

Dec. 19, 1950

M. KATCHER
MAGNETIC FUEL PUMP

2,534,520

Filed April 14, 1945

4 Sheets-Sheet 1

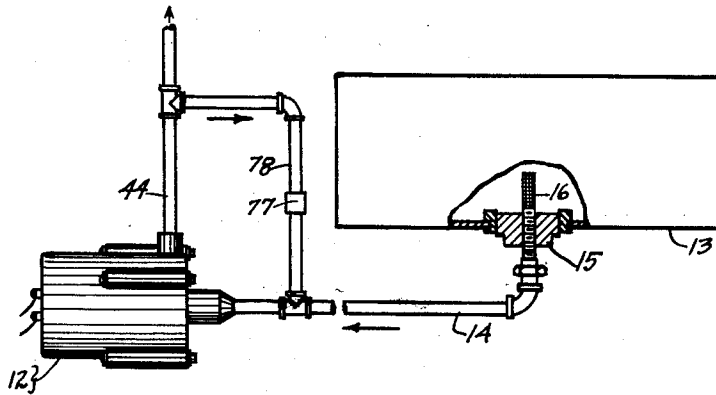


FIG. 1

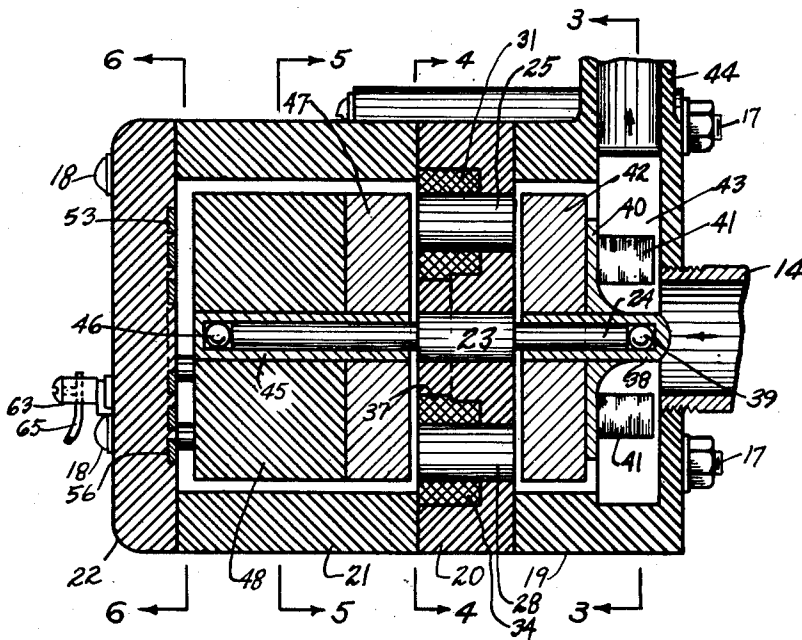


FIG. 2

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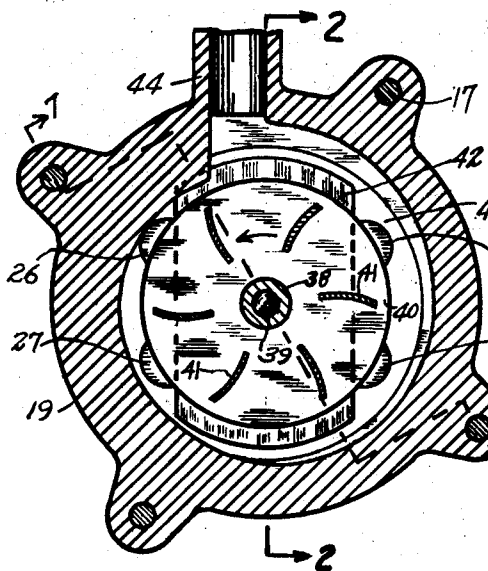


