C. B. DALZELL & H. FELDMEIER.

LIQUID COOLER OR HEATER.

APPLICATION FILED MAR. 8, 1911.

1,067,505.

Patented July 15, 1913.

2 SHEETS—SHEET 1.

Fig. 1.

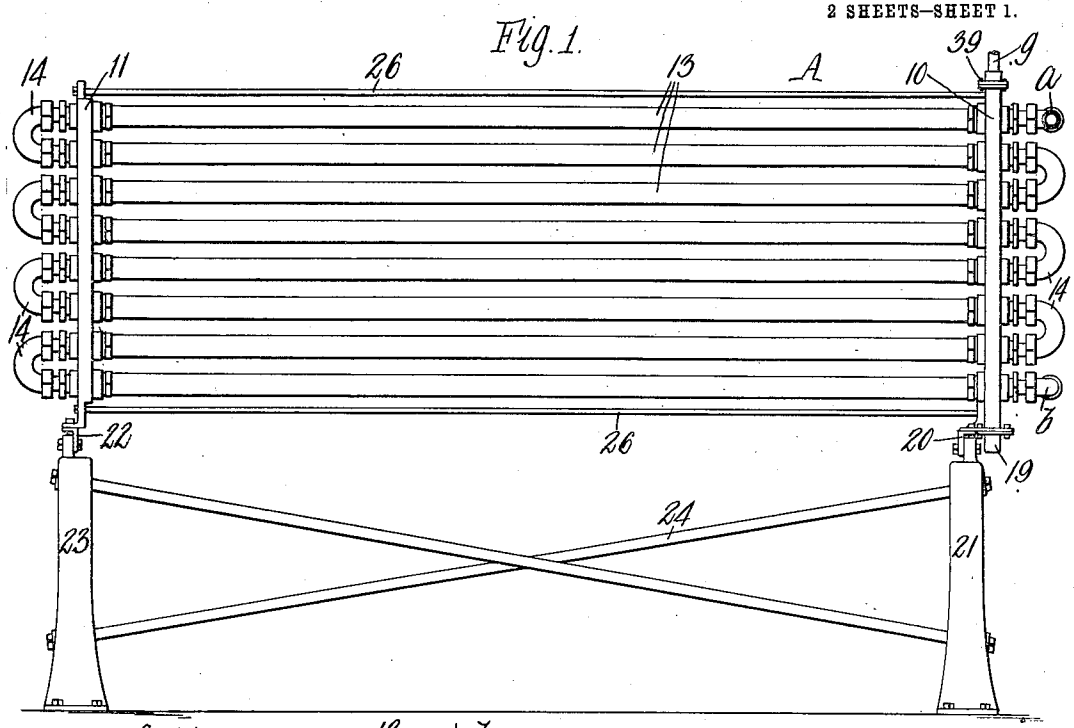


Fig. 2.

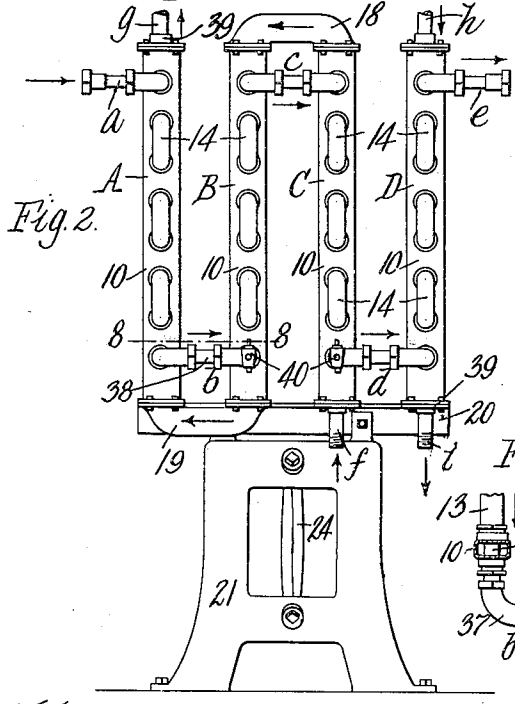


Fig. 3.

