

Nov. 4, 1941.

A. C. KORTE ET AL

2,261,915

ELECTRIC FUEL PUMP

Filed Aug. 23, 1939

4 Sheets-Sheet 1

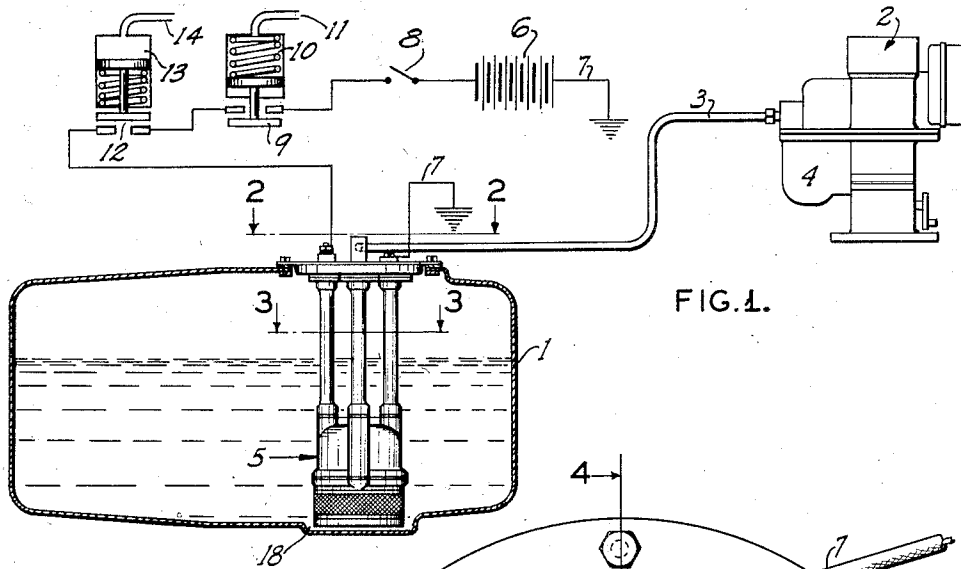


FIG. 1.

FIG. 2.

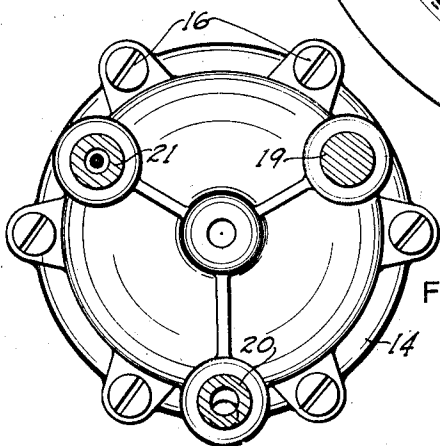
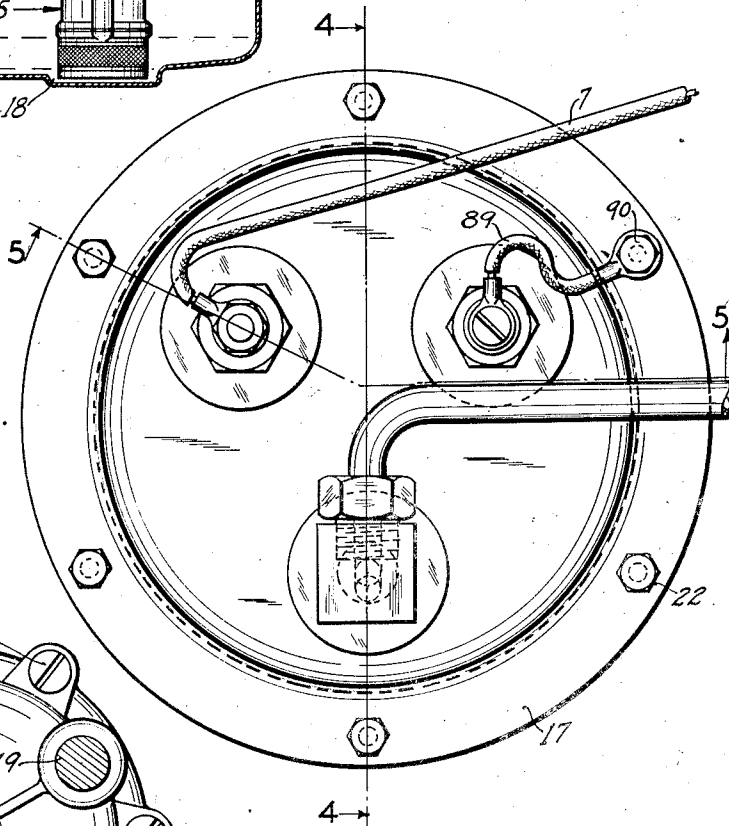


FIG. 3.

