The Overview of Direct Current Motor and their Types

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ABSTRACT: - The speed of any engine must be increased from zero to the operating speed, which is referred to as an engine launch. The speed of the CT motors may be adjusted by changing the voltage or shifting the power in the winding across a wide range. DC motors were originally supplied by the established direct current power supply system, making them the first motors to be widely utilized. A DC engine is a self-starting engine, although it requires some external assistance to start. The study of various types of DC engines and the need for a DC engine external starter is the subject of this paper. Most DC engines need an external starter for their intended usage, and these starters can only be switched off for the first 5 to 6 seconds, according to this research. The starter offers a safe zero to rated voltage start-up voltage. The starting current is likewise restricted by a safe value before the DC engine achieves speed and torque. To guarantee that DC engines start smoothly, without jerks, and in a regulated way, the same procedure should be followed during engine shutdown.

KEYWORDS: - DC Motors, Speed Regulation, Armature, Field winding.

1. INTRODUCTION

Any rotary electrical motor that transforms direct current electrical energy into mechanical energy is referred to as a DC motor[1]. The most popular kinds depend on magnetic fields to generate forces. Almost all DC motors include an internal mechanism, either electromechanical or electronic, that changes the direction of current in a portion of the motor on a regular basis. Because they could be supplied by existing direct-current lighting power distribution networks, DC motors were the first kind of motor to become extensively utilized[2]. The speed of a DC motor may be varied across a broad range by varying the supply voltage or altering the current intensity in the field windings. Tools, toys, and appliances all utilize small DC motors. The universal motor is a lightweight brushed motor that can run on direct current and is used in portable power tools and appliances. Larger DC motors are presently utilized in electric vehicle propulsion, elevator and hoist drives, and steel rolling mill drives. With the development of power electronics, it is now feasible to replace DC motors with AC motors in a variety of applications[3].

An electric engine drives the majority of the mechanical progress around us. Electric motors transform one type of energy into another. An electric motor is a mechanical energy converter that converts electricity into mechanical energy. In general, engines are divided into two categories: AC and DC [4]. The AC engines run on alternating currents, whereas the DC engines run on direct current. The AC engine's input is a torque in current/voltage, which is equal to the DC engine's output, and it differs from AC engines on the input side, while a DC engine's input is direct current/voltage. This page focuses only on DC generators and their many forms[5].

1.1 Types of DC motor

1.1.1 There are three different kinds of DC motors: series, shunt, and compound. These requirements relate to the manner in which the field windings are connected to the frame's circuit.

DC Series motor: A DC Series motor's field windings would be linked in series to the frame (Figure 1). The winding series would contain a relatively small number of turns of wider cables or copper strips capable of transporting the whole motor charge. Because the windings are so short, a significant current may be pulled at first, resulting in a high starting torque. This is advantageous for big beginning weights such as tractors, cranes,

and other heavy applications. The speed of a series engine is dependent on the load, thus when full load streams flow through the circuit, the speed would have increased[6].

Engine speed may be greater than the permissible limit in some situations. As a result, a series engine should not be linked with a load band.

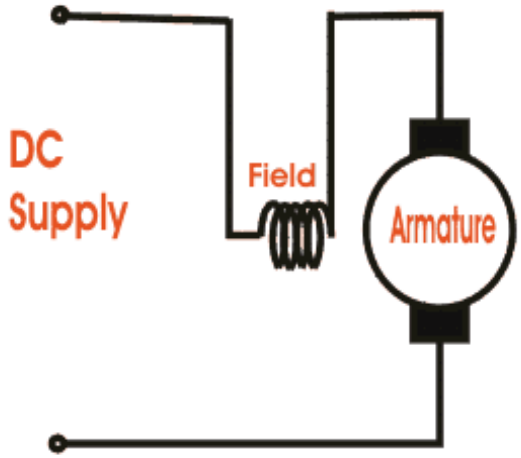

Figure 1: DC series motor

1.1.2 *DC Shunt motor*: In a DC Shunt motor, the field winding is connected to the armature in parallel (shunt). The shunt-winding is made up of many turns of a tiny copper wire, and since it is connected to the DC field source, its field current is constant [7]. The engine is running at rated speed, which has no impact on the load shift (Figure 2). The beginning torque would be lower than a series engine of similar size. However, if this isn't required, a constant speed shunt engine may be required. DC shunt engines may be utilized for a variety of applications, including plastics and wire extrusion.