FIG. 3

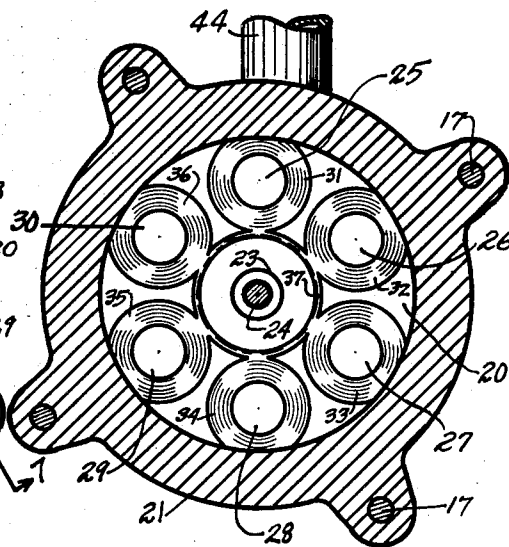


FIG. 4

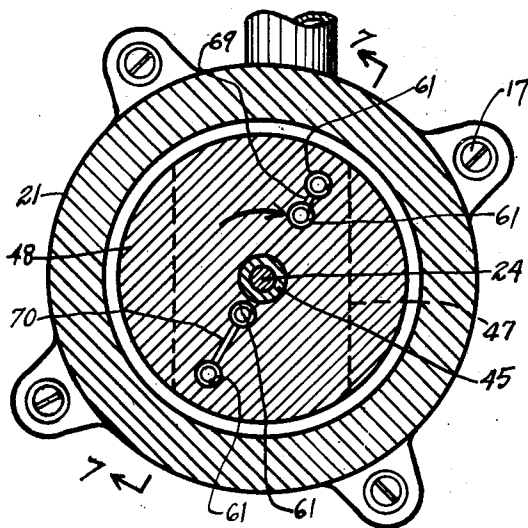


FIG. 5

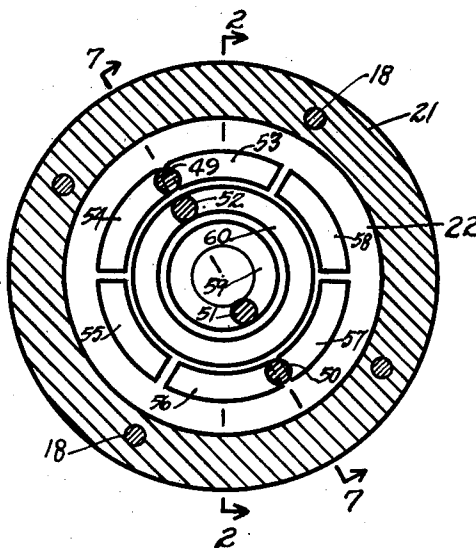


FIG. 6

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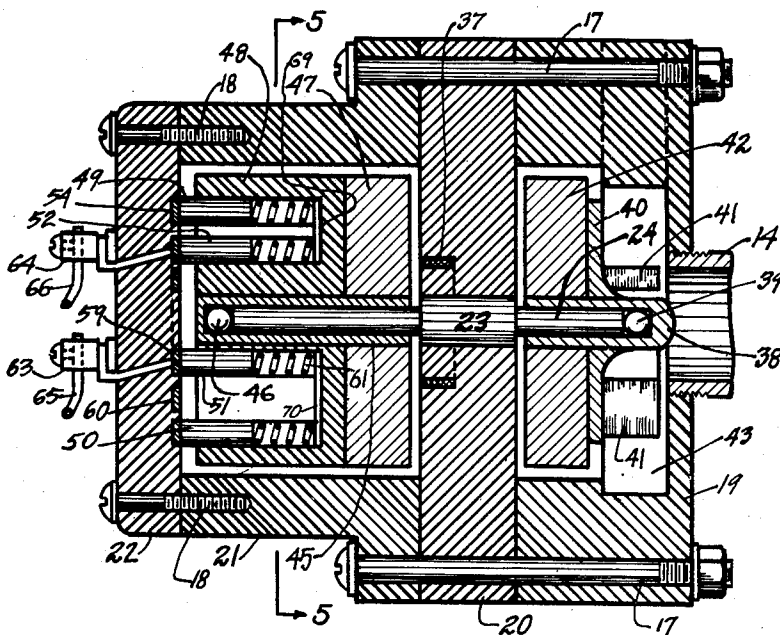


