June 18, 1935. J. F. WINKLER 2,005,515

FLUID CONDITIONING DEVICE

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Fig. 1.

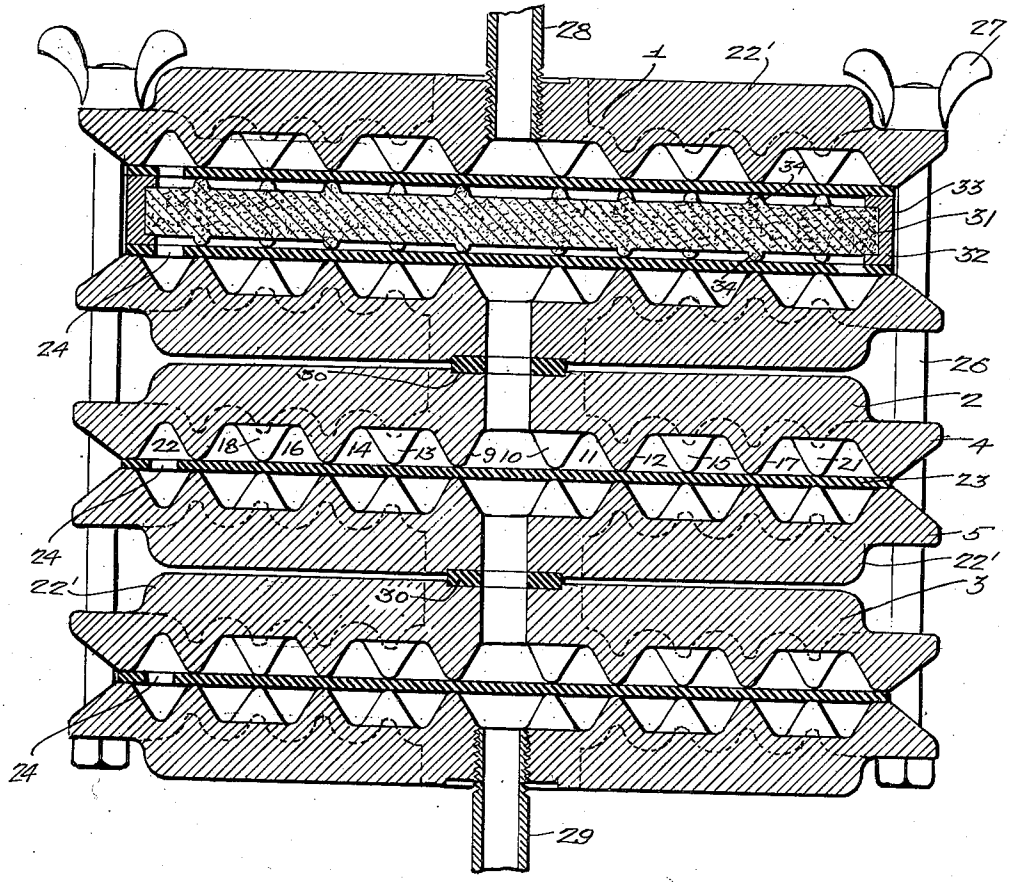
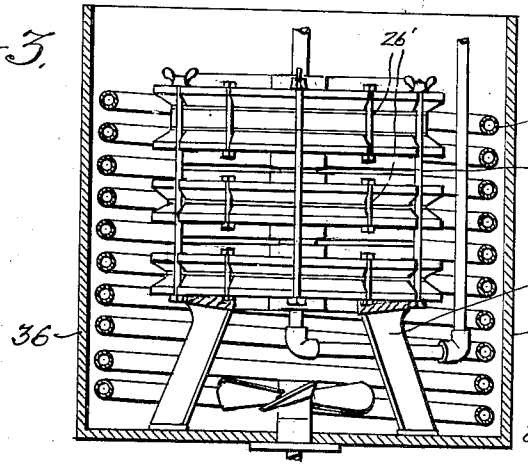


Fig. 3.



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Fig. 2.