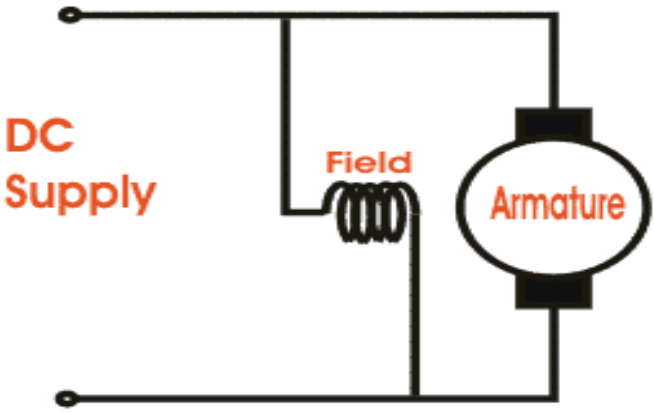

Figure 2: DC shunt motor

1.1.3 *DC Compound Motor*: With a DC Compound Motor, the majority of the field is wrapped to a shunt field, but there are some series turns on top. The shunt is linked to the frame series and the turns of the series are connected to the field supply[8]. This results in a hybrid engine with shunt and series characteristics (Figure 3).

1.1.4 Starting torque is higher than that of a shunt engine, but not as high as that of a series engine. The number is determined by the percentage of the area assigned to the winding string and varies with load. The field of series can be set up to increase or decrease the speed as the load increases or decreases.

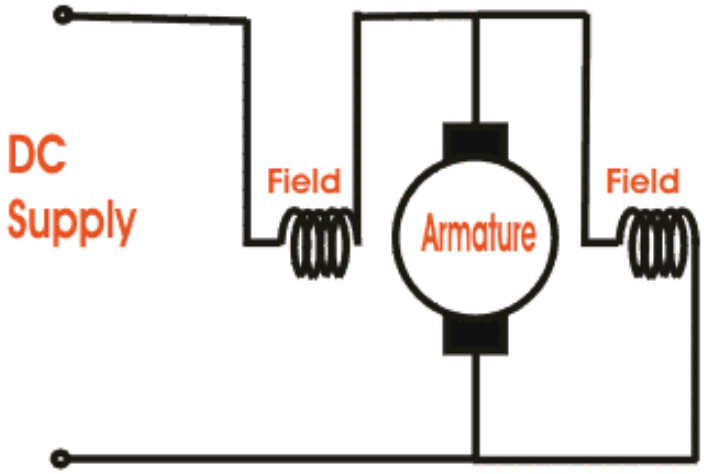

Figure 3: DC compound motor

1.1.5 Permanent Magnet Motor: - A permanent magnet motor does not have a field winding; instead, the field flux is supplied by permanent magnets. Permanent magnet motors provide a higher beginning torque as well as a higher speed. This motor does not have an adjustable speed control feature since the field supply is fixed owing to the permanent magnet and cannot be changed (Figure 4). In tiny motors, the permanent magnet field is thus preferable. Big permanent magnets, on the other hand, are expensive, hazardous, and complex to install, favoring wound fields for large equipment [9].

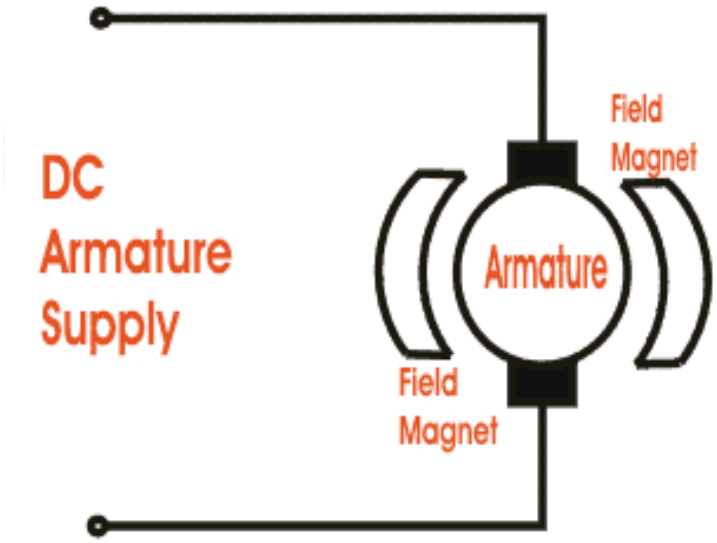

Figure 4: Permanent magnet motor

2. LITERATURE REVIEW

Starting torque is higher than that of a shunt engine, but not as high as that of a series engine. The number is determined by the proportion of the area allocated to the winding string and changes with load. The field of series may be set up to increase or decrease the speed as the load increases or decreases**.** The wrapped engine series is another name for the engine series. A DC series motor's field winding is serially linked to the assembly winding. The strength of the field varies as the frame's current shifts [8]. The engine series has a strong start-up torque and is usually employed with loads with a lot of inertia, such as trains and elevators. The speeds of a group of engines fluctuate significantly from pre-load to full-load circumstances. Because the speed of the engine varies greatly with various loads, it is not possible to utilize a sequence engine in situations where a consistent speed is required [10].

3. DISCUSSION

The bulk of mechanical progress around us is powered by an electric engine. Electric motors are devices that convert one kind of energy into another. A mechanical energy converter, such as an electric motor, transforms electrical energy into mechanical energy. In general, engines are classified as either AC or DC. AC engines operate on alternating currents, whereas DC engines operate on direct current. The AC engine's input is a torque in current/voltage that is equivalent to the DC engine's output; however, the DC engine's input is direct current/voltage, which distinguishes it from AC engines on the input side. This website is solely dedicated to DC generators in all of its many forms**.**

The field windings of a DC Series motor are connected in series to the frame. The winding series would be made up of a limited number of turns of wider cables or copper strips that could carry the whole motor charge. Due to the short length of the windings, a large current may be drawn at initially, resulting in a high beginning torque. This is beneficial for large starting weights, such as tractors, cranes, and other heavy equipment. Because the speed of a series engine is proportional to the load, the speed would have risen as full load streams passed through the circuit.

The field winding is linked to the armature in parallel in a DC Shunt motor (shunt). The shunt-winding is made up of several turns of a small copper wire, and its field current is constant since it is linked to the DC field source. The engine is operating at rated speed, thus the load shift is unaffected. The initial torque would be lower than a similar-sized series engine. A constant speed shunt engine, on the other hand, may be needed if this isn't required. Plastics and wire extrusion are only two examples of uses for DC shunt engines.

The bulk of the field is wrapped to a shunt field with a DC Compound Motor, although there are several series turns on top. The shunt is connected to the frame series, which is connected to the field supply via its turns. As a consequence, a hybrid engine having both shunt and series characteristics has been created.

The field flux is provided by permanent magnets rather than a field winding in a permanent magnet motor. Permanent magnet motors have a greater starting torque and speed than induction motors. Because the field supply is fixed due to the permanent magnet and cannot be altered, this motor does not have an adjustable speed control function. The persistent magnet field is therefore preferred in small motors. Big permanent magnets, on the other hand, are costly, dangerous, and difficult to install, therefore wrapped fields for large equipment are preferred.

4. CONCLUSION

AC engines operate on alternating currents, whereas DC engines operate on direct current. The AC engine's input is a torque in current/voltage that is equivalent to the DC engine's output; however, the DC engine's input is direct current/voltage, which distinguishes it from AC engines on the input side. This website is solely dedicated to DC generators in all of its many forms. This study demonstrates that most DC engines need an external starter for their intended use, and that these starts can only be turned off for the first 5 to 6 seconds. The starter provides a safe start-up voltage of zero to the rated voltage. Before the DC engine reaches speed and torque, the beginning current is also limited by a safe value. The same process should be followed during the engine shutdown to ensure that the DC engines start smoothly, without jerks, and in a controlled manner. The starting current is likewise restricted by a safe value before the DC engine achieves speed and torque. To guarantee that DC engines start smoothly, without jerks, and in a regulated way, the same procedure should be followed during engine shutdown.

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