

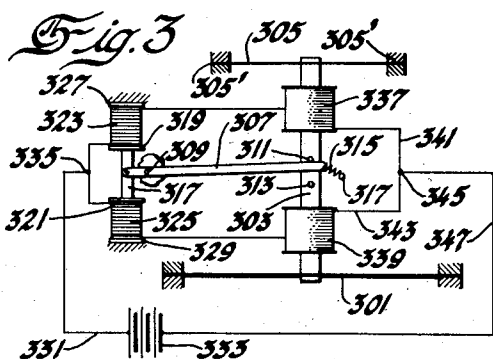
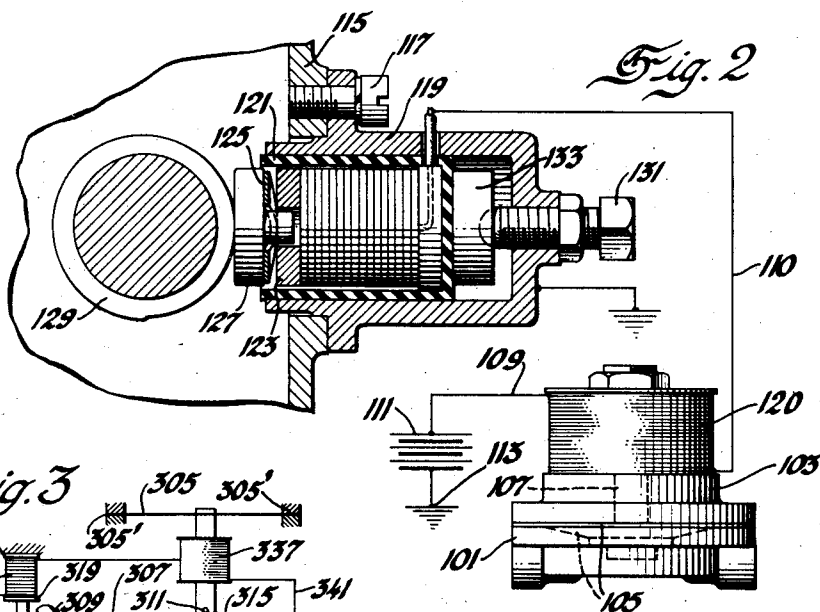
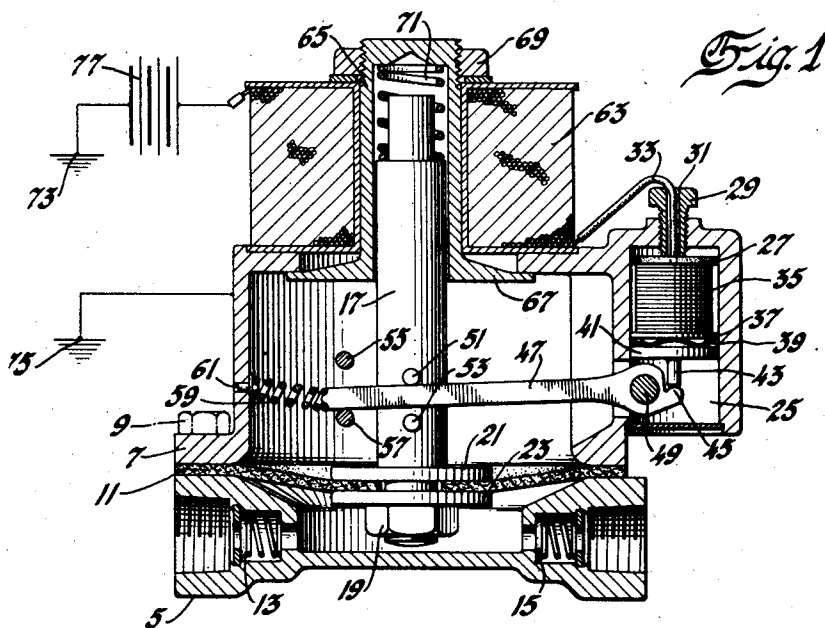
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3 Claims. (Cl. 172—126)

This invention relates to pumps and more particularly to pumps such as are used to deliver fuel from a tank to the carburetor of a gasoline engine.

A major object of the invention is to provide an improvement in the operation of said pumps by the use of electrical means.

A more specific object is to provide for electrical operation by means which shall avoid the usual make and break contact points.

