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Energy-Saving Heat Pump or Refrigeration Machine Using Magnetic Fluids and Highly Porous Solids

Description

Many different types of heat pumps, heat exchangers, and refrigeration machines are known from the literature. There are also uses of magnetic fluids/ferrofluids in combination with highly porous materials (e.g., silica gel, zeolites, etc.) in fields such as medicine, biology, biochemistry, chemistry, technology, and more.

My invention is based on the further development of heat pumps, heat exchangers, and refrigeration machines, which can consume a lot of energy, making an energy-saving version desirable.

There are solutions with magnetic fluids from other fields, for example:
- DE000010035953A1, adjustable particle and pore size as well as adjustable magnetic content of magnetic silica particles for biomolecules,
- WO002018160348A1, cooling in microelectronics,
- EP000003258188A1 mentions ferrofluid for an exotic heat transfer,
- EP000002108904A1 describes a magnetocaloric heat pump for a refrigerator.

The existing solutions fulfill their respective functions under the circumstances but do not correspond to the above-mentioned invention.

An energy-saving solution is desired, and the invention specified in claim 1 of an energy-saving heat pump or refrigeration machine using magnetic fluids and highly porous solids (Fig. 1, here as a heat pump heater) meets these requirements.

An Exemplary Embodiment:

According to the magnetic fluid 4 listed in Fig. 1 (e.g., ferrofluid - superparamagnetic particles), the pore size of the synthetic highly porous solids 2 (e.g., silica gel) can be designed (e.g., according to

DE000010035953A1). The ferrofluid flows into the appropriate pores of the silica gel, generating heat—analogous to adding water to zeolites. A sieve 1 subsequently retains (according to claim 2) the relatively large silica gel grains, so that only the attracted ferrofluid flows through the permanent or electromagnet 3. A permanent magnet could— as shown in claim 3—initially attract the ferrofluid and then, due to a suitable arrangement and thus increasing distance, also possible in a circular arrangement of the permanent magnets, allow the ferrofluid to flow freely. An electromagnet fulfills (according to claim 4) the same purpose by switching on and off. The heat generated by the incorporation of the ferrofluid into the silica gel can—as shown in claim 5—be transferred to a heating system 5. The ferrofluid, cooled during the reaction and attracted by the magnet, reaches (according to claim 6) the pump 8 after passing through the house wall 7 into the heat exchanger 6, which—as shown in claim 7—warms the ferrofluid back to ambient temperature.

A refrigeration machine/refrigerator/air conditioning system can also be easily constructed (according to claims 8 and 9) by adjusting the circuit accordingly.

Claims

1. Energy-saving heat pump or refrigeration machine using magnetic fluids and highly porous solids,
characterized in that magnetic fluids generate heat in appropriately synthesized highly porous solids and are separated again using permanent or electromagnets.

2. Energy-saving heat pump or refrigeration machine using magnetic fluids and highly porous solids, according to claim 1,
characterized in that a sieve retains the relatively large grains of the highly porous solid.

3. Energy-saving heat pump or refrigeration machine using magnetic fluids and highly porous solids, according to one of the preceding claims,
characterized in that a permanent magnet attracts the magnetic fluid and allows it to flow further due to increasing distance from the magnetic fluid.

4. Energy-saving heat pump or refrigeration machine using magnetic fluids and highly porous solids, according to one of the preceding claims,
characterized in that an electromagnet attracts the magnetic fluid and allows it to flow further by switching off.

5. Energy-saving heat pump or refrigeration machine using magnetic fluids and highly porous solids, according to one of the preceding claims,
characterized in that the heat generated by the incorporation of the magnetic fluid is transferred to a heating system.

6. Energy-saving heat pump or refrigeration machine using magnetic fluids and highly porous solids, according to one of the preceding claims,
characterized in that a pump transports the magnetic fluid through the circuit.

7. Energy-saving heat pump or refrigeration machine using magnetic fluids and highly porous solids, according to one of the preceding claims,
characterized in that, in a heating system, the magnetic fluid is warmed back to ambient temperature by the external heat exchanger.

8. Energy-saving heat pump or refrigeration machine using magnetic fluids and highly porous solids, according to one of the preceding claims,
characterized in that, in a refrigeration machine, refrigerator, or air conditioning system, the heat generated by the incorporation of the magnetic fluid is transferred to the environment via a heat exchanger.

9. Energy-saving heat pump or refrigeration machine using magnetic fluids and highly porous solids, according to one of the preceding claims,
characterized in that, in a refrigeration machine, refrigerator, or air conditioning system, the cold of the magnetic fluid is transferred through the internal heat exchanger.

Fig. 1