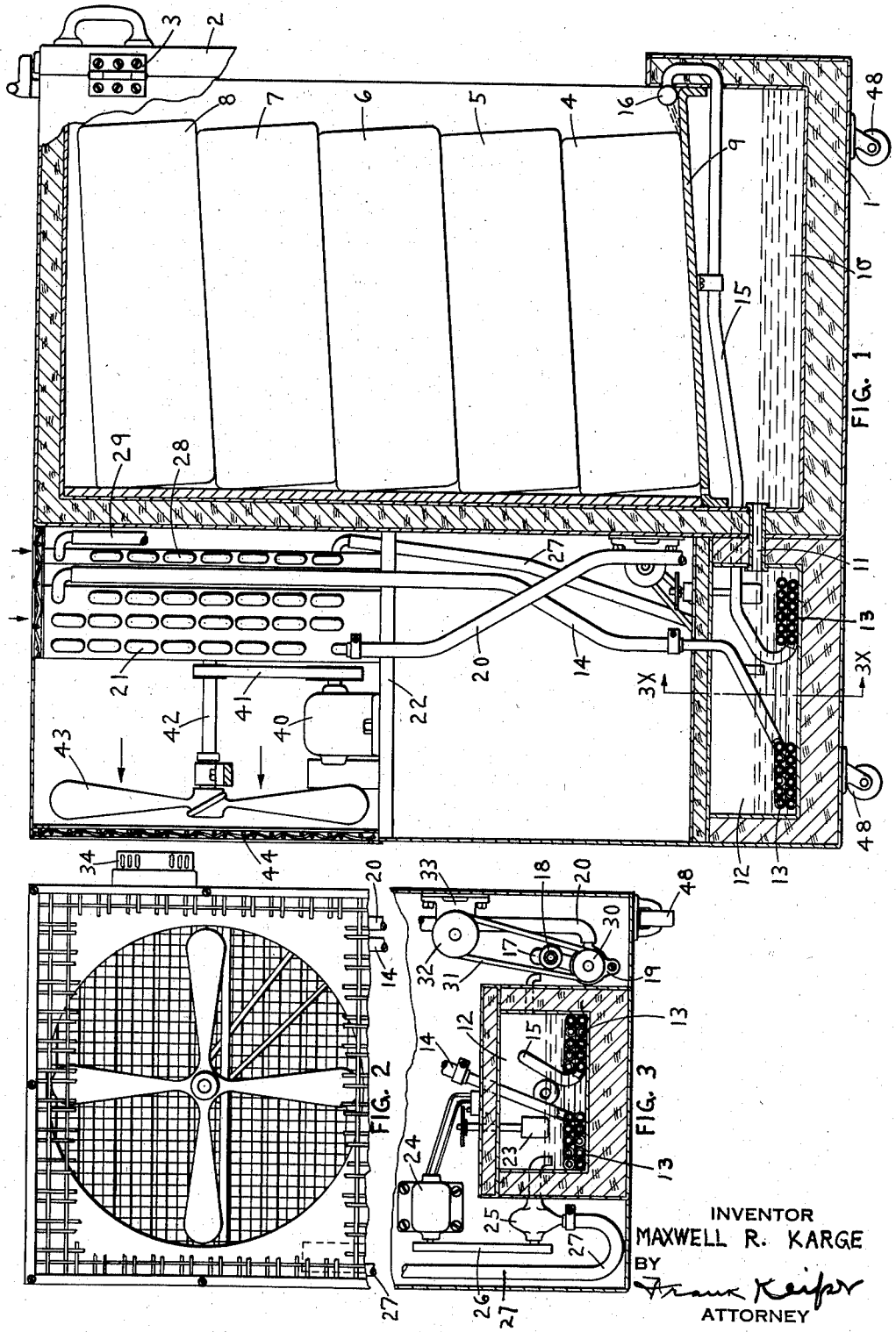
April 30, 1940. M. R. KARGE 2,198,822

AIR CONDITIONING APPARATUS

Filed Sept. 7, 1939 3 Sheets-Sheet 1




INVENTOR
MAXWELL R. KARGE
BY
Frank Keiper
ATTORNEY

