

May 25, 1943.

A. C. KORTE ET AL

2,319,934

ELECTRIC FUEL PUMP

Original Filed Aug. 23, 1939

4 Sheets-Sheet 1

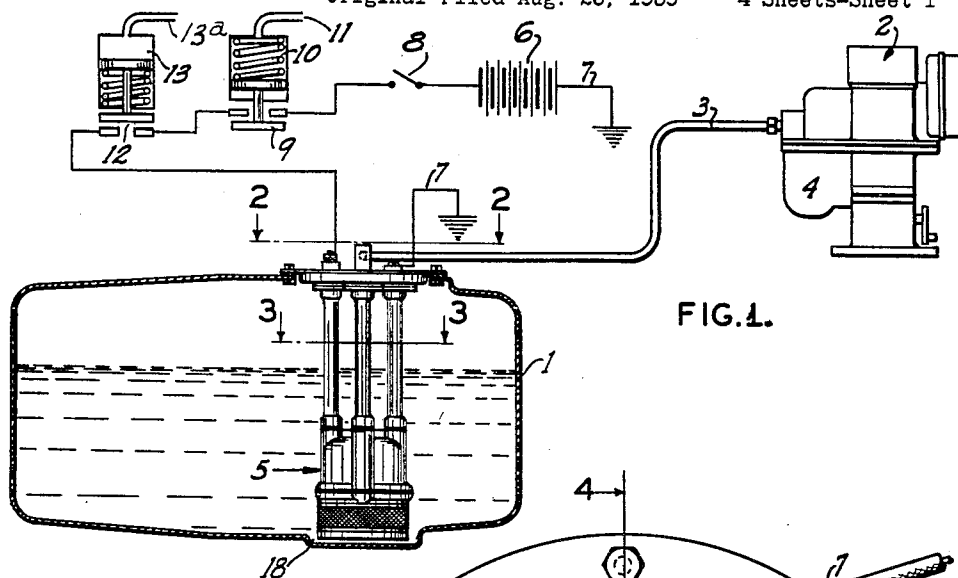


FIG. 1.

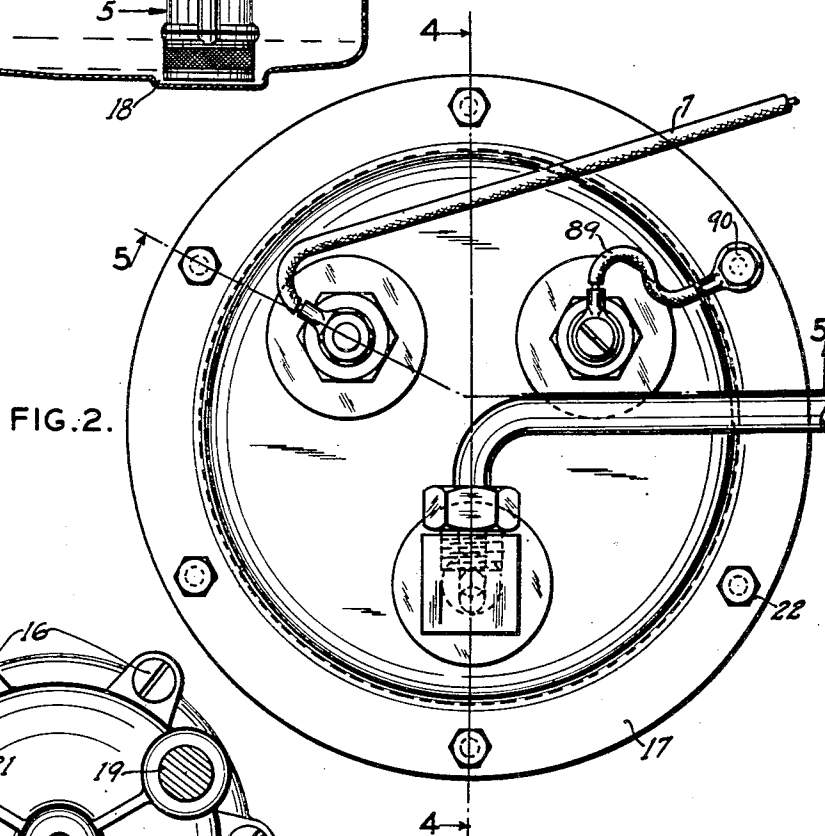


FIG. 2.

