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HIGH VOLUME, ELECTRO-MAGNETIC, RECIPROCATING PUMP MECHANISM

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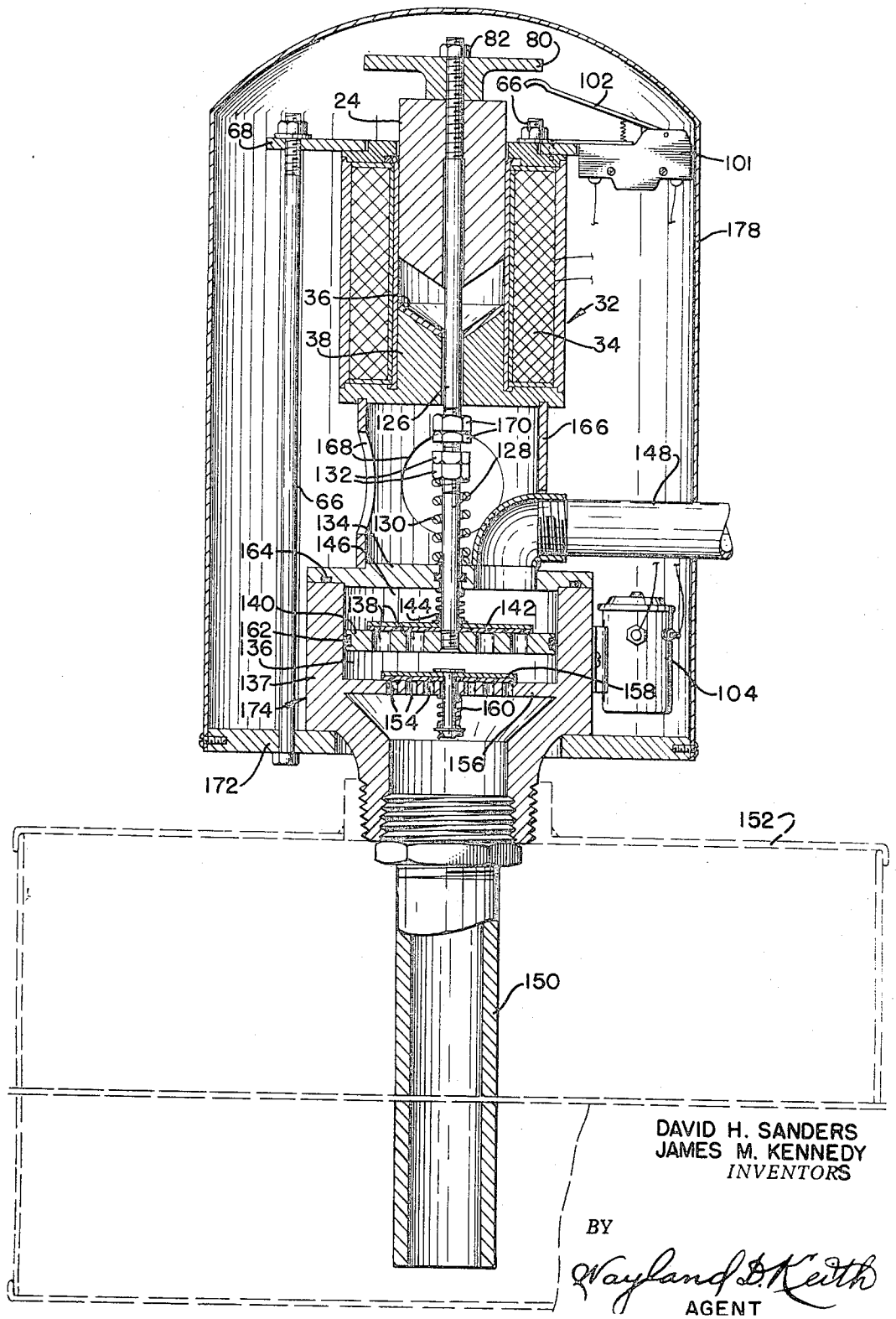

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HIGH VOLUME, ELECTRO-MAGNETIC, RECIPROCATING PUMP MECHANISM

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5 Claims

ABSTRACT OF THE DISCLOSURE

Solenoid operated reciprocating pump utilizing a valve piston operating within a cylinder to pump fluids, such as gases, air, kerosene, gasoline, oil, water, or the like, at a high volume and at a relatively low pressure. A foot valve is provided to prevent the return of the fluid to the container from which it is being withdrawn. The pump unit is self-contained to which an eduction tube is connected so the unit may be readily attached to a container or drum to withdraw fluid therefrom and dispense at a suitable pressure.

