March 3, 1970 R. C. STIEFEL 3,498,072

AIR CONDITIONING METHOD

Filed Aug. 9, 1968

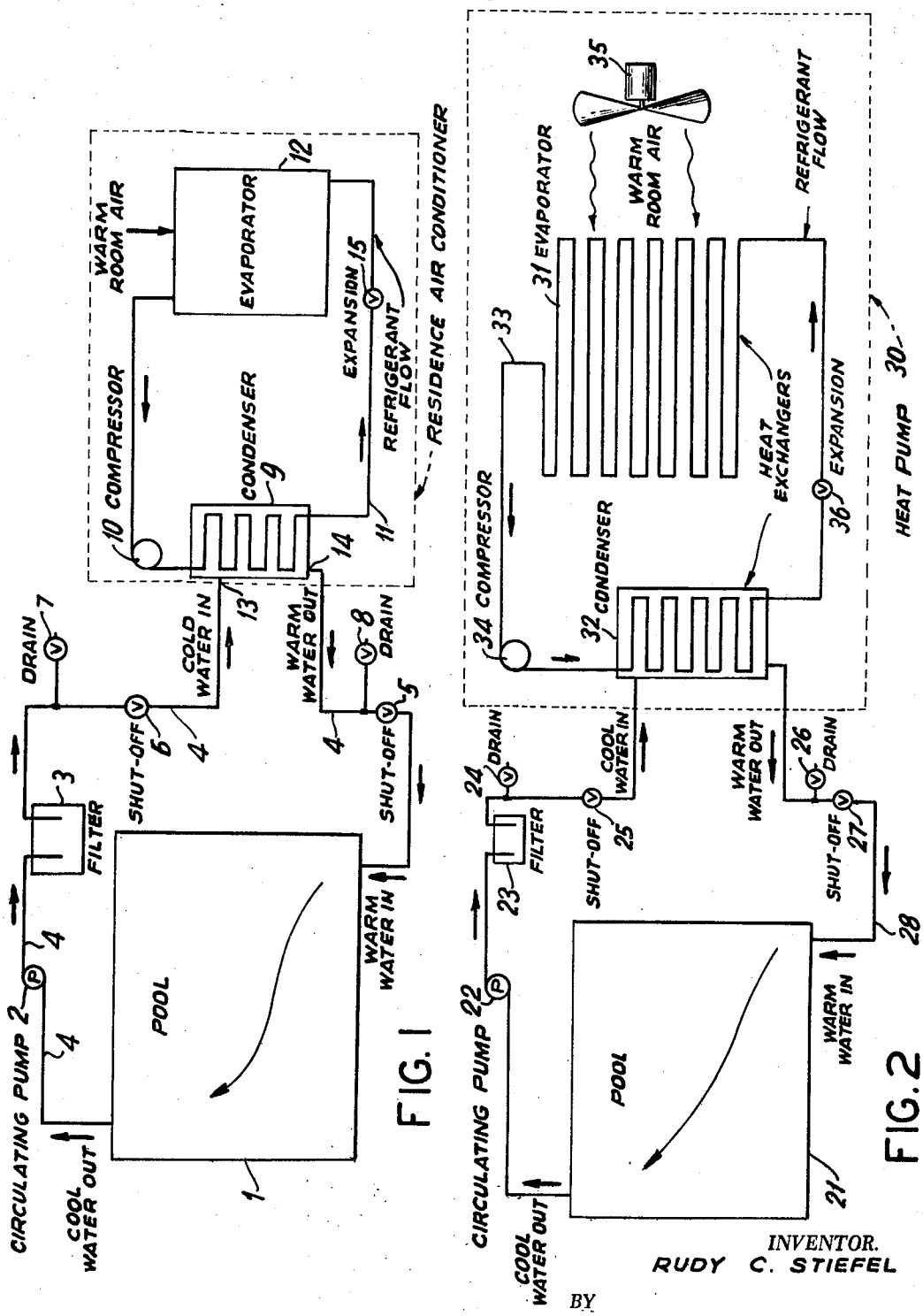


FIG. 1

FIG. 2

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United States Patent Office 3,498,072 Patented Mar. 3, 1970

3,498,072

AIR CONDITIONING METHOD

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Filed Aug. 9, 1968, Ser. No. 751,418
Int. Cl. F25d 17/02; 13/00; 23/12
U.S. Cl. 62—118 2 Claims

ABSTRACT OF THE DISCLOSURE

An air conditioning system for cooling the air in a house includes a water-cooled condenser and an evaporator. The water for cooling the condenser is pumped from a swimming pool. The swimming pool water is warmed and simultaneously the condenser is cooled.

