L. W. CHUBB.
VACUUM PUMP.
APPLICATION FILED JAN. 18, 1915.

1,298,664. Patented Apr. 1, 1919.

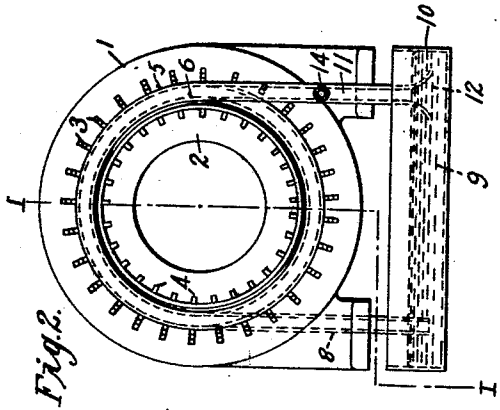

Fig. 2.

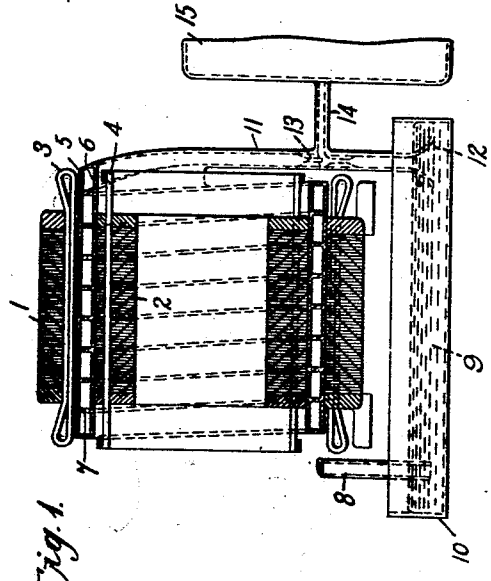

Fig. 1.

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LEWIS W. CHUBB, OF EDGEWOOD PARK, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

VACUUM-PUMP.

1,298,664. Specification of Letters Patent. Patented Apr. 1, 1919.

Application filed January 18, 1915. Serial No. 2,889.

To all whom it may concern:

Be it known that I, LEWIS W. CHUBB, a citizen of the United States, and a resident of Edgewood Park, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Vacuum-Pumps, of which the following is a specification.

My invention relates to apparatus for moving electrically conducting liquids, and it has special reference to fluid pumps and to ejectors of the type in which gases or liquids are transferred by the fluid-entangling effect of a stream of liquid passing at relatively high velocity from a jet.

One object of my invention is to provide apparatus for moving bodies of electrically conducting liquids by means of the magnetic pulling effect of a moving magnetic field.

Another object of my invention is to provide an efficient and rapidly-operating pump of the above-indicated character which shall be simple in construction and which shall embody means for employing, as the ejector fluid, a stream of mercury or other conducting liquid, together with means for magnetically moving the stream of liquid.

One embodiment of my invention is illustrated in the accompanying drawings, in which Figure 1 is a longitudinal view, partially in elevation and partially in section, showing a pump constructed in accordance with my invention, the section being taken substantially along the line I—I in Fig. 2, and Fig. 2 is an end elevational view of the pump shown in Fig. 1, as seen from the right of Fig. 1.

My invention is based upon the fact that mercury and other conducting liquids may be set in motion by the dragging effect of a moving magnetic field. In the modification shown in the drawing, I provide means for inducing a rotating magnetic field, and I provide a helical passage for liquid in the rotating field together with means for supplying mercury or other conducting liquid to the helical tube. The liquid is caused to circulate through the helical tube, at considerable velocity, by the electromagnetic drag of the revolving field and, while in motion, it is conducted to a device for utilizing its kinetic energy. For example, it may be caused to pass through the jet of an ejector connected to the fluid to be pumped.

