June 10, 1958 C. R. STOELTING ET AL 2,838,288

SERPENTINE HOLDING CONTAINER

Filed Sept. 16, 1955 2 Sheets-Sheet 1

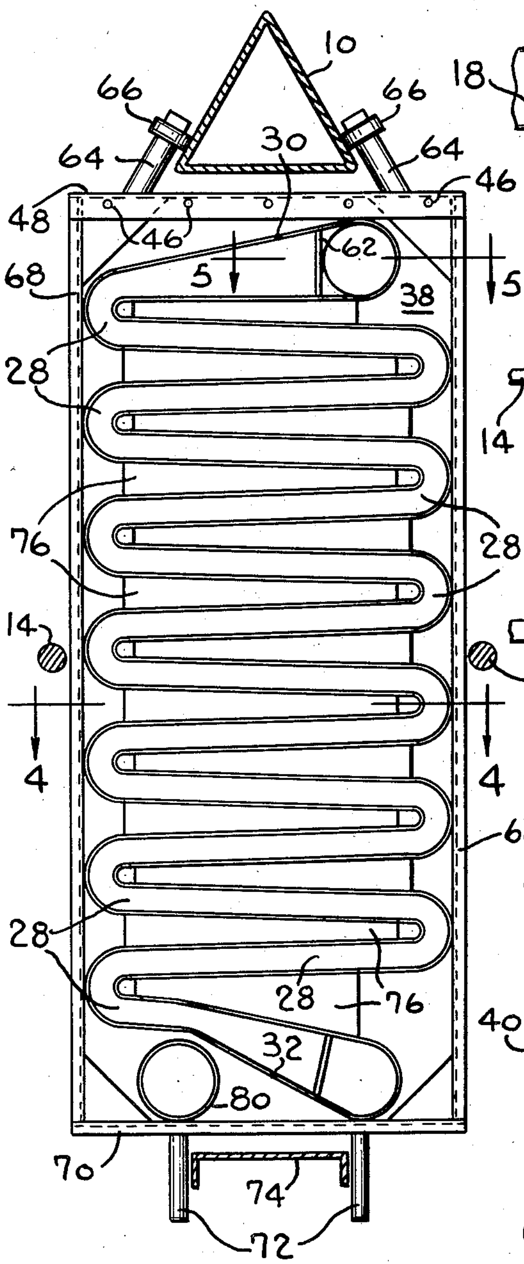

FIG. 2

