March 6, 1951 W. A. OLSEN 2,544,349

HEAT EXCHANGE APPARATUS

Filed Oct. 25, 1946

FIG. 1.

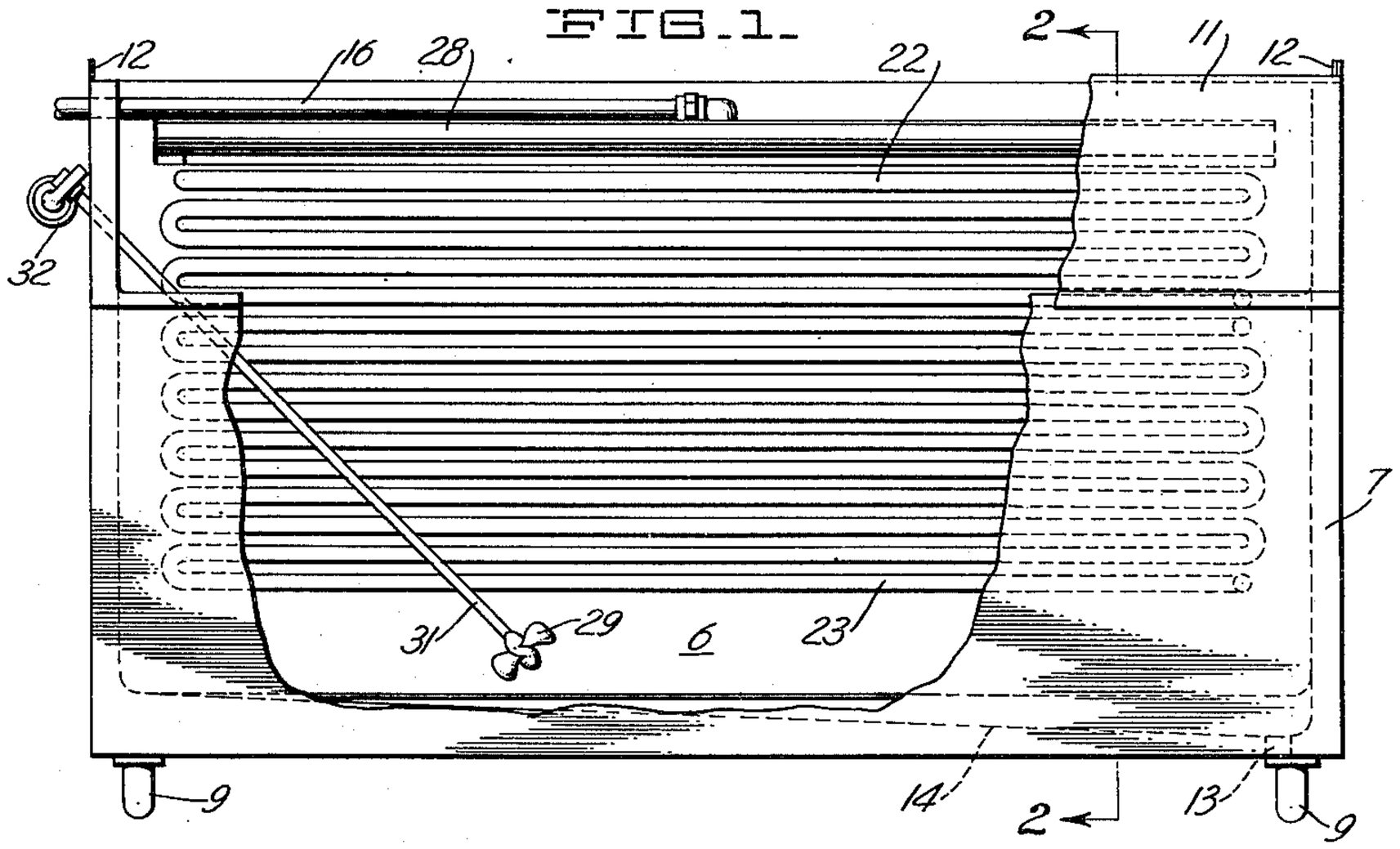


FIG. 2.