FIG. 7

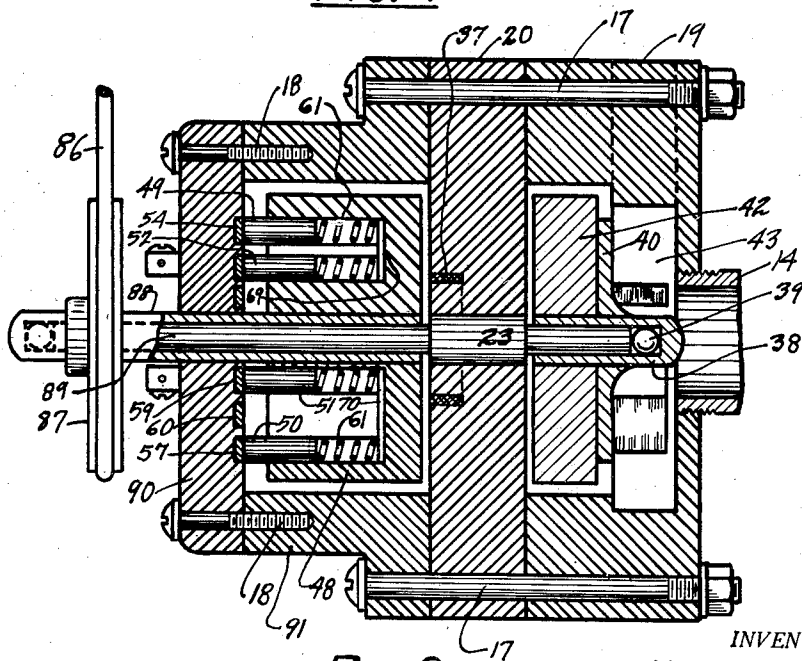


FIG. 8

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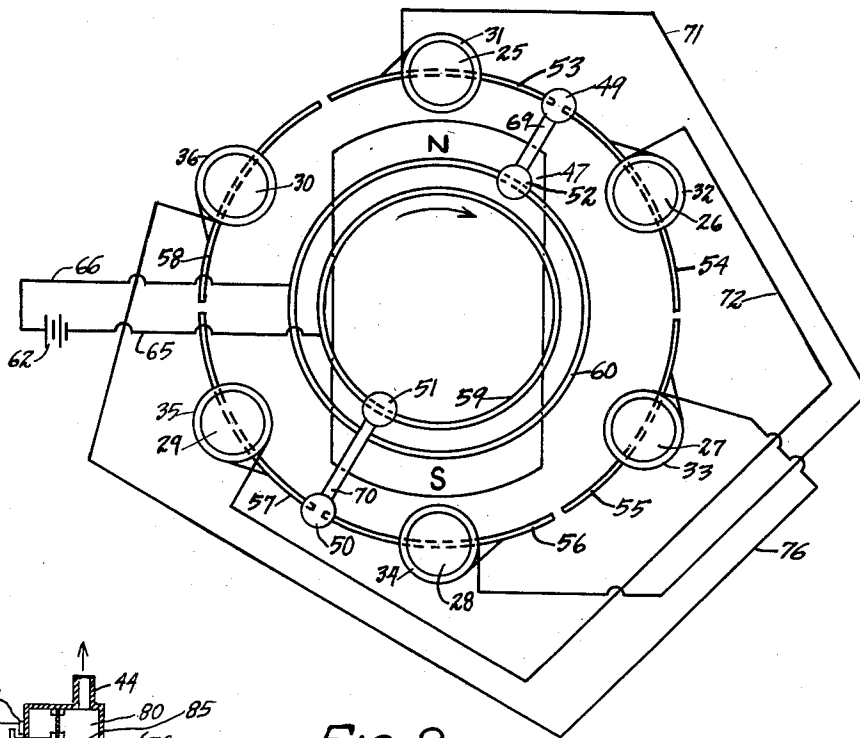