Referring to the drawing, the pump therein shown comprises two concentric laminated cores 1 and 2, similar to the primary and secondary cores of an induction motor. Either or both of these laminated cores may be provided with polyphase windings 3 and 4 so as to produce a revolving magnetic field in the air gap between them. The two windings are so disposed relative to each other that the fluxes produced by them are additive. The annular air gap is occupied by a helical tube which may conveniently be constructed of two concentric shells 5 and 6 between which is a helically-wound partition 7. The parts 5 and 6 should be made of non-conducting material which is non-magnetic and which will not amalgamate, while the part 7 should be of conducting material which is non-magnetic. An alloy of about 30% nickel and 70% iron is suitable for the helical partition 7. One end of the tube formed by the shells 5 and 6 and the partition 7 is connected to an inlet pipe 8 the lower end of which is immersed in a bath of mercury 9 contained in a vessel 10. The other end of the tube is similarly connected to a discharge pipe 11, the free end of which is also immersed in the mercury 9 and is flared as shown at 12. An ejector 13 is disposed in the pipe 11 near its flared outlet end 12, and a tube 14 connects the ejector 13 to a source of fluid 15, such as a chamber to be evacuated.

In the operation of my device, the helical tube and the vessel 10 are filled with mercury to form a closed circulating system. When current is supplied to the polyphase windings 3 and 4, a rotating magnetic field is induced which causes the mercury to circulate through the helical tube at a velocity sufficient to draw fluid from the chamber 14 according to the well known ejector principle. The mercury carrying the entrapped fluid is discharged at the flared outlet 12 and the fluid ejected with the mercury will rise to the surface of the mercury bath 9. The mercury will remain to be circulated again by entrance into the inlet tube 8.

My device is well adapted for use as a vacuum pump, in which case the chamber 15 represents a space to be evacuated, but it is also adapted for use in pumping from atmospheric pressure to some higher pressure, as in injector devices for supplying water

and other fluids. In this case, the entire device should be inclosed in the high-pressure space or in a separate chamber maintained at corresponding pressure, and the tube 14 is connected to a source of fluid supply. The circulating mercury will serve to draw the water or other fluid from the source of supply and deliver it to the inclosing vessel. On account of their non-miscibility, the water and mercury are readily separated by gravity.

The device which I have shown and described, and which employs a rotating magnetic field, may be modified by substituting other devices which induce moving fields that are adapted to impart movement to a body of mercury or other magnetic liquid. One such device is a developed polyphase solenoid having a sliding field. It may also be convenient to equip a single pumping device, having either a sliding or rotating field, with several ejector devices to multiply the pumping effect of the machine. It is to be understood that my invention comprehends these modifications and all others that fall within the scope of the appended claims.

I claim as my invention:

1. A fluid pump comprising means dependent upon a rotating magnetic field for imparting movement to an electrically conducting liquid and an ejector adapted to be operated by the said liquid.

2. A fluid pump comprising means dependent upon a rotating magnetic field for imparting movement to a body of mercury, and an ejector adapted to be operated by the said mercury.

3. A fluid pump comprising means for producing a moving magnetic field, means for subjecting an electrically conducting liquid to the dragging effect of the said moving field and thereby moving the said liquid, and an ejector adapted to be operated by the said moving liquid.

4. A fluid pump comprising means for producing a moving magnetic field, means for subjecting a body of mercury to the dragging effect of the said moving field and thereby moving the said body of mercury, and an ejector adapted to be operated by the said moving mercury.

5. The combination with means for producing a revolving magnetic field, of a helical tube disposed in the said field, and means for introducing an electrically conducting liquid into the said tube, whereby the said liquid is caused to traverse the said tube by the dragging effect of the said revolving field.

6. The combination with means for inducing a revolving magnetic field comprising spaced concentric primary and secondary cores, of two concentric tubes of electrically non-conducting material disposed in the space between the said cores, a helical partition disposed between the said tubes and forming a helical passage, and means for introducing a liquid into the said passage.

7. The combination with means for inducing a revolving magnetic field comprising spaced concentric primary and secondary cores, of two concentric tubes of electrically non-conducting material disposed in the space between the said cores, a helical partition of non-magnetic electrically-conducting material disposed between the said tubes and forming a helical passage, and means for introducing an electrically conducting liquid into the said passage.

8. The combination with a closed system adapted to contain an electrically conducting liquid, of magnetic means dependent upon a rotating magnetic field for circulating the said liquid in the said system, and means for utilizing the kinetic energy of the said liquid.

In testimony whereof, I have hereunto subscribed my name this 15th day of Jan. 1915.

LEWIS W. CHUBB.

Witnesses:
O. W. A. OETTING,
B. B. HINES.