This invention is a divisional application of application Ser. No. 553,358, Electro-Magnetic, Reciprocating Pumping Mechanism, filed May 27, 1966, now Patent No. 3,394,657, which application was co-pending with application Ser. No. 367,313 for Solenoid Actuated Pressure Pump for Grease Guns and the like, filed May 14, 1964, now Patent No. 3,253,742, issued May 31, 1966.

This invention relates to improvements in pressure pumps and more particularly to magnetically operated pressure pumps for pumping fluids, both gaseous and liquids, such as gases, air, kerosene, gasoline, water and liquids of both high viscosity and of low viscosities.

Various solenoid operated and magnetically operated pumps have been proposed heretofore, but these, for the most part, did not lend themselves to a wide variety of uses, such as transmitting grease at high pressures or transmitting liquids such as diesel oil and the like at low pressures, by the use of substantially the same solenoid actuated mechanism and timing mechanisms, merely by changing the size of the pump and the pressure at which the pump operates.

The present solenoid actuated pump is so designed as to operate over long periods of time with a minimum shut down time for repair and the like, but is so constructed that parts may be readily and quickly installed in a minimum of time.

The present device is so constructed that it has a self-contained prime mover and pumping unit, which may be rapidly adapted for use with AC or DC current of standard voltage, such as 110 AC, commercial electricity, or with 6, 12 or 24 volt storage batteries, thereby making possible a wide versatility in the use of the present device in practically all fields of endeavor where a pumping unit for handling liquids is used. Furthermore, in the field of lubrication, it may be readily carried to remote areas for servicing equipment which is not readily accessible to air actuated equipment which requires large air tanks, motors, and the like.

The present device is so constructed that, when used for lubrication equipment, a standard hose may be attached thereto which will readily enable the unit to operate instantly without waiting for air pressure to build up to an operating pressure level.

An object of this invention is to provide a pumping unit which may be readily adapted for use with fluids

of different viscosities so as to pump gases, air, fuel, such as kerosene, gasoline, diesel oil, and lubricating oil.

Another object of the invention is to provide an electrically energized, solenoid actuated pumping unit which is light in weight and which will dispense fluids under pressure to a point of use.

Still another object of the invention is to provide an electrical timing system therefor which may be pulsed either by reciprocation of the pump or by a solid state timer unit.

Another object of the invention is to provide a combination solenoid and spring actuated pump whereby the pumping action is performed by the resiliency of a spring. With these objects in mind and others which will become manifest as the description proceeds, reference is to be had to the accompanying drawings in which like reference characters designate like parts in the several views thereof, in which:

The figure shows a longitudinal, vertical, sectional view through a second form of the pumping unit, with parts shown in elevation to bring out the details of construction.

With more detailed reference to the drawing, the drawing discloses a longitudinal sectional view through the solenoid pumping apparatus, as shown in full outline, with portions broken away and with portions shown in elevation and showing a container in dashed outline, illustrative of installing of the solenoid actuated pump.

The invention as shown herein utilizes a solenoid, which solenoid may be timed for sequential operation either by a mechanically operated timer switch or by a solid state timer, as shown in our co-pending application, Ser. No. 553,358. However, for purposes of illustration, a mechanically actuated switch **101** is utilized, which switch has an outstanding arm **102** thereon which is engageable by the outer periphery of the flange of screw-threaded member **80** upon downward movement of solenoid armature **24**, which elements form a mechanical timing device, which opens the circuit at regulated intervals. Upon downward movement of armature **24**, an armature plunger **126** is moved downward against pump plunger **128** to compress a compression spring **130** which spring surrounds pump plunger **128** and which spring is biased between adjusting nuts **132** on the upper end and pump head **134** at the lower end of the pump plunger. As the plunger **128** moves downward, fluid entrapped in chamber **136** in housing **137** of shouldered pump **174** will flow upward through holes **138** in pump piston **140** to open spring pressed valve **142**, which valve preferably has a normally weak spring **144** biased between the upper face of valve **142** and the lower face of pump head **134**. Upon the movement of screw-threaded, flanged member **80** downward a sufficient distance to cause arm **102** to open switch **101**, the solenoid coil **34** will be deenergized and the solenoid armature **24** will return to position, as indicated in FIG. 6, under the influence of spring **130**. However, upon the upward movement of pump plunger **128**, under the influence of spring **130**, the fluid within chamber **146** will be discharged outward through pipe **148**.

Upon upward movement of piston **140**, a suction is created in chamber **136** which will draw fluid such as gas, water, oil, diesel fuel and the like, upward through pipe **150** from reservoir **152** into and through holes **154** in valve plate **156** to lift valve **158** against tension of spring **160**, whereby the fluid will flow into chamber **136** so long as the upward movement of piston **140** continues. Upon the reversal of piston **140**, the sequence of pumping operation, as set out above, will be had.