FIG. 9

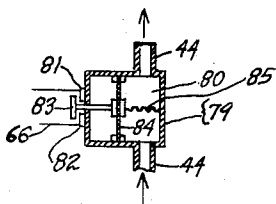


FIG. 11

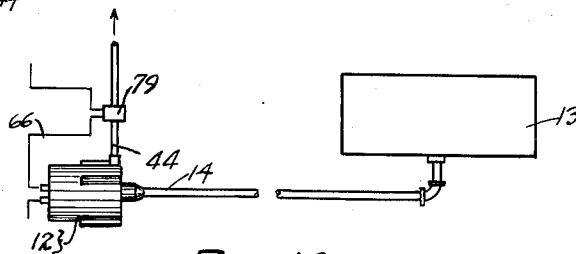


FIG. 10

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UNITED STATES PATENT OFFICE

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MAGNETIC FUEL PUMP

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Application April 14, 1945, Serial No. 588,341

8 Claims. (Cl. 103—87)

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This invention relates to a pump for feeding liquid fuel to an engine. In one type of internal combustion engine the fuel is fed to a carburetor. The pump is magnetically operated enabling it to be set almost at any part of the vehicle front or back so long as it is kept low enough with respect to the fuel tank to require no priming. It is inconvenient to get at the pump if set inside the tank so it is set on the fuel line. With my electrically or magnetically operated pump, a standard form can be used for various types of engines in contrast to the diaphragm operated pumps mechanically operated by the engine, which at present require modification and special design to suit the particular type engine which operates it. The construction of my pump is such that sparking elements are completely sealed off from the fuel. Further it need not be located close to the engine where engine heat tends to create vapor lock.

In one form, my pump is operated from a battery which drives an electric motor operating a commutator device which produces a rotating magnetic field which influences magnetic means inside the fuel system of the engine to rotate with said field. The rotating magnetic means drives the impeller of a centrifugal pump inside the fuel system. In another form, the commutator mechanism is driven preferably by a belt connected to a rotating part of the engine such as the water pump shaft. In the latter form there is not so much leeway in the location of the pump as in the first form.

Other objects and advantages will become apparent upon further study of the description and drawings, in which:

Fig. 1 is a diagram of the pump and its connections to the fuel system of an engine.

Fig. 2 is a longitudinal section through the pump taken along the line 2—2 of Fig. 3.

Fig. 3 is a cross section of the pump taken along the line 3—3 of Fig. 2.

Fig. 4 is a cross section of the pump taken along the line 4—4 of Fig. 2.

Fig. 5 is a cross section of the pump taken along the line 5—5 of Fig. 2.

Fig. 6 is a cross section of the pump taken along the line 6—6 of Fig. 2.

Fig. 7 is a longitudinal section of the pump taken along the line 7—7 of Figs. 3, 5 and 6.

Fig. 8 is a longitudinal section of the belt driven form of the pump taken similarly to Fig. 7.

Fig. 9 is the electrical diagram of the pump of Fig. 2.

Fig. 10 is a diagram of the pump showing an

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electrical control valve for stopping its operation when too much pressure is developed in the fuel line, and

Fig. 11 is a diagram of the electrical control valve.

The pump denoted in its entirety by the numeral 12 is connected to the bottom of fuel tank 13 by means of pipe 14, the latter entering the tank at the place usually occupied by the drainage plug. However, instead of the usual drainage plug, an internally and externally threaded plug 15 is used into which is screwed the end of pipe 14. A strainer 16 is provided inside tank 13 for the end of pipe 14. In the particular embodiment of the pump shown in Figs. 1-7, the pump may be located in many positions. It may be located near the fuel tank, whether the latter is at the rear of a car or elsewhere, or it may be located remote from said tank. In a car with the tank at the rear and the engine and its carburetor forward, the pump may be located near the carburetor.