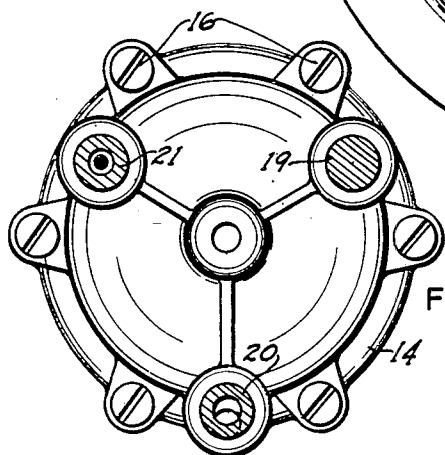


FIG.3.

INVENTORS
ALFRED C. KORTE
KENNETH LANNERT
Donald U. Rich
ATTORNEY

May 25, 1943.

A. C. KORTE ET AL

2,319,934

ELECTRIC FUEL PUMP

Original Filed Aug. 23, 1939

4 Sheets-Sheet 2

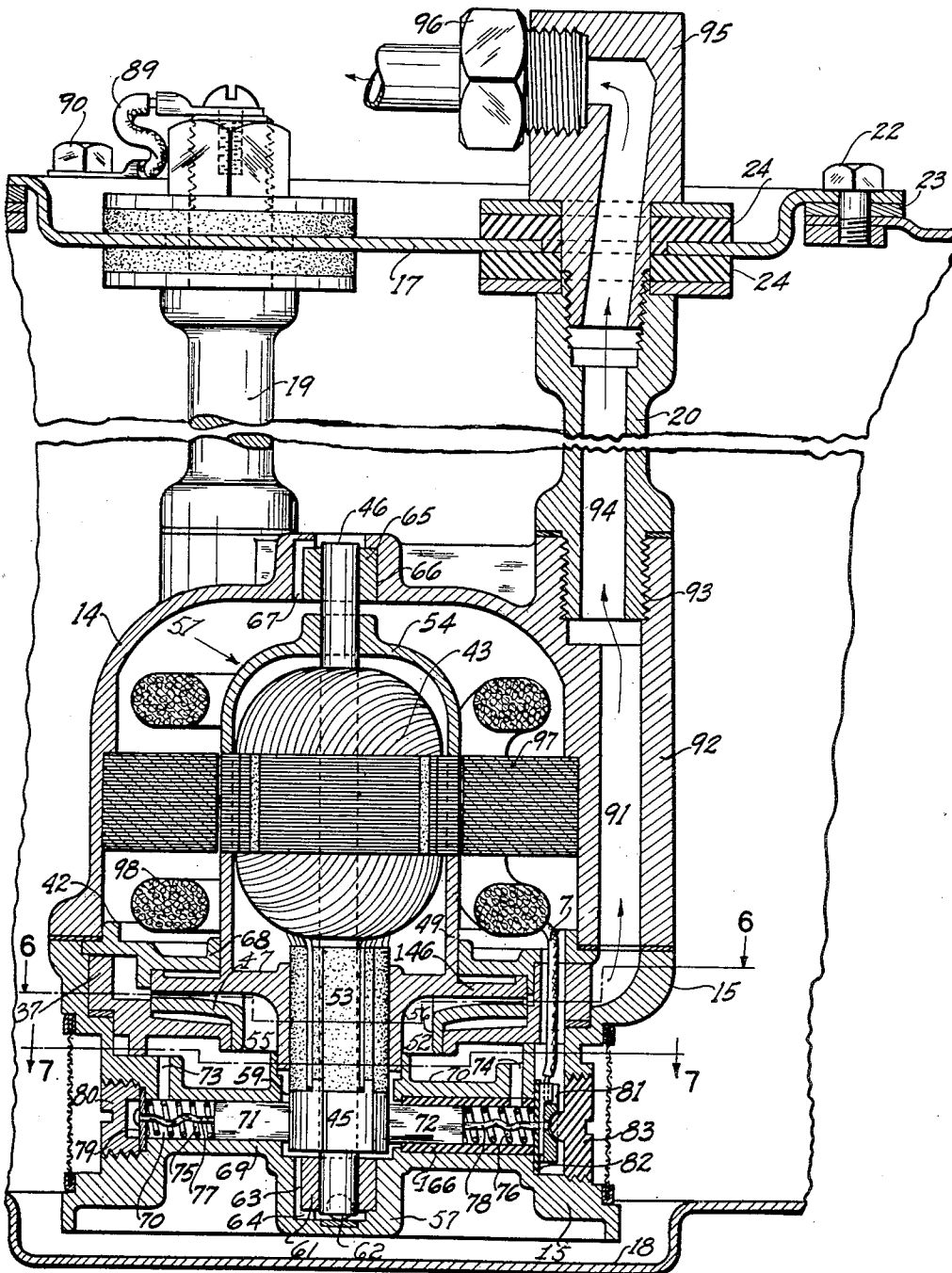


FIG. 4.

