This invention relates to fluid circulating devices and more particularly to devices adapted to lift a liquid a small distance and which are adapted to be hermetically sealed within a closed system such as a continuous absorption refrigerating system.

It is known to circulate fluids in a hermetically sealed system by means of an electromagnetically vibrated disc or fin. An example of a fin for circulating gas in a sealed system is disclosed in co-pending application of Daiger's Serial No. 21,820 filed May 17, 1935, now Patent No. 2,152,243. An electromagnetically operated diaphragm for circulating gas in a similar system is disclosed in the co-pending application to Curtis C. Coons, Serial No. 24,675 filed June 3, 1935, now Patent No. 2,015,341.

It is an object of the present invention to provide means somewhat similar to the arrangement shown in the above mentioned co-pending applications which are adapted to circulate liquids or lift liquids a slight distance in a hermetically sealed system. Such pumps may be used to circulate absorption liquid between the boiler and the absorber of a continuous absorption refrigerating system or elsewhere in systems requiring that a liquid be lifted only a short distance or against a slight pressure.

It is another object of the invention to provide novel means for circulating a liquid.

It is still another object of the invention to provide a novel, electromagnetically operated pump for circulating liquid.

Other objects and advantages reside in certain novel features of the arrangement and construction of parts as will be apparent from the following description taken in connection with the accompanying drawing in which:

Figure 1 is a vertical cross-sectional view of a liquid circulator constructed in accordance with the present invention and illustrating one embodiment thereof.

Figure 2 is a vertical cross-sectional view of a modified form of liquid circulator constructed in accordance with the principles of the present invention and

Figure 3 is a transverse cross-sectional view of the circulator shown in Figure 2, the view being taken on the line 2—3 thereof.

Referring to the drawing in detail and first to the embodiment of the invention illustrated in Figure 1, it will be seen that the liquid pump is there illustrated as consisting of a closed casing which may be hermetically sealed and which consists of a cylindrical cup shaped casing provided with a lid or head piece which may be bolted or otherwise firmly secured thereon. As shown by the bolt the lid may be bolted to the cup shaped casing but if a hermetically sealed unit is desired welding or other sealing means may also be employed.

Located in the bottom of the cup shaped casing is an electromagnet. The core of this magnet may be firmly secured to the bottom of the cup by means of a weld as illustrated at . The bottom of the cup or at least a portion thereof adjacent the electromagnet should be of non-magnetic material. A spool is mounted upon the outside portion of the core and is wound with insulated wire in accordance with known practice, the insulated wire being shown at .

A disc or diaphragm is mounted within the casing with its central portion above the pole of the electromagnet. For securing the diaphragm in position, the screw and spacing rings may be employed. The diaphragm may be provided with a number of holes as shown at 22 to aid in permitting liquid to pass from beneath the diaphragm to the upper surface thereof.

The liquid inlet to the casing is shown at and the arrangement should be such that the liquid level in the lower part of the casing should be slightly above the level of the diaphragm.

Mounted in the upper portion of the casing is a catching pan or liquid receiving element which is annular in shape and which has a central flange opening located immediately above the pole of the electromagnet and the center of the diaphragm. Secured to the top of the casing on the under side of the head piece is a concave deflecting member which is adapted to deflect liquid thrown upwardly by the diaphragm and cause it to fall upon the catch basin. The outlet to the pump is shown at and it will be seen that this is some distance above the inlet pipe, the difference in height being the distance that the pump lifts the liquid.

The operation of the device shown in Figure 1 results from the energizing of the coil of the electromagnet with alternating current or with pulsating direct current. In either case the electromagnet will cause the diaphragm to vibrate. Vibrating liquid will be thrown upwardly against the deflecting member and fall down upon the catch basin at the higher level. The diaphragm in approaching the pole piece of the electromagnet should be so positioned that the liquid will be forced upwardly through the
small holes therein. The spray of liquid leaves the central part of the disc in a conically shaped column or spray which spreads out, umbrella-like, as it rises. Passing through the flanged holes 25 in the catch basin 24, the liquid is either deflected by the member 26 or falls directly upon the catch basin 24 without hitting the deflecting member. While the deflecting member 26 improves the operation of the system its use is not absolutely essential. The under side of the deflecting member 26 may be grooved radially to aid in causing the liquid to be retained upon its surface, although this is not shown in the drawings.

Obviously by the use of a series of such disc pumps situated one above the other, a liquid could be elevated to any desired height.

The arrangement of Figure 2 is somewhat similar to that of the arrangement of Figure 1. I claim:

1. A liquid pump having an electromagnet, a movable element adapted to be vibrated by said electromagnet, means for causing liquid to be pumped to contact said movable element and be thrown thereby to a higher level and liquid catching means located above said movable element and adapted to catch the liquid thrown thereby.

2. A liquid pump adapted for lifting liquid a small distance in a hermetically closed system, said pump having an electromagnet, a movable element adapted to be vibrated by said electromagnet, means for causing liquid to be pumped to contact said movable element and be thrown thereby to a higher level and liquid catching means located above said movable element and adapted to catch the liquid thrown thereby; said movable element having holes therein through which the liquid may pass.

3. A liquid pump adapted for lifting liquid a small distance in a hermetically closed system, said pump having an electromagnet, a movable element, adapted to be vibrated by said electromagnet, means for causing liquid to be pumped to contact said movable element and be thrown thereby to a higher level and liquid catching means located above said movable element and adapted to catch the liquid thrown thereby, said movable element comprising a disc disposed in a horizontal position with its center substantially above the core of said electromagnet.

4. A liquid pump adapted for lifting liquid a small distance in a hermetically closed system, said pump having an electromagnet, a movable element adapted to be vibrated by said electromagnet, means for causing liquid to be pumped to contact said movable element and be thrown thereby to a higher level and liquid catching means located above said movable element and adapted to catch the liquid thrown thereby, said movable element comprising a flexible blade or fin fixed at one end and having a movable end disposed near said electromagnet.

5. A liquid pump, comprising a receptacle for liquid, an electromagnet, a movable member adapted to be vibrated by said electromagnet to throw liquid from said receptacle, said movable member having an aperture therein through which the liquid may pass, and means for catching the liquid thrown by said vibrating movable member.

6. A liquid pump, comprising a casing having bottom and side walls and adapted to contain a liquid, an electromagnet supported by the bottom wall of said casing, a movable member supported by said casing and adapted to be vibrated by said electromagnet, means for causing liquid to be thrown to a higher level, and means supported by the side walls of said casing above said movable member for catching the liquid thrown thereby to a higher level.

7. A liquid pump comprising, a receptacle for liquid, an electromagnet, a movable member adapted to be vibrated by said electromagnet, being normally positioned above the liquid level in said receptacle and adapted to raise liquid from said receptacle, said member being so constructed as to allow liquid to pass from one side thereof to the other and means for catching liquid raised by said member.