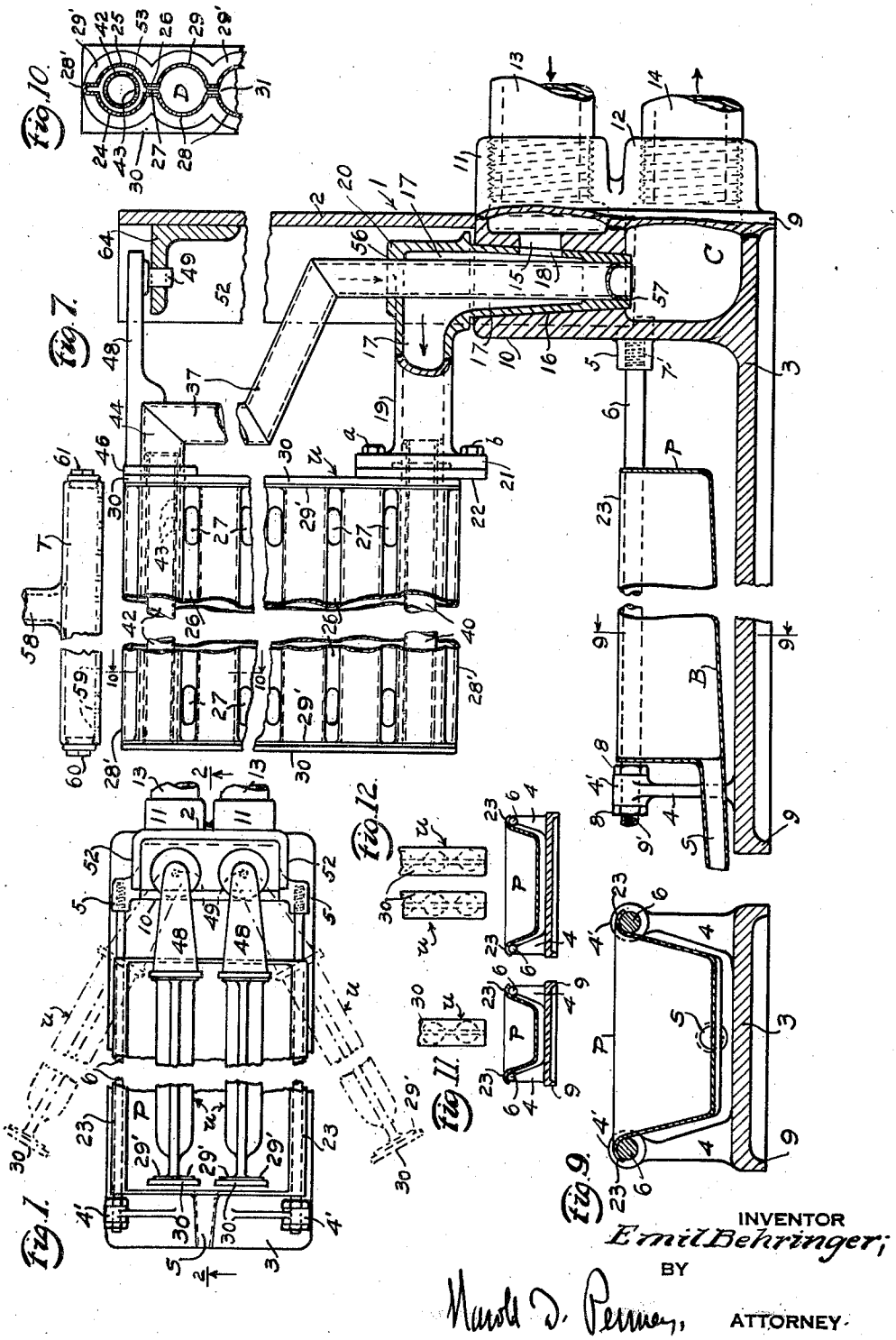
Nov. 24, 1936. E. BEHRINGER 2,061,645

HEAT EXCHANGER

Filed Sept. 19, 1935 2 Sheets-Sheet 1



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HEAT EXCHANGER

Filed Sept. 19, 1935 2 Sheets-Sheet 2

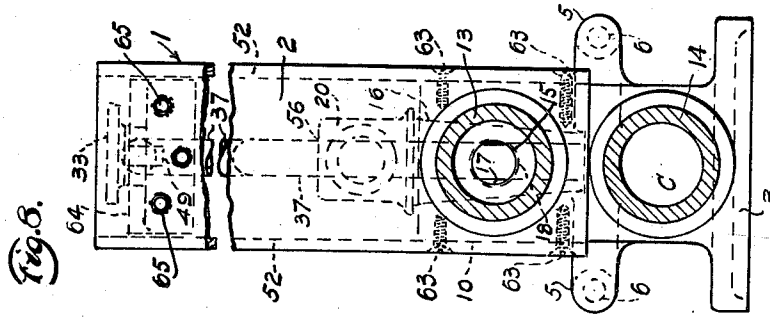


Fig. 6.

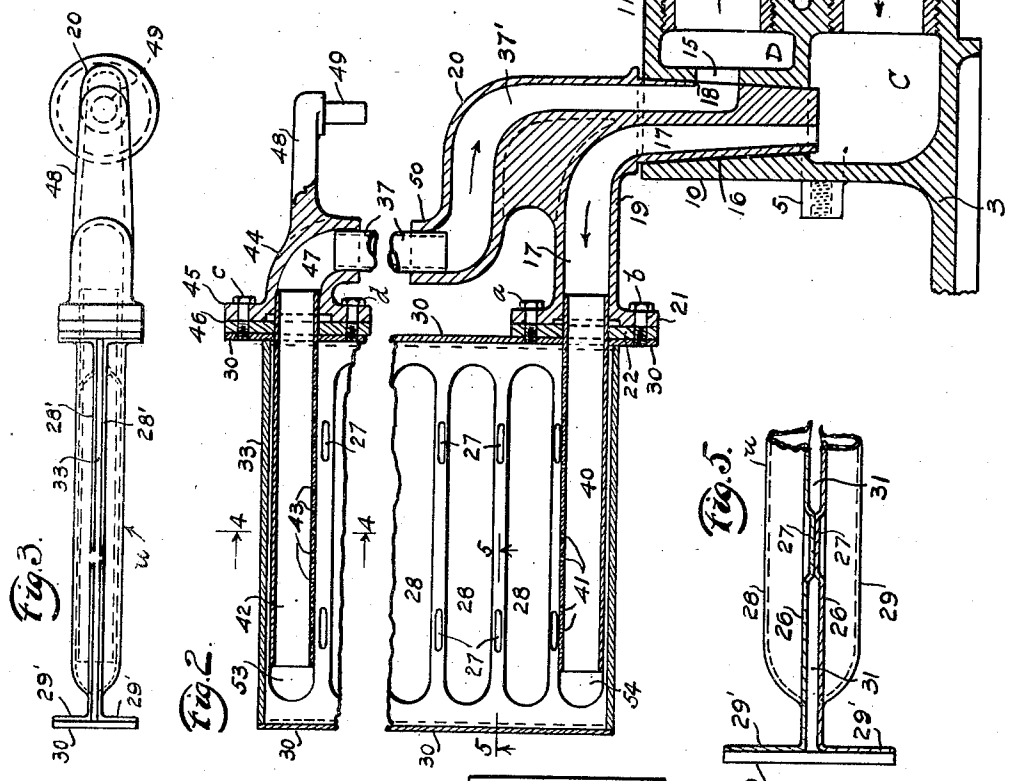


Fig. 3.

Fig. 2.

Fig. 5.

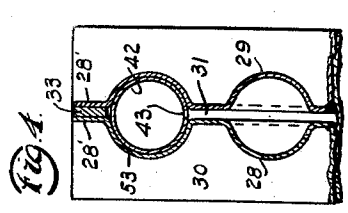


Fig. 4.

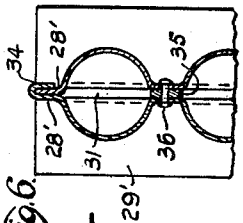


Fig. 6.

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2,061,645

HEAT EXCHANGER

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Application September 19, 1935, Serial No. 41,216

18 Claims. (Cl. 257—179)

The present invention relates to an improvement in heat exchangers, for use in heating or cooling liquids, such as milk, by gravitationally trickling such liquids upon the exterior of the multiple sections of a single cooler unit, or a plurality, or parallel gang sections of such unit exchangers, the number of such units in a gang, controlling the capacity and volume of liquid treated over a given period of time. During such liquid trickling over the exterior of the units a hot, or cold, liquid is passed through such units, counterwise to the gravity flow of the trickled liquid and thereby alters the temperature of the trickled liquid.