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AIR CONDITIONING APPARATUS

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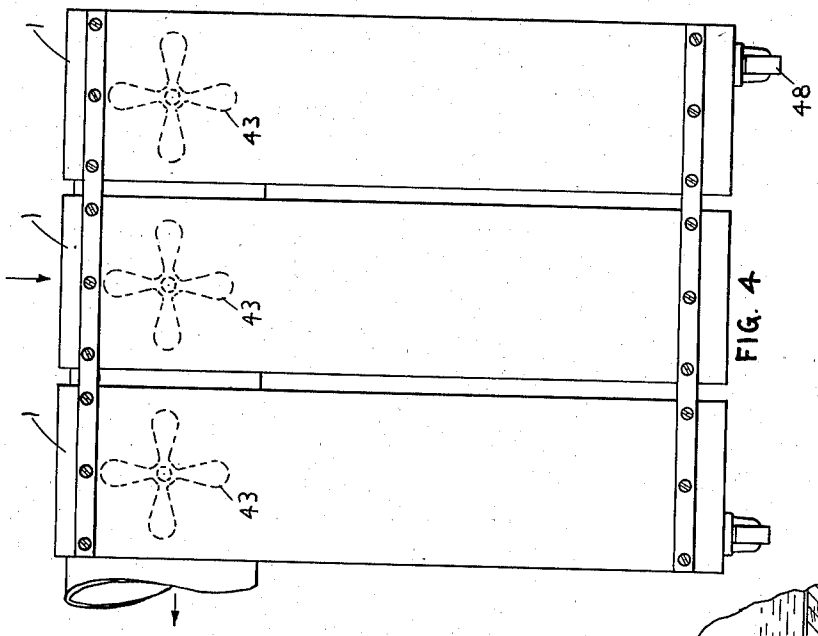



FIG. 4

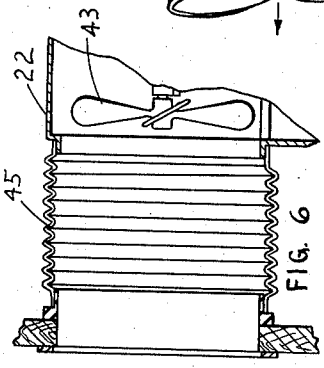
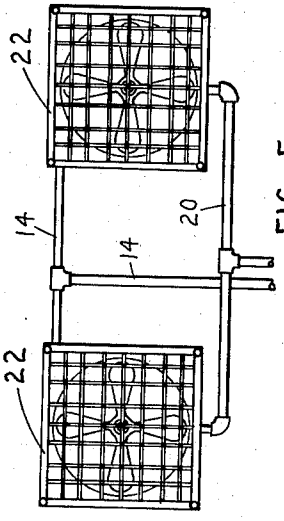



