March 17, 1942. V. I. GROVE 2,276,964

REFRIGERATING APPARATUS

Filed July 31, 1940 2 Sheets-Sheet 1

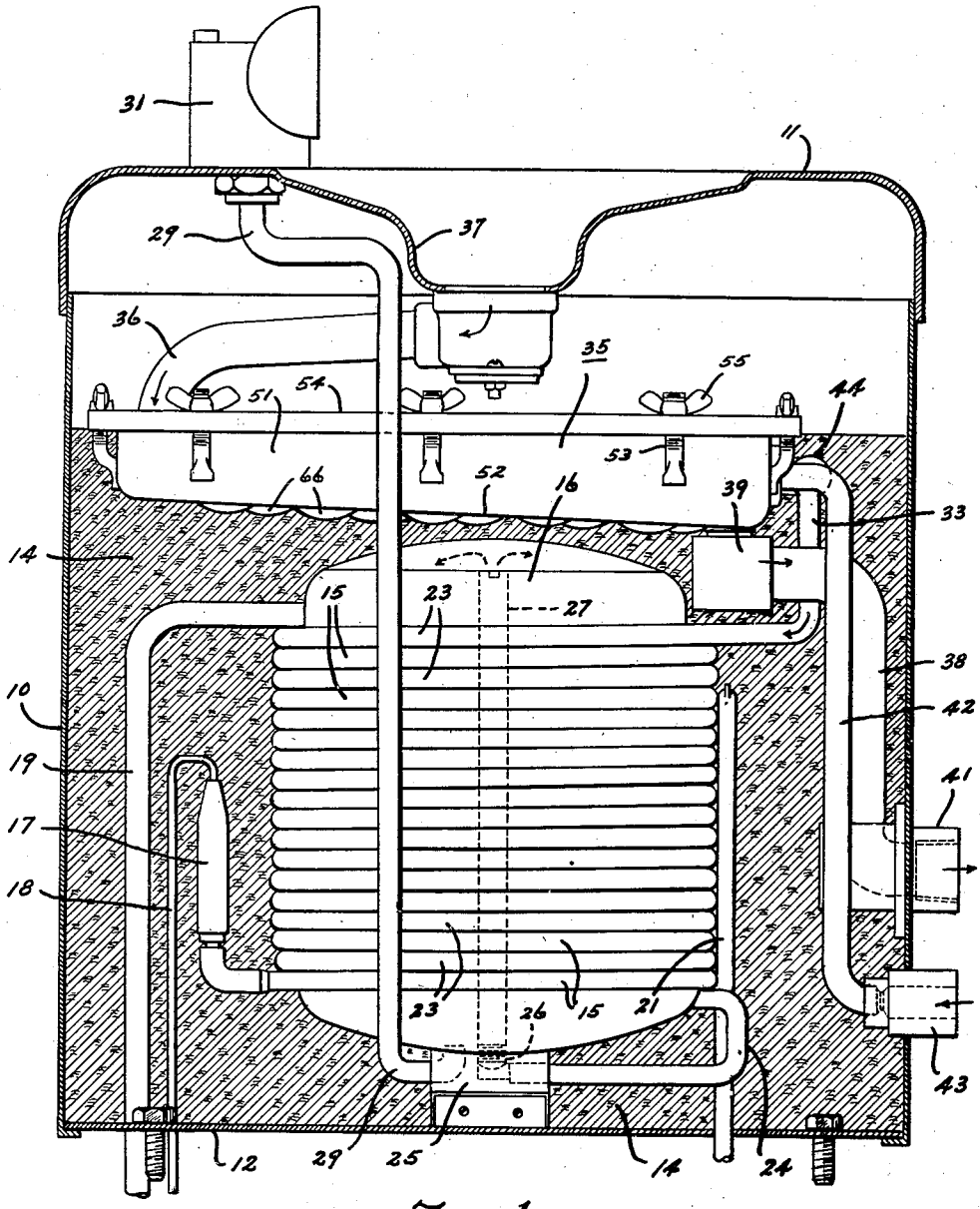

Fig. 1

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HIS ATTORNEYS.

