

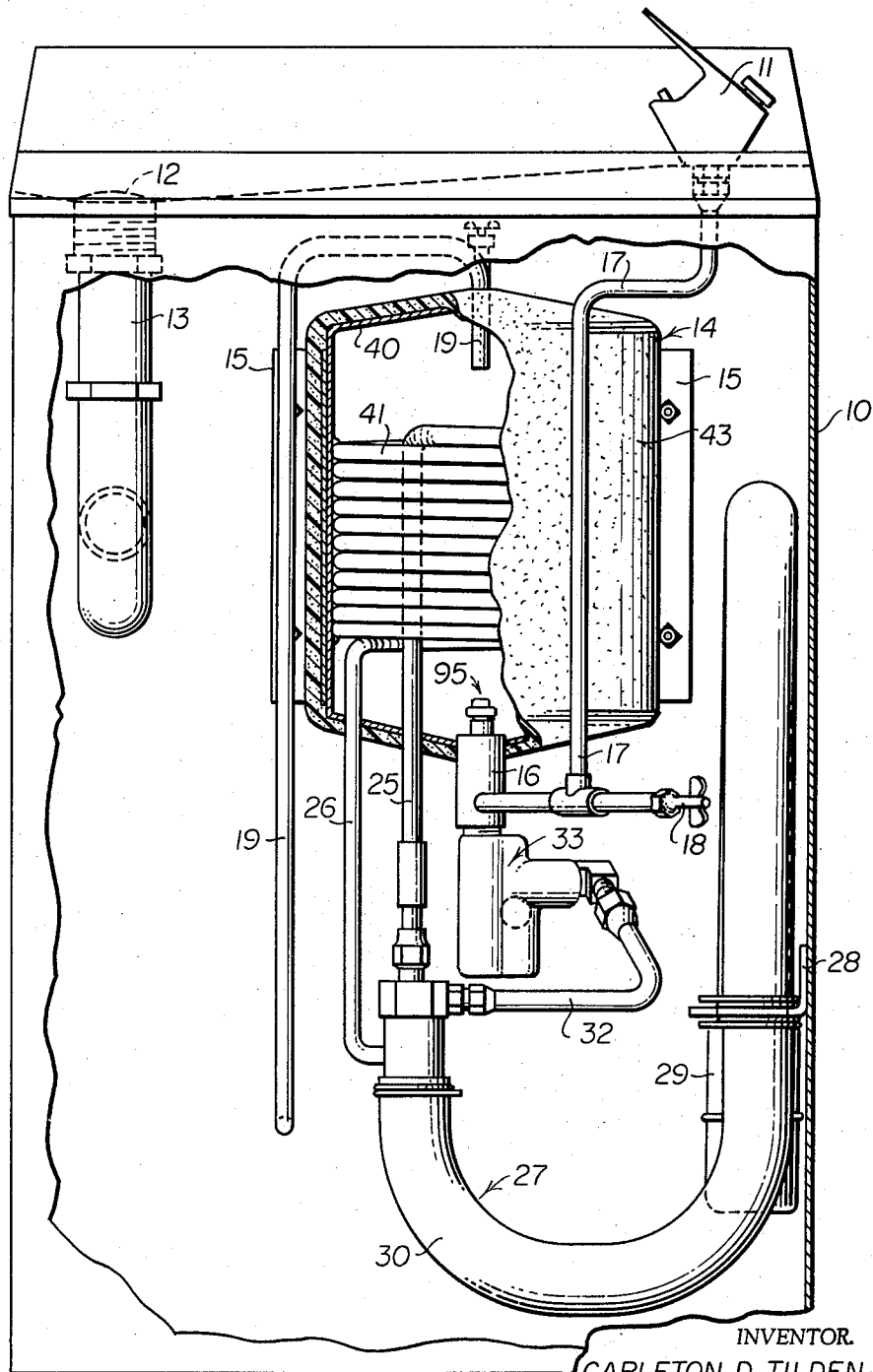
Aug. 18, 1964

C. D. TILDEN
LIQUID COOLING SYSTEMS

3,144,754

Filed June 17, 1963

4 Sheets-Sheet 1



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4 