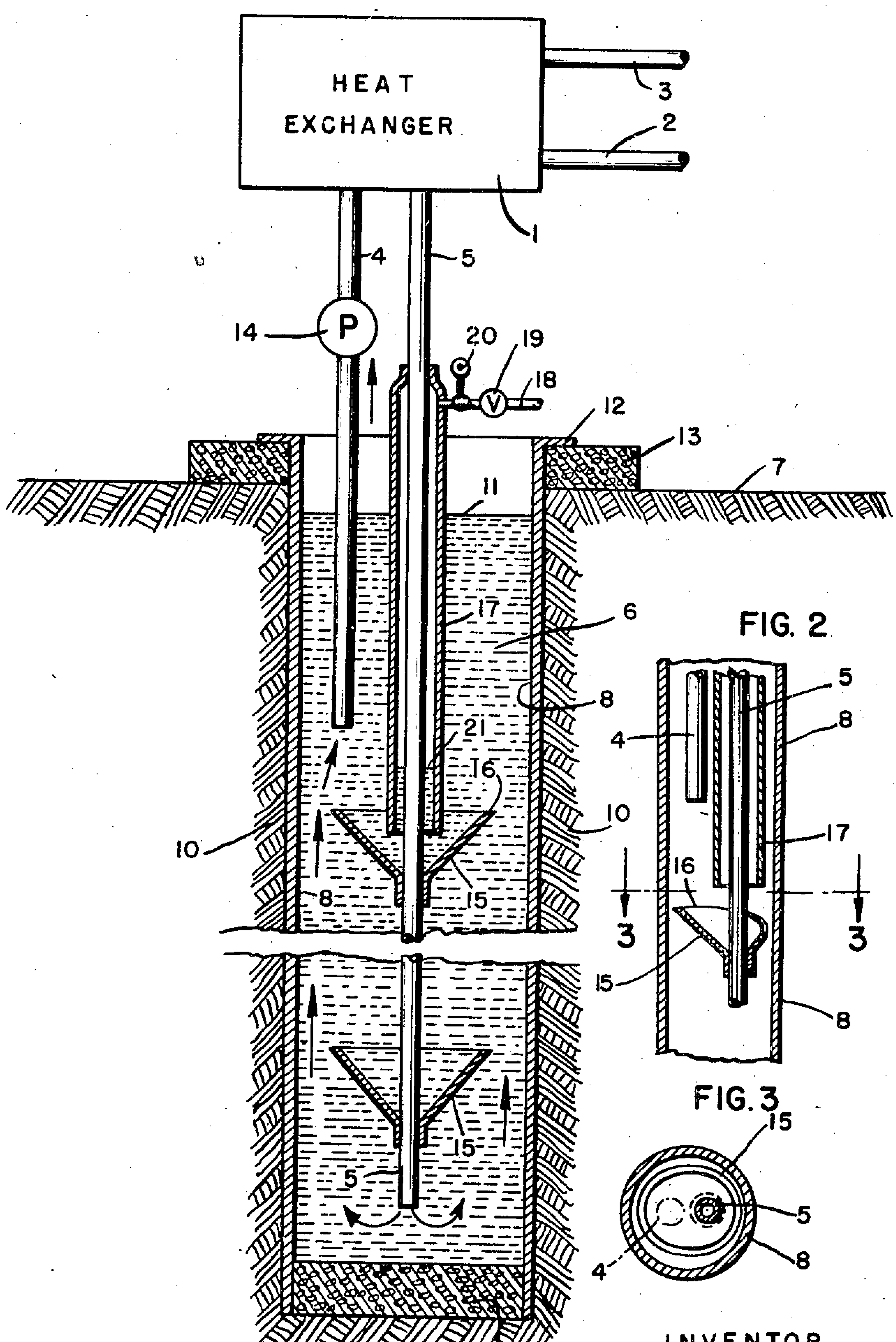
March 30, 1948. M. M. SMITH 2,438,720

DEEP WELL CIRCUIT FOR HEAT PUMPS

Filed Feb. 19, 1947

FIG. 1



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Patented Mar. 30, 1948

2,438,720

UNITED STATES PATENT OFFICE

2,438,720

DEEP WELL CIRCUIT FOR HEAT PUMPS

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Application February 19, 1947, Serial No. 729,521

2 Claims. (Cl. 62—129)

This invention relates to heat pumps and particularly to the construction of deep wells utilized for the purpose of supplying heat to a heat pump during the heating season and discharging heat therefrom during the cooling season of operation of the heat pump.

The main objects of this invention are to provide an improved form of heat exchanger of the deep well type; and to provide an improved form of deep well apparatus that is particularly suited for serving a deep well in places where ground water is not available or is so scarce or impure as to make it desirable to construct the well so as to exclude ground water from the heat exchanger circulatory system of the heat pump.

The present disclosure is directed to a species of the deep well construction that is more broadly disclosed and claimed in the application of Emory N. Kemler, Serial No. 700,417 filed October 1, 1946, and the joint application of Marvin M. Smith and Emory N. Kemler, Serial No. 703,264 filed October 14, 1946, all relating to deep well apparatus constructions for use in connection with heat pumps of the general type disclosed and claimed in the application of Marvin M. Smith for patent on Heat pump, Serial No. 624,351 filed October 25, 1945.

