

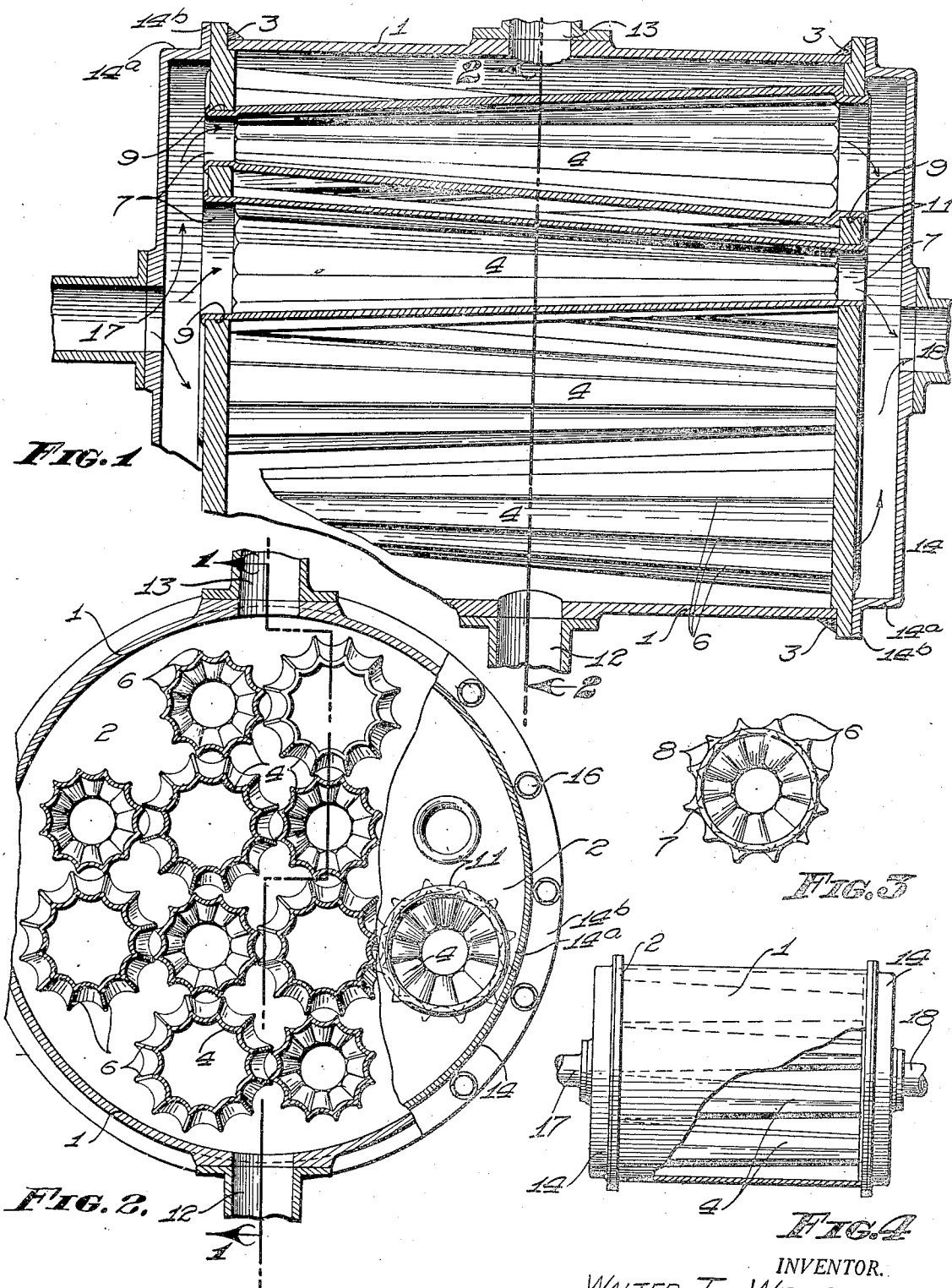
Oct. 22, 1935.

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2,018,163

HEAT EXCHANGE APPARATUS

Filed July 14, 1934



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UNITED STATES PATENT OFFICE

2,018,163

HEAT EXCHANGE APPARATUS

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Application July 14, 1934, Serial No. 735,214

3 Claims. (Cl. 257—236)

The present invention is an improvement in heat exchange apparatus and relates to a tubular conduit of novel structure.