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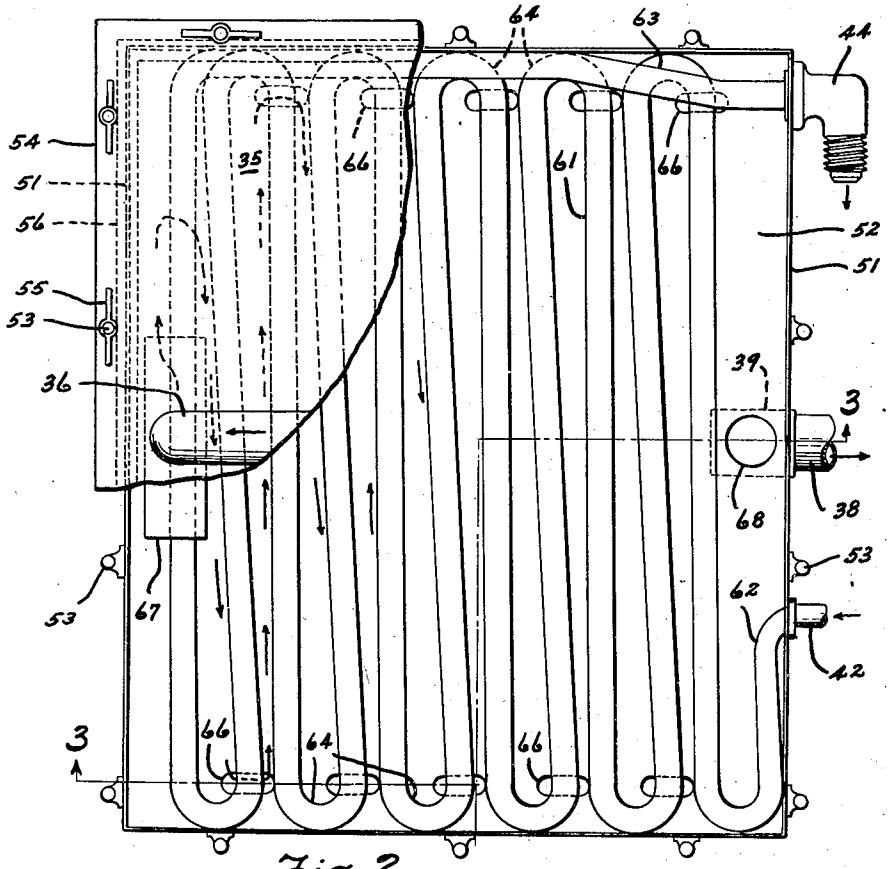

Fig. 2

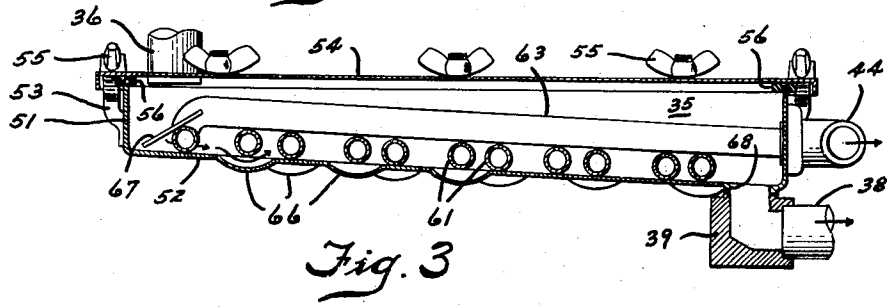

Fig. 3

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Patented Mar. 17, 1942

2,276,964

UNITED STATES PATENT OFFICE

2,276,964

REFRIGERATING APPARATUS

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Application July 31, 1940, Serial No. 348,699

8 Claims. (Cl. 62—141)

This invention relates to refrigeration and particularly to water cooling apparatuses.