INVENTORS
ALFRED C. KORTE
KENNETH LANNERT
Donald U. Riel
ATTORNEY

May 25, 1943.

A. C. KORTE ET AL

2,319,934

ELECTRIC FUEL PUMP

Original Filed Aug. 23, 1939

4 Sheets-Sheet 3

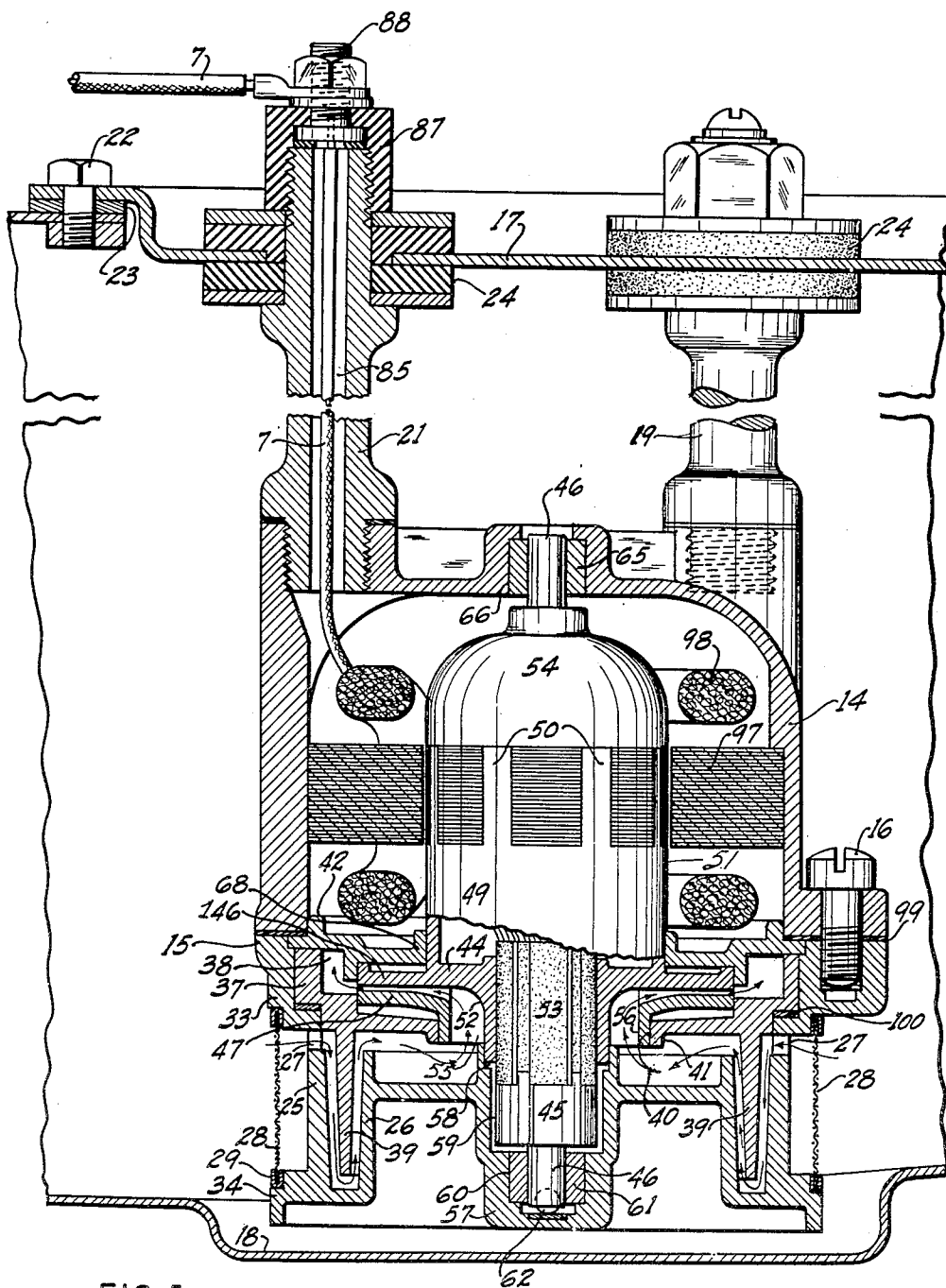


FIG. 5.