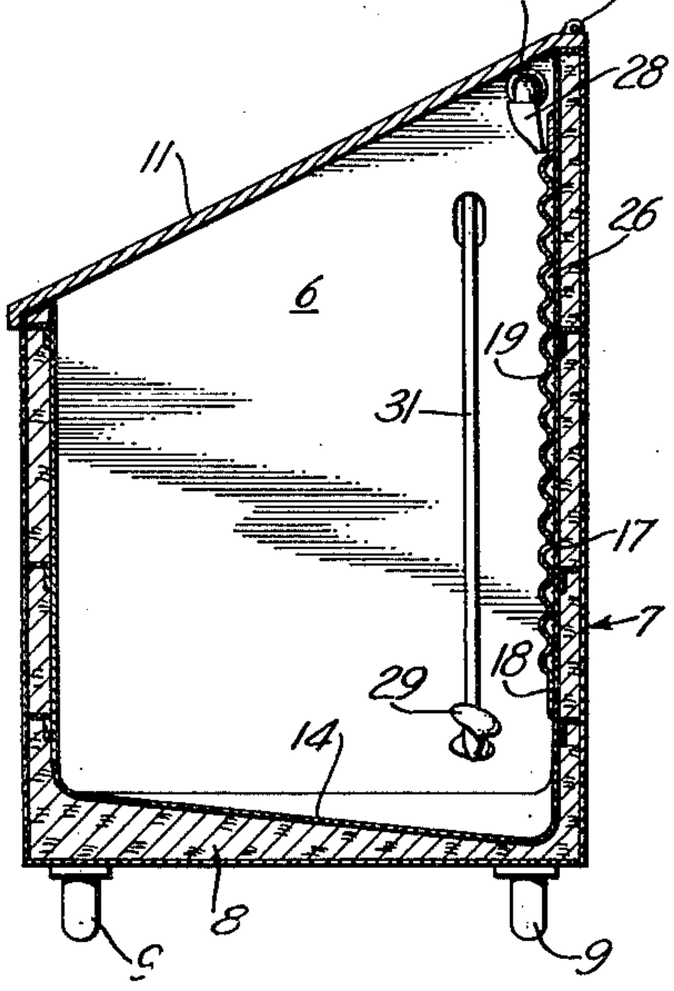


FIG. 3.

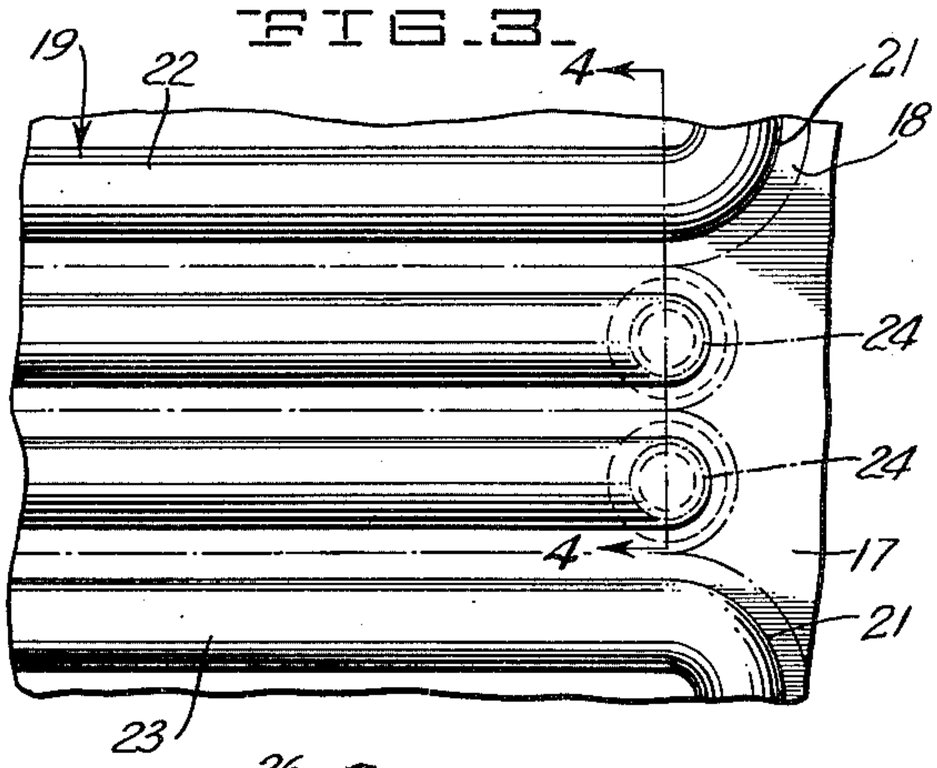
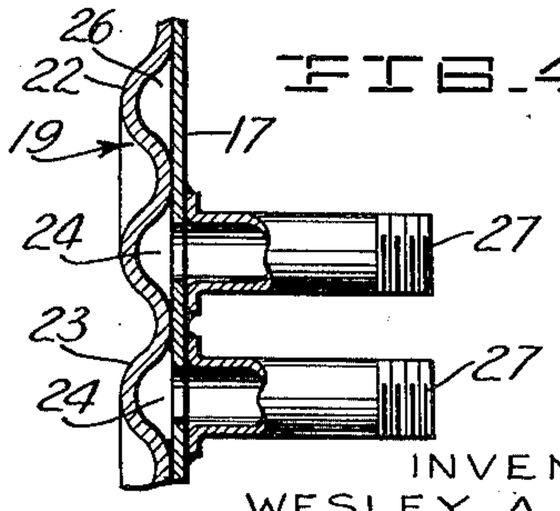


FIG. 4.