Where the present improvement is used as a milk cooler, to lower the temperature of milk after the pasteurizing step, it is necessary, after a run of milk, to clean and sterilize the outer surfaces of the exchanger units, which contact with the milk.

It is customary to utilize two or more exchanger units, in a parallel group, according to capacity requirements. Where two or more units are required they are usually operated with the units in parallel relation to each other, and as close together as is practicable, to save space, and under these conditions, it is imperative to provide means to permit of exposing the normally inaccessible faces of the adjacent units for the purpose of cleaning and sterilizing.

To the foregoing ends, the present improvement provides a structure, wherein the inlet and outlet ends, of the continuous passage of each exchanger unit, are combined at a single point, preferably at or near the bottom of each unit, the combined inlet and outlet of each unit, being so conformed as to form each a separate port, but combined in a common cylindrical structure, in the form of a tapered valve, thereby to form, with an upper alined, solid pivotal member, a pivotal axis upon which the entire cooler unit may be swung, angularly, or radially, away from its next adjacent, parallel unit, or units.

The foregoing, and other features of advantage will appear as the herein description proceeds, and it is obvious that modifications may be made in the herein structure without departing from the spirit hereof or the scope of the appended claims.

In the drawings accompanying,

Fig. 1 is a plan view of an exchanger, showing two units in a single assembly;

Fig. 2 is a fragmentary, vertical view of a unit, in section, with parts broken away, taken on the line 2—2, Fig. 1, looking in the direction of the arrows;

Fig. 3 is a plan view of the unit of Fig. 2, removed from its pivot support;

Fig. 4 is an enlarged, fragmentary sectional view taken on the line 4—4, Fig. 2, looking in the direction of the arrows;

Fig. 5 is an enlarged, fragmentary sectional view, taken on line 5—5, Fig. 2, looking in the direction of the arrows;

Fig. 6 is an enlarged, fragmentary transverse sectional view of a modified form of cooler unit, the section being similar to that as described for Fig. 4;

Fig. 7 is a vertical, fragmentary view, partly in section and broken away to better show the details, in a form modified over Fig. 2;

Fig. 8 is a rear view of Fig. 7;

Fig. 9 is a sectional view of the base taken on line 9—9, Fig. 7, looking in the direction of the arrows 9—9;

Fig. 10 is a fragmentary, sectional view taken on line 10—10, Fig. 7, looking in the direction of the arrows; and

Figs. 11 and 12 are sectioned, fragmented, reduced views, similar to Fig. 9, showing the relative position of a single unit exchanger over a receiving pan, and a double unit exchanger over a receiving pan, respectively.

Indices indicating like parts are the same throughout the drawings herewith.

The present device comprises, in its main embodiments an L-shaped support, generally denoted by 1, and includes a cast metal base portion 3, Fig. 7, having near its outer ends, spaced support struts 4—4, these being provided with upper bored bearings 4'—4', Fig. 9, which support the outer ends of two strut rods 6—6, the inner threaded ends 7 of which, are firmly screwed into threaded bosses 5—5, Fig. 7, only one being shown in the sectional view, Fig. 7. The outer ends 9, of rods 6—6 are threaded to receive thereon lock units 8—8 on opposite faces of the bearings 4'—4', thus to lock the outer ends of said rods 6—6 to the upright struts 4—4.

As shown in Figs. 7, 9, 11 and 12, these rods not only act as stiffeners for the base 3 and its integral upright valve column 10, Fig. 7, but also act as pan supports for the treated liquid receiving pan P which is located below the cooler units, and rests upon the strut rods 6—6, by means of curled over longitudinal edges 23—23. The pan is open at its top and its bottom B slopes from the rear to the front edge of the pan, said front end being provided with a discharge spout S, whereby

the treated liquid falling into said pan P is gravitationally discharged through spout S to any desired type of receiver, or duct, not shown.

The pan is readily accessible, for removal, cleaning and replacing, as it merely rests on rods 6—6 in operative assembly.

Where only one cooler unit is used, as in Fig. 11, the pan P lies directly under the unit U, but where two or more units U are used, as in Fig. 12, the pan P is wider and rests directly under said units U—U. In some installations two or more cooler units are used in a gang, according to capacity output of treated fluid required.