INVENTORS
ALFRED C. KORTE
KENNETH LANNERT
Donald U. Rice
ATTORNEY

May 25, 1943.

A. C. KORTE ET AL

2,319,934

ELECTRIC FUEL PUMP

Original Filed Aug. 23, 1939

4 Sheets-Sheet 4

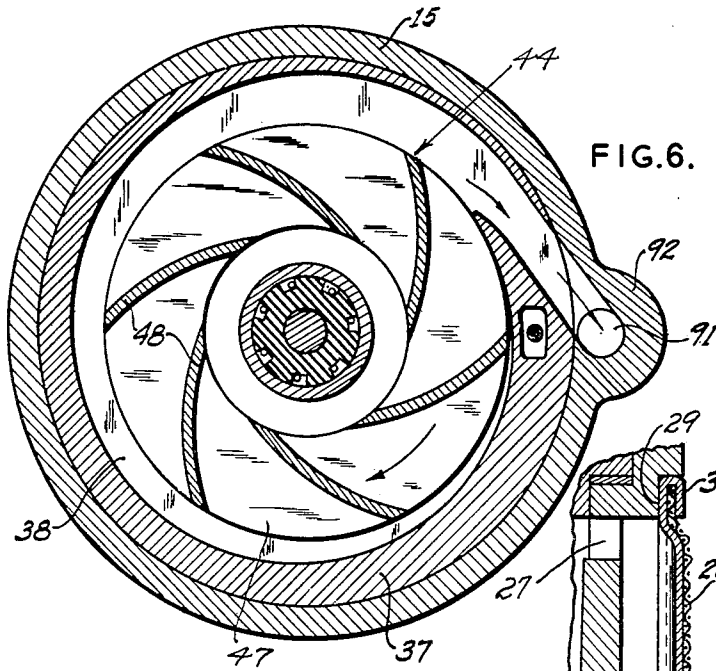


FIG. 6.

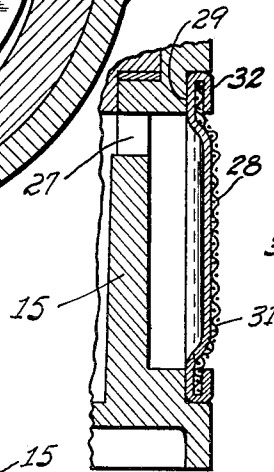


FIG. 8.

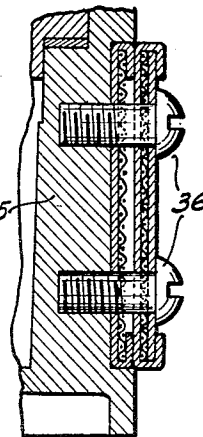


FIG. 9.

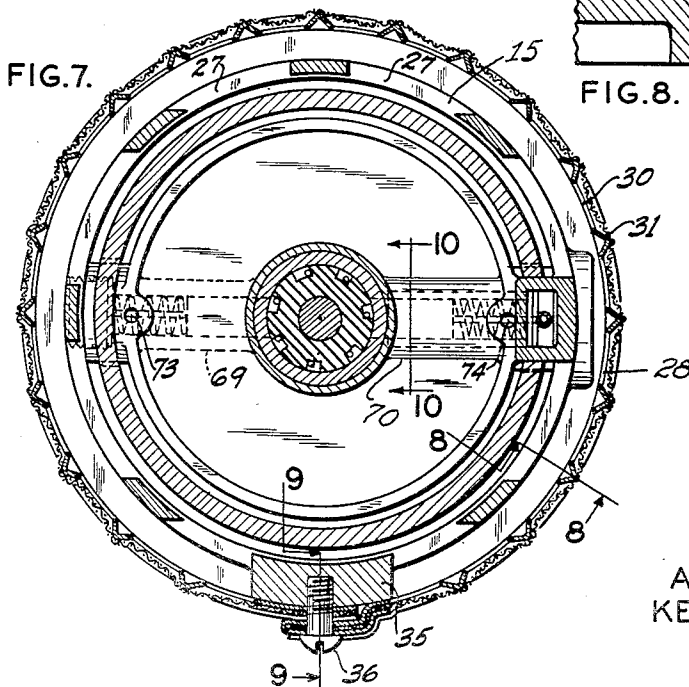


FIG. 7.

