

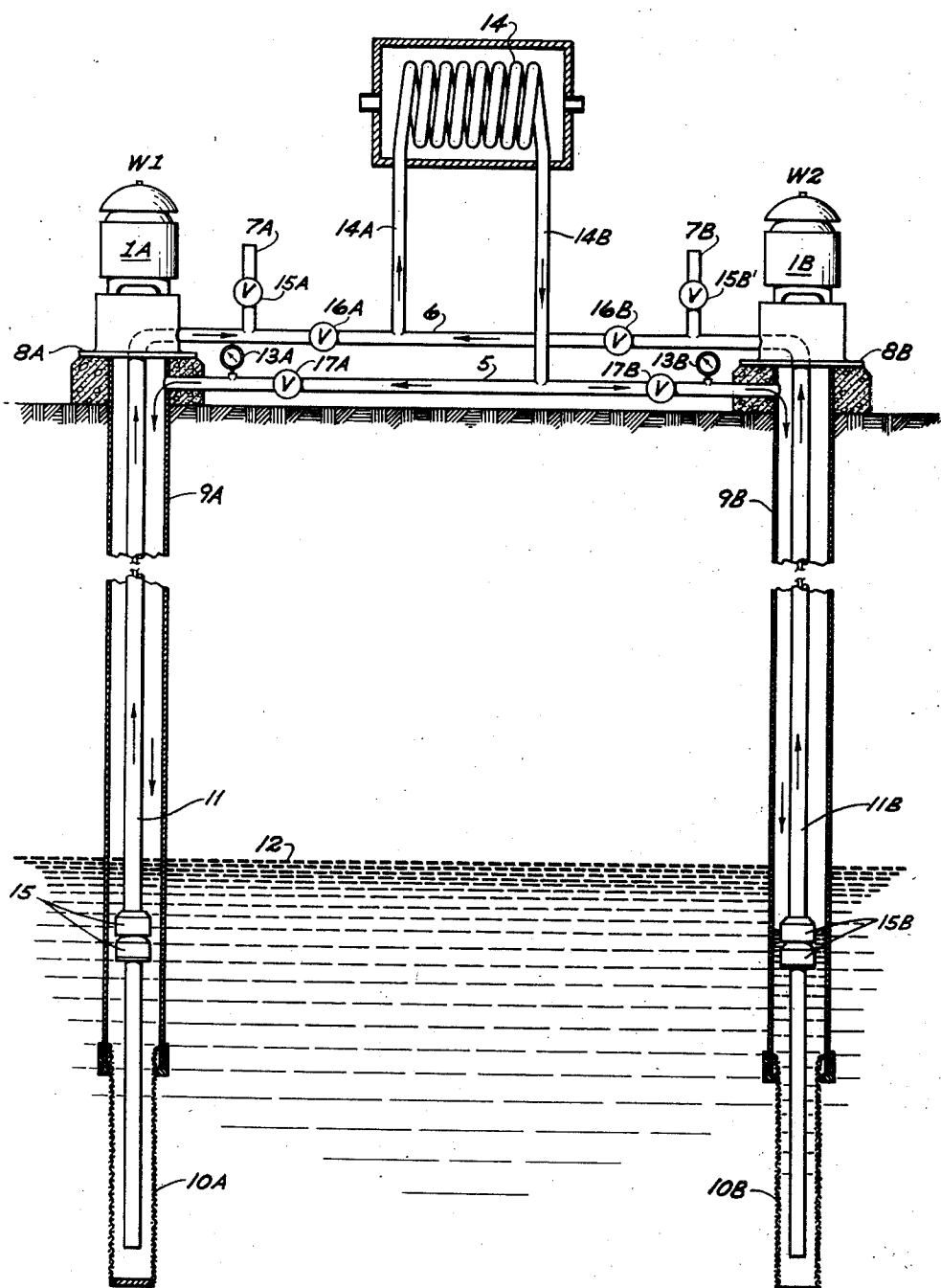
May 5, 1953

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2,637,531

APPARATUS FOR CIRCULATING WATER

Filed Sept. 17, 1949



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UNITED STATES PATENT OFFICE

2,637,531

APPARATUS FOR CIRCULATING WATER

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Application September 17, 1949, Serial No. 116,374

5 Claims. (Cl. 257-122)

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This invention relates to an apparatus for pumping water from a subterranean source and returning water to the subterranean source after it has been used for absorbing heat from or delivering heat to a heat exchanger.

Well water is used extensively for absorbing the heat in condensers, heat exchangers or other equipment and it has been common practice to simply discharge the water into the sewer after it has served such purposes.