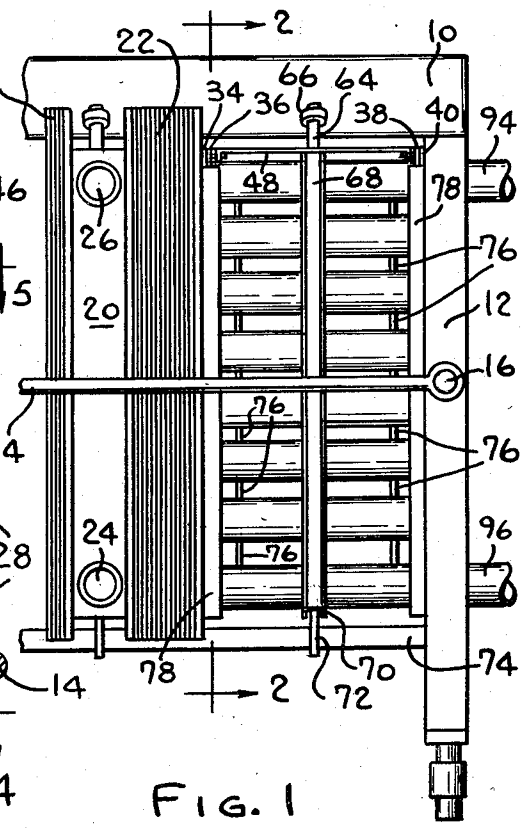

FIG. 1

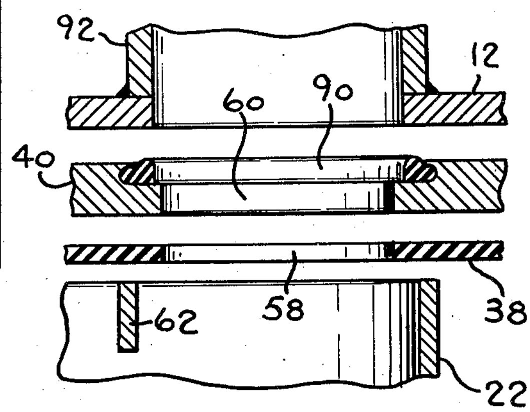

FIG. 5

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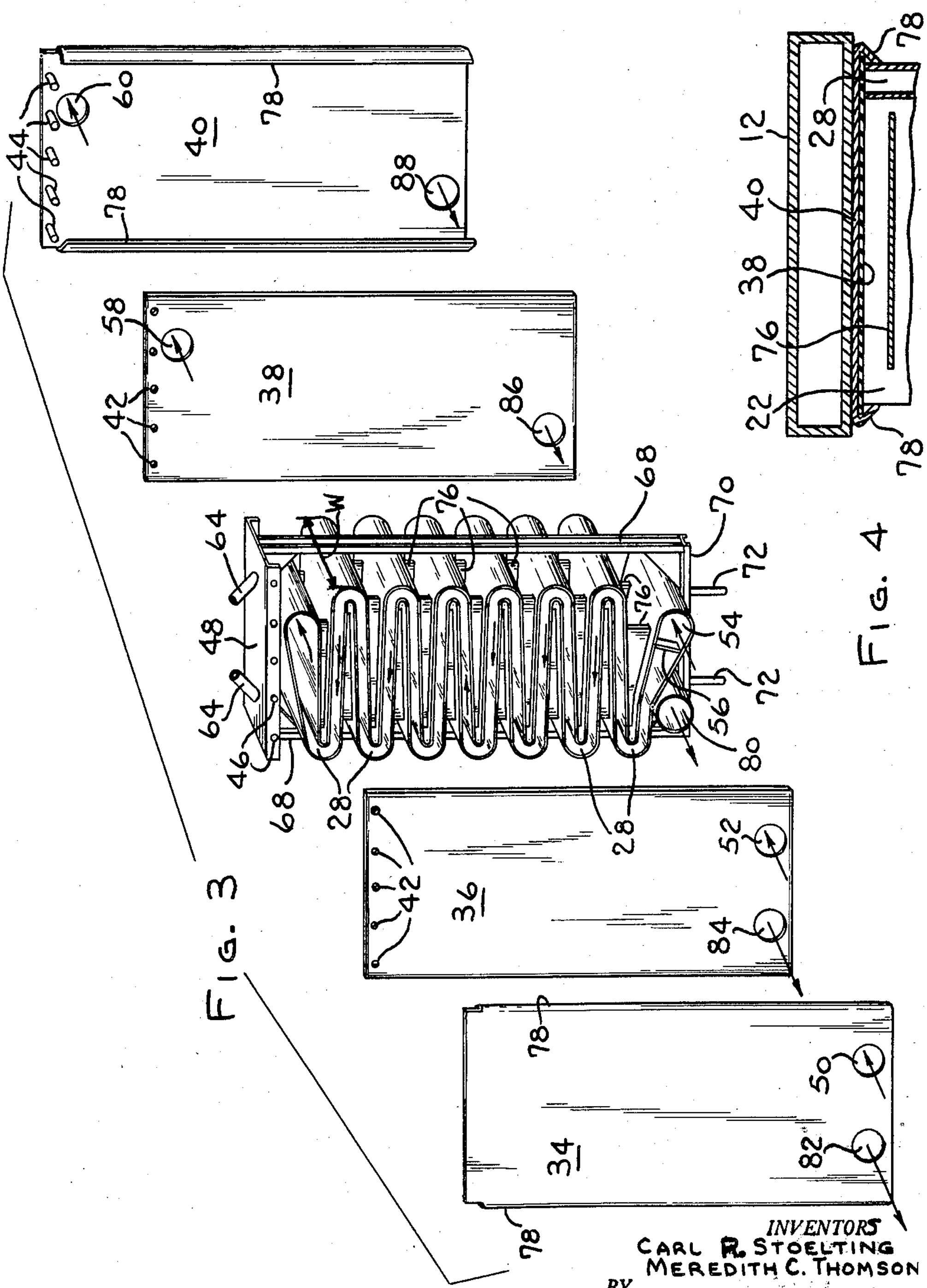