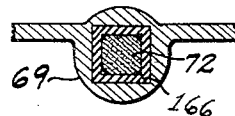


FIG. 10.

INVENTORS
ALFRED C. KORTE
KENNETH LANNERT
Donald U. Pier
ATTORNEY

UNITED STATES PATENT OFFICE

2,319,934

ELECTRIC FUEL PUMP

Alfred C. Korte and Kenneth Lannert, St. Louis, Mo., assignors to Carter Carburetor Corporation, St. Louis, Mo., a corporation of Delaware

Original application August 23, 1939, Serial No. 291,588. Divided and this application August 2, 1940, Serial No. 349,642

9 Claims. (Cl. 103—87)

This invention relates to fuel supply systems and particularly to electrically operated pumps for supplying fuel from the main tank to the carburetor. The invention is intended to be mainly, though not exclusively, used for pumping highly inflammable fuels, such as gasoline, and is especially, though not exclusively, useful in motor vehicles.

This application is a division of our co-pending application, Serial No. 291,588, filed August 23, 1939.

It has come to be recognized that with present day fuel it is impossible to operate an engine satisfactorily under all conditions unless the fuel pump is mounted at a point below the fuel level and preferably, directly at the main fuel tank. The position of this tank with respect to the carburetor and engine in most installations is such that mechanical power transmission means for operating the pump is not satisfactory.

Our invention overcomes the above-mentioned and other difficulties by the provision of an electrically driven centrifugal pump mounted in the main tank below the level of fuel therein.

According to the construction and arrangement shown in the accompanying drawings in which like reference numerals refer to like parts throughout,

Fig. 1 is a schematic illustration of a fuel system according to our invention.

Fig. 2 is a plan view of the electrically driven centrifugal pump taken on line 2—2 of Fig. 1.

Fig. 3 is also a plan view taken on line 3—3 of Fig. 1 at a point below the pump mounting plate and shows the pump supporting members in section.

Fig. 4 is a sectional elevation through the pump, the pump mounting plate and one of the supporting members taken on line 4—4 of Fig. 2.

Fig. 5 is also a sectional elevation showing another of the supporting members in section and taken on line 5—5 of Fig. 2.

Fig. 6 is a cross section through the pump impeller and volute taken on line 6—6 of Fig. 4.

Fig. 7 is a cross section through the pump at the level of the inlet ports on line 7—7 of Fig. 4.

Fig. 8 is a vertical section through the wire mesh filter taken on line 8—8 of Fig. 7.

Fig. 9 is a vertical section showing the attaching means for the wire mesh filter taken on line 9—9 of Fig. 7.

Fig. 10 is a transverse section through the field brush taken on line 10—10 of Fig. 7.

Reference numeral 1 indicates a fuel storage tank located at an elevation lower than that of

the conventional carburetor generally indicated at 2. Fuel is supplied by the storage tank to the carburetor constant level chamber 4 through a fuel conduit 3 by means of an electrically driven, centrifugal pump generally indicated at 5. Electrical energy for driving the pump is supplied by a storage battery 6 through a circuit 7. A manual control switch 8 in the circuit 7 is provided. A safety switch 9 is also provided in circuit 7. This switch is controlled by conventional pressure responsive means, which functions to hold switch 9 closed as long as a sub-atmospheric pressure exists in the intake manifold of an engine (not shown) and to which the switch operating cylinder 10 is connected by means of conduit 11. A second safety switch 12 is provided in circuit 7. This switch is also controlled by conventional pressure responsive means which functions to hold switch 12 closed as long as a safe pressure exists in an engine pressure feed lubricating system (not shown) and to which switch operating cylinder 13 is connected by means of conduit 13a. The above described means for controlling safety switch 9 and 12 are preferable. However, any suitable means may be used for automatically breaking circuit 7 when the operation of the pump is undesirable or hazardous.

