June 19, 1928. 1,673,837

A. LOTZ

MAGNETIC SEPARATOR

Filed March 26, 1928

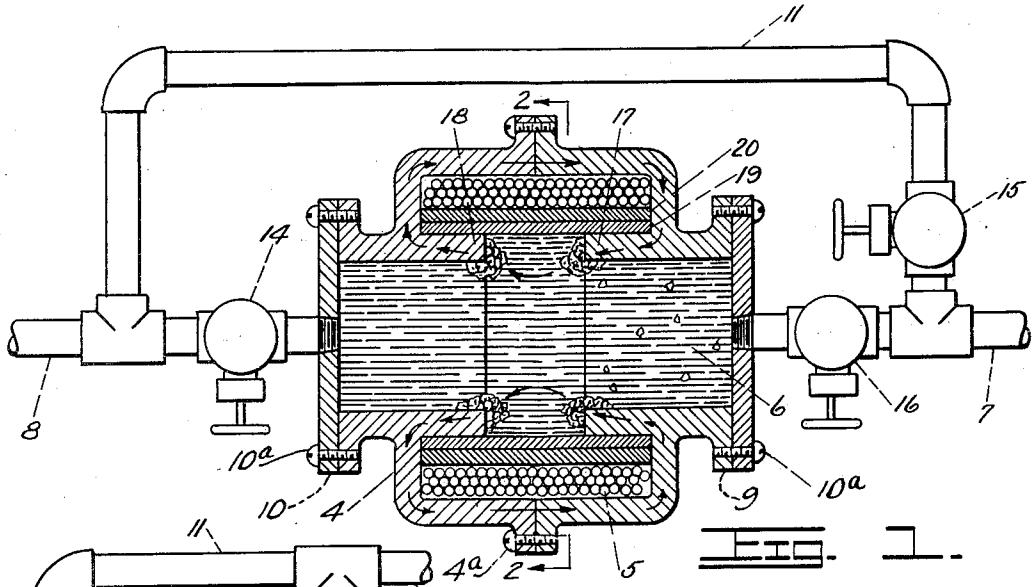

FIG. 1.

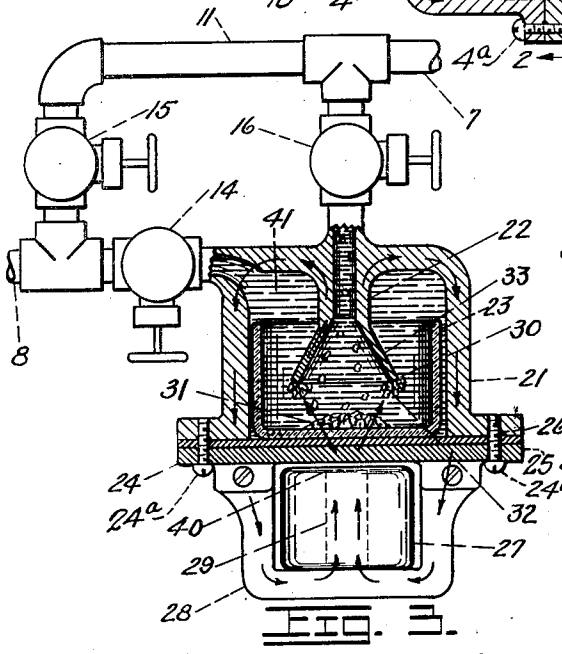

FIG. 3.

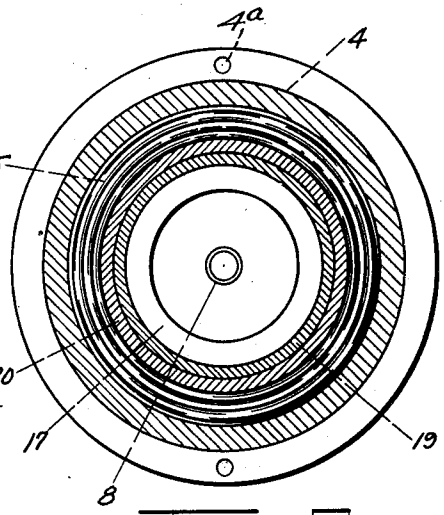

FIG. 2.