Sheets-Sheet 2

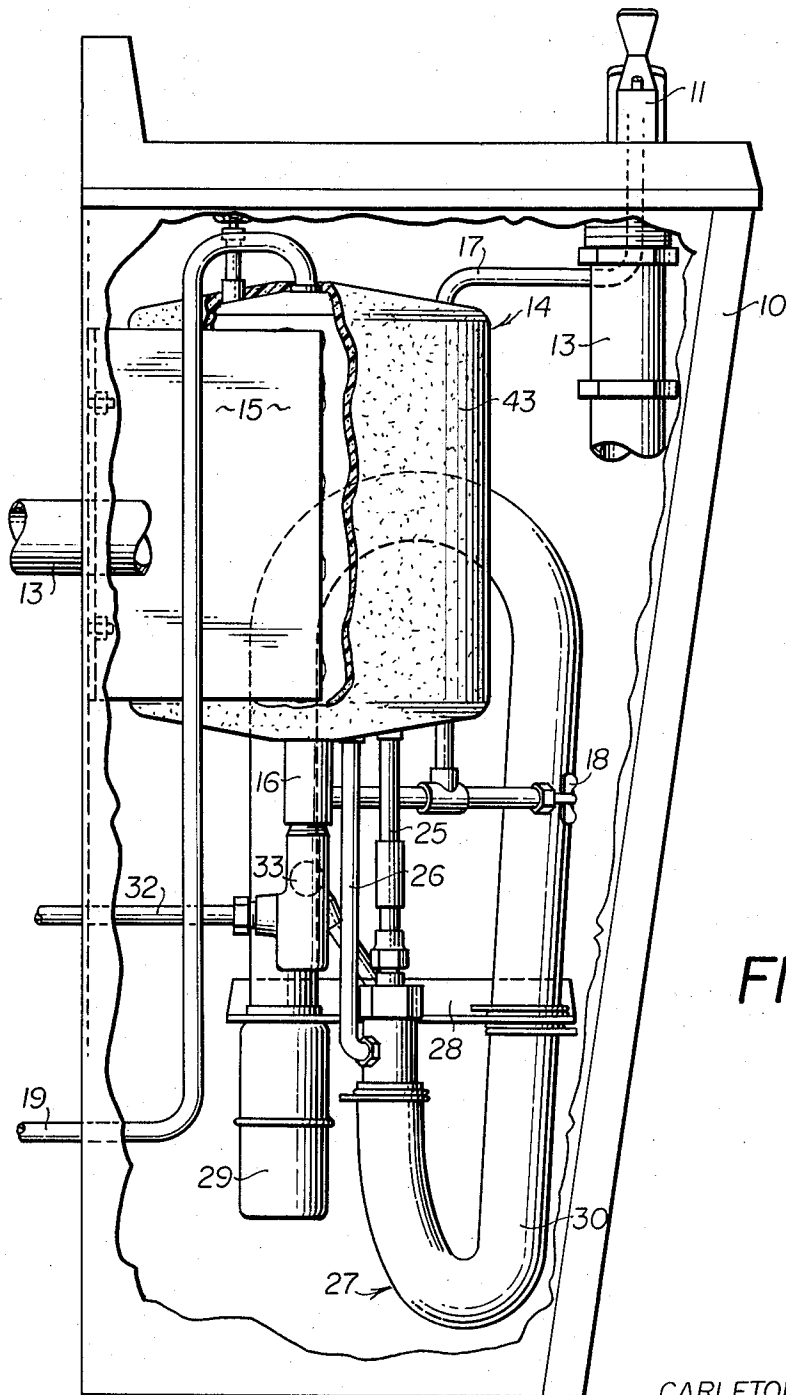


FIG. 2

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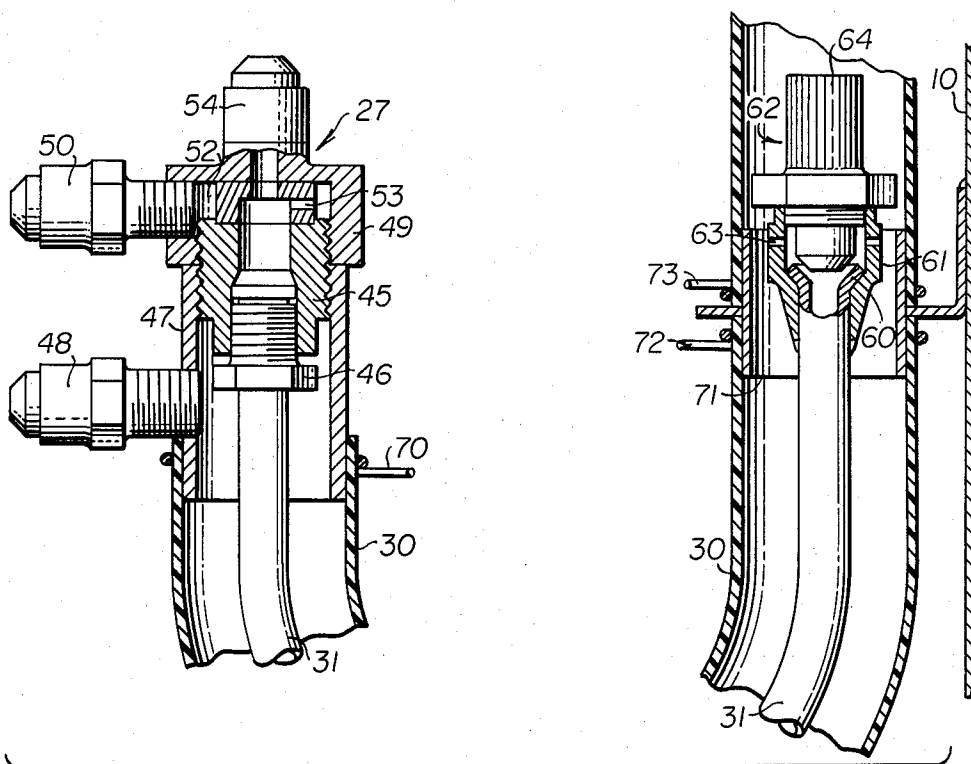