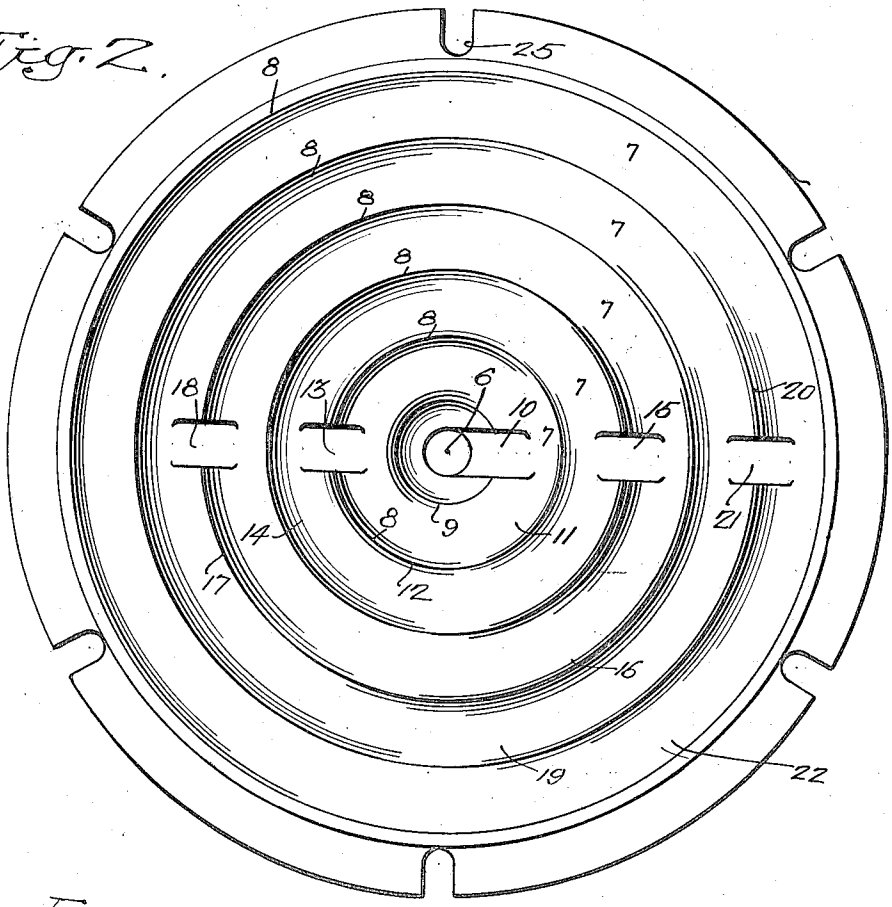
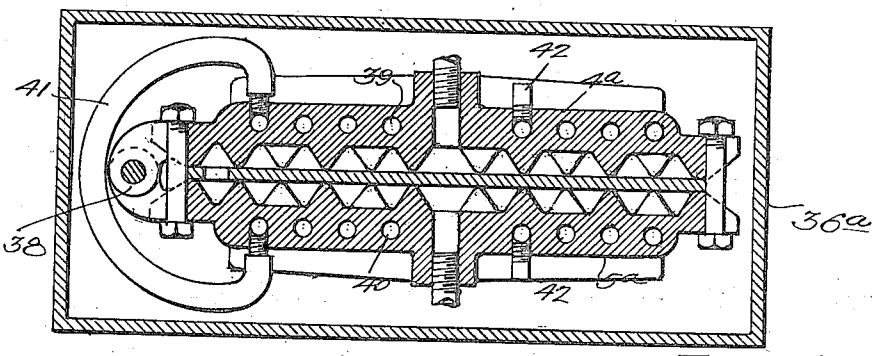


Fig. 4.