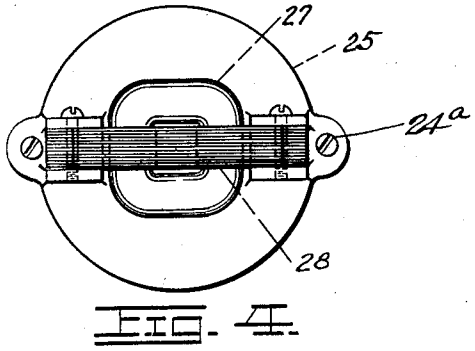

FIG. 4.

Albert Lotz
INVENTOR

by Harry S. Demarest
ATTORNEY

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UNITED STATES PATENT OFFICE.

ALBERT LOTZ, OF BERLIN-SIEMENSSTADT, GERMANY, ASSIGNOR TO SIEMENS-SCHUCKERTWERKE AKTIENGESELLSCHAFT, OF BERLIN-SIEMENSSTADT, GERMANY, A CORPORATION OF GERMANY.

MAGNETIC SEPARATOR.

Application filed March 26, 1928, Serial No. 264,668, and in Germany February 17, 1927.

This invention relates to a magnetic separating device for separating magnetic substances, or substances which are only partially magnetic from a liquid or gas while passing through a pipe or conduit.

The object of this invention is to provide a device which will collect such magnetic substances which usually accumulate from scale or the like which loosens from the interior of piping and may prevent clogging thereof, and accordingly provide a central station at which point said accumulations may be readily removed from the system.

This device is particularly useful in connection with refrigerating machines of the absorption type in which the difference of pressure throughout the fluid contained therein sometimes becomes very delicately balanced and consequently it is desirable to avoid as much as possible any restrictions or resistance to the fluid flow, such for instance as would be set up in a fluid passing through a filter.

Other objects will be apparent from the following description taken in connection with the accompanying drawing, in which similar numerals refer to similar parts throughout the several views.

Figure 1 represents a vertical sectional view of one form of my invention in connection with suitable piping therefor;

Fig. 2 is a sectional view of Fig. 1 taken on line 2—2;

Fig. 3 is a vertical sectional view of a modified form of my invention also shown in connection with suitable piping therefor; and

Fig. 4 is a bottom view of the electro magnet shown in Fig. 3.

With reference to the drawing, 4 is a casing made of magnetic iron and is formed of two parts secured together by screws 4^a to house a magnet coil 5, and provide a chamber 6 through which the fluid, ladened with a magnetic substance, is caused to flow. The fluid in this instance may be fed into the chamber 6 through the pipe line 7 and pass therefrom through the pipe line 8. The pipe lines 7 and 8 are connected to the casing 4 through flanges 9 and 10 respectively by screws 10^a or similar means, and thereby means are provided for removing the casing 4 from the system for clearing the chamber 6 of magnetic substances which have been collected therein in a manner which will hereinafter appear.

So as not to interrupt continuous operation of the fluid flowing system while the casing 4 is removed for cleaning, etc., a by-pass 11 is provided and also valves suitably located as shown at 14, 15 and 16; the valves 14 and 16 are closed while the casing 4 is removed and the valve 15 is open to permit the fluid to flow from pipe line 7 to pipe line 8 by way of said by-pass 11. Normally, however, the valve 15 is closed while valves 14 and 16 are open to cause the fluid to flow through chamber 6.

The casing 4 is provided with two hubs 17 and 18 extending inward which serve as pole pieces for the magnetic circuit indicated by the small arrows. The sleeve 19 is made of a metal which is non-magnetic and which will endure when in contact with the fluid which flows through chamber 6. In a refrigeration machine employing ammonia, it is suggested that the sleeve 19 may be made of lead; however, this metal does not have sufficient strength to support the pressure sometimes maintained in such systems and accordingly it must be re-enforced; therefore, a sleeve 20 is provided which surrounds the sleeve 19 and may be made of brass or any non-magnetic metal, the lead lining 19 serving to protect the sleeve 20 from coming in contact with the ammonia and from its deteriorating action.