FIG. 3

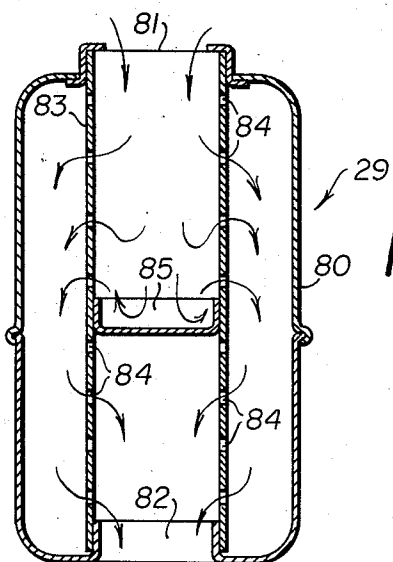


FIG. 4

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4 Sheets-Sheet 4

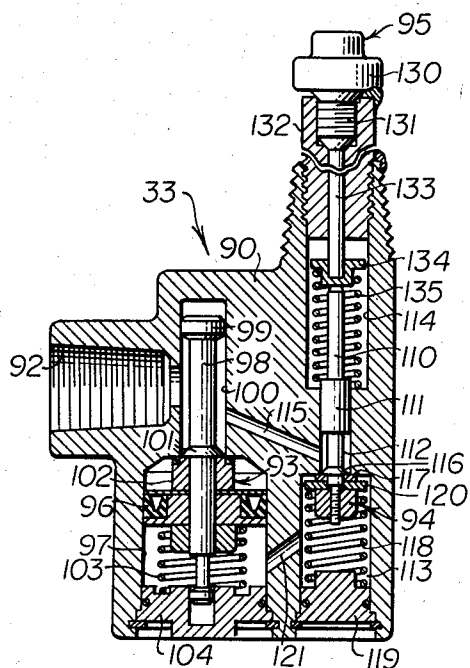


FIG. 5

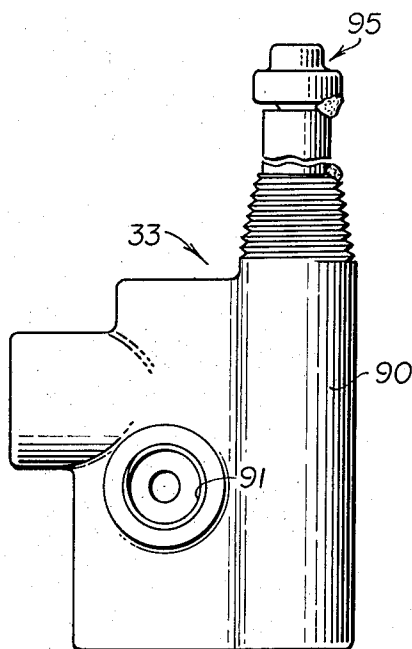


FIG. 6

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LIQUID COOLING SYSTEMS

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4 Claims. (Cl. 62-5)

This invention relates generally to liquid cooling systems, and more specifically to improvements in water cooler constructions which are particularly adapted to the use of vortex tube refrigeration devices.

Mechanically refrigerated water coolers customarily include an electric motor which drives a compressor for compressing a suitable gas, such as Freon, a gas expansion valve, and a condenser which is cooled by a fan for removing heat from the condenser. In the usual construction, the gas passes through the expansion valve into an evaporator coil which surrounds a water tank mounted in a cabinet. The space between the cabinet walls and the tank is filled with insulation material, such as cork or the like.