Referring now more particularly to Figs. 2-7, the housing of the pump, in the particular embodiment illustrated, is composed of a plurality of sections 19, 20, 21 and 22, held together by bolts 17 and lag screws 18. Partition section 20 has embedded therein the large diameter portion 23 of fixed shaft 24. Section 20 has also embedded in it iron field pole cores 25, 26, 27, 28, 29 and 30. Shaft 24 and said cores are embedded so tightly in section 20 that a liquid tight seal is effected between them and the section. Surrounding one end of cores 25, 26, 27, 28, 29 and 30 are respectively field coils 31, 32, 33, 34, 35, and 36. These field coils are interconnected as will be hereinafter explained, by wires located in annular channel 37.

Loosely mounted on shaft 24 inside of impeller section 19 is a sleeve 38. One end of sleeve 38 is closed and between said closed end and the end of shaft 24 is located a thrust ball bearing 39. The material of shaft 24, sleeves 38 and 45 and impeller 40 is of non-magnetic metal. Impeller 40, which is provided with blades 41, is fixed to sleeve 38 as is also permanent bar magnet 42. The latter may also be fixed to impeller 40. Section 19, opposite blades 41, is hollowed out to form a volute 43 as part of the centrifugal pump comprising impeller 40. The fuel enters the pump from pipe 14 at the axis of impeller 40 and leaves from the volute through pipe 44. From pipe 44, the fuel is sent to the engine or motor, usually to the carburetor, not shown, for that type of motor operating with a carburetor.

Sleeve 45 is loosely mounted on shaft 24 for its portion inside commutator brush section 21. One end of sleeve 45 is closed and a thrust ball bearing 46 is located between said closed end and the end of shaft 24. A permanent bar magnet 47 is fixed to sleeve 45. Sleeve 45 is of non-magnetic metal. Brush holder 48 is also fixed to sleeve 45. It may also be fixed to magnet 47. There are four commutator brushes set in holes provided in holder 48. Brushes 49 and 50 slide over commutator segments 53, 54, 55, 56, 57 and 58 set in commutator section 22, Figs. 6 and 9. Slip rings 59 and 60 are also held in commutator section 22. Brush 51 slides over slip ring 59, while brush 52 slides over slip ring 60. All of the brushes are pressed into contact with their corresponding segments and rings by compression springs 61. Ring 59 is connected to battery 62 through binding post 63 and wire 65, while ring 60 is connected to the battery through binding post 64 and wire 66. Segments 53, 54, 55, 57 and 58 are connected respectively to field coils 31, 32, 33, 34, 35 and 36 as shown in Fig. 9, the connecting wires for this being omitted from the other figures.

It is essential that partition section 20 be held in liquid tight contact with impeller section 19, so that no fuel or its vapor may reach the brushes and commutator segments and rings where sparking may occur. Sections 19, 20, 21 and 22 are preferably made of plastic material such as one of the phenolic resins.