The piston **140** is shown to have a sealing element **162** around the periphery thereof, which, in the present instance, is shown to be an O-ring. The chamber **144** is

sealed around the upper edge thereof by a peripheral sealing element **164** which, in the present instance, is shown to be an O-ring.

It is to be pointed out that the solenoid armature **24** may be timed to operate at the desired number of cycles per minute to create best pumping efficiency; and, due to the large volume of fluid handled by the present pump, the pipes **150** and **148** may be considerably larger than the conduits shown in the first mentioned form of the invention.

The present solenoid is seated in piloted relation on a ring **166**, which seats in piloted relation on the head **134** of the pump. Holes **168** are provided in the sides of ring **166** by which to gain access to the adjusting nuts **132** and nuts **170**. The solenoid **32** is held in secure relation by bolts **66** which pass through an annular ring **172** below the shouldered pump **174** and through a ring **68** which surrounds the upper portion of the solenoid **32** in a manner similar to that described in the aforementioned form of the invention. A cover **178** is provided and is secured to ring **172** to prevent damage to the mechanism and to the circuitry.

This solenoid operated pump does not require a pressure switch as the pressure is automatically controlled in accordance with the setting of tension of spring **130** by adjusting nuts **132** on pump plunger **128**. As the pressure is built up in discharge pipe **148** to a pressure that spring **130** will not return piston **140**, the screwthreaded, flanged member **80** will maintain switch arm **102** depressed to maintain the contacts within switch **101** open until such time that the pressure in chamber **146** is less than the force exerted by spring **130**.

A toggle switch **72** is connected within a circuit to enable the current leading to solenoid actuated switch **104** and switch **101** to be interrupted to enable the unit to be immobilized.

Having thus clearly shown and described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. A pump mechanism which comprises:

(a) an electro-magnetically actuated mechanism,
  (1) an armature guide means,
  (2) a longitudinally movable armature associated with said mechanism in guided relation,

(b) a bar secured to said armature and extending outward therefrom,

(c) a spacer member associated with said electro-magnetically actuated mechanism,

(d) a pump cylinder associated with said spacer member,
  (1) said spacer member interposed between said electro-magnetically actuated mechanism and said pump cylinder,
  (2) means securing said electro-magnetically actuated mechanism and said pump cylinder in fixed relation,
  (3) said pump cylinder having an inlet opening formed therein,
  (4) said pump cylinder having an outlet opening formed therein,
  (5) a reciprocating plunger mounted within said pump cylinder and extending outwardly therefrom,
  (6) an end of said pump plunger complementally contacting an end of said bar in operative relation,

(e) a spring associated with said pump plunger for returning said pump plunger to a normal position, when said electro-magnetically actuated mechanism is de-energized,

(f) an electrical circuit associated with said electro-magnetically actuated mechanism for supplying electrical current thereto,
  (1) timing means within said electrical circuit to selectively direct electrical current to said electro-magnetically actuated mechanism,

(g) said pump plunger having a valved piston near the distal end of said piston rod within said pump cylinder,
  (1) sealing means surrounding said pump plunger, and
  (2) an inlet valve associated with the inlet opening of said pump cylinder to admit fluid into said cylinder.

2. A pump mechanism as defined in claim **1**; wherein

(a) said pump cylinder is spaced from said electro-magnetically actuated mechanism and is in axial alignment therewith,

(b) said pump plunger has an abutment formed thereon near the end thereof opposite said valve piston,

(c) said spring surrounding said pump plunger is in bearing engagement with said abutment on said pump plunger and with said pump cylinder and is of such strength to move said plunger so as to draw liquid inward through said valved inlet and to discharge liquid outward above said valved piston,
  (1) said pump piston being perforate, and
  (2) said valve on said pump piston being adapted to cover said perforations in said piston when in one position and to open said perforations when in another position.

3. A pumping mechanism as defined in claim **2**; wherein

(a) said spring, which surrounds said plunger, is of such strength that it will discharge fluid in accordance with a predetermined stress of the spring impressed on said abutment,

(b) means adjusting said abutment to vary the stress impressed on said spring to regulate the output pressure of fluid from said pump cylinder, and

(c) said electrical timing mechanism being operative only when spring pressure impressed on said piston is equal to or is greater than the fluid output pressure on the outlet side of said pump cylinder.

4. A pumping mechanism as defined in claim **3**; wherein

(a) said means adjusting said abutment is a nut threadably engaging said plunger.

5. A pumping mechanism as defined in claim **1**; wherein

(a) said electro-magnetically actuated mechanism, said spacer member, and said pump cylinder are positioned in axially alignment to form an assembly,

(b) a perforate ring positioned on each end of said assembly, and

(c) screwthreaded bolts passing through said perforations in said rings to bindingly engage said electro-magnetically actuated mechanism, said spacer member and said pump cylinder in secure relation.

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