The foregoing conventional construction is relatively expensive because of the several components which are necessarily employed. In addition, the mechanical refrigeration system requires considerable maintenance, particularly under severe operating conditions of vibration, wear and dirt such as encountered, for example, in railroad locomotives. Furthermore, there are many applications in which sparks cannot be tolerated because of the explosive environment. In these applications, the electrically operated mechanical refrigeration systems of the prior art cannot be safely used.

Another objection to conventional water cooler constructions is the expensive and typically inefficient manner of producing and insulating the water tank. According to the most common construction, the evaporator coil is secured around the tank so that only a small peripheral part of the coil contacts the tank walls. Consequently, the heat transfer from the liquid through the tank walls to the coil is relatively inefficient. In order to overcome this objection, it has been proposed to form the tank walls with grooves in which the coil is seated to increase the area of surface contact; however, this provision adds to the cost of construction. It has also been recognized that the conventional practice of packing insulating material around the coil and tank does not prevent significant heat transfer losses which lessen the efficiency of the cooling system.

As generally described above, the present invention provides improvements in water cooling systems which are particularly adapted to the use of vortex tube refrigeration devices. The vortex refrigeration device is the essence of simplicity and consists essentially of a tube including an air inlet nozzle for tangentially introducing air or other gas into the tube and creating a high speed vortex flow, the vortex being characterized by an axially moving shell of hot air and a core of relatively cold air. Because of the vortex phenomenon, two fractions of gas can be caused to issue from the tube at temperatures which are above and below the temperature of the supply gas. For the purposes of illustration, one commercially acceptable embodiment of a vortex tube hereinafter will be discussed in detail.

Since vortex tubes do not involve any moving parts and are of a relatively simple construction, the cooling system provided by this invention is inexpensive and is substantially maintenance-free. Further, no electrical connections are required so that the improved water cooler embodying the vortex tube can be employed safely in those applications in which electrically operated mechanical systems cannot be used.

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Although vortex tubes have been known and used prior to the present invention, the principle of operation remains in dispute and has never been clearly understood. Hence, for each proposed application of a vortex device, it is usually necessary thoroughly to investigate the operating conditions and requirements before a device can be constructed which will satisfy these operating conditions and requirements in a most optimum manner. As will also be described in detail, this invention provides improvements in the arrangement and construction of a vortex tube which particularly adapt it for use in water cooling apparatus that can be installed in offices and in places where the available space is limited, such as in railroad locomotives and the like.

The invention also contemplates a new and improved heat insulated water tank construction which is relatively inexpensive, easy to install, and which reduces to a minimum heat transfer losses. The improved heat insulation characteristic of the new water tank construction and the improved efficiency which is obtained in extracting heat from the water makes the assembly especially suited for use with a vortex refrigeration system which by itself is relatively inefficient as compared to mechanical systems. While the improved water tank construction is particularly adapted for use with a vortex tube refrigeration device, it will be apparent, however, that it can also be employed to advantage in water cooling apparatus embodying conventional mechanical refrigeration systems.

Accordingly, an object of the invention is to provide new and improved liquid cooling systems which overcome the disadvantages previously discussed.

A more specific object of the invention is to provide a new and improved vortex tube refrigeration system.

Another object of the invention is to provide improvements in the construction of water cooling apparatus which are especially adapted to the efficient use of a vortex tube refrigeration system.

Still another object of the invention is to provide a new and improved heat insulated water tank construction which is relatively inexpensive, easy to install, and which reduces heat transfer losses to a minimum.

Other objects and advantages of the invention will become apparent from the following detailed description and the accompanying drawings.

In the drawings:

FIGURE 1 is a front elevational view, partially in cross-sections, of a water cooler apparatus embodying the present invention;

FIGURE 2 is a side elevational view of the apparatus illustrated in FIG. 1;

FIGURE 3 is a fragmentary cross-sectional view illustrating a preferred vortex tube refrigeration device;

FIGURE 4 is a cross-sectional view of a portion of the apparatus illustrated in FIG. 1;

FIGURE 5 is a cross-sectional view of the apparatus illustrated in FIG. 6; and,

FIGURE 6 is an elevational view of the apparatus illustrated in FIG. 5.

Referring now to the drawings, and to FIGS. 1 and 2 in particular, the preferred arrangement provided by the invention is shown embodied in a water cooling apparatus which includes a cabinet 10. The cabinet 10 has the usual water dispensing mechanism 11, a drain 12, and a drain pipe 13 which extends from below the drain pipe 13 which extends from below the drain through the back wall of the cabinet.

A heat insulated water tank assembly 14 is mounted within the cabinet 10 by brackets 15. A drain adapter 16 is fitted in the bottom of the tank assembly 14 and is connected to the water dispensing mechanism 11 by an outlet pipe 17. The outlet from the tank assembly may include a discharge valve 18. Water under pressure is

supplied into the top of the tank assembly through an inlet pipe 19.