INVENTORS

KENNETH LANNERT

ALFRED C. KORTE

BY

Donald H. Rich

ATTORNEY

Nov. 4, 1941.

A. C. KORTE ET AL

2,261,915

ELECTRIC FUEL PUMP

Filed Aug. 23, 1939

4 Sheets-Sheet 2

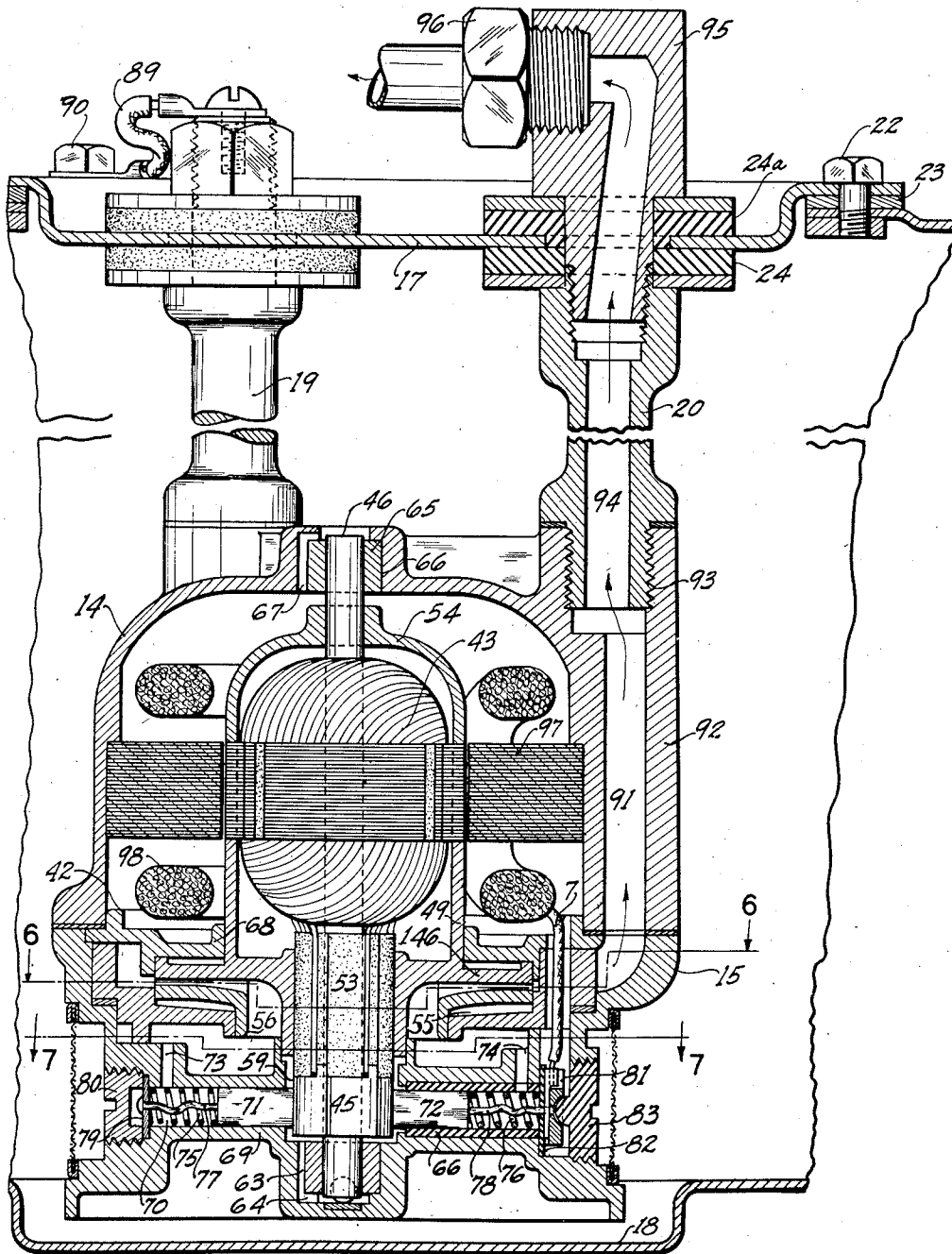


FIG. 4.