A general object of my invention is to provide an improved drinking water cooling apparatus.

Another object of my invention is to utilize cold waste water ordinarily drained from a water cooling apparatus in an improved manner for precooling relatively warm water entering the apparatus.

Another object of my invention is to provide a water cooling apparatus wherein the water to be cooled for drinking purposes is precooled in stages by different cooling sources prior to its final cooling and withdrawal from the apparatus.

A further object of my invention is to provide a water cooling apparatus with an improved low cost and compact precooler having extended heat transfer surfaces that utilize waste water of the apparatus for rendering the surfaces effective.

A still further and more specific object of my invention is to provide a precooler for a water cooling apparatus in the form of a relatively flat pan or tank, adapted to receive cold waste water from the drain basin of the apparatus, constructed and arranged to cause the waste water to flow back and forth across the pan or through the tank and in contact with a water precooling pipe upon flowing downwardly over an inclined bottom wall of the tank or pan.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the present invention is clearly shown.

In the drawings:

Fig. 1 is a vertical sectional view through the upper part of a refrigerated water cooling apparatus having a precooler incorporated therein and constructed in accordance with the present invention;

Fig. 2 is a top view of the precooler disclosed in Fig. 1 and showing a part of the cover thereof broken away; and

Fig. 3 is a sectional view of the precooler taken on the line 3—3 of Fig. 2 with the cover thereon.

I am aware of the fact that precoolers, utilizing cold waste water from the drinking fountain of mechanically refrigerated water coolers, have previously been employed but little attention has been given these precoolers to obtain maximum efficiency therefrom. Accordingly the feature of my invention is to provide a precooler for a water cooler which utilizes to the utmost efficiency the temperature of the cold waste water for precooling relatively warm water entering a water cooler. For the purpose of illustrating my invention I have shown in Fig. 1 of the drawings the upper part only of a refrigerated water cooler cabinet which may be of rectangular or square form in horizontal cross-sectional contour. The water cooler comprises a casing 10 having a basin 11 mounted thereon and a bottom plate 12. Elements 10, 11 and 12 form an enclosure which houses an evaporator of a closed refrigerant circulating system. Any suitable insulating material 14 surrounds the evaporator and extends outwardly therefrom to the walls of the enclosure. The evaporator is in the form of a vertically disposed coil 15 which surrounds and is preferably secured to a closed water tank or cooling chamber 16. Cooling chamber or tank 16 may be formed of two shells telescoped and secured together to provide a spaced apart double walled structure which receives refrigerant between the walls for directly and finally cooling water within the chamber or tank. Such a structure is well-known in the sheet metal evaporator art and needs no further description herein. The evaporator coil 15 is provided with an inlet connection in the form of a suitable restrictor or expansion valve 17. A pipe 18 conveys liquid refrigerant to the restrictor or expansion device 17 from a condenser (not shown) of a conventional refrigerating system whereupon the liquid refrigerant is expanded upon entering the coil 15. The outlet pipe 19 of the evaporator coil 15 is connected to the compressor (not shown) of the conventional refrigerating system and the compressor withdraws evaporated or gaseous refrigerant from the evaporator coil 15 to augment the expansion or vaporization of refrigerant therein to cause same to produce a refrigerating effect. A thermostat bulb or tube 21 contacts coils of the evaporator 15 and may be connected to a bellows located within a suitable snap switch for controlling operations of the motor-compressor-condenser unit of the refrigerating system as is also conventional in the art. The convolutions of evaporator coil 15 are spaced apart and a water coil 23 which also surrounds the tank 16 is inter-nested with the evaporator in the space between its coiled convolutions. Water coil 23 has an outlet pipe connection 24 connected into a fitting 25, upon which the tank 16 is supported from the bottom plate 12, and this fitting is provided with a port 26 communicating with the interior of the water storage and cooling tank 16. A pipe 27 is threaded into the port 26 and extends upwardly within the tank 16 to a point near the top thereof. Any suitable baffle ar-