The water tank assembly 14 also includes a gas inlet pipe 25 through which a refrigerated gas, preferably air, is supplied, and an outlet pipe 26 for exhausting the gas from the assembly. According to the preferred construction, refrigerated gas is generated by a vortex tube assembly 27 which is connected to one side of the cabinet 10 by a bracket 28. The outlet of the vortex assembly 27 for the cold gas fraction is in communication with the pipe 25, while the hot gas fraction is preferably exhausted through a muffler 29. As shown, the vortex tube assembly includes an outer conduit 30 which is connected to the pipe 26 so that the gas exhausted from the tank assembly 14 is caused to flow along the outside of the vortex tube 31 (FIG. 3) in heat exchange relationship and is then exhausted with the hot gas through the muffler.

Gas is supplied to the vortex assembly 27 through an inlet line 32 that is connected to a suitable source (not shown), such as an air compressor or the like. In the preferred embodiment, a mechanically operated control valve 33, hereinafter described in more detail, is operatively disposed in the gas inlet line 32. This valve includes a temperature sensitive element which is exposed to the liquid in the tank assembly through the adapter 16, and is operable selectively to establish and prevent gas flow to the vortex assembly in response to temperature changes of the liquid.

As shown most clearly in FIG. 1, the new water tank assembly of this invention includes a sealed, metal tank 40 and a gas conducting channel 41. As generally described above, the water inlet pipe 19 extends through the top of tank 40 and the drain adapter 16 is mounted through the bottom wall. The gas conducting channel 41 is preferably formed by a metal coil which is mounted within the tank and brazed to its walls. The gas inlet line 25 and the exhaust line 26 extend through a wall of the tank and are connected to the top and bottom of the coil, respectively.

The tank 40 is completely enveloped by a shell of heat insulating material 43. This heat insulation material is preferably a rigid foam form of polyurethane resin which is formed around the tank to provide an integral assembly. The polyurethane foam has the advantages of imparting strength and rigidity to the tank at little increase in weight, and has good insulating properties. In addition, the enveloping shell of polyurethane foam protects the tank 40 against detrimental environmental conditions.

Because of the foregoing construction of the tank assembly 14 in which the coil 41 is directly exposed to the liquid, the efficiency of cooling is improved over prior art constructions. Furthermore, the mounting of the coil within the tank and the provision of the enveloping shell of polyurethane foam reduces heat transfer losses to a minimum. At the same time, the tank assembly can be economically and easily produced. The preferred construction also provides an assembly which can be conveniently shipped and easily installed.

The vortex tube assembly 27 is most clearly shown in FIG. 3. As illustrated, the tube 31 of the assembly is of a bent, generally U-shaped configuration. One end of this tube 31 extends into an externally threaded adapter cylinder 45 and is held in place by a nut 46 which is secured to the tube and threaded into an end of the adapter. The adapter 45 is in turn partially threaded into a housing 47 which has a nipple 48 connected through its wall. The nipple 48 is adapted to be connected to the exhaust line 26 from the gas conducting channel 41 of the tank assembly (FIGS. 2 and 4).

A cap 49 is threaded on the upper end of the adapter cylinder 45. This cap 49 has a nipple 50 which is adapted to be connected to the gas supply line 32 (FIG. 1). Mounted within the cap and spaced from its sides is a nozzle 52 having a tangentially formed inlet port 53. The

nozzle 52 is secured between the top of the cap and the adapter cylinder 45 so that the gas supplied into the cap around the nozzle will tangentially enter the top of the tube 31 through the port 53 to create a high speed vortex. The resulting cold gas fraction passes from the end of the tube through the top of the cap 49 and an integrally connected nipple 54 which is adapted to be connected to the gas channel inlet line 25 (FIGS. 1 and 4).

The opposite end of the vortex tube 31 is provided with a flange 60 and is mounted within the housing 61 of a throttle valve 62 which is operable to release the hot gas fraction from the tube. As shown, the throttle valve housing 61 has a plurality of outlet ports 63 and a valve stem 64 which is threaded into the housing. The stem is axially adjustable toward and away from the flanged end of the tube 31 so that the volume of hot gas that is released can be varied. In this manner, the volume and temperature of the cold gas fraction can be selectively varied to suit the operating conditions of the cooling apparatus.