This invention relates generally to a method by which a swimming pool may be heated. More particularly, the present invention relates to a method of heating a swimming pool through utilization of heat rejected from a residence air conditioning system.

The basic air conditioning system to cool the air in a house is a closed system consisting of a compressor and two heat exchangers. A gaseous refrigerant is compressed by the compressor to a high-pressure superheated gas. The superheated refrigerant flows into the first heat exchanger, the condenser. In the condenser, cold water passes over the tubing that carries the superheated refrigerant and removes heat from the refrigerant. The refrigerant leaves the condenser as a saturated liquid under high pressure. It flows through an expansion valve, which reduces the pressure, and then flows to the evaporator, the second heat exchanger. A fan forces warm room air over the evaporator tubes and the refrigerant expands, removing heat from the air. The refrigerant leaves the evaporator as a saturated gas under low pressure, flows back into the compressor, and the cycle is repeated.

In a conventional house air conditioning system, the water which is used to cool the refrigerant in the condenser is circulated through a cooling tower, the third heat exchanger. In the cooling tower the outside air passes over the tubes that carry the warm cooling water and removes heat, thus lowering the temperature of the cooling water before it returns to the condenser.

Swimming pools have become increasingly popular with many homeowners. But, particularly in the northern states, the water in swimming pools is uncomfortably cold, some years until late August. A swimming pool contains a large body of water, which may in some places be ten feet deep. The water is heated very slowly by the sun. Those who wish to use their pools for a longer period, from May to October, often heat the water. Such heating of a large body of water may be expensive.

The basic swimming pool heating system consists of a pump and a heater. Water is pumped out of the pool, through a filter, and into the heater. The heater warms the water by exposing the tubes which carry the water to the hot combustion gases. This water continues out of the heater and back into the pool.

It is the principal objective of the present invention to provide a low cost method for warming the water in a swimming pool.

It is another objective of the present invention to provide a method of utilizing a home air conditioning system so that it operates effectively and at a relatively lower cost.

In accordance with the present invention, an air cooling air conditioning system is utilized. The air conditioner has a water cooled condenser. The water recirculating system of a swimming pool is connected to the intake and outflow ports of the jacket of the condenser of the air

conditioning system. The air conditioning system does not require a separate water cooling pump and heat exchanger.

In another embodiment, the swimming pool recirculating system is connected to the jacket of a water cooled condenser of a heat pump.

These and other objectives of the invention are attained in the manner described herein, and illustrated in the accompanying drawings, in which:

FIG. 1 is a schematic diagram of the interconnected swimming pool and air conditioner systems; and

FIG. 2 is a schematic diagram of a heat pump connected for swimming pool heating.

The method of the present invention, as shown in FIG. 1, utilizes the swimming pool **1** and its water circulaton system. The circulation system is composed of a circulating pump **2**, a filter **3**, two shut-off valves **5** and **6**, two drain valves **7** and **8**, and connecting piping **4**. The piping **4** is connected to the condenser unit **9** of the residence air conditioner. The air conditioner is composed of a compressor **10**, a condenser **9**, an evaporator **12**, an expansion valve **15**, and connectng tubing **11**.

The swimming pool water circulating system is connected with the air conditioning system at the condenser cooling jacket inlet **13** and the condenser cooling jacket outlet **14**. The cool pool water flows through the condenser **9** and is warmed because of the transferral of heat from the hot refrigerant to the water. The warm pool water is returned to the swimming pool.

The principal advantages which derive from the present invention are the economy and efficiency of a combined heating and air conditioning system over separate heating and air conditioning systems. For example, the present invention would eliminate the necessity of a cooling tower with its water circulating pump and cooling fan for the residence air conditioning system and a heater for the swimming pool heating system. This eliminates the purchase, installation and maintenance costs associated with both the cooling tower and heater units. In addition, power is not required to operate the pump and fan of a cooling tower.

The present invention reduces the fuel costs associated with the heater to the lower electricity cost of the air conditioner. For example, to raise the temperature of a 33,000 gallon pool 10° F., a gas burning swimming pool heater with an output of 224,000 B.t.u./hr. will take 12.3 hours. The amount of heat required to raise the temperature of 33,000 gallons of pool water 10° F. is computed as follows:

$Q = MCp\,T$

1 gallon water = 8.345 lbs.

Cp = 1 B.t.u./lb.-° F.