FIG. 3

FIG. 4

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SERPENTINE HOLDING CONTAINER

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6 Claims. (Cl. 257—255)

This invention relates to apparatus which replaces the usual holding tubes employed in connection with pasteurizing equipment and the like. The apparatus is not, however, limited to such use.

The United States Public Health Service requires holding milk, for example, at an elevated temperature for a period of time (commonly 161° F. for 16 seconds) to secure proper pasteurization. Most pasteurizing equipment operates on a continuous flow principle and employs the heat of the pasteurized milk to pre-heat the raw (cold) milk. The usual equipment employed for holding the milk at the proper temperature for the prescribed time comprises holding tubes which must, by code, be upwardly pitched and readily cleaned and inspected. This results in an assembly of tubes on a separate frame and employing costly elbow conections at each reverse bend of the tubing. Not only is the equipment bulky and costly, but it must be separately plumbed on the site. All of this results in a rather unsatisfactory unit.

The principal object of this invention is to provide apparatus which is more compact, less costly and easier to clean and inspect than the usual holding tubes.

Another object of this invention is to provide apparatus of the type described which meets all code requirements.

In carrying out the present invention we provide apparatus which can be used in connection with the plate type heat exchangers which enjoy wide popularity in this type of food processing equipment. The apparatus can, however, be used in connection with other type heat exchangers since the desirable features of space saving and easy cleaning and inspection are not dependent upon use with plate-type heat exchangers. When used in connection with plate-type heat exchangers, however, the desirable features are best utilized.

Plate-type heat exchangers are commonly carried on a frame and provided with compression means usually in the form of a screw-type press for compressing the plates together to effect the desired sealing between the plates. The present holding container is adapted to be mounted in the frame along with the plate-type heat exchanger assembly which may include terminals in addition to the plates. The present apparatus provides a continuously upwardly inclined serpentine flow path for the milk and this path is very readily designed to provide any desired velocities and holding periods. Since the entire holding container is carried in the press-type frame of the heat exchanger and is designed to be readily disassembled when the pressure is taken off the exchanger to permit separation of the plates etc., the unit is extremely easy to take apart for cleaning. Furthermore, there are no parts which are not readily visible for inspection.

Other objects and advantages will be pointed out in, or be apparent from, the specification and claims, as will obvious modifications of the single embodiment shown in the drawings in which:

Fig. 1 is a partial elevation of a plate-type heat ex-

changer provided with a holding container according to this invention;

Fig. 2 is a section taken as indicated by line 2—2 of Fig. 1;

Fig. 3 is an exploded perspective view showing the manner in which the present holding container is assembled;

Fig. 4 is a section taken as indicated by line 4—4 on Fig. 2; and

Fig. 5 is a fragmentary exploded section taken as indicated by line 5—5 on Fig. 2.

Referring now to the drawings, the general framework commonly employed in connection with plate-type heat exchangers includes a triangular frame member or girder 10 which runs the length of the frame and from which all the plates, terminals, etc. are suspended. The end box-like frame member 12 has horizontal rods 14 connected thereto at 16. These rods run from the frame member 12 to the end of the assembled plates, terminals, etc. where it connects to a cross head on which the screw-type press is mounted to compress the plates and terminals so as to effect sealing therebetween. In the fragmentary Fig. 1 a series of plates 18 is shown to the left of terminal 20 and this is followed by a series of plates 22. Plates 18 and 22 are generally designed so that a heating fluid passes on one side of the plates and the fluid to be heated passes on the other side of the plates. For example, in Fig. 1 the series of plates 18 would probably be a preheating section in which hot pasteurized milk is made to give up its heat to the cold raw milk moving through the assembly from the left. Plates 22 then would be the final heating stage in which hot water is made to give up its heat to the pre-heated raw milk. Between the pre-heat and heating stages there is shown a terminal 20 having ports 24, 26.