As a consequence of the sleeves 19 and 20 being made of nonmagnetic metal we have a magnetic gap between the pole pieces 17 and 18, and accordingly when the magnet coil 5 is energized by an electric current the magnetic influence emanating from said pole pieces will attract and collect all magnetic substances contained within the fluid passing through the chamber 6.

With reference to the modification shown in Fig. 3, here the pipe lines 7 and 8, by-pass 11 and valves 14, 15 and 16 are arranged and function in substantially the same order as described with reference to Fig. 1. A casing 21 is provided with a nozzle 22 protruding downward into a vessel 23. The casing 21 and nozzle 22 should be made of a magnetic metal but the vessel 23 should be nonmagnetic, and might be made of porcelain. A cover 24 for the casing 21 and which carries the vessel 23 should be made of nonmagnetic

metal and preferably in two parts as shown, part 25 being of brass for strength and part 26 of lead to protect the brass from deterioration, the parts being secured to the casing by screws 24a.

A frame structure 28 preferably made of laminated iron is carried by the portion 25 of lid 24, and is provided with a central core 29 which carries a magnet coil 27 and thus forming an electro-magnet particularly suitable for A. C. current. The magnetic circuit is indicated by small arrows and includes the frame structure 28, casing 21, nozzle 22 and central core 29; with an air gap provided between the end 30 of the nozzle and end 40 of the central core. Consequently when the magnet coil 27 is energized while the fluid, ladened with magnetic substances, passes through the chamber 41, said substances will be collected in the vessel 23 or adhere to the nozzle 22 as indicated by 31 and 32 respectively. The nozzle 22 is funnel-shaped as shown at 23 to provide space for an appreciable quantity of magnetic substance to adhere thereto without restricting the flow of fluid through the nozzle 22; however, an instant break in the current through the coil 27 will release the magnetic substance from the nozzle 22 and permit it to fall to the bottom of vessel 23.

At certain intervals, of course, the vessel 23 must be emptied and otherwise cleaned, and this may be done without interruption to continuous operation in the system by diverting the fluid flow to pass through the by-pass 11, and then removing the lid 24 to gain access to the inside of the device.

In either device shown, Fig. 1 or Fig. 3, either A. C. or D. C. current may be employed, as any heat generated by A. C. current will readily be dissipated by the fluid flowing through the system.

In the device of Fig. 1 the sectional area of the chamber is large relative to the sectional area of the piping in general and accordingly the velocity of the fluid through the system is reduced at this point and thus affording ample opportunity for the magnetic substances to be attracted to the pole pieces of the magnetic circuit. This same condition exists in the device of Fig. 3, but in addition the fluid is sharply diverted in its travel from the nozzle 22 and through the chamber 41, and further facilitates the retention of the magnetic substances within this device. It is obvious that the fluid might flow through either of these devices in either direction without altering the effectiveness thereof.

I claim:—

1. A magnetic separator comprising a casing having a chamber therein, an electromagnet provided with a magnetic circuit having pole pieces relatively spaced to provide a magnetic gap within said chamber, a vessel of nonmagnetic material within said chamber for collecting magnetic substances, such as may pass through said chamber, and interposed between said pole pieces, and means for connecting said chamber in a pipe line.

2. A magnetic separator comprising a casing having a body portion of magnetic material and a hollow tubular pole piece projecting inwardly from said body portion, a casing portion of non-magnetic material removably connected to said body portion to form a chamber, means for connecting said chamber in a pipe line comprising a connection to said hollow pole piece, and an electromagnet associated with said removable casing portion to form a magnetic gap between its core and said tubular portion.

3. A magnetic separator comprising a casing formed of magnetic material and of inverted cup shape, said casing having a pole piece projecting downwardly from the bottom thereof toward its open side, a cover of non-magnetic material removably secured to said casing to close the open side thereof, means for connecting said casing in a pipe line, and an electromagnet associated with said cover to form a magnetic gap between its core and said pole piece.

4. In a magnetic separator, an inlet pole piece having a flaring end, a non-magnetic collecting cup surrounding said pole piece, an electromagnet supported adjacent the base of the collecting cup in such manner that its lines of force pass through the base of the cup and toward the flaring end of the pole piece.

Signed at Berlin-Siemensstadt, in the Republic of Germany, this 1st day of March, A. D. 1928.

ALBERT LOTZ.