The pump mechanism is enclosed in a divided casing, comprising a dome-shaped upper portion 14 and lower cup-shaped portion 15 attached together by means of screws 16. The encased pump is supported slightly above tank bottom 18 by means of a circular mounting plate 17 and support members 19, 20 and 21. The mounting plate 17 is fitted into a circular opening in the top of the fuel storage tank and is attached thereto by means of attaching screws 22. Metal to metal contact between the mounting plate 17 and the storage tank, and between the support members and the mounting plate is avoided by the insertion of pliable gaskets 23 and 24, respectively. These gaskets are sufficiently resilient and of ample proportions to satisfactorily dampen vibration generated within the pump and prevent their transmission to the storage tank. They also serve the purpose of electrically insulating the support members from the mounting plate.

The lower casing 15 is provided with an outer vertical wall 25 and a concentric inner vertical wall 26 as shown in Fig. 5. Inlet ports 27 formed in the outer wall 25 as indicated in Figs. 5 and 7, are protected by a closely woven wire mesh screen 28 framed by bracing members 29 and 31.

These bracing members conveniently may be stamped from a strip of thin metal slightly wider than the screen and have substantial inlet openings 30. The edges of the strip are crimped over the screen as at 32. The assembly is then formed circular to accurately fit rebates in upper and lower flanges 33 and 34 formed on lower casing 15. These flanges space the screen from the outer vertical wall 25. A rib 35 is provided (Figs. 7 and 9) for attachment of the lapped ends of screen 28 by means of screws 36.

Fitted within the cup-shaped lower casing 15 is a disc-shaped voluted member 37 having a volute channel 38 formed therein and having a downwardly extending, cylindrical flange 39 projecting into the annular space between the walls 25 and 26. It will be seen upon referring to Figs. 5 that projection 39 interferes with direct communication between the fuel tank and the inside of the pump casing, and provides a devious path therearound. It is the intention that the clearance between the projection 39 and the walls 25 and 26 will be small enough to arrest flame propagation. Volute member 37 is further provided with a large, central perforation 40 and a short rim or flange 41 surrounding this opening. Fitted over member 37 and held rigidly in place between the upper and lower casing is a cover plate 42. Pliable sealing gaskets 99 and 100 are provided between the upper and lower casings 14 and 15 and between the underside of volute member 37 and casing 15, respectively.

Mounted within the upper and lower casing parts is a rigid rotor assembly generally indicated at 51 comprising armature coils 43, an impeller member 44, and a commutator 45 all mounted on a rotor shaft 46. The impeller member 44 comprises a pair of spaced discs 146 and 47 having therebetween a plurality of impeller blades 48 shown in Fig. 6. Projecting upwardly and axially from upper disc 146 is a cylindrical shell 49 which forms the lower half of an armature casing. Axially projecting tangs 50 at the upper end of shell 49 are adapted to neatly fit within the armature slots, thereby keying the impeller to the armature. Extending downwardly and axially from disc 146 is a smaller diameter cylindrical portion 52 which is press-fitted over the insulating core 53 of the armature. An upper, dome-shaped shell 54 completes encasement of the armature. The upper shell 54 is press-fitted on the shaft 46. It will be seen that the armature, as encased, presents a smooth, streamline surface which reduces resistance to turning as compared to the irregular surface of an open armature, and thereby increases efficiency. This is of particular advantage in the present device wherein the armature is rotating at high speeds submerged in a liquid. The lower impeller disc 47 is provided with a large, central opening 55 and a short, downwardly extending flange 56. The clearance between the flange 56 and the central opening 40 of voluted member 37 is minimized to provide additional sealing against pressure loss from the volute channel 38.

Located centrally of the lower casing 15 is a cylindrical boss 57 having a counter bore at its upper end, as at 58 within which member 52 rotatably fits with a practical minimum of clearance. A somewhat smaller diameter intermediate bore 59 receives the commutator 45. The diameter of bore 59 is also intentionally reduced to minimize the clearance between the commutator and the bore. It will be seen that with this construction the commutator, at which arcing is like-

ly to occur is isolated as regards flame propagation from the upper chambers and is further isolated from the fuel storage tank, and that further, with this arrangement, a minimum of space is retained for combustibles in the commutator chamber 59.

It will be seen that as long as liquid fuel completely surrounds the commutator, any tendency toward arcing at that point will be immediately quenched, there being no oxygen available for flame propagation. With this in view we have extended the commutator to a point substantially below the level of the intake passage 55 to the impeller. With this arrangement the commutator will still remain submerged when the pump has ceased to supply fuel to the engine which will result in the engine stopping and a consequent breaking of circuit 7.