The raw milk leaving the heating stage 22 is at the prescribed pasteurizing temperature and must now be held at this temperature for a predetermined period of time. The right-hand end of plate section 22 is designed to discharge the hot raw milk into the bottom of the serpentine holding passage 28 for flow from the bottom to the top of the passage. The serpentine passage is, as will be described more fully hereinafter, pitched upwardly constantly and is designed to discharge the now pasteurized milk from the top to the customary three-way valve assembly which may now be mounted on the frame if desired. This three-way valve assembly is either manually or automatically operated to permit recirculation of the milk leaving the serpentine passage through the final heating stage during the time of starting the process in operation. When the milk temperature at the outlet of the holding container reaches the prescribed minimum temperature, the three-way valve may be operated to cause the pasteurized milk to now flow to the pre-heat stage 18. This type of operation of a three-way valve is customary in this art, the only difference here being that the holding container is mounted directly on the frame 10 rather than being separate from the frame.

Turning now to the details of the construction of the holding container, it will be noted that the serpentine passage is formed between the spaced apart interfitting reverse bends of wall-like members. In actual practice the serpentine passage is fabricated of two sheets of stainless steel which are welded at 30 and 32. Each sheet, prior to the welding, is formed with the reverse bends shown in the drawings and the parts are then brought together for welding. Since the two sheets of stainless steel are spaced apart as shown, they define an open-sided serpentine passage therebetween. The bends are so formed that the serpentine passage 28 is pitched upwardly constantly. This is necessary to satisfy the Public Health Service code and is based upon the theory that air bells cannot form where the pitch is constantly upwardly.

It is to be noted that there is no interconnection between the two sheets of stainless steel to take the lateral pressure exerted by interior fluid pressure when the apparatus is in use. Such internal bracing would, of course, provide a source of contamination and with this in mind no such bracing has been used but external bracing is employed as will be pointed out more fully hereinafter.

As noted above, the serpentine passage has open sides in its natural state as shown in Fig. 3. In order to seal these sides and thus close the serpentine passage, the assembly illustrated in Fig. 3 is employed. Here a flat end plate **34** is pressed against the left side of the serpentine section with the sheet rubber gasket **36** interposed between the plate and the serpentine assembly. Similarly, the right side of the serpentine assembly is sealed by means of gasket **38** and end plate **40**. The gaskets are provided with holes **42** which permit the gasket to be hung on pegs **44** projecting inwardly from the end plates **34**, **40**. These pegs also project through the holes **46**, **46** on either side of the top cross head **48** of the framework which carries the serpentine assembly. This permits the gaskets and the end plates to be hung on the cross heads **48**, **48** prior to drawing up on the heat exchanger press which firmly compresses the gaskets to seal the open sides of the serpentine assembly.

As may be seen most clearly in Fig. 3, end plate **34** and gasket **36** are respectively provided with ports **50**, **52** which communicate with the inlet **54** at the bottom of the serpentine passage. The pressure against the gasket, when this assembly is completed, prevents leakage around the stainless steel plates making up this serpentine passage except that it is necessary to employ the strut **56** to further effect the seal around port **52** in gasket **36**. If this were not done, milk flowing to the serpentine passage could leak between the end plate **34** and gasket **36** and this would lead to an unsanitary condition. It is also to be noted that gasket **38** and end plate **40** are respectively provided with outlet ports **58**, **60** which are adapted to communicate with the top of the serpentine passage at the top right side of the serpentine passage. Strut **62** is provided to seal the outlet in a manner similar to that just described.