A specific embodiment of the present invention is illustrated in the accompanying drawings in which:

Figure 1 shows, to some extent diagrammatically, heat exchange apparatus including a deep well particularly constructed for making use of earth temperatures in places where the presence or absence of ground water may be disregarded, the well and some of its apparatus being shown in section.

Fig. 2 is a fragmentary section of the same with a modified form of baffle plate suited for use in cases where the diameter of the well casing is small compared to that of the pipes that extend into it, so that the baffle-carrying pipe occupies an eccentric position with respect to the axis of the casing.

Fig. 3 is a cross-sectional view of the same taken on line 3—3 of Fig. 2 and illustrating the uniformly concentric spacing of the peripheral margin of the baffle plate from the walls of the casing.

In the drawings the heat pump construction per se is not illustrated, but is represented by one of its heat exchangers 1 through which the refrigerant is circulated by pipes 2 and 3 in heat-exchange relation to a circulation of water or other fluid heat-conveying medium by means of

pipes 4 and 5 leading into the interior of a well 6 extending deeply below the surface 7 of the earth and comprising a casing 8 of metal or other material impervious to liquid which is closed at its lower end by a plug of concrete or the like.

The casing 8 may be driven into the earth by any of the well-known deep well construction methods, and the well bore represented in the drawing by the irregular lines 10 is filled about the exterior of the casing as by flushing earth or other material into it, so as to bring the walls of the casing into intimate heat-exchange relation with the surrounding soil or rock. The well casing is filled with water, or any other appropriate fluid heat-conveying agent, to a level 11 close to its top which may be provided with a suitable flange 12 resting on a concrete slab 13 of suitable dimensions to stabilize the support of the well.

The suction pipe 4 extends a sufficient distance below the surface of the water 11 to remain submerged regardless of normal incidental fluctuations in the water level and is associated with a pump 14 which circulates the water from the well through the heat exchanger 1 and back through the discharge pipe 5, which extends to a point near the bottom of the well. Both of these pipes are open at their lower ends so that the water of the well forms part of the circulatory system.

The long return pipe 5 supports a plurality of baffles 15 which may be of conical form, as shown in Figs. 1 and 2, and of which the marginal periphery is so arranged with respect to the walls of the casing 8 that the upward flow of the water in the well will be distributed uniformly about the walls of the casing and will tend to hug and wipe along the vertical walls of the casing under the action of the pump 14. To this end, the periphery 16 of the baffle should preferably be uniformly spaced from the wall of the casing regardless of whether the pipe 5 extends along the axis of the casing, as in Fig. 1, or is eccentric to such axis, as in Fig. 2.

Preferably the pipe 5 should be insulated against transfer of heat to or from the water in that part of the well that is co-extensive with the suction pipe 4, and to this end the pipe 5 is shown to be surrounded by a larger pipe 17 which may be open at the bottom but closed to the air at its upper end. A small air pipe 18 is tapped into the upper end of the insulating pipe 17 so that the space between the pipes 5 and 17 may be filled with air. The pipe 18 is provided with a pet cock 19 and a pressure gauge 20 which indicates the head of water standing between the level 11 of the well and the level 21 to which the water may enter the lower end of the pipe 17.

The operation of the device shown is as follows:

The well is made deep enough to hold a sufficient quantity of water to take care of the normal operation of the heat pump. Water is drawn from the well by pipe 4, circulated through the heat exchanger by the action of the pump and returned to the bottom of the well by pipe 5.

The heat exchanger 1 acts as an evaporator during the heating cycle of the heat pump and consequently takes heat from the water circulated therein, and this cold water takes up heat from the earth as it flows upward in the well. In the cooling season, the heat exchanger 1 serves as the condenser of the heat pump and heats the water that circulates through it. This added heat is discharged to the earth as the water circulates in the well. The baffles cause the water delivered to the well to flow back along its casing wall for maximum heat transfer as will be understood.

Although but one specific embodiment of this invention is herein shown and described, it will be understood that numerous details of the structure shown may be altered or omitted without departing from the spirit of the invention as defined by the following claims.

I claim:

1. In a heat pump, a well bore subject to subterranean temperature and containing a fluid heat-conveying agent, a heat conducting casing defining said well bore, a pipe extending downward within said well bore and communicating therewith near the bottom thereof, and baffle

means carried by said pipe at its lower part to direct an upward current of said fluid heat conveying agent toward and along the walls of said casing, said pipe being insulated against direct transfer of heat between it and the water in the upper portion of said casing.

2. A heat exchanger comprising refrigerant circulating means and water circulating means in heat-exchanging relation to each other, said water circulating means comprising a deep well bore, a casing lining said well bore and in heat-exchange relation to the earth, a suction pipe connecting said heat exchanger to the upper part of said well bore, a discharge pipe extending downwardly in said casing to near the bottom thereof, pumping means for circulating the water in said suction and discharge pipes, and a plurality of baffles attached to said discharge pipe and extending upward and outward therefrom and having their peripheral edges substantially uniformly spaced from said casing to concentrate the upward flow of water along the casing at the edges of said baffles.

MARVIN M. SMITH.

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