With the brushes set as shown in Fig. 9, the current flows from the positive terminal of battery 62, through wire 66 to segment 60 where it is picked up by brush 52. From brush 52 it passes through connecting bar 69 to brush 49 and from the latter splits into segments 53 and 54. The current in segment 53 enters coil 31 which passes around field pole core 25 in a clockwise direction causing the field pole to be magnetized with the S pole toward the observer, that is toward permanent magnet armature 47. The current after passing through coil 31 flows through wire 71 to coil 34 and through the latter. Coil 34 is wound around field pole core 28 so that the current flows around in a counter-clockwise direction causing the field pole comprising core 28 to be magnetized with the N pole toward the observer, that is toward armature 47. The current enters segment 56 from coil 34, passing into brush 50, connecting bar 70, brush 51, slip ring 59 and finally through wire 65 to the negative pole of battery 62. The other half of the current from brush 49 passes into segment 54 from whence it flows through coil 32, the latter being wound around core 26 so that the current passes in a clockwise direction causing the field pole comprising core 26 to be magnetized with the S pole toward the observer, that is toward armature 47. The current after passing through coil 32 flows through wire 72 to coil 35 and through the latter, to segment 57, brush 50, bar 70, brush 51, slip ring 59 and wire 65 to battery 62. Coil 35 is wound around core 29 so that the current flows through it in a counter-clockwise direction causing the field pole comprising core 29 to be magnetized with the N pole toward the observer, that is toward armature 47. With the field poles at 25 and 28 both magnetized into S poles and the field poles at 34 and 35 both magnetized into N poles, armature 47 will move toward the poles at 26 and 35. So will armature 42 which has its S pole on a line with the N pole of armature 47. Armature 42 is dragged around magnetically with

armature 47, because when a field pole such as the one at 25 is magnetized with the S pole toward the observer, it is magnetized with N pole away from the observer, that is adjacent armature 42. This holds true of course, for all the field poles, so as they are successively magnetized one end will influence armature 47 while the other end will influence armature 42, said armatures facing each other with opposite polarity.

As armature 47 moves toward the center of magnetism between the field poles at 25 and 28 brush 49 moves away from segment 53 so that it is entirely on segment 54 and brush 50 is entirely on segment 57. The centers of magnetism then are at the field poles 26 and 29, attracting both armature 42 and 47 to lie across them. In this manner, as is well known to the art, brush holder 48 is caused to rotate in a clockwise direction, Figs. 5 and 9, causing the field poles to be successively magnetized in the same direction. When brush 49 reaches segment 55, it sends the current through coil 33 in a clockwise direction around core 27 and in a counter-clockwise direction through coil 36 via wire 76. From coil 36 the current passes by means of brush 50, bar 70, brush 51, slip ring 59, wire 65 to battery 62. The field pole at 27 thus is S facing the observer and the field pole at 36 is N facing the observer. With the field poles successively magnetized in a clockwise direction, armature 47 and impeller 40 are also rotated in this direction when looking at them in the same direction as in Fig. 5, that is to the right in Fig. 2. When viewed to the left, as in Fig. 3, the impeller appears to rotate in a counter-clockwise direction. The fuel from pipe 14 enters segment 19 at the axis of impeller 40, from whence it is thrown out radially by blades 41 so that it is discharged at pipe 44 when the impeller is rotated.

For engines using a carburetor, the fuel is fed to the carburetor through pipe 44. A bypass is provided so that when more fuel is being supplied than is being used by the engine, the pressure in pipe 44 rises and the fuel is forced past pressure controlled check valve 77 on pipe 78, Fig. 1, back to pipe 14. Check valve 77 prevents flow from pipe 14 into pipe 78, and has a pressure control in it, not shown but which is well known in the art, which prevents flow past it by fuel received from pipe 44 until the pressure of the fuel from said pipe exceeds a predetermined amount.

An alternate to the bypass just described, is shown in Figs. 10 and 11. This alternate is not a bypass, but shuts off the current from battery 62 when the pressure in pipe 44 exceeds a predetermined amount. A circuit breaking valve 79 is set in pipe 44. Said valve has a chamber 80 into which the fluid from pump 12 is led. Terminals 81 and 82 in battery wire 66 are insulatively mounted on the valve. These terminals are adapted to be connected by contact piece 83 when pulled against them by diaphragm 84. Tension spring 85 normally holds diaphragm 84 and contact piece 83 against terminals 81 and 82, but when the pressure in pipe 44 exceeds a predetermined amount, the tension of spring 85 is overcome and contact between said terminals is broken stopping the action of the pump.