The primary object of my invention is to provide a tube which affords a maximum surface area, for a given length and diameter, adapted to facilitate transfer of heat from one medium to another by convection or radiation.

In the accompanying drawing, Figure 1 is a longitudinal sectional view of a heat transfer unit embodying my invention taken substantially along 1—1 of Figure 2 and with parts and portions in elevation;

Figure 2 is a vertical, central, transverse section of Figure 1, taken on the line 2—2 of said figure with parts and portions in elevation.

Figure 3 is an end view of my improved tube as it would appear from the larger end.

Figure 4 is a reduced partial elevational partial sectional view similar to Figure 1 showing the tubes arranged so that they all taper the same direction.

Referring to the drawing, the numeral 1 indicates an open ended housing, here shown as cylindrical in form, adapted to contain heat exchange apparatus.

Tube sheets 2 close the open ends of tube 1 when welded or otherwise secured thereto, as indicated at 3, and said tube sheets are bored through to receive ends of tubes 4.

Tubes 4 are tapered from end to end and are fluted, as indicated at 6 to form internal and external ribs and provide a perimeter greater than that of a cylinder of regular form of the same diameter and length.

The ends, both large and small, of the tubes 4 are reduced, or swedged either by die forming or by subsequent machine operation, to cylindrical, concentric form indicated at 7, each arris 8 being cut away to abut an inner surface of a tube sheet 2, when said cylindrical portions are extended through bores 9 in said tube sheets, and the ends of tubes 4 rolled, peened, or welded, as indicated at 11, against the outer surface of tube sheets 2.

When the parts enumerated have been assembled as described, an air-tight enclosure is formed around the banded tubes 4, and when any fluid agent is circulated through said container, entering through an inlet pipe 12 and leaving through an outlet pipe 13, said fluid is evenly distributed around the outside of fluted tubes 4.

In order to provide means for continuous circulation of another fluid agent through the inside of tubes 4, for the purpose of heat exchange between the circulated mediums, I provide cover-plates 14, having concentric, annular flanges 14-a and radially disposed flanges 14-b. Said plates

are secured to tube sheets 2, as by bolts 16, extending through flanges 14-b and into tube sheets 2.

Cover plates 14 are provided with centrally disposed pipes, providing an inlet 17 and outlet 18.

The bank formation of tubes is shown in the drawing as composed of a plurality of banks wherein the tubes 4 occur in alternating relation, the small end of each conductor being secured to a tube sheet 2 between the large ends of two adjacent tubes. This arrangement provides an unrestricted passage, of uniform capacity, around the tubes 4 and between the tube sheets 2, for a medium circulated through inlet 17 and discharge 13.

In some installations, where the medium, so circulated, expands rapidly when heated, or where thermo-siphon movement is to be accelerated, the banks can be so arranged that all the smaller ends of said conductors extend through one of the tube sheets 2 and the larger ends through the other tube sheet, as shown in Figure 4.

In such an installation an opposite influence can be applied to the circulated medium by circulating it in a reverse direction.

I claim:

1. A heat exchanger including a pair of headers and two equal groups of similar tubes extending between said headers, said tubes being tapered and those of one group having their smaller ends communicating with one header and the tubes of the other group having their larger ends communicating with said header.

2. A heat exchanger including a pair of headers and two equal groups of similar tubes extending between said headers, said tubes being tapered and those of one group having their smaller ends communicating with one header and the tubes of the other group having their larger ends communicating with said header, a chamber surrounding said tubes, and means for circulating a fluid through said chambers and around said tubes, the tubes of each group being arranged in alternating relation to provide a tortuous path for said fluid.

3. A heat exchanger including a pair of headers and two equal groups of similar tubes extending between said headers, said tubes being tapered and those of one group having their smaller ends communicating with one header and the tubes of the other group having their larger ends communicating with said header, each of said tubes provided with axially directed ribs, and the tubes of the two groups arranged in alternating relation whereby a fluid traversing said tubes tends to flow along the exterior of said tubes.

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