The conduit 30 is formed in two sections. The section that surrounds the vortex tube 31 has one end secured to the housing 46 by a clamp 70 and its opposite end secured around a sleeve 71 by another clamp 72. The sleeve 71 is connected to the mounting bracket 28. The other section of the conduit has an end secured to the sleeve 71 by a clamp 73 and its opposite end connected to the muffler 29 (FIG. 2). With this construction, the gas leaving the tank assembly channel 41 enters the conduit 30 through the nipple 48 and flows around the tube 31 to cool it. This gas flowing around the vortex tube is then exhausted through the muffler 29 jointly with the hot gas released by the throttle valve 62.

Reference is now made to FIG. 4 which illustrates in detail a preferred construction of the muffler 29. As shown, the muffler includes an outer casing 80 having an inlet end 81 and an outlet end 82. A tube 83 having a plurality of holes 84 through its wall is mounted between the inlet and outlet ends of the casing 80, and a deflector plate 85 is centrally disposed intermediate the ends of the tube 83.

The exhaust gas from the conduit 30 enters the inlet end 81 of the muffler 29 and strikes the deflector plate 85. As illustrated by the arrows in FIG. 4, the gas striking the deflector plate rebounds and collides with incoming gas to obtain a decelerating effect, whereupon the gas flows at reduced intensity out of the upper end of the tube 83 through the holes 84. The gas is then expanded in the chamber defined by the casing walls and the outside of the tube and flows from this chamber through the holes 84 in the left hand end of the tube out through the outlet end 82 of the muffler. In the preferred construction, the total area of the holes 84 exceeds the area of the inlet opening to the muffler so that the gas is able to move freely and quickly through the muffler with minimum back pressure, while providing extremely efficient noise dampening.

As generally described above, gas is supplied to the nozzle 52 of the vortex tube assembly through a gas supply line 32 and a mechanically actuated control valve 33 which is operatively disposed in the gas line. Referring to FIGS. 5 and 6, the control valve 33 is shown to include a valve body 90 having an inlet port 91 and an outlet port 92. Control of gas flow through the valve from the inlet port to the outlet port is provided by the combined action of the main poppet 93 and a pilot poppet 94. As will be explained in more detail, actuation of the poppets is effected by a temperature sensing mechanism 95.

The main poppet 93 comprises a piston 96 mounted in a piston bore 97 which is formed in the valve body 90. A piston rod 98 is connected to the piston 96 and has a head 99 that is reciprocal in a bore 100. The bore 100 is formed between the outlet port 92 and the piston bore 97. The rod 98 is also provided with a tapered flange 101 and a ring 102 between the ends of the rod, and this

flange and ring serve to block fluid communication between the bores 97 and 100 in the closed position of the main poppet illustrated in FIG. 5. A spring 103 between the piston 96 and a plug 104 which closes one end of the bore 97 serves to bias the main poppet toward the closed position.

The pilot poppet 94 is formed by a rod 110 having a plunger 111 which is reciprocal in a bore 112. This bore 112 extends between larger bores 113 and 114 and is connected to the bore 100 by a passage 115. The end of the rod 110 which extends into the bore 113 is provided with a flange 116 and a ring 117 which serve to block fluid flow from the bore 113 into the bore 112 and the passage 115 when the pilot valve is closed. The pilot valve 94 is urged into the closed position illustrated in FIG. 6 by a spring 118 which is disposed between a bore closing plug 119 and a washer 120 connected to the top of the rod 110. As is also shown in FIG. 6, the bores 97 and 113 are connected by a fluid passage 121 in the valve body 90.

In the illustrated construction of the valve 33, the temperature sensitive mechanism 95 includes a temperature sensitive medium, such as a suitable gas or a liquid, which is sealed in a container 130. The container 130 has an extending portion 131 in which is mounted a diaphragm (not shown) that is exposed to the sensing medium, and this container portion 131 is threaded into a member 132. The member 132 is in turn partially threaded into the valve body 90 at one end of the bore 114. The portion of the valve body surrounding the member 132 is externally threaded and is adapted to be mounted within the drain fitting 14 (FIG. 1) so that the container 130 is exposed to the liquid in the tank 40. A rod 133 is reciprocally disposed in the member 132 and extends between the diaphragm of the container 130 and a cap 134 which is fitted over the rod 133 at the end of the rod 110. A spring 135 is disposed within the bore 114 and bears against the cap 134 to maintain the rod 133 in contact with the diaphragm.

