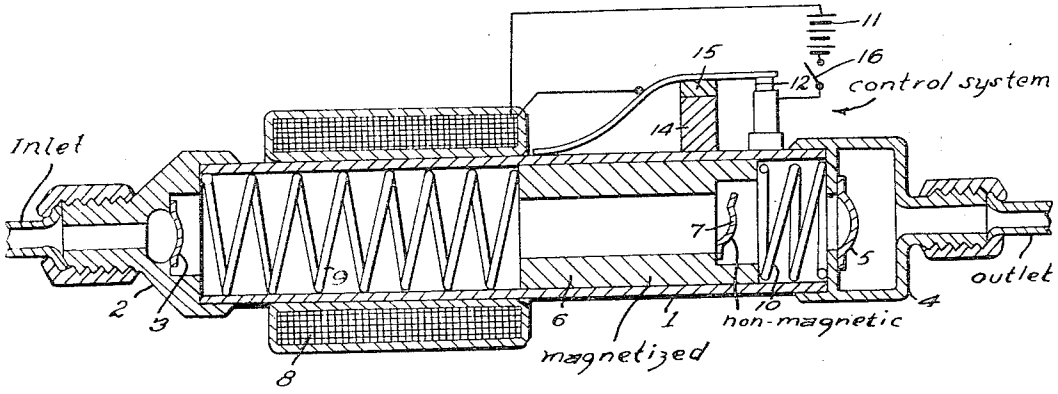
Feb. 14, 1967 F. W. INMAN 3,303,787

PUMP

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PUMP

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1 Claim. (Cl. 103—53)

The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

The present invention relates to a reciprocating pump driven by electrical energy pulses through the intermediary of an energy storing device, such as a spring. There is no mechanical connection between the exterior electrical elements and the interior mechanical pumping elements. Therefore, no fluid seal is required.

This is an improvement over my copending application for Pump, filed January 7, 1965, Serial No. 424,155, now Patent No. 3,282,220.

In the drawing, the single figure is a longitudinal cross-section through a preferred embodiment of my invention.

Pump casing **1** is substantially cylindrical and is made of a nonmagnetic material. The inlet or suction end of the cylinder is closed by a member **2** and has an inlet check valve **3** therein to prevent backflow of fluid as the pump plunger is drawn toward the inlet end of the pump. The outlet or pressure end of the cylinder is closed by a member **4** and may have an outlet check valve **5** therein.

Magnetized plunger **6** may have a check valve **7** therein to permit fluid to flow through the plunger when the plunger is moved toward the inlet end of the pump and to prevent fluid flow through the plunger when it is moved toward the outlet end.

Solenoid coil **8**, when energized, draws magnetizable plunger **6** toward the inlet end of the pump against the thrust of spring **9**. Plunger **6** may, under certain conditions, approach the outlet end at a very rapid rate. Therefore, a buffer spring **10** may be added to absorb the energy of the fast travelling plunger and start it back toward the inlet end. This conserves the energy and minimizes shock and internal damage to the pump, e.g. when the pump is "racing" and is pumping little or no fluid.

Power may be supplied to coil **8** from power source **11** through an electrical make-and-break system comprising points **12** and members **14, 15**. Switch **16** may be used to start or stop the pump.

It will be noted that plunger **6** is different from that disclosed in my copending case identified above. The plunger is actually, permanently magnetized, not merely magnetizable to complete a magnetic circuit to members **14, 15**. Therefore, as magnetized plunger **6** approaches member **14** the magnetic attraction draws element **15** down, to close points **12**. This makes it possible to eliminate an exterior electro-magnet (as shown at **13** in my copending case) and yet retain the function. And, an increase in operating efficiency is obtained because the magnetized plunger **6** is attracted by electro-magnet **8** with a lower current and magnetic field.

From the foregoing it is seen that a part has been eliminated, the function has been retained, and operating efficiency has been increased.

Operation

Upon start-up the parts will assume the positions illustrated in the drawing. Magnetic force from magnetized plunger **6** travels through nonmagnetic pump casing **1** to magnetizable member **14**. The then magnetized member **14** attracts magnetizable member **15** to draw points **12** together thereby completing the circuit to coil **8**.

Magnetic flux from coil **8** passes through cylinder **1** and attracts magnetized plunger **6** toward the inlet end of the pump, compressing spring **9**. Fluid trapped between plunger **6** and valve **3** is forced through the plunger and valve **7**. As magnetized plunger **6** moves past magnetizable member **14** the magnetic circuit therebetween is broken, points **12** open and coil **8** is de-energized. Valve **7** closes and spring **9** forces plunger **6** toward the outlet end to pump fluid out through valve **5**. As the plunger approaches the outlet end the magnetic circuit is completed from **6** to **14, 15** and points **12** are closed to energize coil **8** to draw plunger **6** back toward the inlet end.

If desired, valve **5**, or spring **10**, or both, could be omitted. However, these parts are simple and inexpensive and they add to proper functioning of the apparatus as explained hereinbefore.

This pump is simple and inexpensive in construction and efficient in operation. There is no mechanical seal between the electrical driving element and the armature-pump plunger. No mechanical connections are required between the armature-pump plunger and the electrical make-and-break point set. Therefore, no fluid seal is required because no mechanically moving part projects through the pump housing. This eliminates leakage and possible fire or explosion if the fluid being pumped is gas or gasoline, as examples.

During a large percentage of the time no electrical power is required. Electrical power is used for a split-second and this power is converted to potential energy stored in spring **9**. That energy then stands ready to pump fluid instantly upon demand, or to pump slowly over a period of seconds, minutes or hours, or to pump fluid when called upon at a much later time, and, until that stored energy is used, no further electrical power is required.

I claim:

Pump and motor means comprising: a substantially cylindrical casing; means to close one end of said casing; fluid inlet means adjacent to said end; inlet valve means for said fluid inlet means; means to close the other end of said casing; fluid outlet means adjacent to said other end of said casing; an outlet valve for said pump and motor means; magnetized pump plunger means in said casing; means urging said plunger means in one direction; electromagnetic means urging said plunger means in the opposite direction when energized; and means to energize said electromagnetic means when said plunger means is moved to a position toward said outlet end; said electromagnetic means comprising a solenoid coil surrounding said cylindrical casing and said casing comprising a nonmagnetizable material whereby, upon energization of said solenoid coil, said magnetized pump plunger is attracted into said coil against the force of said means which urges the plunger means in said one direction; said means to energize said electromagnetic means comprising; a magnetizable member operable to close and open a circuit to said electromagnetic means; said mag-

netized pump plunger means serving to attract said magnetizable member as said plunger approaches said other end of said casing to thereby close said circuit to said electromagnetic means and move said magnetized pump plunger toward said one end of said casing; said means urging said plunger in one direction comprising a coil compression spring; and means adjacent to said other end of said casing to buffer movement of said plunger as it approaches said other end and to assist in returning said plunger toward said one end; and an additional outlet valve in the path of fluid flow past said plunger.

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