In Fig. 7, the cooler unit of Fig. 7, generally denoted by U, is constructed of dual, pressed sheet metal plates, so stamped or pressed as to form opposing sides enclosing, continuous duct forming elements 24—25—28—29, as in Figs. 5 and 10, the sheets are so pressed as to form said duct elements 24—25—28—29 and intermediate baffle flanges 26—26 etc., said baffles being not completely closed, or in contact interiorly, thus leaving a space 31 between each duct interior and between each baffle 26 on each cooler forming plate. Spacers 27, in the form of oval indents, Fig. 7, are so pressed into the spaced baffles 26, as to contact on a medial line, Fig. 5, and, these contacts 27, may be welded so as to connect the duct forming members together, at intermediate points as shown in Figs. 2 and 7.

The upper and lower edges of the duct forming plates, may be inturned, as at 28', Figs. 7 and 10, and butt welded, or the edges may, as in Fig. 4, be reinforced by a metallic strip 33 placed between the upper and lower edges 28—28, and welded.

The upper and lower edges 28' may also be in the form of a lap weld 34, Fig. 6, with spotting fillers 35, as an equivalent to the weld spots 27 of Fig. 7, riveted as at 36, Fig. 6, or welded, at the intermediate points of attachment of the duct forming side plates, and as described for the weld points 27 of Fig. 7.

The opposite sides of the exchanger units may have opposed, right angled flanges 29'—29' developed from the side plates forming the exchanger units U, as in Figs. 3 and 5, and the flanges united by a closure strip 30, which may be welded to both flanges 29' on each side of the unit. By this manner of construction, the exchangers U are unified into a light, rigid, liquid tight construction by reason of the unified top edges, side edges and intermediate weld points 27 or 35.

A unit, constructed as above described, is therefore formed into a flat compartment consisting of parallel elongate ducts with intermediate parallel liquid flow constraining baffles 26, and as the cooling liquid enters at the bottom of a unit, as will later be described in detail, it is caused to flow upwardly from one duct, through the constrained baffle passage, to the next successive duct above, until it reaches the topmost duct and is then returned to the liquid cooling means, not shown, but understood in this art. Thus the flow of liquid, upwardly, is simultaneous, along the entire length of the ducts and the full width of the unit U.

Two forms of inlet and outlet connections are shown herein, one form being mostly of cast iron construction as in Fig. 2, the other form, Fig. 7, being somewhat similar but having its outlet duct 37 made up of welded piping.

In Fig. 2, one side 29'—30 of the unit U, has an upper outlet fitting and at the lower end an inlet fitting, the outlet comprising an opening in said flange 29 and closure plate 30, into which is fitted an outlet distributor pipe 42, which extends into the upper duct for substantially its entire length, said distributor 42 being open at both ends, and is provided along its lower face with a plurality of orifices 43.

One end of the distributor 42 is firmly fitted into an outlet elbow pipe fitting 44, which is held by its flange 45 to a ring flange 46, by bolts *c* and *d*, flange 46 being welded to the closure strip 30.

The duct 47, of outlet elbow 44, turns at right angles to the distributor 42, and receives therein, in a liquid tight fit, one end of a down pipe 37, the opposite end of which is tightly fitted into the upper end 50 of a plug valve elbow 20.

The valve elbow 20, has its lower end 16 tapered and ground, and is carefully fitted, valve like, into a corresponding valve seat in the upright post 10 of base 3. This valve is so fitted that the attached unit U may be swung thereon, as will be described later.

The plug valve 16 has two ducts therein running parallel to each other, one being inlet duct 17, the other being outlet duct 37'. As in Fig. 2, the inlet duct 17, terminates in an integral flange 21, which is bolted to a pipe flange 22, by bolts *a* and *b*, the ring flange 22, being welded to the closure strip 30 of the unit. An inlet distributor pipe 40 fixedly mounted in the inlet 17, and extending into substantially the entire length of the lower duct 54, is supplied with a row of perforations 41 along its top surface, and acts as an inlet liquid flow distributor, and being open on both ends as described for outlet distributor 42, it causes a general dispersion of the inflowing cooling liquid, upwardly, thus to distribute the upward liquid flow along the entire width of the unit U.