Where a number of wells are constructed and operated in a given area to take out water at a rate higher than the natural recharge rate the static water level will be lowered gradually, thereby increasing the pumping head and in some cases eventually exhausting the supply. To forestall such conditions, laws have been enacted in some localities to enforce return of the water to the source, thereby preserving the static water level as well as the supply.

Under excessive use, the temperature of the source water will be changed. However, there are now year-round combination heating and cooling plants operating on a subterranean source of water that raise the temperature of the water during the cooling or summer season and lower it during the heating or winter season with the net result of very little change in the year-round average. Illustrative, if water were taken out of the ground, during the summer, at 60 degrees and returned at 70 degrees and during the winter months, taken out at 60 degrees and returned at 50 degrees very little, if any, actual change in subterranean water temperature would result.

During recent years, some communities have enacted a sewer tax, which is based upon the water bill and collected along with the same. Also such a sewer tax has been based upon the number of gallons "dumped" into the sewer by well water users who are required to put water meters on wells owned and operated by them. This sewer tax is a heavy burden on large water users such as dairies and distilleries. This tax runs into thousands of dollars per year in some cases.

The above stated conditions have developed a demand for apparatus adaptable for supplying and discharging water for heat exchangers under private ownership. To supply this demand and provide apparatus for operation wherein the source of water and the temperature thereof can be safeguarded while providing for long periods of operation with minimum of service are the principal objects of my invention.

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Other objects of this invention, somewhat more specifically stated, are to provide the following:

(1) To reduce the cost of supplying water.

(2) To reduce the cost of disposing of water.

(3) To provide apparatus and a flexible method of operation for pumping and disposing of the water, after changing the temperature thereof, wherein only a portion of the equipment need be employed to maintain successful operation.

(4) To provide means for protecting the source of water and the apparatus against clogging incident to the precipitation of solids.

In installations where water is pumped from one alluvial well to a heat exchanger and then discharged into another similar well the various minerals that were in solution are converted into solids, of course in varying degrees, and carried in suspension while the water is under active circulation and finally deposited. Under less active circulation or when in a quiescent state the particles lodge in the well screen and in the alluvium, thus eventually the well becomes clogged in part or entirely. The time required for this clogging to take place will depend on the nature of the well, the chemical constituents of the water and to what extent it has been heated or aerated.

To disclose this invention a specific embodiment is illustrated in the accompanying drawing wherein:

The sole figure in the drawing is an elevation, principally in section to indicate diagrammatically two deep wells projecting into water bearing sand, gravel and earth and each well equipped with independent motor driven pumping apparatus for delivering water to a heat exchanger through cross connected conduits having valves for directing water discharged from the exchanger to return to the source and for controlling and varying the flow of the water within and from the system.

Referring to the drawing, W1, W2 designates individual wells that comprise, respectively, casings, 9A and 9B, well screens, 10A and 10B, motors 1A and 1B for operating conventional impellers within bowls 15, 15B. Conduits 11, 11B to which are attached impeller bowls 15, 15B, respectively, and in which are mounted impeller shafts according to conventional practice are to be understood as "pump columns." 8A, 8B are bases, respectively, for motors 1A, 1B and also serve as seals for the casings.

The static water level, indicated as 12, may be anywhere from a few feet from the surface to

several hundred feet deep depending on location and local conditions. Wells of this type are common in the river valleys and in numerous flat land sections where the bed rock is not close to the surface. Return systems can also be successfully operated in areas of this kind where there is no water on top of the rock. In such cases the wells are often not cased nor screened and depend on the flow of water or return flow of underground streams or porous layers. Also, under these conditions it is desirable to "back-wash" (reverse flow) periodically to remove accumulated solids. The apparatus described previously and the operation thereof would be the same except for construction of the well.

In operation, the pump associated with well W1 draws water from the area adjacent screen 10A and forces it through pump column 11, pressure conduit 6, and conduit 14A. With valve 15A closed, valve 16A open, and valve 16B closed, water is supplied to condenser or cooling coil 14 and, by means of return conduit 5 (with valve 17A closed and valve 17B open) the discharge is forced into casing 9B of well W2. Likewise, to use well W2 in connection with the cooling coil, motor 1A of W1 is stopped and all the valves are closed except 16B and 17A, thus, the flow of water is through screen 10B, impeller bowl 15B, central conduit 11B, pressure conduit 6, conduit 14A, the cooling coil, conduits 14B and 5 into casing 9A. These conduits will be referred to hereinafter, sometimes, as "pipe lines." Gauge 13B will indicate the freedom with which the water is flowing into the return well or when back pressure starts to build up from clogging, thus the operator will know by the pressure indicated on the gauge when it is time to "back-wash" (reverse flow) the well to remove the accumulated matter which is clogging the screen, sand, gravel, or other subterranean structure.