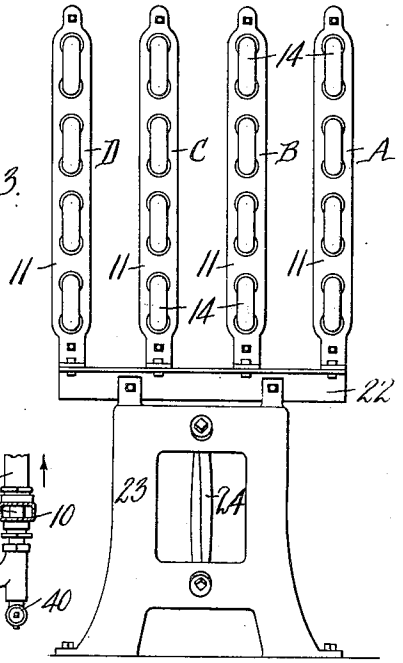
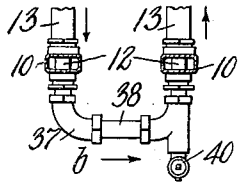


Fig. 8.



Witnesses.

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2 SHEETS—SHEET 2.

Fig. 4.

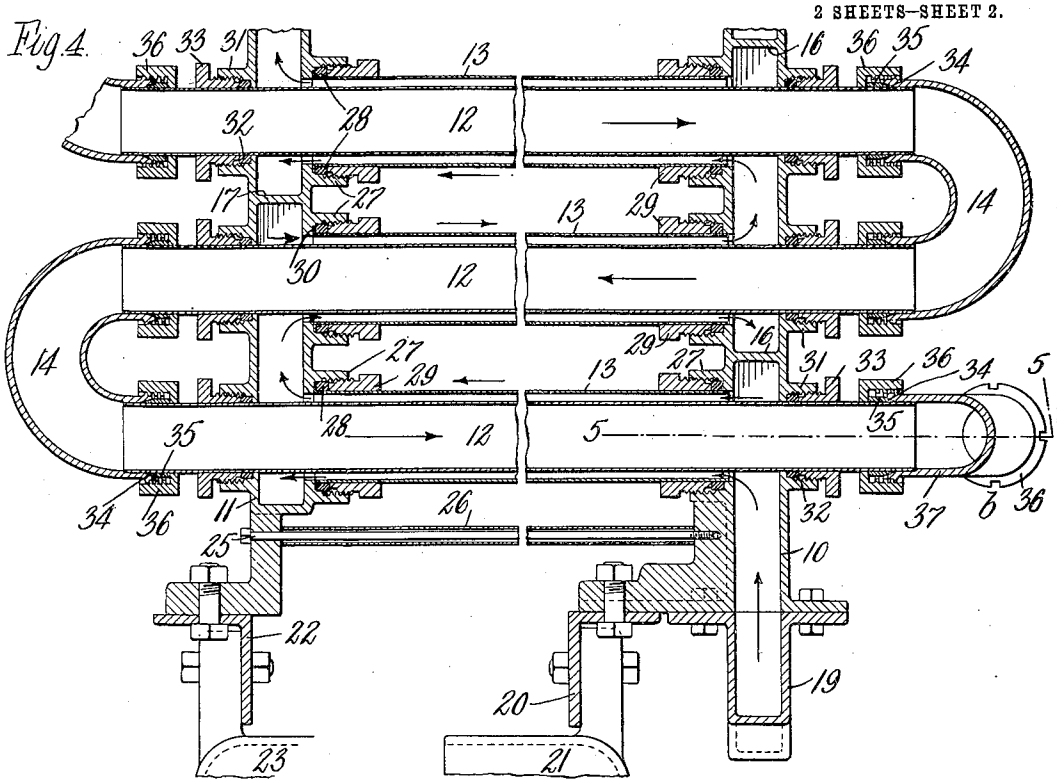


Fig. 5.