INVENTOR.
WESLEY A. OLSEN
BY Joseph B. Gardner
HIS ATTORNEY.

Patented Mar. 6, 1951 2,544,349

UNITED STATES PATENT OFFICE

2,544,349

HEAT EXCHANGE APPARATUS

Wesley Andrew Olsen, Oakland, Calif., assignor to Sanitary Metal Products Company, Oakland, Calif., a copartnership

Application October 25, 1946, Serial No. 705,650

1 Claim. (Cl. 257—178)

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This invention relates to receptacles in which substances may be cooled or heated, and has particular reference to such receptacles designed for use in milk processing plants.

An object of the invention is to provide a combined heater or cooler and storage vat arranged as a compact unit.

Another object of the invention is to provide a vat of the character described whose sidewall members function as sidewall elements of tortuous ducts through which a heating or coo'ing medium may be passed to effect re'ative heat transfer between the medium and the substance contained in the vat.

A further object of the invention is to provide apparatus of the character described in which the inner surfaces of the vat exposed to direct contact with the liquid contained therein are all devoid of folds or recesses of a like nature which might interfere with or retard the thorough cleaning of the surfaces.

Still another object of the invention is to provide, in a heat insulated vat of the nature referred to provided with an inbu'lt duct through which a heating or cooling medium may be continuouslv circulated, an improved wall structure, comprising said coil and the insulating material therefor, which is arranged to produce a minimum wall thickness without sacrificing anv of the insulating qualities of the wall and contributing towards a diminished volumetric bulk in the apparatus.

A still further object of the invention is to provide, in apparatus of the character described, a wall member duallv serving as a side of the vat and as a side wall common to a plurality of ducts associated with the side of the vat so that stresses due to temperature changes which might exist unequally in structures emp'oying separate vat walls and coils are equalized.

The invention possesses other objects and features of advantage, some of which, with the foregoing, will be set forth in the following description of the preferred form of the invention which is illustrated in the drawings accompanying and forming part of the specification. It is to be understood, however, that variations in the showing made by the said drawings and description may be adopted within the scope of the invention as set forth in the claim.

Referring to the drawing:

Figure 1 is a front elevational view of a fluid holding vat in which the improvements of my invention are embodied. The view is longitudinally condensed to conserve space in the drawing and portions are broken away so as to more clearly disclose the interior structure.

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Figure 2 is a vertical sectional view taken in the plane indicated by the line 2—2 of Figure 1.

Figure 3 is an enlarged portional front elevational view of the rear interior wall of the vat.

Figure 4 is a vertical sectional view taken in the plane indicated by the line 4—4 of Figure 3.

The drawing illustrates a vat structure, commonly known in the milk-processing field as a holding tank in which a considerable volume of milk may be accumulated or stored between various steps in the process. The vat comprises an inner open-top receptacle 6 formed of sheet metal, preferably stainless steel or a surface-tinned or plated material having a separate outwardlv-spaced exterior shell 7 defining a space surrounding the sides and bottom of the receptacle 6 in which insulating material such as cork 8 is placed so as to thermally insulate the receptac'e. Suitable supporting feet 9 are provided, interposed between the bottom of the shell and the floor or other surface on which the apparatus may rest, and one or more covers 11 are provided overlying the upper opening of the tank and are movable from closed to open positions on suitable hinges 12 interconnecting the cover, or covers, and the shell. A suitable drain duct 13, situated at the lowermost portion of the sloping receptacle bottom 14, is provided through which the contents of the receptacle may be drawn off and suitable means such as an inlet pipe 16 may be used to introduce the fluid into the tank. Holding tanks of the type just described are employed as receivers for fresh incoming whole milk or as reservoirs between pasteurizer and separator, between separator and packaging machine or in simi'ar locations. In the average process, heating or cooling of the milk while passing between process stages are essential and consequentlv require, in addition to the pumps needed to effect flow of the milk, apparatus wherein the desired degree of temperature may be imparted to the liquid mass. I have provided means built into the holding tank for effecting cooling or heating of the milk as the latter passes through the tank or is stored therein and such means is arranged to impart to the incoming flow of liquid a conditioning temperature which may be intermediate the respective temperatures at which the liquid enters and leaves the tank. Referring to Figures 2 through 4, it will be seen that I have provided overlying the sheet 17, forming the inner rear wall of the receptacle 6, a face sheet 18 of stainless steel or