INVENTORS
KENNETH LANNERT
ALFRED C. KORTE
BY *Ronald H. Rich*
ATTORNEY

Nov. 4, 1941.

A. C. KORTE ET AL

2,261,915

ELECTRIC FUEL PUMP

Filed Aug. 23, 1939

4 Sheets-Sheet 3

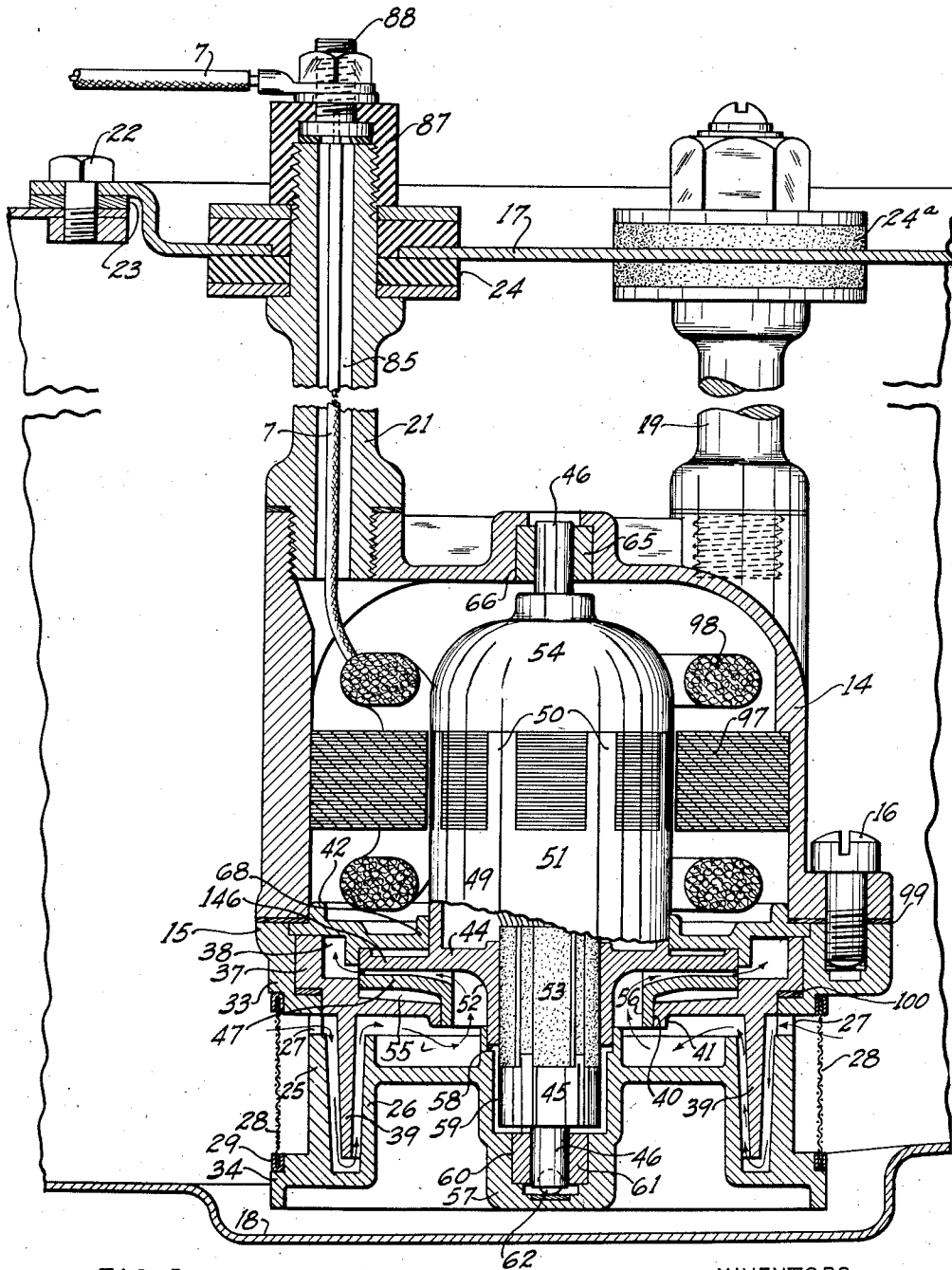


FIG. 5.