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Fig. 5

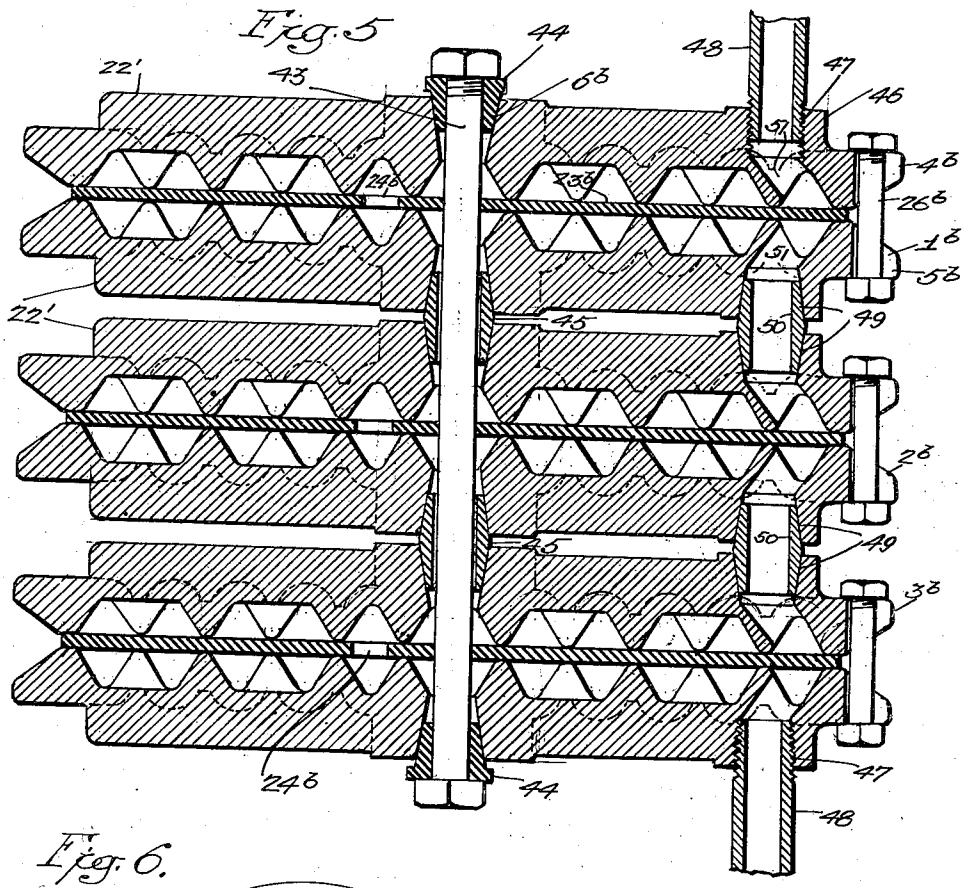
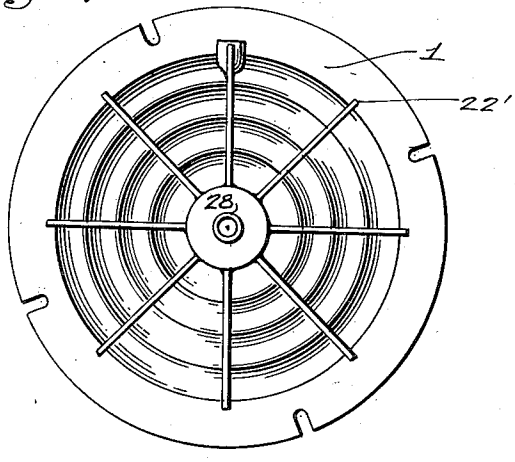


Fig. 6.



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Fig. 7.

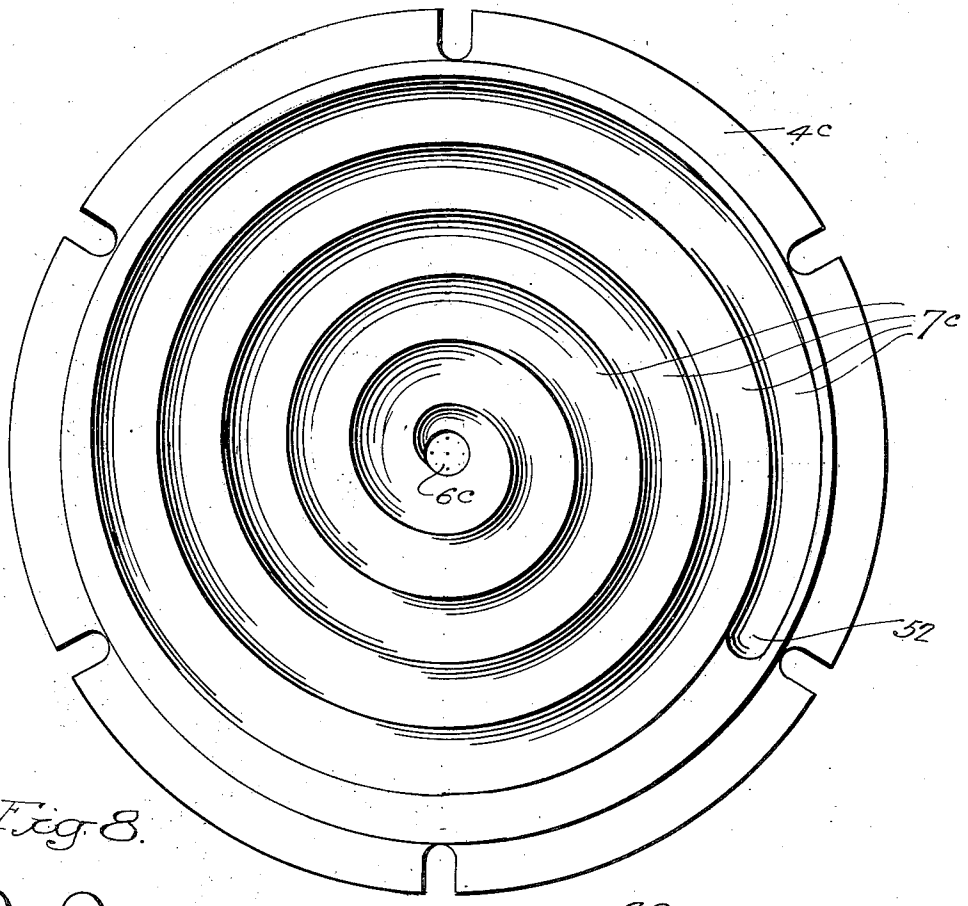
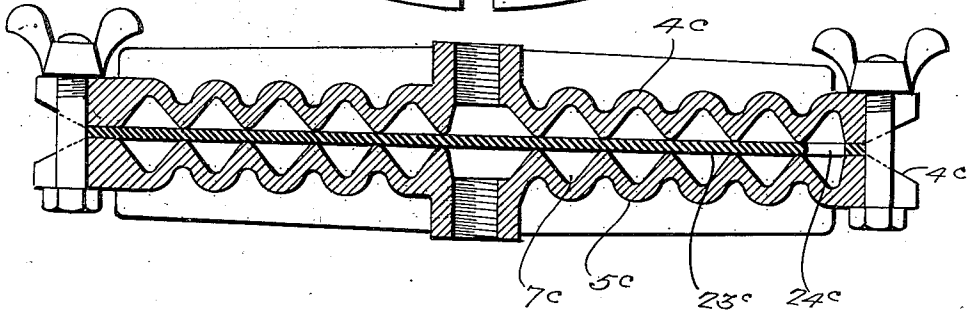