The inlet duct 17 extends downwardly and opens into chamber C, which in turn threadedly receives therein an inlet pipe 14 connecting to the source of cooling liquid supply.

The outlet duct 37' passes downwardly and opens up at the side of the plug valve 16 at 18, and this latter port normally registers with a valve port 15 in the side of the valve upright 10, and port 15 communicates with outlet chamber D, which in turn is threadedly connected by an outlet pipe 13 to the cooling liquid source of supply.

On the elbow fitting 44 there is integrally mounted an offset arm 48, on the lower face of which is mounted an integral, solid pivot 49, the axis of which coincides with the axis of the plug valve 16, so that when the complete exchanger unit is suspended by these members in means to be later described, the whole unit U, may be moved on said pivots, such movement automatically cutting off the cooling liquid by reason of the cut-off action of the valve port 18.

The inlet and outlet structure of Fig. 7, while varying somewhat from that of Fig. 2, is as follows: In the showing of Fig. 7, like numerals indicate like parts throughout, except that, the inlet valve 14, and the outlet valve 13 of Fig. 2, are reversed in the structure of Fig. 7 wherein the inlet valve is 13 and the outlet valve is 14. Minor modifications of structure permit of this reversal of porting with no change in function, or advantages. The plug valve 16 and the solid pivot 49 of Fig. 7 are constructed the same as and function as described for Fig. 2.

In Fig. 7, the distributor pipes 40 and 42 are present, each being connected to their respective inlet and outlet connections and function in the same manner as described for Fig. 2.

Inlet connections of Fig. 7 are as follows, pipe 13, connected to cooling liquid supply source, supplies liquid through valve body port 15, through valve port 18 to duct 17, which is formed by the valve plug 16, and its integral upper body portions 19—20. The flanged fitting 21 on 19, is held by bolts *a*—*b* to the welded on ring flange 22, as described for Fig. 2.

The outlet connection comprises a, preferably, welded pipe having a straight portion 44 welded to a flange 46, which in turn may be welded to closure strip 30.

Connection 44, in turn is welded by an angular joint to outlet pipe 37, this latter portion, at its lower end, entering plug valve 16 axially, and being fitted tightly to the plug valve at 56 and at its lower axial inlet end 57.

As thus described, liquid enters pipe 13, through port 15, past cut-off port 18, through duct 17 to distributor 40, thence upwardly through pipe 42, through outlet pipe 37 to chamber C and thence through pipe 14 to supply source.

As a means for gravitationally supplying milk in a trickle at the upper edge of each unit U, and as in Fig. 7, there is located in a longitudinally central position over each unit a trickle pipe, denoted by T, which is connected to a source of milk supply by connection 58. The trickle pipe is provided along its lowermost surface with a row of perforations 59, through which the flow of milk passes, and is plugged at its ends with threaded clean-out plug assemblies 60 and 61. The trickle pipe may be mounted in any suitable manner in operative position above the unit U, and as heat exchangers of the herein type are invariably enclosed in an openable, dust-proof housing, not shown in the present instance, the trickle pipe may be mounted to the upper part of said housing.

As a means for pivotally and operatively supporting the units U in parallel and movable relation, there is shown, in Figs. 7 and 8, a cooperative upright, post-like construction, which is mounted upon the horizontal base 3, and at one end thereof.

In Fig. 7 the exchanger supporting structure is shown as comprising an upright length of channel beam 2, the side webs 52—52, as in the rear view, Fig. 8, at their lower ends spanning the valve block body 10, and being rigidly held thereto by any suitable means, in the present instance machine screws 63. Riveting may also be used.

The channel beam at its upper end, Fig. 7, is provided with a short length of angle iron 64, which is rigidly affixed between the channel sides 52, such as by screws or studs 65—65—65 by one leg thereof, the other leg standing out horizontally from the web of said channel and being provided with a pivot hole in which solid pivot 49 is mounted, in axial relation to the axis of plug valve 16. As thus mounted, the unit U is easily swung to either side of its normal operative position, manually, and thus the surfaces of each unit, in a gang, are accessible for cleaning.

Fig. 1 discloses, in full and dotted lines, in plan, the normal operative, and cleaning positions, respectively, of an exchanger, comprised of two units, which are mounted upon a base and support as described for Figs. 1 and 8, except, that, the channel beam upright and base are of double the width of the upright of Fig. 8.