INVENTORS
KENNETH LANNERT
ALFRED C. KORTE

BY *Donald M. Rich*
ATTORNEY

Nov. 4, 1941.

A. C. KORTE ET AL

2,261,915

ELECTRIC FUEL PUMP

Filed Aug. 23, 1939

4 Sheets-Sheet 4

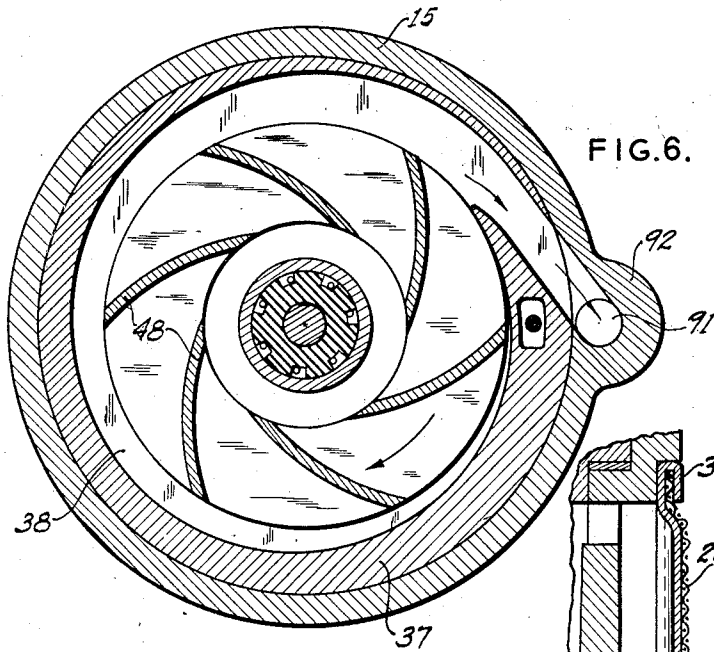


FIG. 6.

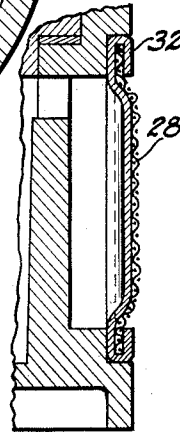


FIG. 8.

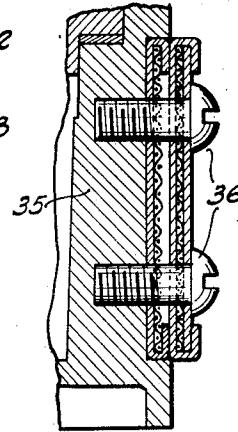


FIG. 9.

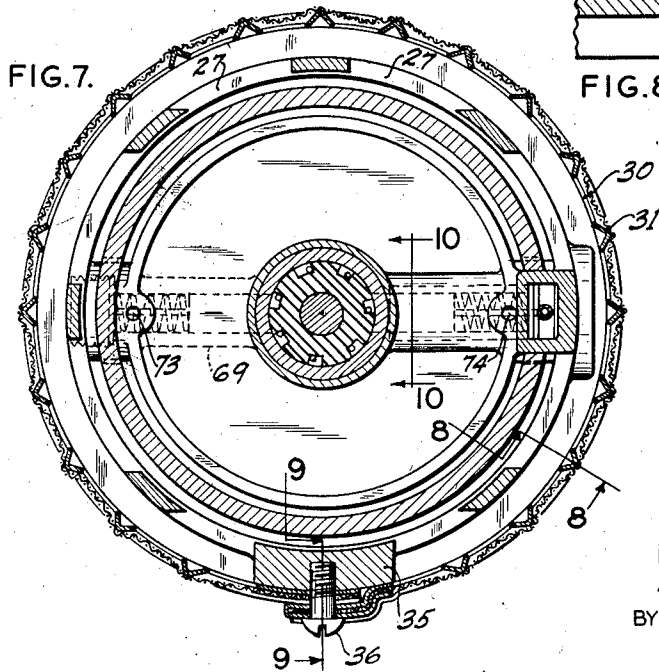


FIG. 7.