$Q = 33{,}000\ (8.345)\ (1)\ (10)$

$Q = 2.76 \cdot 10^6$ B.t.u.

For a typical gas heater:

Q_{in} = 280,000 B.t.u./hr.

Q_{out} = 224,000 B.t.u./hr.

Efficiency = 80%

LHVC (propane) = 2,400 B.t.u./cu. ft.

Time required:

$$\text{Time} = \frac{\text{amount of heat required}}{\text{rate of heat supplied}} = \frac{2.76 \cdot 10^6}{2.24 \cdot 10^5} = 12.3$$

An 80% efficient burner would use 1,435 cu. ft. of gas at a unit cost of $0.77 per 100 cubic feet, for a total fuel cost of $11.05. The coupling of the two systems realizes maximum efficiency through utilization of the heat rejected from the air conditioner to warm the pool water.

The method of the present invention, as shown in

FIG. 2, utilizes the form of a standard heat pump. The main advantage of using a heat pump to heat the swimming pool water, rather than a fuel burning heater, is the more efficient utilization of enregy. The fuel burning heater converts the fuel's potential energy into heat and, therefore, the maximum heat available is limited to that which would be obtained during complete combustion of the fuel.

The heat pump-swimming pool system of FIG. 2 includes a swimming pool **21**, a circulating pump **22**, a filter **23**, a first drain valve **24**, a first shut-off valve **25**, a second drain valve **26**, a second shut-off valve **27** and connecting piping **28**. The heat pump **30** includes a first heat exchanger which is the evaporator **31**, and a second heat exchanger which is the condenser **32**. The heat pump also is comprised of an expansion valve **36**, the connecting tubing **33**, and a water-cooled compressor **24** within a jacket. A fan **35** blows warm room air over the coils of the evaporator **31**, cooling the room air. The circulating pump **22** flows water from the swimming pool over the coils of the condenser **32** within the jacket of the condenser.

The heat pump uses electrical energy to power equipment that transfers heat from one reservoir to another. The heat available by this means depends upon the heat available from the hot reservoir, which is warm room air, and the capabilities of the particular heat pump. For example, a 5-ton heat pump (the typical size of a residence air conditioner) operating at a transfer efficiency of 80%, will deliver 72,730 B.t.u./hr. under full operating conditions. The heat pump requires 5 kilowatts/hr.

Time=38 hrs.
Power required=5 kw. (including compressor and fan)
Energy required=5 kw. (38 hrs.)=190 kw. hrs.
Price of electricity—2.71¢/kw.-hr.
Total cost=.0271 (190)
Total cost=$5.15

At a rate of $0.0271/kw.-hr., the total cost for heating a 33,000 gallon pool under the conditions of the previous example would be $5.15, though the time required would be 38 hours. If the same heating requirements were met through direct conversion of electric energy into heat energy by means of resistance heating, the following analysis would be true:

1 kilowatt—3,415 B.t.u./hr. for a 5 kilowatt heater:
Q_{out}—5 (3,415)=17,075 B.t.u./hr.

Time required to heat pool:

$$\text{Time}=\frac{Q}{Q_{out}}=\frac{2.76\cdot10^6}{2.7\cdot10^4}$$

Time=162 hrs.
Power required=5 kw.

The comparison of a heat pump over a fuel burning heater is seen in the following tabulations of the results of the sample calculations:

Gas Heater—Total Cost $11.05
Heat Pump—Total Cost $5.15

The latter figure reduces to zero if air conditioning is the prime requirement. Moreover, the method illustrated in FIG. 2 reduces air conditioning costs by not requiring an extra circulation pump and a fan and a cooling tower to bring the hot condenser water back to the outside temperature.

From the foregoing it will be apparent to those skilled in this art that I have provided a relatively simple and highly efficient method of accomplishing the objectives of the invention. Minor modifications from the embodiments disclosed in the drawings and in the above specification may be resorted to without departure from the spirit of this invention which is defined as to scope in the appended claims.

I claim:

1. A method by which the heat rejected from a water-cooled air conditioner may be utilized to heat the water of a swimming pool, including the step of circulating the swimming pool water by means of the swimming pool recirculating system through the cooling jacket of the condenser of said water-cooled air conditioner.

2. A method by which the heat rejected from a water-cooled heat pump may be utilized to heat the water of a swimming pool, including the step of using the swimming pool recirculating system to circulate said swimming pool water through the cooling jacket of the condenser of said water-cooled heat pump.

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U.S. Cl. X.R.

62—260, 310, 506