any of the other above-mentioned materials, having embossed corrugations 19 therein. Adjacent corrugations are joined at their ends, as shown in Figure 3, by semicircular continuing corrugations 21 so that a group of the corrugations cooperate to form a tortuous continuous passage. In the drawing an upper group 22 and a separate lower group 23 of the corrugations are so joined to form separate units. The outer side corrugation of each group has a terminal portion 24 which may be substantially in line with the adjacent return bends or arcuate corrugations 21. As shown in Figure 4, and as indicated by the dot and dash lines of Figure 3, the sheets 17 and 18 are pressure-welded together so as to outline the various convolutions of the groups of corrugations and the terminals 24 of each group, thus forming between the sheets continuous flow passages 26. Inlet and outlet nipples 27, we'ded into suitable apertures in the sheet 17 aligned with the corrugation terminals 24, are provided by means of which cooling or heating fluids may be introduced into and circulated through the flow passages.

It will be seen in Figure 2 that the parallel corrugations of the face sheet 18 form a series of vertically spaced riffles extending over substantially the entire vertical height of the inner rear wall of the tank. I provide, in association with the inlet pipe 16, a distributing trough 28 adapted to receive milk or other liquid to be heated or cooled and to discharge the liquid in a comparatively thin film toward and onto the uppermost portion of the face sheet 18 so that the liquid may then flow gravitationally, downwardly over successive riffles until it joins the body of liquid previously passed over the riffles and held in the tank. Heating or cooling of the liquid as it is passing over the riffles may be accomplished by causing steam or refrigerant, as the case may be, to circulate through the flow passages defined by the associated groups of corrugations. While such heating or cooling of the incoming liquid is in progress the bulk of the previously admitted liquid in the tank is also subjected to a continuing heating or cooling process by means of a screw impeller 29, which may be rotated by means of a shaft 31 driven by a motor 32 positioned exteriorly of the tank and which causes a circuitous flow of the liquid toward and over the corrugations of the lower group 23 thereof. In the handling of milk it is desirous that the liquid be given a preliminary intermediate heating or cooling before it is subjected to the final and desired hotter or colder temperature as the case may be. This may be accomplished in the apparatus of my invention by circulating low-pressure and high-pressure steam through the upper and lower flow passages respectively when heating of the liquid is desired or by circulating cold water through the upper flow passage and a refrigerant such as Freon gas, ammonia, sulfur dioxide or the like through the lower flow passage when cooling of the liquid is to be obtained.

It will be seen that the circulating coil structure within the tank and the riffles over which the liquid may flow to be heated or cooled present

a tank surface which may be cleaned as readily as any of the flat tank walls. It will also be seen that the combination of sheets 17 and 18 of similar material to form the flow passages enables the parts to expand or contract uniformly under changes of temperature so that no strains due to unequal stretching or shrinkage which might fracture or separate joined sections will occur. It will be seen further that the incorporation of a heater or cooler as an integral part of the holding tank eliminates the need of a separate cooler intermediate the holding tank and the preceding unit of processing equipment and also dispenses with the need of a pump or other flow inciting means for transferring the liquid from the aforesaid cooler to the holding tank. In small establishments where space is usually at a premium this latter feature is of considerable value.

I claim:

Apparatus having joined side walls and a substantially rectangular bottom forming a tank in which heat transfer may occur between liquid in said tank and a temperature-influencing substance disposed in proximity to said liquid, comprising a sheet member overlying a surface of the side wall of the tank exposed to said liquid in the tank, said sheet member having embossed areas of the body thereof disposed in substantially horizontal relatively spaced parallel relation and spaced relative to the adjacent side wall of the tank to define a passage through which said temperature-influencing substance may flow, means connecting adjacent embossed areas to form a continuous tortuous conduit, said embossed areas of the sheet member also providing riffles comprising alternate protrusions and depressions extending in a series vertically of the sheet member, said sheet member and the adjacent side wall of the tank being bonded together in the areas of said depressions to outline said conduit, and means for directing a flow of said liquid onto the upper portion of said sheet member to flow gravitationally across said riffles and at substantially right angles thereto into the tank and in proximity to said temperature-influencing substance, said means including an open-bottomed trough extending substantially the entire horizontal length of one of said embossed areas whereby said liquid will be uniformly distributed across said area.

WESLEY ANDREW OLSEN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,751,317	Gail	Mar. 18, 1930
1,797,014	Nichols	Mar. 17, 1931
2,057,895	Hougland	Oct. 20, 1936
2,064,141	Askin	Dec. 15, 1936

FOREIGN PATENTS

Number	Country	Date
103,555	Australia	Apr. 7, 1938