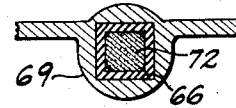


FIG. 10.

INVENTORS
KENNETH LANNERT
ALFRED C. KORTE
BY *Donald A. Rich*
ATTORNEY

UNITED STATES PATENT OFFICE

2,261,915

ELECTRIC FUEL PUMP

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

Application August 23, 1939, Serial No. 291,588

12 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.

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 carburetor fuel supply 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 of the pump 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 through the pump showing another of the supporting members in section and is 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 14. The above described means for controlling safety switches 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. The upper and lower casing portions 14 and 15 being attached by means of screws 16. The encased pump is suspended from a circular mounting plate 17 to within a short distance of the bottom of the storage tank sump 18, by means of 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 are formed in the outer wall 25 as indicated in Fig.

5 and Fig. 7. A closely woven wire mesh screen 28 framed in a retaining band 29 is provided. The screen retaining band 29 is formed from a strip of thin metal slightly wider than the screen 28, by perforating and forming. Uniformly spaced rectangular perforations 30 are made in the metal strip and the remaining vertical bars or muntins 31 are then formed V-shape in section as shown in Fig. 7, for the purpose of reducing the area of contact with the screen and also to lend rigidity to the unit. The screen is held in assembly by crimping the edges of the band over it as indicated at 32, Fig. 8. The assembly is then formed circular to accurately fit the rebates in the upper and lower flanges 33 and 34 which are formed as a part of lower casing 15. These flanges space the screen from the outer vertical wall 25. A boss 35 shown in Figs. 7 and 9 formed as a part of casing 15 is provided, for attaching screen 28 thereto by means of screws 36.

Fitted within the cup-shaped lower casing 15 is a disc-shaped volute member 37 having a volute channel 38 formed therein and having a downwardly extending, cylindrical portion 39 projecting into the annular space between the walls 25 and 26. It will be seen upon referring to Fig. 5 that the extending of projection 39 into the space between the walls 25 and 26 prevents direct communication between the fuel tank and the inside of the pump casing, by providing a devious path around the projection 39. 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 volute member 37 and held rigidly in place between the upper and lower casing is a volute cover 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.

Rotating within the upper and lower casing is a rotor assembly generally indicated at 51 comprising, in rigid assembly, an armature 43, an impeller member 44, a commutator 45 and a rotor shaft 46. The impeller member 44 comprises a pair of spaced discs 146 and 47 and have 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 joins the lower shell 49 and 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 volute 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 short bore at its upper end 58 into which member 52 projects and is free to rotate with a practical minimum of clearance. A somewhat smaller diameter bore 59 directly below 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 likely 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 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 port and the intake passage 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 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 bearing 61. A similar radial bearing 65 pressed into a bore 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 volute cover 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 current 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.

A transverse boss 69 formed as a part of lower casing 15 and having a longitudinal passage of rectangular cross-section therethrough, indicated at 70, provides a guide for commutator brushes 71 and 72. To the right of the commutator in Fig. 4, wherein is guided the field brush 72, the rectangular passage 70 is bushed with an insulator 66. Near the ends of rectangular passage 70, vertical cross passages 73 and 74 are provided to admit liquid fuel to the passage 70 at points behind the brushes. Brush vibrations and chatter are 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. 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 39 is cut-out to fit over the brush holder boss 69. The conductor disc 81 is provided with means for clipping the conduit 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. Namely, the intensity of any arcing at the commutator is materially reduced, a desirable feature from the standpoint of safety, and 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 extending from the support 19 to a ground connection 90 exterior of the fuel storage tank is provided.

Adjacent the exit of the volute channel 33 and in communication therewith is a vertical passage 91 formed in a boss 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. Support 20 is provided with a through bore 94 which completes the passageway from the volute 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 volute 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. Namely, the closure of the upper end of bore 59 by member 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.

