding outer header, and one hanger serving as a fluid supply pipe, an outlet pipe extending from the other inner header through the wall of its corresponding outer header, and stuffing boxes on the outer headers and through which said hangers and outlet pipe extend.

3. A heat interchanger including an inner unit and an outer unit, each including a series of parallel pipes and a pair of headers, the pipes of the inner unit being smaller and longer than the pipes of the outer unit and disposed therein, and the headers of the inner unit being disposed within the headers of the outer unit and spaced from the walls thereof, means for supporting one inner header within its corresponding outer header and permitting longitudinal expansion thereof, and a conduit from the other inner header through the wall of its corresponding outer header and disposed at right angles to said headers.

4. A heat interchanger including an inner unit and an outer unit, each including a series of parallel pipes and a pair of headers, the pipes of the inner unit being smaller and longer than the pipes of the outer unit and disposed therein, and the headers of the inner unit being disposed within the headers of the outer unit and spaced from the walls thereof, a conduit extending from one inner header through the end wall of its corresponding outer header, a conduit extending from the other inner header through the side wall of the other outer header, and in a direction at right angles to the first mentioned conduit, and stuffing boxes on the outer headers and through which said conduits extend.

Signed at Union Hill in the county of Hudson and State of New Jersey this 21 day of April A. D. 1924.

NORRIS H. FROST