Fig. 8.



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Patented June 18, 1935 2,005,515

UNITED STATES PATENT OFFICE

2,005,515

FLUID CONDITIONING DEVICE

Joseph F. Winkler, Philadelphia, Pa.

Application November 1, 1933, Serial No. 696,292

12 Claims. (Cl. 257—245)

This invention relates to fluid-conditioning devices and, more particularly, to devices for cooling beverages such as beer, milk, etc. The chief object of the invention is to provide an improved device of this character having novel features of construction which render it economic to manufacture, efficient in operation, easy to use and clean, and capable of withstanding high internal pressures.

A more specific object of the invention is to provide a device in which there is a grooved member adjacent a flat member, the grooves forming a circuitous fluid-conducting path and the flat member closing the grooves to form therewith a fluid conduit.

A further object of the invention is to provide a device comprising one or more units which, if there are several, may be associated in cascade relation and each of which is formed to provide circuitous fluid-conducting paths having large heat transfer area.

Another object of the invention is to provide a device of this nature with the incorporation of a filter in one or more of the units.

A still further object of the invention is to provide a device of this character with conduits formed in the body of one or more of the units for the conduction of a fluid-conditioning medium.

These and other objects, as well as the structural features of certain forms of the invention, may be more clearly understood from the following detailed description and the accompanying drawings, in which

Fig. 1 is a sectional view taken through the center of a device comprising several units;

Fig. 2 is an internal face view of one of the complementary members comprising each of the units;

Fig. 3 is a sectional view of a complete fluid-conditioning device showing the device of Fig. 1 in elevation;

Fig. 4 is a sectional view of a modified form of one of the units;

Fig. 5 is a sectional view similar to Fig. 1 of a modification;

Fig. 6 is an external face view of one of the members of a unit;

Fig. 7 is an internal face view of a modified form of member; and

Fig. 8 is a sectional view of a unit embodying the modified members.

Referring particularly to Fig. 1, there is shown a device which comprises three similar units 1, 2 and 3 arranged in cascade relation. The upper unit 1 differs from the other units only in the inclusion of a filter device which is an optional feature and may be incorporated in any or all of the units. This feature will be explained more fully hereinafter. While three units are shown, it is to be understood that a single unit may be used or any desired number of units may be assembled in a single device.

In simple form, the invention contemplates a fluid-conditioning unit such as units 2 and 3 of Fig. 1 and it is, therefore, deemed advisable to first describe such a simple unit. Referring then to unit 2, for example, a pair of similar complementary plate-like members 4 and 5 are provided, each of which is generally circular in shape, as shown more clearly in Fig. 2, and has a central opening 6 and intercommunicating concentric annular grooves 7 formed on its inner surface about the central opening. The grooves are defined by alternate concentric annular ridges 8. The purpose of the grooves is to provide a circuitous path for the fluid to be treated and to obtain a large heat transfer area with consequent effective conditioning of the fluid. To accomplish this end, the grooves are made intercommunicating in a predetermined manner as will now be explained.