Provision must be made to provide against arcing between terminals 81 and 82 and piece 83. Such provision is well known to the art, it being noted that the drawing is largely diagrammatic.

The advantage of this alternate is that there is

no waste of current, only sufficient pumping being done to suit the demands of the engine.

In the alternate form shown in Fig. 8, instead of an electric motor driving the commutator mechanism it is driven by a belt 86. Belt 86 is driven from an engine part, such as the water pump shaft, not shown. Belt 86 engages pulley 87 which is fixed upon sleeve 88. Sleeve 88 is rotatably mounted on fixed shaft 89 and has a loose fit in housing section 90. Also fixedly mounted on sleeve 88 is a brush holder 48, which is the same as in Fig. 7. Brush holder 48 rotates in housing section 91. Adjacent section 91 is partition section 20 which is exactly the same as in Fig. 7, having fixed in it the larger diameter portion 23 of shaft 89 and field cores and coils 25 to 36 inclusive, the latter not being seen in Fig. 8. Annular channel 37 holds the wires connecting the field coils. Section 19 is the same as in Fig. 7 with magnetic member 42 and impeller 40 inside of it. The action and connections of brushes 49, 50, 51 and 52 and commutator segments 53, 54, 55, 56, 57 and 58 is the same as in Fig. 9 as far as magnetic member 42 is concerned.

I claim:

1. A magnetically driven fuel pump comprising a housing consisting of a plurality of sections, means for attaching the sections to each other, a centrifugal pump impeller and a magnetically influenced member in the first of the sections, another magnetically influenced member in a second section, a partition between said magnetically influenced members, sealing off the first and second sections from each other, field poles and an axially extending shaft fixedly mounted in said partition, the shaft projecting into the first and second sections, the impeller and the first of said members being rotatably mounted on the shaft and fixed to each other, the impeller being driven by said first member, a brush holder and a plurality of brushes carried by the holder set in the second section adjacent the second of said members, the holder and said second member being rotatably mounted on the shaft and fixed to each other, commutator pieces for connection to a source of electric energy, in electrical connection with the field poles, fixedly mounted on a third section, the brushes, when rotating, sliding over the commutator pieces, for controlling thereby the rotation of the impeller.

2. A magnetically driven fuel pump comprising a housing consisting of a plurality of sections, means for attaching the sections to each other, a centrifugal pump impeller and a magnetically influenced member rotatably mounted in the first of the sections, a brush holder and a plurality of brushes carried by the holder rotatably mounted in the second section, said first and second sections being hollow, a partition between said latter sections sealing off their interiors from each other, field poles and an axially extending shaft fixedly mounted in said partition, the shaft projecting into the first and second sections, the impeller and magnetically influenced member being rotatably mounted on the shaft and fixed to each other, the impeller being driven by said member, mechanism for rotating the brush holder, the holder and said mechanism being rotatably mounted on the shaft in fixed relative relation to each other, commutator pieces, for connection to a source of electric energy, in electrical connection with the field poles, fixedly mounted on a third section, the brushes, when rotating, sliding over the commutator pieces for

controlling their connection to the source, for effecting thereby the rotation of the impeller.

3. In a fuel system of an engine comprising a fuel pump including an impeller and having a pipe means connecting said pump to a fuel source and to said engine, the improvement which consists in providing a drive for said impeller, comprising a permanent magnet armature rotatably mounted inside the system, the impeller being fixed to said armature, a permanent magnet armature rotatably mounted outside of the fuel system opposite the inside armature, a partition coming between said armatures, said partition completely sealing off the fuel of the system from passing out therefrom, a plurality of field poles arranged substantially in a circle and mounted in said partition, one end of each pole facing the outside armature and the other end of each pole facing the inside armature, and commutator mechanism having a rotatable part fixed to the outside armature and a fixed part electrically connected to the poles, said mechanism, when receiving current, energizing the poles to produce a rotating magnetic field, said field dragging both armatures around with it, rotating the impeller thereby and effecting the flow of fuel in said system.