As thus laterally described, it is obvious that in order to repair, or replace a unit it is only necessary to lift the unit upwardly from its pivotal suspension, with a corresponding reverse action to reseat a unit.

Having thus described the invention what is claimed is:

1. The combination with a heat exchanger comprising a cooler unit having longitudinally connected ducts and baffles and a valve having a common inlet and outlet therefor, of a base member, an upright, valve receiving portion at one end thereof, struts connecting one end of said base member to said valve receiving portion, an upright support on said valve receiving portion and a pivot means between the upper end of said upright support and said heat exchanger, said pivot being located on the axis of said valve and valve receiving portion.

2. The combination with a heat exchanger comprising a flat cooler unit formed of sheet metal and having longitudinally inter-connected ducts and baffles and having an inlet and outlet, a single valve having inlet and outlet ports connected to said inlet and outlet, of a base member, an upright, valve receiving portion at one end thereof in which is rotatably seated said valve, inlet and outlet pipes in said valve receiving portion communicating with said valve inlet and outlet ports, an upright support on said valve receiving portion and a pivot means between the upper end of said upright support and said heat exchanger, said pivot being located on the axis of said valve and valve receiving portion.

3. A heat exchanger, comprising a cooler unit having an inlet and outlet and having longitudinal ducts connected longitudinally by liquid constraining baffles, baffle spacing indents in spaced relation along said baffles on both sides of said exchanger, the indents of one side of said exchanger contacting with the indents on the other side of said exchanger, said opposed indents being connected together at said points of contact and around the outer edges thereof, a plug valve having inlet and outlet ports connected to said inlet and outlet respectively, and a pivot connected to said exchanger in alinement with the axis of said plug valve.

4. A heat exchanger comprising a cooler unit having a plurality of superposed, longitudinal liquid conducting ducts connected by longitudinal liquid constraining passages, an inlet and an outlet therefor, said inlet and outlet being located in a single valve below said unit, a valve body having a seat for rotatively seating said valve on its axis and forming a means in common for controlling the incoming flow of liquid to said inlet and the outgoing flow of said liquid to said outlet and a pivot on said exchanger alined with the axis of said valve.

5. A heat exchanger comprising a cooler unit having a plurality of superposed, longitudinal liquid conducting ducts connected by longitudinal liquid constraining passages, an inlet passage and an outlet passage therefor, a perforated distributor pipe in said inlet passage, a perforated pipe in said outlet passage, said inlet and outlet passages terminating in a single valve at one end of said unit, a valve body having a seat for rotatively seating said valve on its axis and forming a means in common for controlling the incoming flow of liquid to said inlet passage and the outgoing flow of said liquid from said outlet passage, and a pivot on said exchanger alined with the axis of said valve.

6. A heat exchanger comprising a cooler unit having a plurality of superposed longitudinal liquid conducting ducts connected by longitudinal liquid constraining passages, an inlet passage and an outlet passage therefor, perforated pipes in said inlet and outlet passages, said inlet and outlet passages terminating in a single valve at one end of said unit, a valve body having a seat for said valve and forming a means in common for controlling the incoming flow of liquid to said inlet passage and the outgoing flow of said liquid to said outlet passage, and a support pivotally mounting said unit and valve body.

7. The combination with a liquid trickling means of a heat exchanger comprising a cooler unit having a plurality of superposed liquid conducting ducts connected by liquid constraining passages, an inlet passage and an outlet passage therefor, perforated liquid flow control pipes in said inlet and outlet passages, said passages terminating in a single valve, a valve body having a valve seat for rotatably supporting said valve and having inlet and outlet ducts therein, said ducts communicating with the passages in said valve, a support for pivotally and removably mounting said unit and valve body, struts on said support and a liquid receiving pan removably mounted on said struts.

8. A support for a unit of the class described comprising a base portion and an upright portion, said upright portion including an upright valve seat, a pivotal connection in vertical alinement with the axis of said valve and an inlet and outlet opening into said valve seat and spaced strut rods connected between said base and upright portions forming a liquid receiving pan seat.

9. A heat exchanger unit formed of two sheet metal stampings flanged at their outer edges and joined together at said flanged outer edges in a liquid tight jointure, a plurality of liquid conducting ducts connected by liquid constraining ducts therebetween, means for connecting the liquid constraining ducts together at spaced intervals along said latter ducts, and inlet and outlet means on said unit merged at their terminals into a ported valve, said terminals forming a base opening and a side opening in the valve.