Referring particularly to Fig. 2, the innermost ridge 9 is interrupted at 10 to provide a passage from the central opening 6 to the first annular groove 11. The second ridge 12 from the center is interrupted at a diametrically opposite point 13 to provide a passage from groove 11 to the next groove 14. The third ridge is interrupted at 15 diametrically opposite the point 13 to provide a passage from groove 14 to the next groove 16. The fourth ridge 17 is interrupted at 18 at a point diametrically opposite point 15 to provide a passage to the next annular groove 19. The fifth ridge 20 is interrupted at 21 diametrically opposite 18 to provide a passage to the outermost groove 22. This arrangement could be carried on indefinitely to provide any desired number of intercommunicating concentric grooves.

Assuming that the particular grooved member under discussion is one which receives the fluid through opening 6, this opening being an inlet or admission opening, then the fluid passes through passage 10 to groove 11 and divides, part of it going on one side of the groove and part of it on the other side to passage 13. The fluid then passes through passage 13 to groove 14 where it again divides and flows in two parts around the opposite sides of groove 14 to pas-

sage 15. The fluid thus passes in concentric paths through the respective grooves successively until it reaches passage 21 and passes into the outermost groove 22. It will be apparent that during its passage through the various grooves, the fluid covers an overall path of some considerable length and it is, therefore, subjected to effective conditioning action by any cooling or heating medium which may be caused to influence the outer surface of the device. Preferably, members 4 and 5 are corrugationally formed so that their outer surfaces are similar to their inner surfaces. Also there are provided radial ribs 22' on the outside of the members as shown more clearly in Fig. 6, to enhance the heat transfer action and to better enable the device to withstand internal pressure. There are thus provided large heat transfer surfaces and the ribs serve additionally to rigidify and strengthen the members.

Referring again to Fig. 1, the unit 2 further comprises a flat circular gasket member 23 which is interposed between members 4 and 5 and which serves to cover the grooves of those members and to seal the concentric conduits against passage of the fluid in any manner excepting that intended. The gasket may be formed of any suitable material, such as gaskets are commonly formed of, as for example rubber composition. An opening 24 is provided in the gasket at a point near its periphery diametrically opposite passage 21. This opening allows the fluid to pass from one of the grooved members to the other. If for example, the fluid enters the upper member of the unit through its central opening and traverses the said member, as explained above with reference to Fig. 2, it will then pass through opening 24 into the lower member and will traverse the concentric grooves thereof in a direction opposite that explained above, leaving the unit via the central opening of the lower member. The complementary members of the unit may be provided along their peripheral portion with spaced recesses 25 through which bolts, such as those illustrated in Fig. 1, may be passed to clamp the constituent units of the device together.

As previously stated, a single unit may be used. Moreover, a single grooved member and an adjacent closure member may be used, and this is within the scope of the invention. In such a case, a passage or opening may be provided at or adjacent the periphery of the member, as shown in Figs. 5 and 6, so that inlet and outlet openings will be provided for the single circuitous passage. It is also important to note that a complete unit may be used to condition two different fluids, as for example milk and cream. By providing inlet and outlet openings in each of the grooved members of a unit and omitting the opening in the gasket, there may be provided two separate fluid conduits, one on each side of the gasket. One may be used for one fluid and the other for another fluid. Alternately, one of these conduits may be used to carry the conditioning medium and a fluid to be conditioned may be passed about the outside of the unit or brought into heat transfer relation thereto. It is seen then that the device is very flexible in its adaptations to the conditioning of fluids.

It will usually be preferable to assemble a number of units in cascade relation, as illustrated in Fig. 1, in which event, elongated bolts 26 with wing nuts 27 may be advantageously used to fasten the units together and to permit ready disassemblage of the device for cleaning or other purposes. The recesses 25 may be tapered to receive tapered portions of the heads of bolts 26. This construction automatically centers the bolts when they are tightened. Preferably individual bolts 26' (see Fig. 3) are provided for the units. These bolts may be positioned between the main bolts 26. It is important to note that the constituent grooved members of the device may be readily cleaned since the grooved faces of these members are readily accessible for cleaning with any desirable cleaning device, such as a brush.