Another object is found in the accomplishment of the major objects by mechanism having long life.

The invention makes it possible to actuate a pump electrically but without the sparking which takes place with make and break contacts, and by a construction which is simple and inexpensive and which permits the location of the pump in any convenient place.

Other objects and advantages will appear from the following description.

Figure 1 shows a vertical section of one embodiment of the engine.

Figure 2 shows diagrammatically and partly in section a second embodiment.

Figure 3 is a diagrammatic view of another modification.

In Figure 1, numerals 5 and 7 designate two pump members which may advantageously be made by die casting and which are secured together by fastening means 9.

A flexible diaphragm 11 is clamped between the parts 5 and 7. Inlet and outlet valves 13 and 15 communicate with the variable volume pump chamber formed by the part 5 and by the diaphragm. Secured to the diaphragm is a stem 17, the attachment being made by means of a threaded nut 19 and plates 21 and 23, one on each side of the diaphragm. Within a cylindrical region 25 of the upper member 7 is an insulating disc 27 positioned by a threaded screw 29, the latter having an axial aperture 31 for the passage of a lead wire 33 connected to the uppermost of a series of discs 35. These discs may be composed either of hard carbon or partially reduced titanium dioxide. The discs are dimensioned to be free from contact with the wall of the chamber as shown. Contact with the wall is made by the lowermost disc through a contact number 37 which itself engages the wall of the chamber. The disc 37 is pressed upwardly by a spring 39 in abutment with a movable plate 41 having a stem 43. The stem is engaged by a shoulder 45 at the extremity of a lever 47, the lever being pivoted as at 49. The lever

extends through an opening in the wall of the chamber 25. It passes between upper and lower pins 51 and 53 on the diaphragm stem and between pins 55 and 57 within the upper member 7. A coil spring 59 engages the end of the lever and a button 61 seated in an opening in the wall of the chamber 7. The spring reaches its maximum compression as the lever passes through a central position. On either side of the central position of the lever the spring snaps the lever to its limiting positions, either in engagement with pin 55 or with pin 57. A solenoid coil 63 is mounted upon the top of the upper member 7 and around a hollow sleeve 65. The sleeve has at its lower end a flange 67 within the member 7. A nut 69 threaded upon the outermost end of the sleeve holds the sleeve and solenoid in assembled relation. The upper end of stem 17 serves as an armature for the solenoid 63, being drawn upwardly within the sleeve 65 by the solenoid. Spring 71 is located between the upper end of the stem and the closed end of the hollow sleeve 65. Spring 71 functions to push the stem, and with it the diaphragm downwardly. The action of the solenoid and the spring 71 are thus available to produce the strokes of the pump. The electric circuit is grounded as at 73 and 75. It includes a source of energy such as a battery 77. When the parts have just reached the positions shown by the figure the spring 59 holds the lever 47 against the stop 57 and in doing so the lever exerts pressure on the stack of discs 35. Such pressure reduces the resistance offered to the current flow through the stack and the electrical energy is therefore effective through the solenoid to raise the stem 17 within the sleeve 65 and against the action of spring 71, thereby creating potential energy within said spring. As the stem so moves its lower pin 53 engages the lever and rocks it through its central position whereupon the spring 59 snaps the lever into contact with pin 55 thus relieving the pressing of the lever upon the carbon stack. The reduced pressure in the stack increases its resistance. The solenoid is no longer able to hold the stem upwardly against the resilient energy of spring 71 which then forces the stem downwardly and with it the diaphragm to the position shown by the figure. In doing so the spring 59 snaps the lever to its position shown where it engages the pin 57. With such an arrangement there is no sparking such as takes place with the conventional make and break device. The pump may be placed in any convenient position. The stack

of discs is not subject to wear and serves for an indefinitely long period.