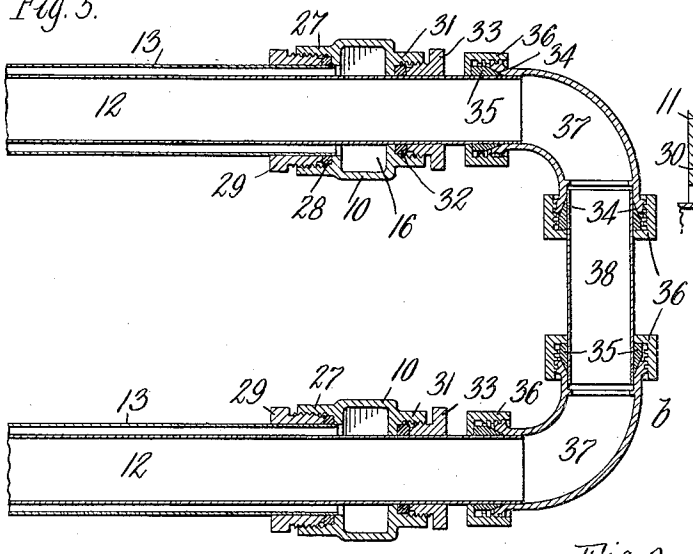


Fig. 6.

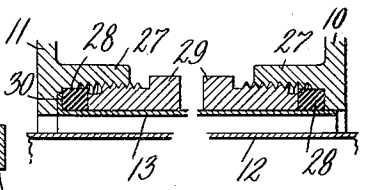


Fig. 7.

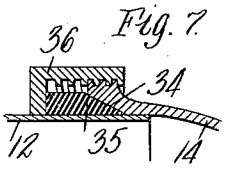
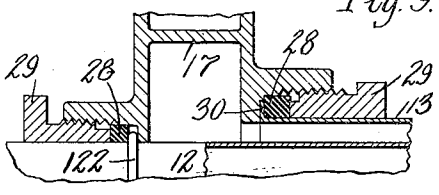


Fig. 9.



Witnesses.

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UNITED STATES PATENT OFFICE.

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LIQUID COOLER OR HEATER.

1,067,505. Specification of Letters Patent. Patented July 15, 1913.

Application filed March 8, 1911. Serial No. 613,163.

To all whom it may concern:

Be it known that we, CHARLES B. DALZELL and HARVEY FELDMEIER, citizens of the United States, residing at Little Falls, in the county of Herkimer and State of New York, have invented a new and useful Improvement in Liquid Coolers or Heaters, of which the following is a specification.

This invention relates to that class of apparatus for cooling or heating liquids in which an inner flow tube or passage is enveloped by an outer flow tube or passage and two liquids flow in opposite directions, one through the inner tube or passage and the other through the annular space between the inner tube and the enveloping tube. If an apparatus of this general character is employed for cooling milk, cream and the like in the process of pasteurization, it is desirable to run the hot milk through the inner tube and the cooling water or other liquid through the annular space between the inner tube and the enveloping tube.

The objects of the invention are mainly to produce an apparatus of this character which is so constructed that the inner surfaces of the inner tube and its return bends and connections are readily accessible for cleaning so that sanitary conditions can be maintained with little effort; that if a leak occurs in the connections of the different members of the inner tube it can be readily repaired; that if a leak occurs in the enveloping tube and its connections it cannot contaminate the milk; that individual sections or units can be readily combined or grouped for use in different ways as circumstances may require, and that the unequal expansion and contraction of different parts of the apparatus when in operation does not cause injurious strains.