When the control valve 133 is connected in the gas supply line 32 and to the tank assembly 14 in the manner illustrated in FIG. 1, the inlet gas from source is transmitted into the bore 97 around the ring 102 of the main poppet 93. Assuming that the pilot poppet is in the closed position shown in FIG. 5, the main poppet is prevented from opening by the spring 103 and the fluid pressure in the bore 97 behind the piston 96 and in the connected bore 113. Thus, the supply gas is prevented from flowing through the outlet 92 of the control valve to the nozzle of the vortex tube assembly. This closed condition of the control valve is maintained until the temperature of the liquid in the tank 40 increases to a predetermined level at which the loading on the rods 110 and 133 that is produced by expansion of the temperature sensitive medium results in motion of the pilot valve to an open position in which fluid is permitted to flow from behind the main piston 96 through the passage 121, the bore 113, and the passage 115 to the outlet 92 of the valve. This fluid flow past the pilot valve establishes a pressure drop behind the piston 96 so that the pressure loading produced by the supply gas opens the main poppet and establishes fluid flow to the vortex tube assembly. The pilot valve remains open to permit fluid flow until the temperature of the liquid in the tank assembly falls below the predetermined level to reduce the loading produced by the temperature sensitive medium and thus effect retractive motion of the rod 133.

The operation of the new cooling system provided by this invention is largely apparent from the foregoing detailed description. In summary, a gas is supplied to the vortex tube assembly 27 through the control valve 33. This supply gas enters the nozzle 52 of the tube assembly and produces a high speed vortex flow characterized by a cold gas component below the temperature of the supply gas and a hot gas component above the temperature of the supply gas. When the supply gas is air at a pressure

in the range of from about 90 to 155 p.s.i., it is common to achieve a cold gas temperature of around 0° F. or even less. The exact temperature of the cold gas component, as well as the flow rate, can be varied by changing the setting of the throttle valve 62. To this end, the sections of the conduit 30 can be readily separated by removing one of the clamps 71 or 73, thereby exposing the throttle valve for adjustment.

The cold gas component passing from a vortex tube assembly through the inlet line 25 enters the coil 41 within the water tank 40. The gas from the vortex tube assembly flows through the coil 41 to cool the water and is then exhausted through the line 26 to the conduit 30. The gas leaving the coil 41 is usually about 40° to 50° F. after the water temperature has been stabilized and is therefore used to advantage to cool the vortex tube 31. As explained above, the gas in the conduit 30 and the hot gas released from the vortex tube by the throttle valve are jointly exhausted through the muffler 29.

The novel construction of the water tank assembly 14 is such that the water is cooled with optimum efficiency by contact with the coil 41 and heat losses from the insulated tank assembly are reduced to a minimum. The construction of the water tank assembly which provides these advantages is particularly important in combination with the cooling system of this invention, since, as noted above, the vortex tube is itself relatively inefficient. Therefore, by reducing the heat losses and increasing the efficiency of cooling, the entire efficiency of the system, including the vortex tube assembly, is improved.

Operation of the vortex tube assembly 27 is controlled by the valve 33 and is such that gas is supplied to the vortex tube assembly only when the liquid temperature is above a predetermined level. When the temperature of the liquid falls below this level, the control valve is closed to block fluid flow to the nozzle of the vortex assembly. The construction of the new water tank assembly also is of advantage since the liquid in the tank can be stabilized at a predetermined temperature and held at this temperature for a relatively long period of time without operation of the vortex tube assembly.

It will be apparent from the foregoing that the invention provides both a novel liquid cooling system and improvements in the construction of water coolers which are particularly adapted to the use of vortex tube refrigeration devices. In addition to the several advantages discussed above, the preferred embodiment of the system which is a generally U-shaped vortex tube is compact and can be mounted in a small wall cabinet that occupies considerably less space than conventional water coolers having mechanical refrigeration systems. Because of this compact construction and the novel arrangement in which the waste gas from the vortex tube is exhausted through a muffler, the cooling system is ideally suited for office-type water coolers and coolers which must be installed in a relatively small area, such as in railroad locomotives. Since the cooling system does not include any moving parts and is operated without electrical connections, the cooling apparatus embodying the system is substantially maintenance-free and also can be installed in those locations where mechanical refrigeration systems cannot be safely used.

The new water tank assembly in which the cooling coil is mounted in the tank and the tank enveloped in a shell of polyurethane has obvious utility in combination with conventional cooling systems and the cooling system comprising one aspect of this invention. However, the tank assembly is particularly useful with a vortex tube refrigeration device, since the minimal heat transfer losses and the improved cooling effected by the coil mounted in the tank result in an improvement in the efficiency of the vortex tube refrigeration system.

Many modifications and variations of the invention

will be apparent to those skilled in the art in the light of the foregoing detailed disclosure. Therefore, it is to be understood that, within the scope of the appended claims, the invention can be practiced otherwise than as specifically shown and described.