FIG. 6



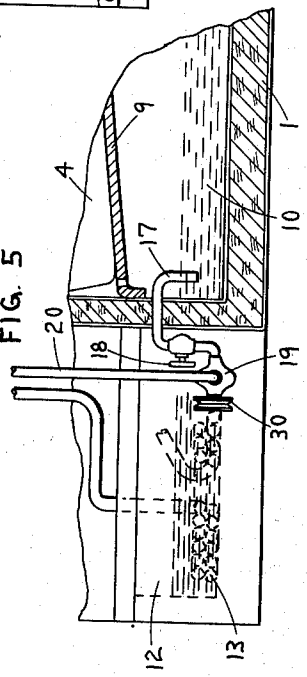




FIG. 5

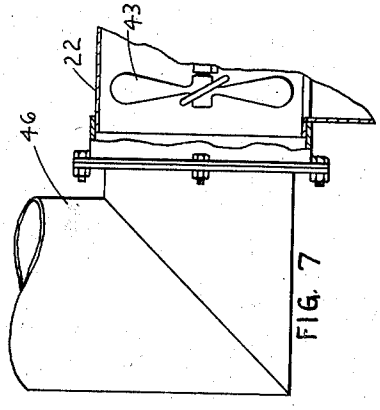



FIG. 7

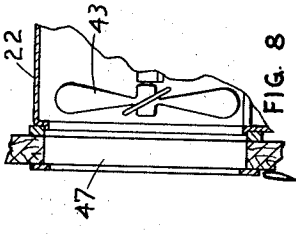



FIG. 8

INVENTOR
MAXWELL R. KARGE
BY
Frank Keiper
ATTORNEY

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AIR CONDITIONING APPARATUS

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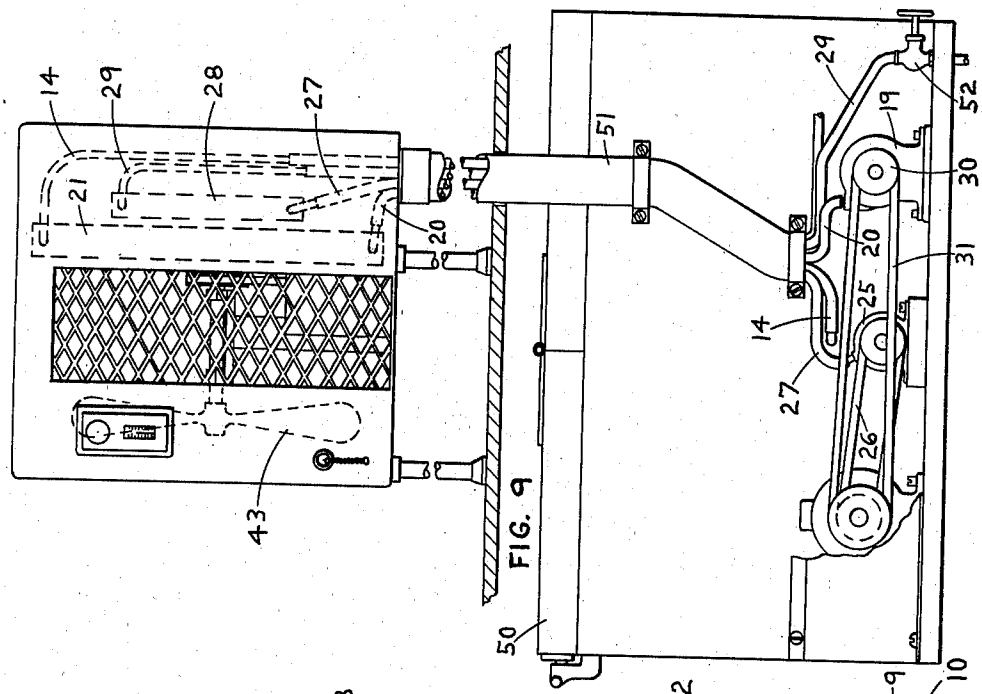