In the accompanying drawings, consisting of two sheets: Figure 1 is a side elevation, Fig. 2 a front elevation, and Fig. 3 a rear elevation of the apparatus. Fig. 4 is a fragmentary vertical section, on an enlarged scale. Fig. 5 is a horizontal section on line 5—5, Fig. 4. Fig. 6 is a fragmentary longitudinal section of one of the outer tubes and its stuffing boxes. Fig. 7 is a fragmentary longitudinal section of one of the return bends of the inner tubes and connecting parts. Fig. 8 is a horizontal section on line 8—8, Fig. 2. Fig. 9 is a fragmentary longitudinal section, showing means for preventing longitudinal displacement of the inner tubes.

Like reference characters refer to like parts in the several figures.

The apparatus represented in Figs. 1, 2 and 3, comprises four longitudinal sections or units arranged vertically side by side and grouped so as to form three initial sections or units A B C in which the hot milk is cooled by spring water, and a final section D in which the milk is cooled by ice water or brine. The hot milk enters the inner tube at the upper front end of the first section A through the pipe *a*, flows back and forth and downwardly through the inner tube of this section; flows across to the second section B through the pipe *b* connecting the lower front ends of the inner tubes of these sections, flows upwardly and back and forth through the second section B, flows across to the third section C through the pipe *c* connecting the upper front ends of the inner tubes of these sections, flows downwardly and back and forth through the third section C, flows across to the final section D through the pipe *d* connecting the lower front ends of the inner tubes of these sections, flows upwardly and back and forth through the final section and escapes from the upper front end of the inner tube thereof through the pipe *e*.

Each section or unit comprises upright front and rear manifold heads or headers 10 and 11, which support both the inner tubes 12 and the outer tubes 13 and also serve as return bends for the outer tubes, while the inner tubes extend through and beyond these headers and are connected by return bends 14 outside of the latter. The flow passages of the headers are divided by horizontal partitions or diaphragms 16 and 17 which subdivide the cavities of these headers in such manner that zig-zag flow passages are formed by the headers and the outer tubes through which the cooling liquid flows back and forth and upwardly or downwardly through the section or unit, as indicated by the arrows in Fig. 4.

In the arrangement of sections represented in Figs. 1, 2 and 3, the cooling water enters the lower end of the front header 10 of the third section C through the pipe *f*, flows upwardly and back and forth through the outer tubes 13 and front and rear headers of this section, flows across to the upper end

of the front header of the second section B through a connection or return bend 18, flows downwardly and back and forth through the outer tubes and front and rear headers of the second section B, flows across to the lower end of the front header of the first section A through a connection or return bend 19, flows upwardly and back and forth through the outer tubes and front and rear headers of the first section A, and escapes from the upper end of the front header of this section through the pipe *g*. The brine or ice water used in the final section D enters the front header thereof at the upper end through the pipe *h*, flows downwardly through the outer tubes and front and rear headers of this section, and escapes at the lower end of the front header through the pipe *i*. The connections 18 and 19 are preferably constructed in the form of flat return bends and permit of the ready connection of any desired number of front headers.

The headers are supported upon a rigid frame of any suitable construction. As shown, the front headers are secured at their lower ends to a transverse angle bar 20 which is supported by an upright frame 21, and the rear headers are secured at their lower ends to a transverse angle bar 22 which is supported on an upright frame 23. These frames are connected by longitudinal diagonal rods 24 and the headers are connected by longitudinal rods 25 and tubular stays 26, Figs. 1 and 4.

The outer tubes 13 are connected with the headers by stuffing boxes 27 arranged on the inner sides of the headers and having packings 28 and glands 29, Figs. 4 and 6. Each tube is preferably secured to one header but free to slide in the other header in expanding and contracting. For that purpose the tube may be provided at one end with a flange 30 which is clamped between the bottom of the stuffing box and the packing, while the tube is straight and free at the other end.

