This application is a division of my application Serial No. 330,873, filed February 14, 1929, for fuel feeding system for internal combustion engines.

The purpose of the invention of this application is to provide an improved construction and control of an electric motor for operating a pump for supplying fuel to an internal combustion engine, said motor, and thereby the pump, being controlled by the pressure of the fuel in the fuel delivery line leading to the engine carburetor. It consists in the elements and features of construction shown and described as indicated in the claims.

In the drawings:

Figure 1 is a diagrammatic view showing in vertical fore-and-aft section an electromagnetic pump submerged in the main fuel tank from which the engine is supplied with fuel, the same being shown diagrammatically with relation to the carbureter and current source by which the electromagnetic element of the pump is energized.

Figure 2 is a section at the line 2—2 on Figure 1.

Figure 3 is a section at the line 3—3 on Figure 1.

Referring to the drawings: A carbureter of conventional form and construction in customary position on the engine may be understood to be connected with the apparatus shown in the drawing by the pipe, 14, as indicated by the arrow leading from that pipe in Figure 1. The main fuel supply tank is indicated at C, having in the lower part, so as to be submerged in the liquid content of the tank, an electromagnetic pumping device indicated as to its entirety by the reference letter, X.

The current source for energizing the electromagnetic element of the pump is indicated conventionally at D, from which a circuit wire, 10, is shown running to the engine ignition switch indicated conventionally at 11, and thence to a coil indicated conventionally by its casing at 12, from which coil a circuit wire, 13, is shown leading to a fitting, E, mounted on the top of the tank, C, and constituting a fuel discharge connection from the pump which is located within the tank to the carbureter, as indicated by the fuel pipe line, 14.

To this fitting, E, at the intake to its chamber, C, at the inner side, within the tank, the pipe, 15, which constitutes the immediate discharge connection of the pump, is connected at 16.

The circuit wire, 45, to the electromagnetic element of the pump extends in the pipe, 15, being connected inside the fitting, E, to the insulated contact, 17, of a switch or circuit-making-and-breaking device, of which the cooperating contact, 18, is carried on the free end of a spring bar, 19, insulatedly mounted inside the fitting, E, by means of an insulated binding post, 21, to which outside said fitting, E, the current wire, 13, is secured by a binding nut, 22.

The cavity, C, of the fitting, E, is closed at the upper side by a flexible diaphragm, 23, clamped to the fitting, E, by a spider, 24, secured by screws, 25; and said diaphragm has a stem, 26, secured to it at its center and serving for clamping the central area of the diaphragm between disks, 27 and 28, said stem being secured at its lower end to the spring contact-carrying bar, 19; and a coil spring, 30, is interposed above the diaphragm, reacting between the diaphragm and the central port of the spider, 24, a centering screw, 31, being set through the hub of the spider for positioning the spring at its upper end; and the clamping screw, 29, which holds the stem, 26, and the disks, 27 and 28, to the diaphragm, has its head elongated and tapered at the upper end to perform a similar function at the lower end of the spring, 30.

The contact, 17, is carried by a flat strip, 32 of conductive metal which is mounted on a bar 33 of insulating material and conductively secured to the circuit wire 45 said insulating bar, 33, being mounted at an inlet port, 34, in the bottom of the fitting, E, said bar not being dimensioned for closing the port, but for being stopped by lodgment of its opposite ends at the margin of the port, where it may be secured fixedly to the bottom of the fitting, E.
Upon considering this construction it may be readily understood that the pressure of the liquid pumped, producing pressure in the chamber, e, of the fitting, E,—hereinafter called the fuel pressure chamber,—operating on the diaphragm, 23, will at some stage overcome the resistance of the spring, 30, and the stiffness of the spring bar, 32, and cause the diaphragm to lift the contact button, 17, out of contact with the contact button, 18, breaking the circuit, and interrupting the energizing of the electromagnetic element of the pump, and causing the pumping action to cease.

And it will be understood that by this means the pressure of the fuel at the carburetor is predetermined and maintained at the predetermined degree, the pump ceasing to act the instant the pressure reaches that degree and resuming action the instant it falls the least below that degree.