FIG. 9

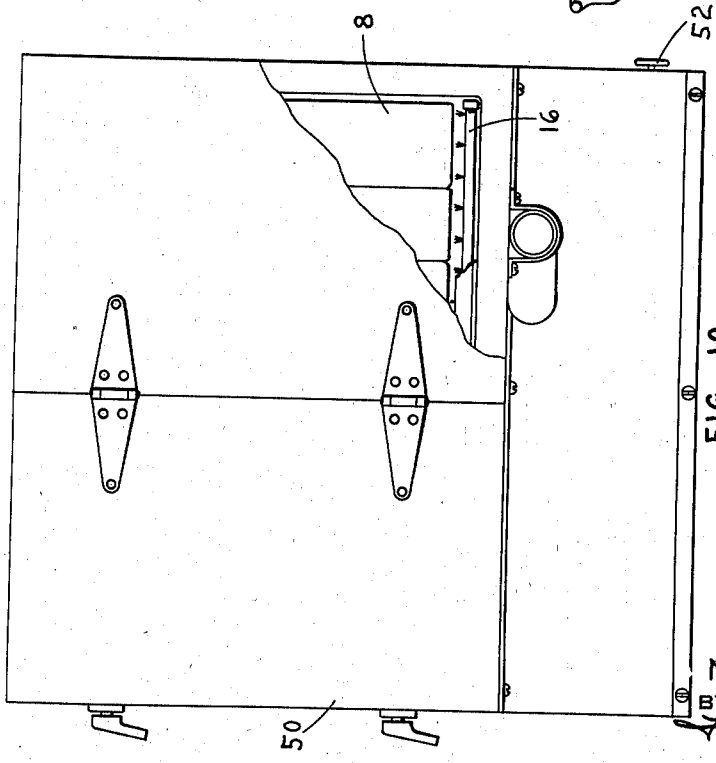


FIG. 10

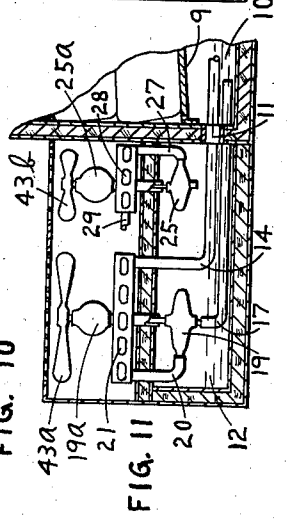


FIG. 11

INVENTOR
MAXWELL R. KARGE
BY
ATTORNEY

Patented Apr. 30, 1940

2,198,822

# UNITED STATES PATENT OFFICE

2,198,822

## AIR CONDITIONING APPARATUS

Maxwell R. Karge, Rochester, N. Y.

Application September 7, 1939, Serial No. 293,772

3 Claims. (Cl. 62—131)

The object of this invention is to provide an apparatus that melts ice for the purpose of air conditioning or cooling and drying the atmosphere of a room.

Another object of the invention is to provide an apparatus which comprises an ice chest that can be placed in the most convenient or any out-of-the-way place, which ice chest is connected to the air conditioning apparatus which is placed where it is most effective in cooling the air of a room.

Another object of the invention is to use ordinary ice in cakes or in scraps, which ice is melted for the purpose of cooling water, which water is then circulated to and through an air conditioning device by which the air of a room is cooled and the moisture of it is dried out, and the water with its temperature raised is returned to the ice chest where its temperature is reduced again.

Another object of the invention is to provide an auxiliary tank into which the surplus waste water is drained, and in which it is held temporarily, and from which at intervals it is discharged into any suitable drain.

Another object of the invention is to use the accumulated waste water to precool the air that goes through the air conditioning apparatus before it gets to the coil that contains the coldest water that is cooled directly by the ice, after which the waste water is discharged into the sewer.

Another object of the invention is to provide an air conditioning apparatus having two sets of coils therein, one set of coils of which is cooled by the waste water and from which the water is discharged into the sewer, and the other coil is cooled by the water that flows from the melting ice, which water is then returned to the ice chest.

Another object of the invention is to provide an air conditioning apparatus having two sets of coils therein, one set of coils of which is cooled by the waste water and from which the water is discharged into the sewer, and the other coil is cooled by the water that flows from the melting ice, which coils are supplemented by a tank which holds a certain amount of accumulated waste water, in which tank is submerged a third coil through which the returned water is passed and from which it is discharged into the ice chest.

These and other objects of the invention will be illustrated in the drawings, described in the specification, and pointed out in the claims at the end thereof.

In the drawings:

Figure 1 is a vertical longitudinal section through one form of the apparatus, showing the ice chest, the fan for circulating the air, and the two coils in the fan housing for cooling the air, and an auxiliary waste water tank and a third coil therein for precooling the water that is returned to the ice chest.

Figure 2 is a front elevation of the fan and housing therefor, showing the lattice front partly broken away.

Figure 3 is a vertical cross section through the waste water tank, the section being taken on the line 3x—3x of Figure 1.

Figure 4 is an assembly view of three of the units placed side by side, with the fan of each unit blowing the air through one common duct, the fans and air cooling coils of the three units being placed in series so that the same air passes through all three cooling units and is driven by all three fans.

Figure 5 is a diagrammatic view of the water circulating system showing two of the air conditioning and fan units arranged in parallel.

Figure 6 is a detail view of a large coupling used to connect the discharge end of the fan unit with a window of a house, or a bus, or a railroad car, et cetera, so that the cooled air is discharged where it is wanted.

Figure 7 is a detail view of a fan unit and a large pipe connected thereto, by which the cooled air can be conveyed to and discharged into any particular place it is desired to have it.

Figure 8 is a detail view of the fan unit with its discharge opening placed against an opening through the wall so that the complete unit can be placed in one room for the purpose of discharging cool air into an adjoining room.