It will be noted that the top cross head **48** of the frame carrying the serpentine wall members is provided with a pair of short arms **64**, **64** which carry bearings **66**, **66** which ride on the top triangular frame member **10** as shown in Fig. 2. This permits the entire assembly to be moved along the top frame to facilitate access to all of the parts. Depending from the top cross head are side frame members **68** which are connected to the bottom cross head **70** from which depend spaced pegs **72**, **72** which ride on either side of the bottom channel member **74** of the press frame. The side frame members **68** are not designed to carry any lateral pressure exerted on the plates. It will be noted that the plates are vertically supported by means of welds made at the point of contact between the reverse bends of the plates and the side frame members **68**. The wedge-shaped braces **76** position the reverse bends along the side frame members **68** and prevent deflection of the plates contacted thereby when subjected to fluid pressure. This can most clearly be seen in Fig. 2. It is to be noted (see Fig. 4) that these braces **76** are spaced inwardly from the open sides of the serpentine passage. This is done so that if there should be any leakage between the gasket and the sheet metal defining the serpentine passage, the leak will go directly to atmosphere where it will be clearly visible, particularly since as soon as it leaks to atmosphere, it lies on an inclined plane which will cause it to flow out into clear view. In addition to having a visible means for detecting leaks, this prevents any possibility of milk shortcutting from the inlet to the outlet and thus achieving passage through the holding container in less than the prescribed time.

When milk flows through the serpentine passage, it is, of course, under pressure and this pressure is exerted laterally on the accordion-like pleats of the serpentine sheet metal. This would normally tend to blow the serpentine plates apart and in order to guard against such an event the vertical edges of end plates **34** and **40** are vertically rolled or turned in as seen in Figs. 1, 3 and 4 so that the turned in edge **78** will contact the outside of each bend. Thus, the end plates, in addition to being employed to exert a uniform pressure on the sealing gaskets **36**, **38**, are employed to take the lateral force exerted on the serpentine plates. This force is considerable and if the end plates were not employed in this manner, a much heavier frame would be required in order to guard against deformation of the serpentine plates.

In the lower left corner (Fig. 3) of the serpentine plate frame it will be noted there is a through conduit **80**. End plate **34** and gasket **36** are respectively provided with ports **82**, **84** which communicate with this conduit **80** while gasket **38** and end plate **40** are provided with ports **86**, **88** which communicate with the other end of the conduit. This conduit and the associated ports in the gaskets and end plates are employed to introduce hot water to the system for conveyance directly to the heat exchange section **22** to heat the already pre-heated milk. Were it not for this additional feature, it would be necessary to employ an additional terminal (similar to terminal **20**) in the press which would add considerably to the cost.

End plate **40** does not constitute the final outlet for the system but the fluid passes through the header-like end frame member **12** which has a box-like cross section as may be seen in Fig. 4. Any conduits passing through this box-like member are merely mounted within the member. The end plate **40** (see Fig. 5) is provided with a ring gasket **90** set in the plate to cooperate with the face of frame member **12** to effect a seal and the liquid then enters the short conduit **92** to pass to the other side of the box-like frame member **12**. This then connects to a pipe **94** which leads to the usual three-way valve or other such equipment, and after passing through such other equipment the fluid is re-entered into the system through port **26** for entry into the pre-heat section **18** where the hot milk gives up heat to the cold raw milk. Hot water pipe **96** communicates through the box frame **12** with ports **88**, **86**, pipe **80** and ports **84**, **82** to convey hot water to the final heat section **22**.

From the above the flow path through this assembly should now be apparent. Arrows have been provided on Fig. 3 to illustrate the flow which is as follows: The hot raw milk flows through ports **50**, **52** into the inlet **54** of the serpentine holding container and then flows upwardly through the serpentine passage until it reaches the top where it then flows through ports **58** and **60** for discharge through pipe **94**. After passing through a three-way valve, for example, the hot pasteurized milk now returns through port **26** while hot water enters pipe **96** and ports **88**, **86** to pipe **80** and thence through ports **84**, **82** to section **22**. Hot water is taken out of the final heat section through a port similar to port **24** but located on the other side of terminal **20**.