The detail structure of the electromagnetic pump is fully described and claimed in the parent application of which this application is a division, and needs only be described here in general terms for the purpose of understanding the drawings. This electromagnetic pump comprises a casing, 40, in which there is snugly fitted the electromagnetic pump unit identified as to its entirety by the enclosing cylindrical shell, 51, encompassing the electromagnetic element, which latter is of a solenoid type, comprising the spool consisting of a central tube member, 52, and heads, 53 and 54, with the circuit windings, 55, occupying the annular space between the spool heads. The tube member, 52, constitutes also the pump cylinder in which the solenoid armature, 56, operates as the pump piston. The solenoid has at one end the fixed head, 57, of magnetic metal, which supports an axially positioned stem, 58, on which the reciprocating armature piston, 56, slides in its reciprocation, a coil spring, 61, reacting between a shoulder, 59, on the stem, and shoulder, 60, on the piston for normally stressing and holding the armature piston at the limit of its stroke away from the fixed magnetic head, 57.

The construction in other respects, particularly in respect to the circuit connections of the solenoid winding, may be understood to be arranged for automatic operation of the pump in respect to the alternating opposite strokes of the piston, which, as above mentioned, derives its stroke in one direction from the reaction of the spring, 61, and in the opposite direction by the magnetic action upon the energizing of the solenoid winding, which is connected in the circuit arranged to be closed by the spring-caused stroke of the pump piston in that direction, and to be opened, interrupting the magnetic action, by the opposite magnetically-caused stroke of the piston. The details of the circuit and the circuit-making-and-breaking devices may be seen in the drawings and fully described in the parent application, and further description is unnecessary for the understanding of the invention to which the present application is directed.

The structure and operation of the pump as a pump may be understood from the drawings. The casing, 40, has at the bottom of the chamber, 41, inlet ports, 62 and 65, located, respectively, beyond the outer end of the solenoid shell, 51, said ports being controlled by inwardly opening check valves, 63 and 64, respectively; and at the upper side said casing contains a chamber, 65, communicating by ports, 66 and 67, with the main chamber, 41, said ports being controlled by outwardly opening check valves, 43 and 44.

It is within this chamber, 65, that the pipe, 15, communicates for fuel delivery to the fuel pressure chamber, e, and the circuit wire, 45, is connected in this chamber to an insulating conducting pin, 46, which is mounted in the horizontal partition, 68, which separates the chambers, 66 and 41; and from the inner end of said conductor pin a resilient conducting clip, 48, extends for resilient contact with a contact button, 69, mounted insulatedly in the head, 54, of the solenoid spool, and having the circuit wire, 55, soldered to its inner end, thus serving to conduct the current from the current source to said spoolly when energizing the electromagnetic unit when the circuit is closed by the reduction of pressure in the chamber, e, on the diaphragm, 23, causing the spring, 30, to stress the diaphragm inwardly for closing the circuit at the contacts, 17 and 18.

I claim: 1. In a fuel feeding system for motor vehicle internal combustion engine, in combination with the engine carburetor and a main fuel supply tank located on the vehicle remotely from the carburetor, an electrically driven pump located in the main supply tank; a fuel discharge pipe from the pump extending therefrom to the outside of the tank; a fitting mounted on the tank containing a pressure chamber to which said pump discharge pipe leads, the pump-energizing circuit comprising a wire extending from the motor element of the pump in said discharge pipe; an insulated contact mounted in said pressure chamber to which said wire is operatively connected; a contact carrier insulatedly mounted in said pressure chamber; a second contact carried by said carrier in position for being normally in contact with the first contact, said chamber having a moveable wall portion operatively connected to said contact carrier for moving the latter to separate the two contacts upon movement of said wall member outwardly upon the fluid pressure chamber due to the pumping of fuel thereto reaching a predetermined degree.

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2. In a fuel feeding system for motor vehicle internal combustion engines in combination with the engine carburetor; a fuel supply tank located on the vehicle remotely from the carburetor; an electrically operated pumping apparatus mounted in the fuel tank; a fuel supply line from the pump discharge to the carburetor comprising a fitting mounted on the outside of the tank; a pipe within the tank leading from the pump discharge to said fitting, and a pipe line connected with the fitting outside the tank and leading to the carburetor, said fitting comprising a pressure chamber, the pump energizing circuit leading from the pump in the first mentioned pipe member to the fitting and from the fitting exteriorly of the tank to the source of current, and comprising within the pressure chamber co-operating contacts and insulated carriers for the same, and means in the pressure chamber adapted to be operated by the pressure of the fuel pumped and connected with one of the contacts for moving the same to separate the contacts upon said fuel pressure in the chamber reaching a predetermined degree.

In testimony whereof I have hereunto set my hand at Chicago, Illinois, this 13th day of February, 1930.

PERCIVAL S. TICE.