In a device comprising several units, such as illustrated in Fig. 1, the upper and lower units may have connected thereto threaded nipples or like connections 28 and 29. The inner communicating central openings of the units may be brought together and sealed in any desired fashion, such as by means of connecting screw connections or the like. If desired, the complementary members of the units may be recessed about their central openings and resilient washers 30 may be used to provide an effective seal. When the units are clamped together and the resilient washers are compressed, a continuous passage from one unit to the next will be effectively provided. Again, it is to be noted that a device comprising a plurality of units lends itself to the conditioning of a plurality of fluids and is very flexible in its adaptation to this purpose. By the proper arrangement of inlet and outlet openings and the inclusion or omission of the gasket openings the fluid conduits of the device may be used separately or in any desired combination. Any arrangement which may be found desirable is within the scope of the invention. It is deemed unnecessary to point out in detail the many arrangements which are possible even in a device comprising only three units, as illustrated.

A refinement of the device consists in incorporating in the unit, if a single one be used, or in any or all of the units, if a plurality of units be used, a filter device 31, as shown in the upper unit of Fig. 1. The filtering device may comprise a circular body 32 and a retaining ring 33. The body of the device may be formed of any suitable filtering material and may take the form, for example, of a filter stone, such as is found in common use. If desired, the filtering body of the filter device may be formed of some relatively non-rigid material, taking the form of a non-rigid mass. The retaining ring 33 should, of course, be formed of non-filtering material, such for example as metal. The device forms a unit which may be clamped between two gaskets, such as gasket 23 above described, and made pressure-tight. In this instance, the gaskets serve the same purpose as does the single gasket in the simple form of the unit.

The filtering body of the filter unit may be provided with spaced projections 34 which support the gaskets and prevent dishing or flexing thereof. These projections may be in the form of annular ridges similar to the concentric ridges of the grooved members 4 and 5, or they may take any other form, such as spaced protrusions. In any event, however, the projections should allow the fluid to pass over the entire surface of the filtering body.

In operation, any unit which has the filter device embodied therein functions in substantially the same manner as does a simple unit, except-

ing that the fluid in passing from one of the grooved members to the other is filtered through the filtering body 32. For example, in the uppermost unit of Fig. 1, if the fluid enters from the top, after passing through the upper grooved member of the unit, the fluid will traverse the upper face of the filtering body and will filter through the same uniformly to the lower side of the filtering body. The fluid will then enter the outermost annular groove of the lower member 5 through the opening in the lower gasket.

In Fig. 3, there is shown an adaptation of the device of Fig. 1 to a cooling device in which the assembled device of Fig. 1 is supported upon a support 35, the legs of which rest upon the bottom of the container 36. The assembled unit may be supported in any manner. For instance, it might be laid on its side. A helical coil 37 is disposed within the container and surrounds the assembled device, this coil functioning to carry some conditioning medium, such as a refrigerant. It will be apparent that the refrigerant flowing through the coil absorbs the heat from the assembled device as the fluid being cooled passes therethrough. Container 36 may be filled with any suitable heat transfer medium such as water, oil, etc. A circulator or agitator may be provided, as shown.

In Fig. 4, there is shown an alternative embodiment of a simple form of fluid-conditioning unit in which the complementary members 4*a* and 5*a* are hinged together at 38 and are provided with refrigerant conduits 39 and 40 formed directly in the bodies of the respective members. These conduits may take the form of spiral passages which may be formed during molding of the members. The respective refrigerant conduits of the two members may be connected together by a flexible connection 41. Inlet and outlet nipples for the conduits are shown at 42. In this form of the device, it is unnecessary to completely disassemble the complementary members in order to clean the device or for other purposes, it being merely necessary to hingedly open the unit. If desired, communication between the refrigerant conduits may be established through the hinge by providing a passage through the hinge bolt.

In this device, the metal of members 4*a* and 5a serves as the heat transfer medium to condition the fluid flowing through the device. It is important to note that this device may be used to condition as many as four separate fluids. Two separate fluids may be conditioned by merely positioning the device within a container 36*a*. The second fluid to be conditioned may then be placed in the container but outside the conditioning device. Thus in the case of cooling two separate fluids, the refrigerant may be passed through conduits 39 and 40 and it serves to cool both the interior and exterior fluids. By providing an opening at or adjacent the periphery of each of the grooved members and omitting the opening in the gasket two separate fluid conduits may be provided in the device instead of one, thus permitting conditioning of three separate fluids. If desired, one of these conduits may be used for the conditioning medium while the conduits 39 and 40 may be used to carry one of the fluids to be conditioned. Also, the container 36*a* may be used for the conditioning medium and all three conduits may be used to carry fluids to be conditioned. Again, by using conduits 39 and 40 separately, four fluids may be conditioned. Thus the device is very flexible in adaptation for its intended purpose.