4. In the fuel system of an engine comprising a fuel pump including an impeller and having a pipe means connecting said pump to a fuel source and to said engine, the improvement which consists in providing a drive for said impeller comprising an armature of magnetic metal rotatably mounted inside the fuel system, the impeller being fixed to said armature, an armature of magnetic metal rotatably mounted outside of the fuel system opposite the inside armature, a partition coming between said armatures, said partition completely sealing off the fuel of the system from passing out therefrom, a plurality of field poles in fixed location arranged substantially in a circle between the armatures, and commutator mechanism having a rotatable part fixed to the outside armature and a fixed part electrically connected to the poles, said mechanism, when receiving current, energizing the poles to cause rotation of the outside and inside armatures.

5. A magnetically driven fuel pump comprising a housing consisting of a plurality of sections, means for attaching the sections together, a centrifugal pump impeller located in the first of the sections, a magnetically influenced member in said section fixed to the impeller for driving the latter, mounting means in said section rotatably supporting the impeller and said member, a brush holder and a plurality of brushes carried by the holder located in the second section, mounting means in the second section rotatably supporting the holder, means for rotating the holder, a partition between said holder and the magnetically influenced member sealing off the first and second sections from each other, field poles mounted in said partition in a ring opposite the magnetically influenced member, commutator pieces, for connection to a source of electric energy, in electrical connection with the field poles, said pieces being fixedly mounted in a third section, the brushes when rotating sliding over the commutator pieces controlling their connection successively to the source, energizing the field poles to produce a rotating magnetic field effecting thereby the rotation of the magnetically influenced member and the impeller.

6. A magnetically driven fuel pump comprising a housing consisting of a plurality of sections,

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means for attaching the sections together, a centrifugal pump impeller located in the first of the sections, the interior of said section opposite the impeller being hollowed out in volute form to receive the discharge from the impeller when the latter is rotated, a magnetically influenced means in said section fixed to the impeller for rotating the latter, mounting means in said section rotatably supporting the impeller and member, a second magnetically influenced member located in a second section, a partition between said magnetically influenced members sealing off the first and second sections from each other, field poles mounted in the partition in a ring between said magnetically influenced members, a brush holder, a plurality of brushes carried by the holder, said holder being located in the second section and fixed to the second member, mounting means in the second section rotatably supporting the holder and the second member, commutator pieces, for connection to a source of electric energy, in electrical connection with the field poles, said pieces being fixedly mounted in a third section, the brushes when rotated by the holder sliding over the commutator pieces controlling their connection successively to the source, energizing the field poles to produce a rotating magnetic field effecting thereby the rotation of the magnetically influenced members and the impeller.

7. In the fuel system of an engine comprising a fuel pump including an impeller and having pipe means connecting said pump to a fuel source and to said engine, the improvement which consists in providing a drive for said impeller, comprising rotatably mounted magnetically influenced means inside the system, the impeller being fixed to said means, and an electric motor having an armature and the rotatable part of its commutator driven by said armature located outside of the fuel system, and its magnetic field means fixedly located adjacent said magnetically influenced means between said armature and said latter means, said motor when supplied with current having its field means induce rotation in

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said magnetically influenced means effecting thereby the rotation of the impeller.

8. In the fuel system of an engine comprising a fuel pump including an impeller and having pipe means connecting said pump to a fuel source and to said engine, the improvement which consists in providing a drive for said impeller, comprising a permanent magnet armature rotatably mounted inside the system, the impeller being fixed to the armature, commutator mechanism, means for rotating part of said mechanism, a partition coming between said armature and said mechanism completely sealing off the fuel from said mechanism, and a plurality of cores and field coils coming about said cores, the cores being mounted in said partition, one end of each core facing said armature, said mechanism having one part electrically connected to the coils and its other part when rotated and receiving current, energizing the cores to produce a rotating magnetic field, said field dragging the armature around with it, rotating the impeller thereby and effecting the flow of fuel in the system.

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