Figure 9 is an assembly view of the ice chest and the circulating apparatus in one unit, and the coils and fan for air conditioning in another unit, with a flexible tube for containing the flexible water circulating tubes and the electric wires for connecting the two units together, with the units placed at any desired distance from each other.

Figure 10 is a top plan view of the ice chest and the housing for the circulating apparatus shown in the lower part of Figure 9.

Figure 11 is a small portion of a vertical longitudinal section on a reduced scale of a compact form of the apparatus, showing an auxiliary waste water tank in which are located two rotary pumps which are operated by two motors in a compartment directly above the water tank. The motors are attached directly to fans which cir-

culate air upwards through two cooling coils located in the some compartment as the fans and motors.

In the drawings like reference numerals indicate like parts.

In the drawings reference numeral 1 indicates an ice chest having a door 2 thereon which swings on hinges 3. The walls of this ice chest are insulated so that the ice will be protected as much as possible from being melted by the surrounding air, and will be melted only in the way that the apparatus is designed to melt it, as hereinafter described.

This chest is filled with large blocks of ice which are indicated by the reference numerals 4, 5, 6, 7, and 8. These blocks ordinarily would each weigh one or two hundred pounds or more. This ice chest has an inclined bottom 9 on which the blocks of ice are piled, which bottom drains to the left as shown in Figure 1. Under this bottom is a tank 10 in which the water derived from the melting ice can accumulate. From this tank is a drain 11 through which the surplus water passes into an auxiliary tank 12. In this tank is a coil of pipe 13. This coil of pipe is fed from a pipe 14, which is the return pipe from the air conditioning apparatus. The water after it is circulated through this coil 13 passes out through the pipe 15 into a long pipe 16. This pipe has perforations therein, through which the water is sprayed onto the cake of ice at the bottom of the ice chest, which water melts the ice and is cooled thereby. The water cooled to the lowest possible temperature accumulates in the tank 10. This water has a temperature very nearly as low as the temperature of the melting ice. The cold water is drawn out of the tank 10 through an inverted siphon 17 shown in Figure 5 through a valve 18 by a rotary pump 19, which pump is driven by an electric motor.

This pump forces the water up through the pipe 20 into the coil 21, which is contained in the housing 22 of the fan and air conditioning unit. The water passes up through this coil to the top, and from the top is drawn out and passes down through the pipe 14 into the coil 13 submerged in the auxiliary tank 12, where the water is precooled by the waste water, and from this coil it again passes through the pipe 15 to the spray nozzle 16, and is circulated in this way through the apparatus indefinitely.

The excess water as it rises in the tank 10 is drawn off through the drain 11 into the auxiliary tank 12. When the water rises to a certain level in the tank 12 it raises a float 23 which closes a switch and starts the motor 24 to operating, which drives a rotary pump 25 through a belt 26. This rotary pump 25 draws off the excess water from the tank 12 and discharges it through the outlet pipe 27 into an auxiliary coil 28 carried in the back of the housing 22, through which air passes on its way to the fan and by which the air is precooled before it gets to the coil 21 which contains the coldest water drawn from the tank 10.

It will be understood that the tank 10 contains the coldest water; that is, water having a temperature nearly the temperature of melting ice, and the tank 12 contains water having a temperature several degrees higher than this. In this way the cooling effect of the waste water is utilized to the utmost before the water passes from the drain pipe 29 into the sewer.

When the level of the water in the tank 12 drops, the float 23 drops and opens the circuit causing the electric motor 24 to become idle. In this way the surplus water is removed from the tank 12 intermittently only as it is needed to prevent an overflow from that tank. The water from the tank 12 flows through the coil 28 when the pump 25 operates, and when the pump stops the water stands still in the coil 28.

The rotary pump 19 is driven by a pulley 30, which in turn is driven by a belt 31 from a pulley 32 driven by a motor 33, which operates continuously as long as the manually operated switch remains closed. It will also be understood that instead of a manually operated switch this motor may be controlled by a switch that is operated by a thermostat 34 which opens the switch as soon as the temperature of the room that is being air conditioned is reduced to the proper point.

It will also be understood that the bottom of the housing 22 that is under the coils 21 and 28 is water tight. This bottom catches the drip from the coils, which drip is the water of condensation that is condensed from the moist air by the cooling coils 21 and 28 of this apparatus. This water of condensation can be drained directly into either the tank 12 or the tank 10.