The present unit fully complies with the Public Health Service milk ordinance and code in that it provides a continuous upwardly inclined path for milk flow during the holding stage. Compliance with the requirements of minimum velocity is readily achieved by a proper selection of the space between the serpentine plates and the width of the serpentine plates. The width is designated on the drawing as W. The capacity of the present unit can be changed very easily by varying the dimension W. This further demonstrates the versatility of the present design. Finally, it will be noted that the visible leak detection requirement of the milk code is amply provided for without any sacrifice in the other design parameters. The ease with which the entire assembly may be disassembled for cleaning or inspection will be readily apparent. As soon as the press-type heat exchanger is relieved of pressure from the usual screw apparatus, the parts may be lifted apart and thoroughly washed. Furthermore, there are no hidden crevices or difficult-to-see points which would make inspection difficult. It can safely be said that there is no comparable processing equipment available today which permits of as thorough cleaning and inspection as the present equipment.

Throughout this description reference has been made to wall-like members and serpentine plates in describing the plates which make up the serpentine passage. This is not to be taken as a limitation on the manner of fabrication. Present practice favors construction out of two reversely bent plates as described but fabrication out of one plate or even castings or the like may prove practical in some instances. The use of the above mentioned terminology in the claims is not to be taken as limiting the construction to that illustrated.

Although but one embodiment of the present invention has been illustrated and described, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

We claim:

1. A fluid holding container, comprising, co-extensive spaced apart wall-like members provided with a plurality of reverse interfitting bends providing a continuous upwardly inclined generally vertical serpentine passage therebetween, sealing plates for covering the openings defined by the edges of said wall-like members, means for securing said parts in assembled relationship, an inlet port in the bottom of one of the plates communicating with the lowermost part of said passage, an outlet port in the top of one of the plates communicating with the uppermost part of said passage, sheet gasket means located between said plates and said edges to seal a major portion of the associated ports, and struts spanning the space between the wall members adjacent each port with an edge of the strut coplanar with the wall member edges to cooperate with the gasket means to complete the seal about the ports.

2. A holding container according to claim 1 including vertically disposed wedge-like braces between facing portions of the reversely bent wall-like members, said braces

being spaced from the edges of the wall-like members so that any fluid leakage past the edges of the wall-like members will be exposed to view.

3. A fluid holding container, comprising, co-extensive spaced apart wall-like members provided with a plurality of reverse interfitting bends providing a continuous serpentine passage therebetween, sealing plates for covering the openings defined by the edges of said members, means for releasably securing said parts in assembled relationship, and turned edges on the sealing plates contacting said members on the exterior of the reverse bends for resisting internal pressures on the members.

4. A fluid holding container, comprising, co-extensive spaced apart wall-like members provided with a plurality of reverse interfitting bends providing a continuous serpentine passage therebetween, sealing plates for covering the openings defined by the edges of said members, means for releasably securing said parts in assembled relationship, a frame for supporting the members and adapted to be suspended from the top of the frame, and cooperating means on the frame and sealing plates for removably supporting the sealing plates on said frame.

5. A fluid holding container, comprising, co-extensive spaced apart wall-like members provided with a plurality of reverse interfitting bends providing a continuous serpentine passage therebetween, sealing plates for covering the openings defined by the edges of said members, means for releasably securing said parts in assembled relationship, frame for supporting the wall-like members so the serpentine passage starts in a lower corner of the frame and ends in an upper corner of the frame, a through conduit positioned in a corner of the frame and having a length equal to the width of the wall-like members so the ends of the conduit are coplanar with the edges of the wall-like members, openings in said sealing plates communicating with the conduit, and ports in said sealing plates communicating with the start and end of the serpentine passage.

6. A holding container according to claim 5 in which the serpentine passage is upwardly pitched from start to end, said sealing plates having curled vertical edges contacting the exterior of the reverse bends of the wall-like members to resist movement thereof when the passage is subjected to internal pressure.

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