What is claimed is:

1. A liquid cooling system comprising:

- (a) a cabinet including liquid dispensing means,
- (b) sealed liquid containing means including a tank, a serpentine gas conducting channel having an inlet and an outlet, and a shell of heat insulating material enveloping said tank and channel,
- (c) means mounting said containing means in said cabinet,
- (d) liquid inlet means communicating with said tank for supplying a liquid to be cooled,
- (e) liquid outlet means connecting said tank to said liquid dispensing means,
- (f) a vortex assembly mounted in said cabinet, said assembly including a tube, a nozzle for tangentially introducing a gas into said tube to create a vortex, a cold gas outlet in communication with said channel inlet, and a throttle valve for releasing relatively hot gas from one end of said tube,
- (g) a conduit extending around said tube and beyond said one end,
- (h) means connecting said channel outlet to said conduit so that gas exhausted from said channel is caused to flow along the outside surfaces of said tube in heat exchange relationship, and
- (i) means for supplying gas to said nozzle,
- (j) said gas supply means including a mechanically actuatable control valve having an inlet port and outlet port, and means operatively disposed between said ports and exposed to the liquid in said tank for selectively establishing and blocking gas flow through said valve in response to temperature changes of said liquid.

2. The system as claimed in claim 1 wherein a muffler is connected to said conduit for jointly releasing the relatively hot air released by said throttle valve and the gas flowing from said channel through said conduit, and wherein said gas conducting channel comprises a coil disposed within said tank.

3. A liquid cooling system comprising:

- (a) sealed liquid containing means including a tank, an enveloping shell of heat insulation material formed around said tank, and means for conducting cooling gas through said containing means,
- (b) liquid inlet means communicating with said tank for supplying a liquid to be cooled,
- (c) liquid out means connected to said tank,
- (d) a vortex assembly including a tube, a nozzle connected to said tube for tangentially introducing a gas to create a vortex, a cold gas outlet from said tube, and means for releasing relatively hot gas from one end of said tube,
- (e) means connecting said cold gas outlet to said cooling gas conducting means,

- (f) means for supplying gas to said nozzle, said gas supplying means including a pipe and a control valve operatively disposed in said pipe,
- (g) said valve including means responsive to temperature changes of said liquid for selectively establishing and preventing gas flow to said nozzle,
- (h) a conduit surrounding said tube and extending beyond said one end thereof,
- (i) an exhaust line connecting said gas conducting means to said conduit so that gas flowing from said conducting means is caused to pass along the outside of said tube in heat exchange relationship, and
- (j) a muffler connected to said conduit for jointly exhausting the relatively hot gas released from said tube and the gas flowing through the said tube from said gas conducting means.

4. A liquid cooling system comprising:

- (a) a frame,
- (b) a liquid containing assembly mounted as a unit on said frame, said liquid containing assembly including a tank defining a liquid containing chamber and an integral shell of heat insulating material surrounding said tank, portions of said assembly defining a gas conducting passage in heat exchange relation with said tank chamber and extending from an assembly gas inlet to an assembly gas outlet,
- (c) means communicating with said tank chamber for supplying a liquid to be cooled to said chamber,
- (d) a liquid dispenser,
- (e) a liquid outlet conduit connecting said tank chamber to said liquid dispenser,
- (f) a vortex assembly mounted on said frame, said vortex assembly including a tube, a nozzle for tangentially introducing a gas into said tube to create a vortex, a cold gas outlet connected to said assembly gas inlet, and a hot gas outlet for releasing relatively hot gas from said tube,
- (g) a muffler,
- (h) means connecting said muffler to said vortex assembly so that the relatively hot gas released from said hot gas outlet is exhausted through said muffler.
- (i) gas supply means connected to said nozzle for supplying gas to said nozzle, and,
- (j) said gas supply means including a mechanically actuatable control valve having a valve inlet port and a valve outlet port, and means operatively disposed between said ports and exposed to liquid in said tank for selectively establishing and blocking gas flow through said valve in response to temperature changes of said liquid.

References Cited in the file of this patent

UNITED STATES PATENTS

2,698,525	Lindenblad	Jan. 4, 1955
3,006,979	Rich	Oct. 31, 1961
3,074,243	Tilden	Jan. 22, 1963
3,084,523	Bottom	Apr. 9, 1963

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

August 18, 1964

Patent No. 3,144,754

Carleton D. Tilden

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 2, line 21, for "makes" read -- make --; line 47, for "cross-sections" read -- cross-section --; line 64, strike out "13 which extends from below the drain pipe"; column 5, line 13, for "12" read -- 112 --; line 54, for "senistive" read -- sensitive --; column 7, line 52, for "out" read -- outlet --.

Signed and sealed this 17th day of August 1965.

(SEAL)

Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents