HYBRID PESTICIDE PUMP

Vishwajit K. Barbudhe,
Assistant Professor
Jagadambha college of Engineering & Technology
Electronics & Telecomm Engineering Department,
Yavatmal, India.

Shailesh N.Sisat,
G.H.Raisoni college of Engineering & Managment
Electronics & Telecom Engineering Department,
Amravati , India.

ABSTRACT

We have made a attempt to assemble a multisource pump with the reliability of engine operated pump as well as cost efficiency reducing the consumption of fuel by using the petrol pump as backup which is detachable with the development of future vision. It operates first on battery and in case battery gets discharged then it can be operated on petrol engine thus maintaining reliability and continuity of work. Which is the main advantage of this pump. Here we are using the petrol engine as a backup for battery.

Introduction

India is an agricultural country, most of people in India are farmers and they lives in villages. So we have made suitable pump for the farmers. Hybrid pesticides pump is a multi-source pump. This project is electrical as well as mechanical based and it is use for agriculture purpose. The main objective of the project is to provide a suitable pump to the farmer. It is the combination of petrol engine operated pump as well as battery operated pump, means it is a multisource pump. It operates first on battery and in case battery gets discharged then it can be operated on petrol engine thus maintaining reliability and continuity of work. Which is the main advantage of this pump. Here we are using the petrol engine as a backup for battery. It consists of following main parts:

1. Dc Motor
2. IC Engine
3. Battery

4. Tank (Water & Fuel)
5. Blower
6. Nozzle

Energy transfer mechanism

Dc Motor

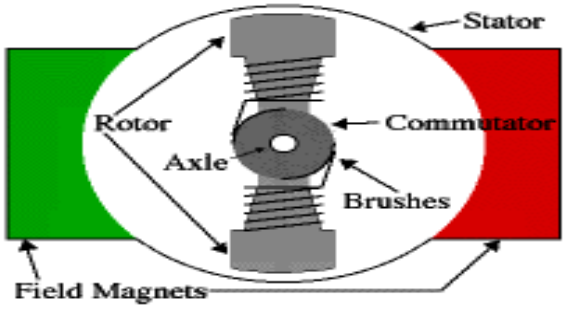


figure Dc Motor

Principle of DC Motor:

A machine that converts d.c powerinto mechanical power is known as a d.c.motor. Its operation is based on the principle that when a current carrying conductor is placed in a magnetic field, the conductor experiences a mechanical force. The direction of this force is given by Fleming's left hand rule and magnitude is given by;

F = BIl newton's

Basically, there is no constructional difference between a d.c. motor and a d.c. generator. The same d.c. machine can be run as a generator or motor.

Principle of Operation:

Consider a coil in a magnetic field of flux density **(**figure). When the two ends of the coil areconnected across a DC voltage source, current I flow through it. A force is exerted on the coil as a result of the interaction of magnetic field and electric current. The force on the two sides of the coil is such that the coil starts to move in the direction of force.

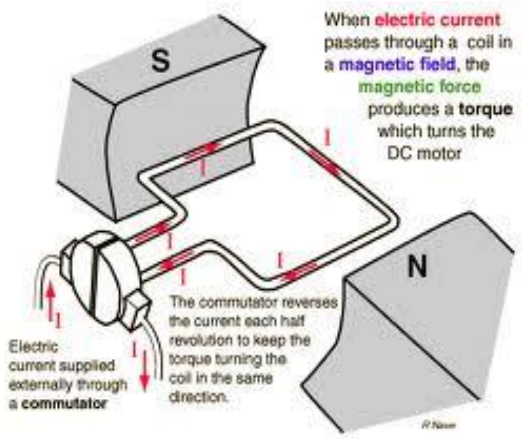


Figure (a) Torque production in a DC motor

In an actual DC motor, several such coils are wound on the rotor, all of which experience force, resulting in rotation. The greater the current in the wire, or the greater the magnetic field, the faster the wire moves because of the greater force created. At the same time this torque is being produced, the conductors are moving in a magnetic field. At different positions, the flux linked with it changes, which causes an *emf* to be induced ($e = d0/dt$) as shown in figure (a).

This voltage is in opposition to the voltage that causes current flow through the conductor and is referred to as a *counter-voltage* or *back emf*.

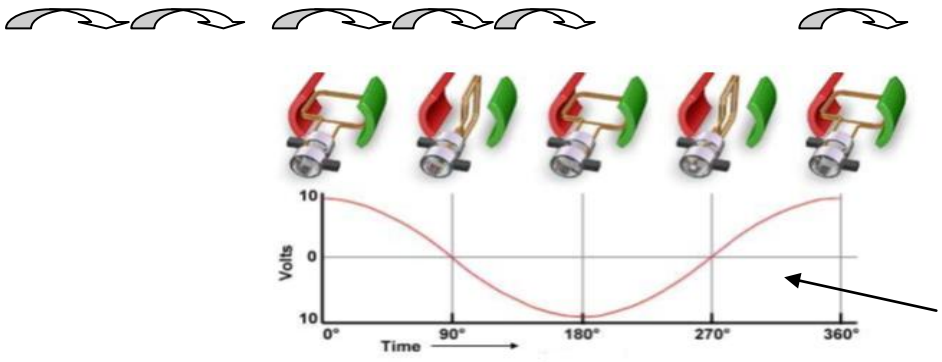


Figure (b) Induced voltage in the armature winding of DC motor

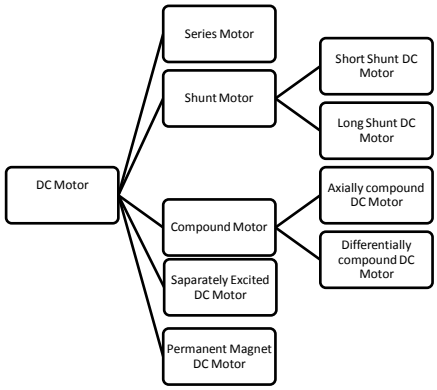
The value of current flowing through the armature is dependent upon the difference between theapplied voltage and this counter-voltage. The current due to this counter-voltage tends to oppose the very cause for its production according to Lenz's law. It results in the rotor slowing down. Eventually, the rotor slows just enough so that the force created by the

magnetic field ($F = Bil$) equals the load force applied on the shaft. Then the system moves at constant velocity.

Classification of DC Motor:

DC Machines can be classified according to the electrical connections of the armature winding and thefield windings.

Tree Diagram:



Separately Excited Machines

The armature and field winding are electrically separate from each other. The field winding is excited by a separate DC source.

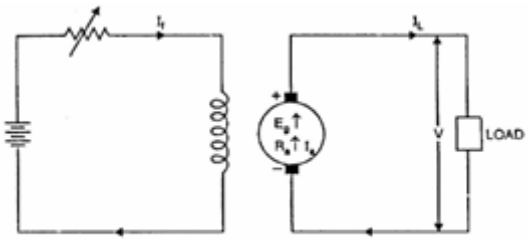


Figure (a)Separately excited DC Motor

The voltage and power equations for this machine are same as those derived in the previous section. Note that the total input power = *Vf If + VT Ia*

Self-Excited Machines

In these machines, instead of a separate voltage source, the field winding is connected across the main voltage terminals.

Shunt Machine

The armature and field winding are connected in parallel.The armature voltage and field voltage are the same.

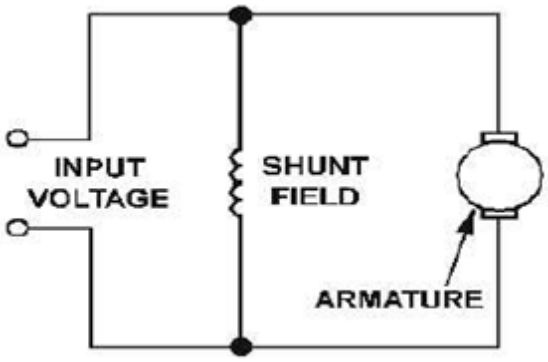


Figure (b) shunt dc motor

Series DC Machine

The field winding and armature winding are connected in series. The field winding carries the same current as the armature winding. A series wound motor is also called a *universal* motor. It is universal in the sense that it will run equally well using either an ac or a dc voltage source.

Reversing the polarity of both the stator and the rotor cancel out. Thus the motor will always rotate the same direction regardless of the voltage polarity.

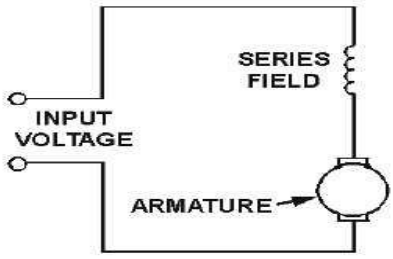


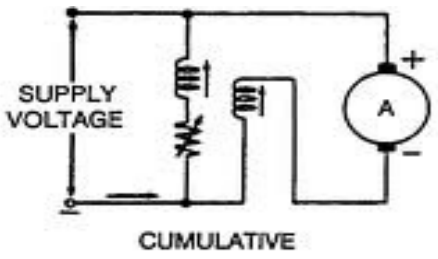
Figure (c)series dc motor

Compound DC Machine

If both series and shunt field windings are used, the motor is said to be compounded. In a compound machine, the series field winding is connected in series with the armature, and the shunt field winding is connected in parallel. Two types of arrangements are possible in compound motors:

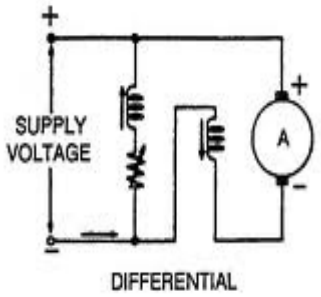
Cumulative compound DC Motor

If the magnetic fluxes produced by both series and shunt field windings are in thesame direction (i.e., additive), the machine is called cumulative compound.



Differential compound DC Motor

If the two fluxes are in opposition, the machine is differential compound. In both these types, the connection can be either short shunt or long shunt.



Construction

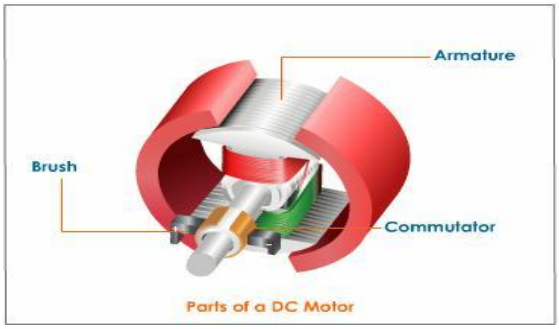


Figure Construction of DC motor

DC motors consist of one set of coils, called armature winding, inside another set of coils or a set ofpermanent magnets, called the stator. Applying a voltage to the coils produces a torque in the armature, resulting in motion.

Stator:

The *stator* is the stationary outside part of a motor.

The stator of a permanent magnet dc motor is composed of two or more permanent magnet pole pieces. The magnetic field can alternatively be created by an *electromagnet*. In this case, a DC coil (fieldwinding) is wound around a magnetic material that forms part of the stator.

Rotor:

The *rotor* is the inner part which rotates. The rotor is composed of windings (called armature windings) which are connected to the externalcircuit through a mechanical commutator.

Both stator and rotor are made of ferromagnetic materials. The two are separated by air-gap.

Winding:

A winding is made up of series or parallel connection of coils. Armature winding - The winding through which the voltage is applied or induced. Field winding - The winding through which a current is passed to produce flux (for the electromagnet) Windings are usually made of copper.

Armature:

In a DC machine, the main field is produced by field coils. In both the generating and motoring modes, the armature carries current and a magnetic field is established. This is called the armature flux. The effect of armature flux on the main field is called the armature reaction.

Yoke:

It provides mechanical support to poles & acts as protecting cover for whole machine. It carries magnetic flux produced by the poles.

Armature winding:

The armature winding usually former wound. These are first wound in the form of flat rectangular coils & are then pulled into their shape in a coil puller. Various conductor of the coils are insulted form each other. The conductor is placed in armature slots which lined with tough insulating material. This slot insulation is folded over above armature conductor placed in slots and is secured in place by special hard wooden or fiber wedges.

Principle of Permanent Magnet DC Motor

Essentially all electric motors operate on the same principle: current flowing through a magnetic field creates a force on the conductor carrying the current. Because of this relationship between current and force, electric motors can be used to convert electrical energy to mechanical energy. They can also be used to convert mechanical energy to electrical energy; generators in hydropower dams and regenerative braking in electric and hybrid cars are examples of this.

Figure Permanent Magnet Dc Motor

Specification of PMDC Motor:

Max operating voltage =24V **,** Operating current = 1A **,** Speed of operation = 2500 rpm

Construction of Permanent Magnet Dc Motor

Permanent magnet DC motors are constructed out of a number of components. The exact design and materials vary with each type of motor and depend on the application and constraints, but several elements are common to most. Figure 3.1.6 (a) shows a cut-away view of a typical permanent magnet brushed DC motor. The construction generally consists of a stator, which is made up of powerful permanent magnets that generate a static magnetic field; a rotor which carries the armature (also known as the windings or coils) and the commutation, and rotates in the bearings that support it; and a housing that holds the stator, rotor bearing supports and brushes in a fixed relationship to one another.

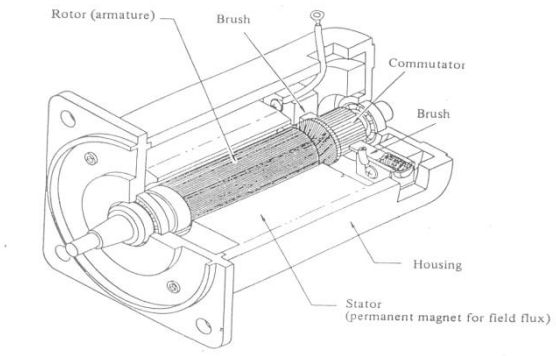


Figure (a) Permanent Magnet DC Motor Construction

In terms of generating torque, the critical elements of the motor are the stator and the armature, which are the sources of the two interacting magnetic fields. The stator is commonly shaped like a thick-walled tube, and the rotor and armature fit in the hollow space in the middle of the stator. The lines of magnetic flux established by the stator run from one side of the stator to the other. Figure (b)demonstrates the magnetic flux lines in a simplified representation.

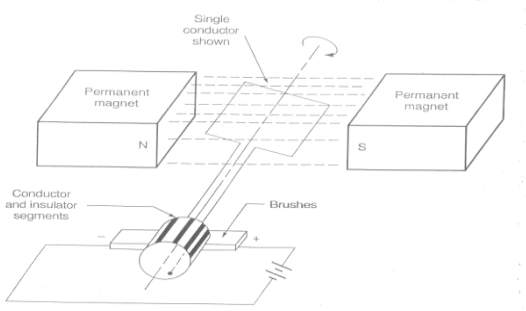


Figure (b) Permanent Magnet DC Motor Stator and Armature Detail

Figure (b) also shows a single winding of the armature, and makes it easier to understand the interaction between the armature and the stator. The armature contains a large number of wire loops, or coils, identical to the single one shown, arranged in a radial pattern around the rotor so that continuous torque is generated as the rotor rotates. Also, the additional loops contribute additional resulting forces, and hence more motor torque.

Working

Hybrid pesticide pump is a multisource pump. The exact working of pump is discussed below: Firstly the battery supply is given to the motor, the motor starts running. We have made a special arrangement for the transfer of output mechanical energy obtained from the

motor with the help of which blower which is attached to this assembly get its energy required for the operation. The surrounding air enters into the blower chamber from the provision of air made at the backside of blower chamber, as the blower is rotating and this air is coming into the blower chamber the blower compress this air into high pressurized air. Then this compressed air is passed at the tip of the nozzle through nozzle pipe.

Pesticide water from the upper tank comes into that nozzle tip at which compressed air is present through the tube. The diameter and the length of pesticide tube are about 1.5cm and 45cm respectively. At the tip of nozzle the compressed air mix with pesticide water and spraying is done. There is a provision for controlling the spraying with the help of adjuster. This pump spray 1 to 1.25 hectors per charge while working on battery. It runs two to three hours continuously when battery is fully charged. For fully charging the battery it requires one unit of electricity. For charging the battery voltage regulator and floating type charger is to be required. While spraying is done on the battery there is no need to take the additional weight of petrol engine. So the engine can be taken out as it is detachable. The engine can made detachable simply by taking out the threads. If in case battery will discharge and some field of the work will remain without spraying then we have the petrol engine to do reaming work.

Figure Working of Hybrid Pesticide Pump

Firstly the engine which is taken out is to be attached with the help of threads. And there after the chain is connected in between shaft of the engine and the motor. Now the engine starts by pulling the pulley.

Petrol from the fuel tank is supplied to the carburettor at the same time the surrounding air is comes through the air filter. When the air and petrol comes in the piston block through suction valve, due to this SUCTION STROKE executes. At this position piston is at bottom, the space occupied by pressurised air and fuel after that piston moves upward the combustion of fuel with help of compressed air takes place and COMBUSTION

STROKE executes spark get produced. at the same time POWER STROKE exists due to this crank moves upward and downward direction. Spark is produced by the spark plug which is connected to the high tension coil, in this way engine starts and flue gases comes out through silencer and EXHAUST STROKE executes.

As the engine starts it rotates freewheel which is connected to the shaft of engine. This freewheel is connected to the other freewheel which is also connected to shaft of the motor with the help of chain mechanism. As, the freewheel is rotating, it rotates the shaft of the motor and hence blower also starts rotating. The surrounding air enters into the blower chamber, as the blower is rotating and this air is coming into the blower chamber the blower converts this air into the compressed air. Then this compressed air is passed at the tip of the nozzle through nozzle pipe. Pesticide water from the upper tank comes into that nozzle tip at which compressed air is present through the tube. At the tip of nozzle the compressed air mix with pesticide water and spraying is done. There is a provision for controlling the spraying with the help of adjuster. This pump pumps sprays 1 to 1.25 hector per litre while working on petrol engine.

The total weight of the pump is 3 to 3.5 kg greater than that of simple petrol engine pump. While working on petrol engine we can charge two 12v batteries. We get the 12v supply due to the rotation of motor by using simple generator principle. In engine assembly there is an already one current coil is present. We have added one more current coil in engine assembly and from that coil we can generate 12v supply. In this way we can generate total 24v supply. By using this supply we can charge the battery which was exhausted while working on battery in first case.

Advantages

The engine is detachable when operates on battery and hence weight of pump get reduced. It is a multisource pump. It is economical. Environmental impact is less. Fuel consumption is less.

Disadvantages

There is slight increase in weight of pump, when it is operated on petrol engine. While operating on petrol engine there may be problem of noise pollution..

Future scope

We can use solar panel to charge the battery. We can make detachable mechanism simpler. Self-start arrangement can be made.

Conclusion

Keeping into consideration the reliability of engine operated pump and cost efficiency of battery operated pump, we have made a successful attempt to assemble a multisource pump with the reliability of engine operated pump as well as cost efficiency reducing the consumption of fuel by using the petrol pump as backup which is detachable with the development of future vision.

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