In Fig. 5, there is shown a modification of the device of Fig. 1, this device comprising the modified units 1*b*, 2*b*, and 3*b*. These units are similarly formed as before but in this case, they are provided with central openings 6*b* which are adapted to receive a central bolt 43 extending through the entire assembly. The gaskets 23*b* are also provided with central openings 24*b* to accommodate the bolt. Tapered sleeves or nipples 44 and 45 may be used in conjunction with the bolt to connect the units together and provide fluid seals along the bolt. The constituent units of the device are further modified in that they are provided with bosses 46 at or adjacent their periphery with inlet and outlet openings therethrough. In the present illustration, the openings 47 of the outermost grooved members are threaded to receive nipples 48. The other openings 49 of the grooved members are tapered to receive tapered sleeves or nipples 50 which are adapted to connect the units together in a fluid-tight manner. It will be understood, of course, that threaded nipples may be used in place of the tapered sleeves herein illustrated or any other suitable connection between the units may be provided. If desired, a boss of the form shown at 46*a* in Fig. 6 may be provided on a member, this boss having a radial threaded opening for attachment of a nipple or the like radially of the member.

In this form of the device, the fluid enters and leaves each of the units at the peripheral portion. For example, assuming that the fluid enters the uppermost unit, via nipple 48, the fluid flows through passage 51 to the outermost groove of the upper grooved member 4*b*. The fluid then traverses the concentric grooves which are formed in the member the same as in Fig. 1. When the fluid reaches the innermost annular groove, it passes through the opening 24*b* in gasket 23*b* into the innermost groove of the lower grooved member 5*b*. The fluid then traverses the concentric paths of this member until it reaches the outermost annular groove from whence it flows through passage 51 of the member and through sleeve 49 to the second unit.

It will thus be seen that the invention is capable of any desired modification of the inlet and outlet openings. The inlet or outlet openings of the unit may be provided at the center or to one side of the units.

Although not illustrated, a filter device may be used in any or all of the units as before. In such case, it would be necessary of course to provide a central apertured non-filtering portion in the filtering device to prevent filtering of the fluid through to the bolt. If a filter is used the inlet and outlet openings of the unit may be differently arranged. For example, the inlet opening may be at one side and the outlet opening may be at the center or vice versa, the openings in the gaskets being arranged accordingly. In such case, the fluid would flow in the same direction through the grooved members of the unit.

The units may have their parts fastened together in cooperative relation by individual bolts 26*b* provided at spaced intervals about the periphery of each unit. If desired, bolts similar to those of Fig. 1 may be provided at the periphery of the device to aid the central bolt in securing the units together in assembled form.

In Figs. 7 and 8, there is illustrated a further

modification of the device in which the complementary members 4c and 5c are formed with inner and outer spiral corrugational surfaces instead of the concentric corrugational surfaces of the previously-described embodiments. Aside from this modification, the device illustrated in Figs. 7 and 8 is substantially the same and operates in the same general manner as the above-described devices. In the modified device, however, as it is illustrated, the fluid to be conditioned enters the inlet opening 6c of one of the members and flows along the spiral path defined by grooves 7c to a point 52 at or adjacent the periphery of the members where the fluid passes through an opening 24c in the gasket 23c and then flows spirally in reverse direction through the other member of the device to the outlet opening thereof. In the device shown, the inlet and outlet openings of the members are provided at the center and the passage between the members is at or adjacent the periphery. It will be understood, however, that the inlet and outlet openings may be provided at or adjacent the periphery of the device and the passage opening in the gasket may be provided at or near the center of the device so that the fluid to be conditioned will flow in reverse fashion through the individual members. As such a device has been shown generally in Fig. 5, it is believed unnecessary to disclose a specific example of the same adaptation of the device of Figs. 7 and 8.

Although a single unit has been shown in Figs. 7 and 8, it will be understood, of course, that several such units may be arranged in cascade relation as before. It will also be understood that a filter device may be used in any or all of such modified units in the same manner as it may be used in the previously-described embodiments. If a filter is used, the inlet and outlet openings of the unit may be differently arranged as above mentioned. For example, the inlet opening may be at one side and the outlet opening may be at the center or vice versa with the openings in the gaskets arranged accordingly.