To "backwash" (reverse flow) and clean out well W2, it is only necessary to open the valve 15B' in "blow off" line 7B, and close valve 16B, then start pump 1B, thus reversing the direction of flow of water through screen 10B, which will dislodge and flush out the accumulated minerals or other matter. Thus, reversing the flow of water in this well cleans not only the screen and well itself but also the sand and gravel or other formation around the well screen. By watching the discharge from the "blow off" and observing when it clears up the operator will know how long to "backwash" (reverse flow) which is usually only a matter of a few minutes, then he can close the valve in "blow off" line 7B, open the valves 16B and 17A, close valves 16A and 17B and pump from the second well W2, through the coil or condenser 14, and return the water into the other well W1. Obviously, the reverse flow in well W2 will further loosen up the formation and if the well spacing is liberal, the tendency to heat the underground water will be minimized. The plant can then operate until well W1 needs cleaning when the procedure, described above, is reversed.

Likewise, when pressure builds up in well W1, gauge 13A will indicate the condition whereupon valve 16A is closed, valve 15A opened, motor 1A started to effect the "backwash" (reverse flow) and discharge water laden with accumulated solids from 7A. When effected, the system may be set for normal operation.

It will be noted that the pressure sides of the two pumps in my water circulating system are

directly connected through the pressure conduit 6 while the well casings are directly connected through the return conduit 5, valves being provided in these conduits so that water can be pumped selectively from either well into the pressure conduit, through the heat exchanger, into the return conduit and then into the casing of the second well.

It will be seen that the two wells will be used alternately for production and return but it may also be advisable, under some conditions, to use one well continuously for production and have the other for return, simply stopping the production well occasionally and "blowing off" the return well; therefore, the system may also be composed of a production and return well instead of an alternating system, in which case, obviously, some of the pipes and valves shown on drawing could be eliminated.

It is to be understood that a preferred embodiment of my invention has been disclosed and that alterations and modifications can be made without departing from the spirit of this invention as defined in the following claims.

I claim:

1. A water circulating system comprising in combination a pair of wells which are spaced apart and connected to a source of water, said wells comprising well casings and pump columns, a pair of independently-operated pumps having a pressure side and a suction side and adapted to pump water from said wells, a pressure conduit connecting the pressure sides of said pumps, a return conduit connecting the well casings of said wells, a heat exchanger connected between the pressure conduit and the return conduit and adapted to receive water from the pressure conduit and to discharge it into said return conduit after heat exchange, and valve means in said conduits so connected that water can be pumped selectively from the pump column of one of said wells, through the pressure conduit, through the heat exchanger and through the return conduit to the well casing of the other well.

2. A water circulating system comprising in combination a pair of spaced-apart wells each provided with well casings leading to a common source of water, with pump columns and independently operated pumps having suction sides and pressure sides, a return conduit directly connecting the well casings of the two wells, a pressure conduit directly connecting the pressure sides of the two pumps, a heat exchanger connected between the pressure conduit and the return conduit adapted to receive water from the pressure conduit and to discharge it into said return conduit, and valves positioned in the pressure conduit and in the return conduit in order selectively to direct the water pumped from either one of said wells through the heat exchanger and then into the well casing of the other well.

3. A water circulating system comprising in combination a pair of wells provided with well casings, having screens at their lower ends, and with pump columns, said wells being spaced apart but connected to a common source of water located in an alluvial deposit, a heat exchanger, means including valve-controlled conduits connecting the inlet of said exchanger to said pump columns and other valve-controlled conduits connecting the outlet of said exchanger to said well casings for pumping water selectively from the pump column of either of said wells through said heat exchanger and then into the well casing of

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the second well, and valve-controlled blow-off lines connected to said pump columns, respectively, so that water can be pumped from the pump column of either of said wells directly through a blow-off line thereby to clean the well screen of said well from accumulated solids.

4. A water circulating system according to claim 1 wherein said valve means includes two cut-off valves connected in said pressure conduit between the inlet of said heat exchanger and said pump columns respectively, and including two valve-controlled blow-off lines connected to said pressure conduit at locations between said cut-off valves and said pump columns, whereby solids which accumulate in each well may be flushed through said blow-off lines without passing through said heat exchanger.

5. A water circulating system according to

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claim 4 wherein each of said well casings is provided at its lower end with a screen.

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