We claim:

1. In a centrifugal electric fuel pump for submerged operation in a reservoir of inflammable liquid, a vertical rotor, comprising, an armature at its upper end, a commutator at its lower end, and an impeller therebetween, a casing for said rotor, and fuel inlet ports in said casing at a point below said impeller and substantially above said commutator.

2. In an electrically driven centrifuge for operation submerged in a liquid, a rotor, a stator surrounding said rotor, said rotor comprising a shaft having an armature and an impeller thereon, said impeller having an axially extending hollow cylindrical portion formed integral therewith and providing an encasement with a smooth exterior for said armature, said stator comprising a pump casing, and a field winding, and a housing for said stator.

3. In an electric fuel pump for submerged operation in a reservoir of liquid fuel, a rotor, comprising, an armature having a plurality of longitudinally extending circumferentially spaced slots in the periphery thereof, and an impeller, said impeller having an integral cylindrical portion for the encasement of said armature, said cylindrical portion having axially extending tangs adapted to engage said armature slots for keying said impeller to said armature.

4. In a centrifugal pump, housing structure comprising a circular cup-shaped lower section provided with two concentric vertical walls and inlet ports in the outer vertical wall, and a disc-like volute member having a concentric cylindrical portion adapted to project between said vertical walls to a point substantially below the level of said inlet ports.

5. In an electric fuel pump for submerged operation in a reservoir of liquid fuel, a rotor, comprising, an armature, a disc-like impeller member and a commutator, a casing for said rotor, a commutator chamber formed as a cylindrical recess in said casing, said impeller having an integral cylindrical portion projecting from one side thereof to provide encasement for said armature and having a second cylindrical portion projecting from the other side thereof and into said cylindrical recess, said second cylindrical portion having a free running fit in said recess.

6. In an electric, centrifugal fuel pump for pumping inflammable fuels, a housing, comprising, a lower cup-shaped casing and an upper dome-shaped casing, inlet and outlet fuel passages in said lower casing, a disc-like volute member forming a partition between said upper and lower casings and having a circular central opening, a rotor journaled in the end walls of said housing comprising an armature in said upper casing, a commutator in said lower casing,

and an impeller adjacent said volute member, said impeller having a hollow cylindrical central portion extending longitudinally and adapted to slidably fit in said central opening.

7. A fuel pump unit including in combination, a rotor, an elongated shaft for said rotor, a commutator mounted on the lower end of said shaft, a pump on said shaft interposed between said rotor and commutator, a casing, and a stator and brush rigging carried by said casing.

8. In an electric fuel pump, an outer casing having an upper and a lower section, motor field structure located in the upper section, motor brush holder structure located in the lower section, a two part pump casing located in the upper part of the lower structure and clamped in position between the two sections, a rotor structure within the casing comprising a motor armature in the upper section, a pump rotor in the pump casing and a commutator located within the brush holder structure in the lower section.

9. In an electric fuel pump, an outer casing having an upper and a lower section, said lower section forming a housing for a motor commutator and pump casing, said upper section carrying a motor field structure, a vertical shaft having mounted thereon a motor armature within the upper section, a commutator on its lower end and a centrifugal pump impeller intermediate the armature and commutator and within the pump casing.

10. In an electric pump, an outer casing having an upper and a lower section, the lower sec-

tion closed at the bottom enclosing brush holder structure at its lower end, a sectional pump casing adjacent its open end, the upper section carrying a motor field structure, a vertical rotor shaft journaled in the casing, an armature on the upper part of said shaft, a commutator on the lower portion of said shaft and a pump impeller between the armature and commutator, said impeller having an integral cylindrical extension surrounding the armature structure, and a cap carried by said shaft and cooperating with said extension substantially to enclose said armature.

11. In a rotary electric pump unit for pumping inflammable fuel, a housing formed of horizontally dividible sections, a vertical shaft journaled in the ends of said housing, pump casing structure constructed and arranged to form a partition between said sections effective in arresting the propagation of flame, an armature, and a commutator on said shaft each being confined in a separate housing section.

12. In an electrically driven centrifugal fuel pump, a housing, pump casing structure forming a horizontal partition in said housing, a vertical shaft journaled in the end of said housing and passing through said pump casing, an armature on said shaft above said pump casing, fuel inlet in said housing at a level below said pump casing, and a commutator on said shaft below said fuel inlet.

ALFRED C. KORTE.
KENNETH LANNERT.