Directly below intermediate bore 59 is a reduced bore 60 into which is pressed the lower, radial bearing 61. A ball thrust bearing 62 is also provided at this end of the rotor shaft. A slot 63 shown in Fig. 4, in the wall of bore 60 and a small chamber 64 at the end thereof permits circulation of fuel for the lubrication of bearings 61 and 62. A similar radial bearing 65 pressed into a recess 66 in the upper portion of casing 14 is provided. A slot 67 in the wall of bore 66 permits circulation of fuel for lubrication and further provides a vent for the upper motor chamber which is defined by the casing 14 and the pump cover plate 42.

The radial bearings 61 and 65 are fabricated from a material consisting of phenol resin and a fibrous binder for filler. This material has been found to have an extremely low coefficient of friction when lubricated with a low viscosity fuel such as gasoline. We have also found, through experimentation, that this material is highly effective in inhibiting the formation of gum deposits caused by oxidation of currently available fuels and is used therefore in the construction of bearings 61 and 65 which are in contact with gasoline. A further deterrent to flame propagation from the commutator via the upper chamber and vent 67 is provided by the flange 68 surrounding the central perforation in volute cover 42. The clearance between the flange 68 and the casing 45 is reduced to a free-running minimum.

Transverse bosses 69 and 70 extending radially across lower casing 15 provide housings for commutator brushes 71 and 72. Right hand housing 70 (Fig. 4) wherein is guided the field brush 72, is internally bushed with an insulator 166. Near the ends of bosses 69 and 70, vertical cross passages 73 and 74 are provided to admit liquid fuel to the interiors thereof behind the brushes. Brush vibrations and chatter are thus dampened by the dash-pot effect gained with this provision. Springs 75 and 76 constantly urge the brushes into contact with the commutator. The usual pig-tail conductors 77 and 78 are provided on the brushes. The left-hand pig-tail 77 of the ground brush 71 is soldered to a disc 79 of conducting material. The disc 79 is held firmly in contact with the casing by the passage closing screw plug 80. The right-hand pig-tail 78 of the field brush 72 is soldered to a conductor disc 81. An insulator disc 82 is provided to space and insulate disc 81 from the casing. A screw plug 83 fabricated from insulating material holds discs 81 and 82 rigidly against the end of passage 70. It will be understood, although not shown, that the flame baffle flange 39 is cut-out to fit over the brush holder bosses 69 and 70. The conductor

disc 81 is provided with means for securing connecting wire 7 thereto.

A laminated field frame 97 carrying field windings 98 is press-fitted into the upper casing 14. The field winding is shunted across the armature circuit in the well known manner of shunt winding. This wiring arrangement, however, has distinct advantages over a series wound field when used in connection with the present device, in that the intensity of any arcing at the commutator is materially reduced, a desirable feature from the standpoint of safety. With this arrangement the speed of the motor and, consequently, the pump out-put and pressure can be more accurately predetermined.

Support rod 21 shown in section in Fig. 5 is provided with a through bore 85, through which is threaded the conductor 7 leading to the storage battery 6. Support 21 is further provided with an internally screw threaded insulator cap 87 which supports and insulates the threaded connector 88. A ground lead 89 extends from the support 19 to a ground connection 90 exterior of the fuel storage tank.

Adjacent the exit of the voluted channel 38 and in communication therewith is a vertical passage 91 (Fig. 4) formed in a rib 92 integral with the upper casing 14. An internally threaded counterbore 93 at the upper end of passage 91 provides means for attaching threaded support 20 is provided with a through bore 94 which completes the passageway from the voluted channel to the top of the fuel tank. The upper end of passage 94 in support 20 is internally threaded to receive a conventional fuel conduit fitting 95 carrying a connector 96.

The operation of the device is as follows:

When manual switch 8 is closed and a sub-atmospheric pressure exists in the engine intake manifold to close switch 9 and the lubricating oil pump is functioning to supply pressure for closing switch 12, the circuit 7 will be closed. As the impeller rotates fuel is drawn into the lower casing through the screen 28, through ports 27, and around flame baffle 39 and into the impeller through the large central opening 55, from whence it is thrown by centrifugal force into the voluted channel 38 and thence out through passages 91 and 94.