Speaking generally of the device of the invention and the various embodiments thereof disclosed in the drawings, it will be noted that there are three distinct types of surfaces which may be used on any of the surfaces of constituent members or units of the device and in any suitable combination which may be desired. These surfaces are: a concentric corrugational surface providing concentric passages, a spiral corrugational surface providing a continuous spiral path and radial ribs or ridges which provide radial spaces therebetween. Although the latter type surface has been shown only on the outside of the members of the device and in combination with either of the other two surfaces, it is conceivable that radial ridges or ribs might be provided on the inner surfaces of the members and arranged to cause the fluid to be conditioned to flow in radial paths through the device. In its broad aspect, the invention contemplates the provision of any suitable ribbed, grooved or corrugated surface on a member to provide one or more circuitous paths for the fluid to be conditioned.

It will be apparent from the above description that the device is simple in construction and lends itself to sanitary requirements, being easy to clean. The fluid-contacting surfaces of the device may be readily scoured as will be apparent. The simple construction of the device also renders it economic to manufacture. The main parts of the device, viz., the grooved complementary members, are preferably formed as aluminum castings and require no machining, excepting the tapping of openings where threads are desired.

While the device has been described herein with particular reference to fluid-cooling and particularly the cooling of beverages, it is to be understood that the device may be employed for the heating of fluids or for the conditioning of fluids in general. It is further to be understood that the invention is capable of modification and changes without departing from the spirit or scope thereof.

I claim:

1. In a device of the class described, a member having intercommunicating concentric grooves formed on a face thereof to provide a circuitous path for fluid, and a non-porous member adjacent said face and closing said path.

2. In a device of the class described, a member having a spiral groove formed on a face thereof to provide a circuitous path for fluid, and a member adjacent said face and closing said path, said first member having an axial opening for the passage of fluid to or from said path.

3. In a device of the class described, a member having concentric circular grooves in a face thereof and radial grooves interconnecting said circular grooves, said grooves being arranged so as to form successive concentric paths for fluid and so that the inlet and outlet of each path are diametrically opposite one another, and a flat non-porous member adjacent said face and closing said grooves.

4. In a device of the class described, a pair of opposed complimentary members having axially aligned openings, and an intermediate member having a peripheral opening, said complementary members being provided with spiral grooves on their inner faces to provide a circuitous path for fluid on each side of said intermediate member between a pair of said openings.

5. In a device of the class described, a pair of opposed complementary members, and an intermediate non-porous member, said complementary members being provided with intercommunicating concentric grooves on their inner faces to provide a circuitous path for fluid on each side of said intermediate member.

6. In a device of the class described, a pair of similar complementary members each having a central opening therethrough for the admission or emission of fluid, and an intermediate non-porous member having a fluid-conducting opening therethrough adjacent its periphery, said complementary members having intercommunicating concentric grooves on their inner faces forming a circuitous path for fluid between a pair of said openings on each side of said intermediate member.

7. In a device of the class described, a pair of opposed complementary members having grooves formed on their inner faces to provide circuitous paths for fluid, and an intermediate member comprising a pair of gaskets each with a fluid conducting opening therein, and a filter member interposed between said gaskets having spaced projections on its outer faces engaging said gaskets, whereby the fluid in passing through the device is distributed over said filter member.

8. In a device of the class described, a pair of opposed complementary members having grooves formed on their inner faces to provide circuitous paths for fluid, a gasket adjacent each of said faces and closing said grooves, each said gasket having a fluid-conducting opening therethrough, and a filter member between said gaskets.

9. In a device of the class described, a member having a circuitous fluid-conducting conduit formed in its body and grooves formed on its face to provide a circuitous path for fluid, and a flat member adjacent said face and closing said grooves.

10. In a device of the class described, a pair of hinged opposed complementary members, each having a circuitous fluid-conducting conduit formed in its body and grooves formed on its inner face to provide circuitous paths for fluid, a flat member intermediate said complementary members having a fluid-conducting opening connecting said paths, and means connecting said conduits.

11. In a device of the class described, a pair of opposed complementary members, an intermediate member, said complementary members being formed to provide a circuitous path for fluid on each side of said intermediate member, and each having a circuitous fluid conduit formed in its body, and a container surrounding said members.

12. In a device of the class described, a pair of similar complementary members each having an opening therethrough for the admission or emission of fluid, and an intermediate non-porous member having a fluid-conducting opening therethrough, said complementary members having concentric ridges and depressions on their inner faces forming successive concentric paths for fluid between a pair of said openings on each side of said intermediate member.

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