In the fan unit is placed an electric motor 40 which drives a belt 41, which in turn drives a shaft 42 on which is carried the fan 43. This fan draws the air horizontally in the direction of the arrow shown immediately back of the fan and the air is drawn through the top and sides of the housing of the fan unit, through the coils 21 and 28, as indicated by the arrow at the top of the unit. At the front the fan is covered by a grille 44, through which the air is blown. The motor 40 is controlled by a switch which can be manually operated or operated by a thermostat, for which purpose the thermostat shown at 34 can be used.

In Figure 4 I have shown three of these units assembled side by side. Each of these units comprises an ice chest which is filled through a separate door, it being understood that each chest has its own door; and when the units are assembled in this way, the fan units will be arranged in series so that the air that is circulated will pass through all three fans and through all three sets of cooling coils. Because the three fans are in series they will cause the air to move that much faster.

It will be understood that this apparatus will ordinarily be made in units such as can easily go through an ordinary doorway. One of these units might be sufficient to air condition a room of ordinary size, but to air condition a room of double that size two units would be needed. To air condition a room larger, three or more units would be needed, and by this arrangement any desired number of units can be placed wherever they are desired and can be coupled together for joint action.

In Figure 5 I have shown the water tanks 10 and 12 such as are shown in Figure 1. The pump 19 discharges the cold water from the tank 10 through the pipe 20, which in turn discharges the water into the coils 21 of two fan units placed in parallel relation to each other. These fan units discharge the water that is warmed by the conditioning of the air into the return pipe 14 by which it is returned to the auxiliary coil 13 and from there passes into the pipe 15 to the spray nozzle 16.

In Figure 6 I have shown the fan and the housing 22 of the fan unit partly broken away. To this housing is connected the large bellows tube

arrangement 45 with a suitable tip therefor which can be placed against a window opening through which the air can be discharged into a room, or into a bus, or a railroad car, et cetera, so that cold air can be blown into the room, or into the bus, or railroad car before it starts on the trip.

In Figure 7 I have shown a large discharge tube 46 connected to the housing 22 of the fan by a suitable coupling, through which the cold air can be conveyed to a distant point and discharged into a room, et cetera.

In Figure 8 I have shown the housing 22 of the fan connected to an opening 47, which opening can be provided in a partition, so that the air can be cooled in one room and discharged through a partition into an adjoining room.

It will also be seen that the units shown in Figures 1 and 4 are mounted on casters 48 so that the units can be easily moved around. They can be installed temporarily during the hot season and removed when they are no longer needed. This also facilitates placing the units where they can be used most effectively.

In Figures 9 and 10 I have shown an ice chest with a circulating apparatus such as is shown in Figures 1 and 4, except that the door 50 is placed on top of the unit, so that the ice chest can be filled from above. This type of ice chest is desirable because it can be filled with snow ice, or small pieces of ice, which is waste ice and frequently can be had much cheaper than ice in large blocks. In this unit I have shown the electric wires that control the fan unit and the water tubes that connect the two coils of the air conditioning unit with the tanks 10 and 12 of the ice chest all brought together and enclosed in a large flexible tube 51. This tube 51 and the tube and wires contained therein can be of any length so that the ice chest can be put at one place and the fan unit can be placed where it will be most effective at any point remote from the ice chest.

It will also be understood that the tubes 14, 15, 20, 29, et cetera, can all be rubber tubes, or ordinary hose, or metal tubing. The flexible tubing would be most desirable in many cases because it adds to the flexibility and ease of the installation.

It will also be understood that in the ice chest shown in Figures 9 and 10 the auxiliary tank 12 and coil 13 will be omitted, and the water will be returned from the coil 21 to the ice chest, and the water will be fed into the coil 28 only as it rises above a certain height in the tank 10, and will be discharged from the coil 28 directly into the sewer. To regulate the speed at which the water flows through the coil 28, a valve 52 is provided which checks or throttles the discharge of water so that the water will be discharged only when it has risen to nearly the temperature of the room being air conditioned. This makes it possible to melt the ice with the utmost efficiency in conditioning the air.

