# Design and Fabrication of Electromagnetic Clutch

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*Abstract*— A clutch is a device used to make and break contact from the transmission. When it engages, then power is transferred from engine to gear box and when it disengage, power flow is stop, hence it is called free running of engine. There is an innovation done in automobile industry, called electromagnetic clutch, which is recently used by Renault Car Company, which uses the basic principle of electrical energy as well as magnetic forces. This project revels the manufacturing of electromagnetic clutch. In place of Engine, shaft is directly attached to variance (variable motor) and clutch disc as well as pressure plate is used, in between them friction material called "Asbestos" used to grip between the pressure plate and clutch plate. This project shows, experimental analysis of Electromagnetic clutch, and at last at which speed clutch engage as well as disengage is measured and when clutch disengage, at that time speed of flywheel is also measured.

***Key words:*** Electromagnetic Clutch

## I. Introduction

The clutch is an important part in the transmission system of automobiles. It transmits power from the engine to gear box at various speeds. No shock is caused during this transmission of power.

A clutch is a mechanism for transmitting rotation, which can be engaged and disengaged. Clutches are useful in devices that have two rotating shafts. In these devices, one shaft is typically driven by motor or pulley, and other shaft drives another device. The clutch connects the two shafts so that they can either be locked together and spin at the same speed (engaged), or be decoupled and spin at different speeds (disengaged). The clutch disc (centre) spins with the flywheel (left). To disengage, the lever is pulled (black arrow), causing a white pressure plate (right) to disengage the green clutch disc from turning the drive shaft, which turns within the thrust-bearing ring of the lever. Never will all 3 rings connect, with any gaps.

The function of the clutch is to temporarily disconnect the engine from the gear box unit. When the gear has to be changed from the first to the second, it should be done after disconnecting the engine from the gear box. If this is not done, the gear teeth might break. The clutch is thus helpful when starting, shifting gears and idling.

## II. Components Used

An AC motor is an electric motor driven by an alternating current (AC). The AC motor commonly consists of two basic parts, an outside stator having coils supplied with alternating current to produce a rotating magnetic field, and an inside rotor attached to the output shaft producing a second rotating magnetic field. The rotor magnetic field may be produced by permanent magnets, reluctance saliency, or DC or AC electrical windings.

Fig. 1: A.C motor

A pulley is a wheel on an axle or shaft that is designed to support movement and change of direction of a taut cable or belt, or transfer of power between the shaft and cable or belt. In the case of a pulley supported by a frame or shell that does not transfer power to a shaft, but is used to guide the cable or exert a force.

Fig. 2: pulley

A starter solenoid (or starter relay) is the part of an automobile which switches a large electric current to the starter motor, in response to a small control current, and which in turn sets the engine in motion. Its function is thus identical to that of a transistor, but using an electromagnetic solenoid rather than semiconductor.

Fig. 3: Electromagnetic Actuator

A Pressure Plate is an item that can be used to activate certain features when it is stepped on. It activates red stone next to itself and the block it is on. The most common use of a pressure plate is to open a door (wooden or iron).

Fig. 4: Pressure Plate

## III. WORKING PRINCIPLE

The clutch has four main parts: field, rotor, armature, and hub (output). When voltage is applied the stationary magnetic field generates the lines of flux that pass into the rotor. (The rotor is normally connected to the part that is always moving in the machine.) The flux (magnetic attraction) pulls the armature in contact with the rotor (the armature is connected to the component that requires the acceleration), as the armature and the output start to accelerate. Slipping between the rotor face and the armature face continues until the input and output speed is the same (100% lockup). The actual time for this is quite short, between 1/200th of a second and 1 second. Disengagement is very simple. Once the field starts to degrade, flux falls rapidly and the armature separates. One or more springs hold the armature away from the rotor at a predetermined air gap.

There are actually two engagement times to consider in an electromagnetic clutch. The first one is the time that it takes for a coil to develop a magnetic field, strong enough to pull in an armature. Within this, there are two factors to consider. The first one is the amount of ampere turns in a coil, which will determine the strength of a magnetic field. The second one is air gap, which is the space between the armature and the rotor. Magnetic lines of flux diminish quickly in the air.. Air gap is an important consideration especially with a fixed armature design because as the unit wears over many cycles of engagement the armature and the rotor will create a larger air gap which will change the engagement time of the clutch. In high cycle applications, where registration is important, even the difference of 10 to 15 milliseconds can make a difference, in registration of a machine.

Even in a normal cycle application, this is important because a new machine that has accurate timing can eventually see a "drift" in its accuracy as the machine gets older. The second factor in figuring out response time of a clutch is actually much more important than the magnet wire or the air gap. It involves calculating the amount of inertia that the clutch needs to accelerate.

Fig. 5: Assemble

This is referred to as "time to speed". In reality, this is what the end-user is most concerned with. Once it is known how much inertia is present for the clutch to start then the torque can be calculated and the appropriate size of clutch can be chosen. Most CAD systems can automatically calculate component inertia, but the key to sizing a clutch is calculating how much inertial is reflected back to the clutch or brake. To do this, engineers use the formula: $T = (wk2 \times \Delta N) / (308 \times t)$ Where T = required torque in lbft, WK2 = total inertia in lb-ft2 , $\Delta N$ = change in the rotational speed in rpm, and t = time during which the acceleration or deceleration must take place. There are also online sites that can help confirm how much torque is required to accelerate a given amount of inertia over a specific time.

## IV. CONCLUSION

This project work has provided us an excellent opportunity and experience, to use our limited knowledge. We gained a lot of practical knowledge regarding, planning, purchasing, assembling and machining while doing this project work. We feel that the project work is a good solution to bridge the gates between institution and industries. The fabrication of electro-magnetic Clutch is working with satisfactory conditions. We are able to understand the difficulties in maintaining the tolerances and also quality. We have done to our ability and skill making maximum use of available facilities. In conclusion remarks of our project work, let us add a few more lines about our impression project work.

Thus we have developed a fabrication of electro-magnetic clutch which helps to know how to achieve low cost automation. The operating procedure of this system is very simple, so any person can operate. By using more techniques, they can be modified and developed according to the applications.

## REFERENCES

[1] Arun Kumar N., Srinivasan V., Krishna Kumar P., Analysing the strength of unidirectional fibre orientations under transverse static load, International Journal of Applied Engineering Research, v-9, i-22, pp-7749-7754, 2014.
[2] Srinivasan V., Analysis of static and dynamic load on hydrostatic bearing with variable viscosity and pressure, Indian Journal of Science and Technology, v-6, i-SUPPL.6, pp-4777-4782, 2013.
[3] Srinivasan V., Optimizing air traffic conflict and congestion using genetic algorithm, Middle - East Journal of Scientific Research, v-20, i-4, pp-456-461, 2014.
[4] Praveen R., Achudhan M., Optimization of jute composite as a noise retardant material, International Journal of Applied Engineering Research, v-9, i-22, pp-7627-7632, 2014.
[5] Raja Kumar G., Achudhan M., Srinivasa Rao G, Studies on corrosion behaviour of borated stainless steel (304B) welds, International Journal of Applied Engineering Research, v-9, i-22, pp-7767-7772, 2014.