In Figure 2, the pump marked 101 may be regarded as substantially the same as the pump described above with the exception that the chamber 25 is omitted. The upper part of the pump is marked 103. The diaphragm 105 and the stem 107 are shown in dotted lines. A lead wire 109 is connected to the battery 111 and the latter is grounded at 113. Secured to the wall of the engine casing 115 by fastening means 117 is a hollow cup 119. The cup contains an inner insulating cup 121 housing a series of carbon discs as before, the discs forming the pressure sensitive resistor stack. The outermost disc is connected with a solenoid 120 by the wire 110. The innermost disc is in metallic contact with an abutment ring 123, a flat spring 125 and a spring abutment 127, the latter engaged by a cam 129 within the engine casing and operated by the engine. The minimum pressure of the stack is predetermined by means of a member 131 threaded into the cup 119 and engaging an abutment 133 in contact with the closure of the insulated cup 121. In this form of the invention the pressure variation in the stack is made by the engine driven cam 129. The variations affect the current energy available for the solenoid of the pump. When the cam compresses the discs the resistance of the stack is reduced and the solenoid may raise the diaphragm stem. When the pressure of the stack is released the equivalent of spring 71 operates to reversely move the diaphragm.

It will be obvious that in the absence of a spring like 71 of Figure 1, a second carbon stack and a second solenoid might be used. The duplication of stacks and solenoids for effecting the two reciprocating movements of the movable pump member are shown in Figure 3. In this figure, numeral 301 is the diaphragm which is to be reciprocated. It is connected to one end of a stem 303. A flexible guide spring 305 anchored at 305', 305" is attached to the other end of the stem. A lever 307 is pivoted at 309 and extends between pins 311 and 313 on the stem. A spring 315 between the end of the lever and a fixed point 317 acts precisely like the spring 59 of Figure 1.

At its other end the lever is connected to a rod 317 carrying two heads 319 and 321. Movement of the heads 319 or 321 compresses the discs of two stacks 323 and 325 against abutments 327 and 329. The lead wire 331 from the battery 333 divides at 335, one lead connected to each head. From the stacks 323 and 325 lead wires extend to the solenoid coils 337 and 339 which surround the stem 303. From the solenoid coils two leads 341 and 343 unite at 345 with a wire 347 connected with a battery 333. In this form of the device stack 325 has just become compressed by the lever 307. Its resistance is therefore reduced. The current therefore flows through stack 325 rather than through 323 which is not at this time under compression. The current therefore returns to the battery by way of solenoid 339. Solenoid 339 being energized reciprocates the stem 303 in a downwardly direction similarly flexing the diaphragm 301. As the stem moves downwardly its pin 311 cooperating with the

spring 315 rocks the lever in a direction to release the pressure from stack 325 and apply it to stack 323. Thereupon the current flows through stack 323 and solenoid 337 raising the stem 303 and the diaphragm 301 thus making the opposite stroke of the pump. The upper spring 305 serves to limit the strokes of the diaphragm as influenced by the solenoids. Obviously if preferred a spring loaded by-pass may be used to control the action of the pump. Although not shown, any convenient means may be used to predetermine the tension of spring 305.

We claim:

1. In a machine, a movable member, a stem secured thereto, a solenoid having an armature, said armature being rigid with said stem, means constituting an electric circuit and including a pressure sensitive resistor stack to energize said solenoid, means movable in response to movements of said member to intermittently compress and release said stack whereby said stem and movable member may be moved in one direction when the stack is compressed and other means to move said member in the opposite direction when the stack pressure is released, said other means comprising a second solenoid operable upon said stem and a second stack, said stack compressing means compressing the second stack when its pressure is released from the first stack.

2. In a machine, a movable member, a stem secured thereto, a solenoid having an armature, said armature being rigid with said stem, means constituting an electric circuit and including a pressure sensitive resistor stack to energize said solenoid, means movable in response to movements of said member to intermittently compress and release said stack whereby said stem and movable member may be moved in one direction when the stack is compressed and other means to move said member in the opposite direction when the stack pressure is released, said stack compressing and releasing means comprising a lever, means on said stem to rock said lever and relieve the pressure on said stack as the stem reciprocates whereby said other means may operate as set forth, together with a spring movable through center to snap said lever to its two extreme positions.

3. In a machine, a movable member, a stem secured thereto, a solenoid having an armature, said armature being rigid with said stem, means constituting an electric circuit and including a pressure sensitive resistor stack to energize said solenoid, means movable in response to movements of said member to intermittently compress and release said stack whereby said stem and movable member may be moved in one direction when the stack is compressed and other means to move said member in the opposite direction when the stack pressure is released, said other means comprising a second solenoid operable upon said stem and a second stack, said stack compressing means compressing the second stack when its pressure is released from the first stack, said stack compressing means comprising a lever and a snap spring, said lever being rocked to its extreme positions by said stem and spring.

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