The inner tubes 12 extend through the headers and are held in position by stuffing boxes 31 arranged in the outer sides of the headers and having packings 32 and glands 33. The inner tubes extend straight through these stuffing boxes of both headers and are free to expand and contract. In the arrangement of parts represented in Figs. 1 and 4, the inner tubes are held by the resistance of the stuffing boxes only and as the boxes at opposite ends of a tube seldom offer exactly the same resistance the tube moves usually only or mainly at one end in expanding and contracting, very much as if it were fastened at one end and free at the other. It is preferable, however, to hold the tube positively at one end because that prevents any possible longitudinal displacement or crawling of the tube, and for that purpose the tube may be provided at one end with an external collar or bead 122, as represented in Fig. 9, which collar or bead is held in the stuffing box 31 between the bottom thereof and the packing 32, while the tube is free to move in the opposite stuffing box and header in expanding and contracting. This collar or bead may be swaged on the tube or secured to the same by soldering or brazing or in any other suitable manner.

The return bends 14 which connect adjacent inner tubes in the same section are connected with the ends of these tubes by detachable couplings. These couplings are preferably constructed as represented in Figs. 4 and 7, and comprise a flaring or conical seat 34 in the end of the return bend, which latter is provided with an external screw thread, a tapering ring 35 of ductile metal, preferably copper or brass, which enters said seat and is thereby tightened upon the tube which it surrounds, and a shouldered or recessed screw nut 36 which is screwed upon the threaded end of the return bend and forces the ductile ring into the seat and against the tube. Upon removing these return bends the ends of the inner tubes are exposed and as the tubes are straight they can be readily cleaned.

The transverse tubes *b c d* which connect the inner tubes of the adjacent headers are each composed of two elbows 37 and a straight tube 38 connecting the elbows, Figs. 2, 4 and 5. Each elbow is connected to the end of the inner tube 12 and the transverse tube 38 by a detachable metallic coupling, preferably like that which is employed for connecting the return bend 14 with the inner tube, and comprising a conical seat 34, a tapering metallic packing ring 35, and a screw nut 36. The transverse tube 38 has sufficient clearance at its ends in the elbows to permit the connection to be adjusted to the position of the headers.

The connections between the water flow spaces of adjacent headers can be readily changed as the desired grouping of the sections may require. The pipes *g f h* and *i* are each connected with a tapped flange 39, Fig. 2, and by the use of these flanges and of return bends like those shown at 18 and 19 different groupings of sections can be effected to meet the requirements of the user. For illustration, if five sections are employed one may be used with brine or ice water and four with well water and these four sections may be arranged in pairs, each pair having a separate inlet and outlet for the water, so that these four sections are arranged in two pairs in parallel, so to speak, which arrangement would provide for a comparatively larger flow of water, owing to reduced friction, than if these four sections were connected in series. Each of the lower connec-

tions *b* and *d* of the inner tubes is preferably provided with a drain cock 40, as represented in Figs. 2 and 8.

Among the numerous advantages of this apparatus are the following: Each header is a single piece which can be readily cast and is strong and durable. The headers are rigidly secured to the supporting structure and are not strained by the expansion and contraction of the tubes, which latter are free to move in the headers, such movement being considerable, especially when the apparatus is used for heating a liquid. The inner tubes are easily accessible for cleaning and as the couplings applied to these tubes are of metal and contain no rubber or soft packings or gaskets, the tubes and connections can be easily kept in a sanitary condition. The flow space through the inner tubes is of full size throughout. Solder joints are avoided. The headers need not be disturbed for rearranging the grouping of the sections. The capacity of the apparatus can be increased by lengthening the tubes or by increasing the number of sections. The joints of the inner tubes with their return bends are located outside of the headers where they are easily accessible if a leak should occur, and water cannot leak into the inner tubes from the headers or the outer tubes.

We claim as our invention:

1. The combination of two headers having flow passages, outer tubes connecting said flow passages, inner tubes extending through the outer tubes and headers, means for holding said inner tubes fixed with relation to one of said headers, and stuffing boxes provided at the other header through which the inner tubes are longitudinally movable.

2. The combination of two headers having flow passages, outer tubes connecting said flow passages, means for holding said tubes fixed with relation to one of said headers, stuffing boxes provided at the other header through which the tubes are longitudinally movable, and inner tubes passing through said headers and outer tubes.