10. A heat exchanger comprising a cooler unit having opposed plates forming parallel liquid controlling ducts which communicate directly throughout their length by restricted passages, there being parallel opposed indents in the plates between the ducts, said plates being sealed together at their top and bottom edges and also at their opposed end edges, one pair of said end edges having therein, and in communication with the respective bottom and top terminal ducts, inlet and outlet ports, said ports having their outer ends adjoining and disposed one above the other, whereby fluid entering through one of the ports and the associated terminal duct may flow directly through the interposed ducts to the other terminal duct and associated port.

11. A heat exchanger comprising a cooler unit having opposed metal plates forming parallel liquid controlling ducts which communicate throughout their length by restricted passages there being narrow opposed indents in the plates between the ducts, said indents having projecting inwardly therefrom opposed spacers, said plates being sealed together at their margins adjacent the two outer ducts and the plates being also sealed together at the opposite ends of the ducts, one pair of said ends having connected therewith, and in communication with the respective outer ducts, inlet and outlet tubes, said tubes having their outer terminals adjacent and disposed one above the other, whereby liquid entering through one of said terminals and its associated duct may pass directly through the interposed ducts to the other outer duct and associated terminal.

12. A heat exchanger comprising in combination a base having inlet and outlet chambers disposed one above the other, said base having a hollow seat vertical to one of said chambers and the other chamber being open into one side of the seat; a cooler unit comprising a tier of parallel interconnected liquid conducting ducts disposed above the base, the two outer ducts having inlet and outlet tubes extending therefrom, and a valve seated in said hollow and wherein said tubes have their terminals, said terminals being in communication with the respective chambers.

13. A heat exchanger including in combination a base having therein horizontally disposed upper and lower inlet and outlet pipes, a cooler unit including a vertical tier of horizontally disposed vertically communicating ducts, tubes extending from the top and bottom ducts at one end of the casing and being connected with the respective pipes, and a pair of fluid control pipes extending from said tubes into the top and bottom ducts, each of said control pipes having a line of perforations therein.

14. In a heat exchanger, the combination of a base having therein upper and lower inlet and outlet pipes; a cooler unit including a vertical tier of horizontally disposed interconnected ducts, said ducts having continuous restricted passages therebetween; tubular means supporting said casing and connecting the top and bottom ducts with the respective pipes, and a pair of perforated fluid control pipes extending from said tubular means into said top and bottom ducts.

15. In combination, a base having therein a pair of conical seats, vertically disposed inlet and outlet chambers for each of said seats, which latter have their wide ends uppermost, heat exchanging means including two vertical tiers of interconnected horizontally disposed ducts, pairs of tubes extending from the top and bottom ducts of the tier, and conical valves pivotally disposed in said seats and wherein the respective pairs of tubes have their terminals, said terminals being in communication with the chambers.

16. In combination, a base having a pair of adjoining conical seats, inlet and outlet pipes having their passages opening into the wall of each seat, one of the openings being in the side wall of the seat; heat exchanging means including two adjoining tiers of ducts, a pair of tubes extending from the top and bottom ducts of each tier, and conical valves pivotally disposed in said seats, each pair of the tubes having its terminals in one valve, the bore of one of the tubes of each pair being normally in communication with the side opening of the seat, so that said tiers may be swung outwardly, whereby to close the passage of one of the respective pipes.

17. In a heat exchanger, a cooler having a pair of stamped sheet metal plates providing plural parallel liquid controlling ducts which communicate directly substantially throughout their

length, said plates having their outer edge portions metallically joined, there being baffles or limitedly spaced portions in the plates between the ducts, and opposed engaging spacers projecting inwardly from said baffles.

18. The combination of a heat exchanger comprising a cooler unit including elongated horizontally disposed interconnected ducts, there being restricted passages disposed between said ducts throughout the length thereof, said ducts having a valved vertical terminal at the lower part of one end thereof, a base having a vertical valve receiving portion wherein said terminal is journalled, an upright support cooperating with said base and having a pivot seat disposed coaxial with said portion, and pivot means extending from the top part of said end of the connected ducts, whereby the latter may be swung in a horizontal plane above their terminal, said means being pivoted on said seat.

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