To reduce fire hazard it will be seen upon referring to Fig. 5 that three separate barriers to the propagation of flame from the commutator to the fuel tank via the inlet ports 27 have been provided. These are the closure of the upper end of flanged bore 59 by rotor extension 52, the baffle 39 projecting between the walls 25 and 26, and the closely woven wire screen 28.

For arresting flame tending to propagate upwardly into the upper chamber, the flange 68 surrounding the central opening in the volute cover 42 is provided.

Should the engine cease to operate for any reason and the operator neglect to open manual switch 8, switch 9 will open as the pressure in the intake manifold approaches atmospheric, thus breaking the circuit 7. Or, if the pressure in the engine lubricating oil system should drop below a predetermined point due to lubricating oil, pump failure or broken lines, the switch 12 will open and thus break the circuit 7 at that point.

The detailed drawings and description are intended to be illustrative, not limiting, and the use of all modifications within the scope of the appended claims is contemplated.

1. In an electric motor, a rotor comprising a shaft having an armature and a commutator mounted thereon, casing structure enclosing said rotor, and means forming a flame arresting closure for said commutator comprising a reduced cylindrical recess in said casing closely receiving said commutator, and a cylindrical shoulder member on said shaft and extending into and having a running fit in the open end of said recess.

2. In an electric motor, a housing, a rotor within said housing and journaled in the end walls thereof, a passageway in one of the end walls of said housing extending transversely of said rotor and being intersected thereby, a commutator on said rotor at the point of its intersection of said passageway, means for closing the outer ends of said passageway, a pair of commutator brushes having a sliding fit in said passageway, yieldable means urging said brushes against said commutator, a source of liquid, and restricted passageways connecting said commutator brush passageway with said source of liquid at points between said brushes and the outer ends of said brush passageways.

3. In an electric motor having a commutator, a pair of commutator brushes, casing structure for said motor, guide passageways in said casing for receiving said brushes in sliding fit relationship, yieldable means for urging said brushes against said commutator, a source of liquid, and restricted passageways connecting said source of liquid with said brush passageways near their outer ends.

4. In combination with an electric motor having a commutator and brushes, a casing having fluid openings disposed annularly therearound, an annular recess on the casing wall near said openings, and an annular rib extending into said recess and spaced from the walls thereof so as to provide a tortuous flame arresting passage between said openings and said commutator.

5. In combination with an electric motor having a rotor, a commutator and brushes, and a casing with a fluid admitting opening, an annular recess formed in the casing wall and extending around said commutator and brushes, and an annular rib extending deeply into said recess but spaced from the walls thereof so as to provide tortuous flame arresting communication between said openings and said commutator.

6. In combination, an electric motor including a rotor, a stator, and collectors, a pump impeller on said rotor, a casing enclosing said motor and impeller and having fluid inlet and outlet ports and passages arranged to direct pumped fluid over said collectors, an annular recess formed around the wall of said casing between said inlet ports and said collectors, and an annular rib extending deeply into said recess and spaced from the walls thereof so as to provide a tortuous, restricted flame arresting communication between said inlet ports and said collectors.

7. In combination, an electric motor including a rotor, a stator, and a commutator and brushes, a pump impeller on said rotor, a casing enclosing said motor and impeller and having fluid inlet and outlet port means, and means for arresting flames propagated from said commutator and brushes comprising a cylindrical pocket in a wall of said casing receiving said commutator, a cylindrical shoulder on said rotor closely fitting within the open end of said pocket and substantially closing the same, a recess on the casing

wall adjacent said inlet port means, and a rib extending deeply into said recess and spaced from the walls thereof, said substantially closed pocket and said recess and rib forming a restricted, tortuous flame arresting communication between said commutator and said port means.

8. In an electric motor, a rotor comprising a shaft having an armature and a commutator mounted thereon, casing structure enclosing said rotor, and means forming a flame-tight enclosure for said commutator comprising a recess in a wall of said casing receiving said commutator, and an enlargement on said shaft within the open

end of said recess and substantially enclosing the same within the practical limits of a running fit.

9. In an electric motor for operation submerged in a combustible fluid, a rotor comprising an armature and a commutator, a casing structure enclosing said rotor and having a recess receiving said commutator and closely fitting about portions of said rotor on opposite sides of said commutator for resisting the propagation of flame therepast.

ALFRED C. KORTE.
KENNETH LANNERT.