It will also be understood that in the apparatus shown in Figure 1 the auxiliary tank 12 may be dispensed with and the waste water may be pumped directly from the tank 10 intermittently through the coil 28, the water passing from there into the drain. In such case the drain 11 would be closed up.

In Figure 11, I have shown a more compact form of my invention. A small insulated tank 12 is attached to the large insulated tank 10. A drain 11 connects the two tanks so that the surplus water accumulating in the tank 10 will flow into the tank 12. The coldest water is drawn from the tank 10 through the pipe 17 by the rotary pump 19 which forces this cold water upwards through the pipe 20 through the radiator coils 21 through the pipe 14 which carries the water to the pipe 16 which sprays this water against the ice which rests on the inclined bottom 9 from which it flows by gravity into the tank 10. This procedure is repeated over and over again by the pump 19 which runs continuously or at intervals, which action may be controlled either manually by a switch or automatically by a thermostat.

The surplus water, which results from the melting ice, flows into the tank 12 and is drawn out of the tank 12 by the pump 25 when the level of the water rises and immerses the pipe at the bottom of the pump 25. This water is then forced upwards through the pipe 27 through the radiator coils 28 and out of the tube 29 to the sewer. This pump 25 operates continuously.

As shown in Figure 11 the tank 12 contains the two pumps 19 and 25 and the four tubes 17, 20, 14 and 27. The inside of this tank is made air tight so that the temperature will remain as cold as possible. In a compartment directly above this is located the motor 19a which directly drives the fan 43a. The motor 19a also drives the pump 19 directly by a shaft which extends through the radiator 21 and through the top insulation of the water tank 12. In this same compartment is located also the motor 25a which directly drives the pump 25 and the fan 43b. The motor shaft in this case also extends through the radiator 28 and through the top insulation of the water tank 12. At the top of each fan is located a grille through which passes the cold air from the fans and the coils.

I claim:

1. In an air conditioning apparatus, the combination of a chest adapted to hold ice, a spray pipe at the bottom of the chest adapted to spray water on the ice, a tank below the ice chest into which the water of the spray and of the melting ice drains, an air conditioning coil comprising pipe, means for circulating air through the coil on the outside of the pipe, means for taking water from the tank below the ice chest and circulating it through the inside of the pipe of the coil, an auxiliary tank, a drain connecting the two tanks through which the surplus water of the first tank passes into the second tank, a coil submerged in the auxiliary tank, means for returning the water from the first named coil and passing it through the second coil to the spray pipe.

2. In an air conditioning apparatus, the combination of a chest adapted to hold ice, a spray pipe at the bottom of the chest adapted to spray water on the ice, a tank below the ice chest into which the water of the spray and of the melting ice drains, an air conditioning coil comprising pipe, means for circulating air through the coil on the outside of the pipe, means for taking water from the tank below the ice chest and circulating it through the inside of the pipe of the coil, an auxiliary tank, a drain connecting the two tanks through which the surplus water of the first tank passes into the second tank, a coil submerged in the auxiliary tank, means for returning the water from the first named coil and passing it through the second coil to the spray pipe, a second air conditioning coil of pipe adjacent to the first named air conditioning coil,

a second coil of pipe submerged in the auxiliary tank, means for taking water from the auxiliary tank and passing it through the second named submerged coil and through the second named air conditioning coil and then discharging it into a drain.

3. In an air conditioning apparatus, the combination of a chest adapted to hold ice, a spray pipe at the bottom of the chest adapted to spray water on the ice, a tank below the ice chest into which the water of the spray and of the melting ice drains, an air conditioning coil comprising pipe through which cold water circulates, an electric motor and fan for circulating air through the coil on the outside of the pipe, a tube for taking water from the tank below the ice chest and delivering it to the pipe of the coil, an auxiliary tank, a drain connecting the two tanks through which the surplus water of the first tank passes into the second tank, a coil submerged in the auxiliary tank, a tube for returning the water from the air conditioning coil and passing it through the second coil to the spray pipe, a pump for circulating the water through the two coils, wires connecting the fan motor to the source of electric power, a large flexible tube in which are contained the wires to the fan motor and the tubes conveying water to and from the coil and holding them in a single unit.

MAXWELL R. KARGE.