rangement may be provided within tank 16 to cause water discharged from the open end of pipe 27 to flow outwardly therefrom and downwardly along and in contact with the side walls of tank 16 which water is thereby cooled by the refrigerating effect produced by evaporator 15. A discharge pipe 29 communicating with the bottom portion of tank 16 is secured to fitting 25 and extends therethrough and upwardly to a valved fountain or bubbler 31 mounted upon the basin 11 of the water cooling apparatus. This fountain or bubbler may be of any suitable or well-known construction and is preferably of the type disclosed in the copending application of Wilford H. Tetter, Serial No. 347,344, filed July 24, 1940. Water coil 23 is provided with an inlet pipe 33 for directing water through the coil into the tank 16. The inter-nesting of the water coil 23 with the refrigerant evaporator coil 15 provides a precooler for water entering the tank 16 to be cooled. Ordinarily all the pre-cooling of incoming water to tank 16 is carried out by transferring heat of the water within coil 23 to refrigerant within evaporator coil 15 and such method of precooling the water places an undue load or requirement on the refrigerating system. My invention contemplates a precooling of the water to be cooled for drinking purposes prior to its flowing in intimate heat exchange relation with the evaporator coil 15 to thereby take some of the load off the refrigerating system and increase the efficiency thereof as well as to increase the capacity of the water cooler.

In the present disclosure I provide a precooler generally represented by the reference character 35 in Fig. 1 of the drawings and connect the same to a pipe 36 which conveys cold waste water from the drain-pit 37 of basin 11 thereinto. The precooler device 35 is preferably disposed above the tank 16 so that the insulation 14 within casing 10 surrounds the bottom sides thereof. A pipe 38 having a connection 39 with the precooler 35 and a connection 41 projecting through a wall of casing 10 conveys the waste water from the precooler 35 to the sewer drain. Precooler 35 contains a water pipe that has an inlet pipe connection 42 provided with a coupling 43 which projects through a wall of casing 10 for connection with a source of water supply. The precooler 35 also has an outlet connection 44 to which the inlet pipe 33 of water coil 23 is connected. Describing the precooler 35 more in detail with reference to Figs. 2 and 3 of the drawings it will be noted that this precooler is in the form of a flat closed tank. The tank of precooler 35 comprises a shallow horizontally disposed pan 51 having an inclined bottom wall 52. A plurality of studs 53 welded or otherwise suitably secured to the upright side walls of pan 51 extend through openings provided in a cover 54 and wing nuts 55 threaded upon the studs 53 hold the cover tightly in place on pan 51 to provide the closed tank precooler 35. A rubber or other suitable resilient material gasket 56 is disposed between cover 54 and the edges of the upright pan walls to seal the tank. The cover 54 prevents foreign matter from getting into the tank and prevents clogging or stoppage of the path of flow of waste water to be hereinafter described. A flat, serpentine in form, water conveying pipe 61 is disposed in tank 35 and is welded or otherwise suitably sealed to the inclined bottom wall 52 thereof. This serpentine pipe 61 has its one end 62 connected to the water inlet pipe 42 and has its opposite end portion 63 raised and extended over the reversely bent end portion 64 thereof and connected to the outlet connection 44. It will be noted that the portions of pipe 61 intermediate the bends 64 extend across the pan 51 in a direction opposite or substantially at right angles to the direction of inclination of the pan bottom wall 52 and that these intermediate portions of pipe 61 are disposed at a slight angle with respect to one another. The reversely bent end portions 64 of pipe 61 are also welded or otherwise suitably sealed to the upright side walls of pan 51. Along two sides of pan 51 adjacent the reversely bent end portions 64 of pipe 61 I provide a plurality of spaced apart depressions 66 in the inclined bottom wall 52 of pan 51. Cover 54 of precooler 35 has an opening therein which receives the one end of pipe 36 extending from the drain-pit 37 of basin 11. A plate 67 is welded to pipe 61 at a point beneath the open end of pipe 36 and this plate is disposed at an angle so as to direct water entering the device 35 onto the pan on the one or upper side of the pipe 61. In the central lower portion of the inclined bottom wall 52 of pan 51 I provide an outlet opening 68 which communicates with the connection 39.

When a lever or button on bubbler or fountain 31 is depressed cooled water from the cooling chamber or tank 16 flows through pipe 29 and bubbler or fountain 31 and is emitted therefrom in an inclined stream for drinking purposes. Obviously when cooled water is discharged from bubbler 31 relatively warm water enters pipe 42, under pressure from the source of water supply 43, and flows through the precooling pipe 61 within device 35 and thence through connection 44 and pipe 33 into the second precooling coil 23. Water is directed from coil 23 by pipe 24 into the upper part of the cooling and storage chamber 16 and flows downwardly over the inner walls of tank 16 where it is cooled to its proper or final low temperature by the refrigerating effect produced by evaporator 15. Cold water discharged from bubbler or fountain 31, which is not consumed by the person seeking a drink or drinking, flows into the pit 37 of basin 11 and is directed by pipe 36 into the precooler device 35. This cold waste water emitted from pipe 36 strikes the plate 67 within device 35 and is directed thereby to the bottom wall 52 of pan 51 on the upper or left hand side of the first turn of pipe 61 as viewed in Figs. 2 and 3 of the drawings. This waste water flows along the first part of pipe 61 in a direction represented by the arrows in Fig. 2 of the drawings to a point where this first part of pipe 61 is elevated relative to the bottom wall 52 of pan 51. Here the cold waste water flows under the pipe 61 and is directed by the next angularly disposed intermediate portion of the pipe 61 to the opposite side of pan 51. Since the portions of pipe 61 intermediate its bends 64 are sealed to the bottom wall 52 of pan 51 and since the reversely bent end portions 64 thereof are sealed to the side walls of the pan waste water is caused to flow in a zigzag or serpentine path across the pan 51 in its passage down the inclined bottom wall of the precooler device 35. The depressions 66 in the bottom wall 52 of pan 51 serve to co-operate with the sealing of pipe 61 to pan 51 to provide the back and forth or serpentine path of flow of the waste water described and provide ducts or passages for the flow of water from the upper to the lower side of each intermediate portion of the pipe 61. The direction of flow of the

waste water is opposite the direction of flow of drinking water passing through pipe 61 and this preference makes for better heat exchange between the cold waste water and the relatively warm inflowing drinking water. The extended path of flow of waste water and drinking water in thermal heat exchange relationship with one another afforded by the device 35 renders this device very efficient as a precooler. Thus the device 35 may be termed a secondary precooler where cold waste water from the bubbler or fountain 31 is utilized to remove some heat from the incoming drinking water before the drinking water flows to the primary precooler associated with the evaporator of the refrigerating system.

It will be apparent from the foregoing that I have provided an improved precooler wherein the extended path of flow of waste water in intimate thermal heat exchange relationship with the extended path of flow of relatively warm incoming drinking water insures complete utilization of the low temperature of the waste water before this waste water flows away from the water cooling apparatus. I have provided a structure wherein incoming drinking water is precooled in stages prior to its flow into the final cooling chamber to thereby increase the capacity of the water cooler under peak demands of cold water and prevent periodic too frequent starting and stopping operations of the refrigerating system or machine incorporated in the apparatus under normally cold water dispensing requirements. The improved precooler is simple in construction and its manufacturing cost is completely negatived when compared to the increased efficiency and larger capacity afforded by its use in a water cooling apparatus.

While the form of embodiment of the invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follows.

What is claimed is as follows:

1. An apparatus for cooling drinking water comprising in combination, a cooling chamber and means for conveying water thereto to be cooled, means for cooling the water delivered to said cooling chamber, means for delivering the cooled water to a place of use, said first named means including a precooler, said precooler comprising a pan having an inclined bottom wall and a pipe disposed thereupon, said pipe being bent into a serpentine form with the portions thereof intermediate its bends extending across the pan transversely of the direction of inclination of the pan bottom, means for admitting cooled waste water to said pan at the top of the inclination of the pan bottom wall, and said pipe and said pan being so constructed and arranged with respect to one another as to direct the waste water back and forth across said pan and in contact with the intermediate portions of said pipe during flow thereof down the inclined bottom pan wall for lowering the temperature of water to be cooled by said second named means.

2. An apparatus for cooling drinking water comprising in combination, a cooling chamber and means for conveying water thereto to be cooled, means for cooling the water delivered to said cooling chamber, means for delivering the cooled water to a place of use, said first named means including a precooler, said precooler comprising a horizontally disposed pan having an inclined bottom wall and a pipe disposed thereupon, said pipe being bent into a serpentine form with the portions thereof intermediate its bends extending across the pan transversely of the direction of inclination of the pan bottom, means for admitting cooled waste water to said pan at the top of the inclination of the pan bottom wall, said pipe and said pan being so constructed and arranged with respect to one another as to direct the waste water back and forth across said pan and in contact with the intermediate portions of said pipe during flow thereof down the inclined bottom pan wall for lowering the temperature of water to be cooled by said second named means, and said intermediate portions of said pipe being disposed at an angle to one another to provide inclined paths of flow of the waste water in both directions across the pan.

3. An apparatus for cooling drinking water comprising in combination, a cooling chamber and means for conveying water thereto to be cooled, means for cooling the water delivered to said cooling chamber, means for conveying the cooled water to a place of use, said first named means including a precooler, said precooler comprising a pan having an inclined bottom wall and a pipe disposed thereupon, said pipe being bent into a serpentine form with the portions thereof intermediate its bends extending across the pan transversely of the direction of inclination of the pan bottom, means for admitting cooled waste water to said pan at the top of the inclination of the pan bottom wall, said pipe being sealed to the pan walls and normally obstructing the flow of waste water downwardly over the inclined bottom pan wall, means adjacent the bends of said pipe forming a passage for the waste water between the intermediate portions thereof, and said last named means being arranged to cause the waste water to flow back and forth across the pan along and in contact with the intermediate portions of said pipe for lowering the temperature of water to be cooled by said second named means.

4. An apparatus for cooling drinking water comprising in combination, a cooling chamber and means for conveying water thereto to be cooled, means for cooling the water delivered to said cooling chamber, means for conveying the cooled water to a place of use, said first named means including a precooler, said precooler comprising a pan having an inclined bottom wall and a pipe disposed thereupon, said pipe being bent into a serpentine form with the portions thereof intermediate its bends extending across the pan transversely of the direction of inclination of the pan bottom, means for admitting cooled waste water to said pan at the top of the inclination of the pan bottom wall, said pipe being sealed to the pan walls and normally obstructing the flow of waste water downwardly over the inclined bottom pan wall, means adjacent the bends of said pipe forming a passage for the waste water between the intermediate portions thereof, said last named means being arranged to cause the waste water to flow back and forth across the pan along and in contact with the intermediate portions of said pipe for lowering the temperature of water to be cooled by said second named means, and said intermediate portions of said pipe being disposed at an angle to one another to provide inclined paths of flow of the waste water in both directions across the pan.

5. An apparatus for cooling drinking water comprising in combination, a cooling chamber

and means for conveying water thereto to be cooled, means for cooling the water delivered to said cooling chamber, means for conveying the cooled water to a place of use, said first named means including a precooler, said precooler comprising a pan having an inclined bottom wall and a pipe disposed thereupon, said pipe being bent into a serpentine form with the portions thereof intermediate its bends extending across the pan transversely of the direction of inclination of the pan bottom, means for admitting cooled waste water to said pan at the top of the inclination of the pan bottom wall, said pipe being sealed to the pan walls and normally obstructing the flow of waste water downwardly over the inclined bottom pan wall, said bottom wall of said pan having a set of spaced apart depressions formed therein along one side thereof and a second set of spaced apart depressions formed therein along the opposite side thereof, said depressions along the one side of said pan cooperating with alternate intermediate portions of said pipe and the depressions along said other side of said pan also cooperating with alternate intermediate portions of said pipe to form passages for the flow of waste water down the inclined bottom pan wall, and said depression and said pipe causing the flow of waste water to be in a back and forth path across said pan and in contact with each of said pipe portions for lowering the temperature of water to be cooled by said second named means.

6. An apparatus for cooling drinking water comprising in combination, a cooling chamber and means for conveying water thereto to be cooled, means for cooling the water delivered to said cooling chamber, means for conveying the cooled water to a place of use, said first named means including a precooler, said precooler comprising a pan having an inclined bottom wall and a pipe disposed thereupon, said pipe being bent into a serpentine form with the portions thereof intermediate its bends extending across the pan transversely of the direction of inclination of the pan bottom, means for admitting cooled waste water to said pan at the top of the inclination of the pan bottom wall, said pipe being sealed to the pan walls and normally obstructing the flow of waste water downwardly over the inclined bottom pan wall, said bottom wall of said pan having a set of spaced apart depressions formed therein along one side thereof and a second set of spaced apart depressions formed therein along the opposite side thereof, said depressions along the one side of said pan cooperating with alternate intermediate portions of said pipe and the depressions along the other side of said pan also cooperating with alternate intermediate portions of said pipe to form passages for the flow of waste water down the inclined bottom pan wall, said depressions and said pipe causing the flow of waste water to be in a back and forth path across said pan and in contact with each of said pipe portions for lowering the temperature of water to be cooled by said second named means, and said intermediate portions of said pipe being disposed at an angle to one another to provide inclined paths of flow of the waste water in both directions across the pan.

7. An apparatus for cooling drinking water comprising in combination, a cooling chamber and means for conveying water thereto to be cooled, means for cooling the water delivered to said cooling chamber, means for delivering the cooled water to a place of use, said first named means including a precooler, said precooler comprising a substantially pan-like element and a pipe disposed thereupon, means for admitting cooled waste water to said pan-like element and means for conveying the waste water away from said pan-like element, said pipe being bent with portions intermediate its bends disposed between said waste water admitting means and said waste water conveying means, and said pipe and said pan-like element being so constructed and arranged with respect to one another as to direct waste water admitted to said pan-like element in contact with intermediate portions of said pipe during flow thereof through the pan-like element to said waste water conveying means for lowering the temperature of water to be cooled by said second named means.

8. An apparatus for cooling drinking water comprising in combination, a cooling chamber and means for conveying water thereto to be cooled, means for cooling the water delivered to said cooling chamber, means for delivering the cooled water to a place of use, said first named means including a precooler, said precooler comprising a substantially pan-like element having an inclined bottom wall and a pipe disposed thereupon, means for admitting cooled waste water to said pan-like element at the top of the inclination of the bottom wall thereof, said pipe being bent with portions intermediate its bends disposed between said waste water admitting means and said waste water conveying means, and said pipe and said pan-like element being so constructed and arranged with respect to one another as to direct waste water admitted to said pan-like element in contact with intermediate portions of said pipe during flow thereof down the inclined pan-like element bottom wall for lowering the temperature of water to be cooled by said second named means.

VERNET I. GROVE.