3. The combination of two headers having flow passages and provided with stuffing boxes in their inner and outer sides, outer tubes connecting said flow passages and having their end portions arranged in said inner stuffing boxes, means for holding said tubes against lengthwise movement in said inner stuffing boxes at one end only, inner tubes extending through the headers and through the outer stuffing boxes, and connections between the outer ends of the inner tubes.

4. The combination of two headers, each provided with transverse partitions which divide the header into separated flow passages, such headers having stuffing boxes on their inner and outer sides, outer tubes having their end portions arranged in said inner stuffing boxes, inner tubes extending through the outer tubes and the headers and through the outer stuffing boxes, means for holding said inner tubes at one end in said outer stuffing boxes, said tubes passing freely through the opposite stuffing boxes, and connections between the outer ends of the inner tubes.

5. The combination of two headers having flow passages, outer tubes connecting said flow passages, means for holding said outer tubes fixed at one end with relation to a header, connections between said outer tubes and the other header permitting longitudinal movement of said outer tubes, inner tubes passing through said headers and outer tubes, means for holding said inner tubes fixed at one end with relation to a header, and connections between said inner tubes and the other header permitting longitudinal movement of said inner tubes.

6. The combination of two headers having flow passages, said headers having stuffing boxes on their inner and outer sides, outer tubes having their end portions arranged in said inner stuffing boxes, one end of each of said outer tubes having a projection clamped in one of said stuffing boxes, and inner tubes extending through the headers, outer stuffing boxes and outer tubes.

7. The combination of two headers having flow passages, said headers having stuffing boxes on their inner and outer sides, outer tubes having their end portions arranged in said inner stuffing boxes, and inner tubes passing through said headers, outer stuffing boxes and outer tubes, each inner tube having a projection near one end thereof clamped in one of said outer stuffing boxes.

8. In an apparatus for changing the temperature of liquids, the combination of two sections, each comprising two headers having flow passages, outer tubes connecting said passages, inner tubes extending through said outer tubes and said headers, and a transverse connection between the ends of inner tubes in both sections, said transverse connection comprising a transverse tube connected to one of said inner tubes, an elbow connected to the other tube, and a detachable coupling connecting said elbow with said transverse tube.

9. In an apparatus for changing the temperature of liquids, the combination of two sections, each comprising two headers having flow passages, outer tubes connecting said passages, inner tubes extending through said outer tubes and said headers and connections between the ends of adjacent inner tubes in the same section, and a transverse connection between adjacent ends of inner tubes in both sections, said transverse connection comprising a transverse tube, elbows connecting said tube with the inner tubes,

and detachable couplings connecting said elbows with said inner tubes and with said transverse tube, substantially as set forth.

10. The combination of two headers having flow passages, outer tubes connecting said flow passages, inner tubes extending through the outer tubes and headers and return bends connecting the ends of the inner tubes, the end portions of the tubes fitting within the return bends, the ends of the return bends having internal conical seats, tapered metal rings surrounding the tubes and fitting said seats, and means for forcing said rings into said seats.

11. In an apparatus for changing the temperature of liquids, the combination of a plurality of sections, each comprising two headers having flow passages, outer tubes connecting said passages, inner tubes extending through said outer tubes and said headers, and connections between the ends of adjacent inner tubes, the ends of all the headers at one end of the apparatus being alike, an inlet pipe connected to one end of the header of the first section, an outlet pipe connected to one end of the header of the last section, and return bends connecting the ends of the headers of adjacent sections, the portions of said inlet and outlet pipes and of said return bends which engage the ends of the headers being alike, whereby the inlet and outlet pipes may be connected to any header and any number of headers may be connected together.

Witness our hands in the presence of two subscribing witnesses.

CHARLES B. DALZELL.
HARVEY FELDMEIER.

Witnesses:
GRIFFITH PRICHARD,
CELIA WOODARD.