The DIY Dynamo

This may seem a curious entry... But there have been cases of locomotives which have used electric traction and dynamos to power them. What has powered the dynamos has normally been a device selected to do the job...

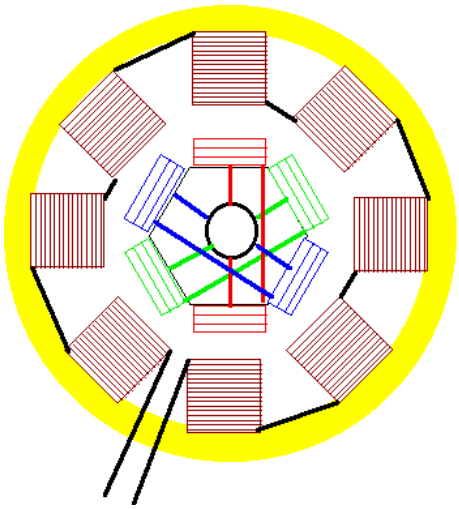
High Speed Steam engines powered the 3 Heilmann locomotives.
Large flywheels have been used to provide urge over the insulating gaps and at stations.
Diesel or petrol engines (and compressed gas) have also been used.

Historical Designs.

Broadly speaking dynamos break down into two topologies “The Shunt Wound” of which the “Gramme Ring” is the most famous, and “The Series Wound” of which the “Manchester” is the most famous.

The Gramme Ring.

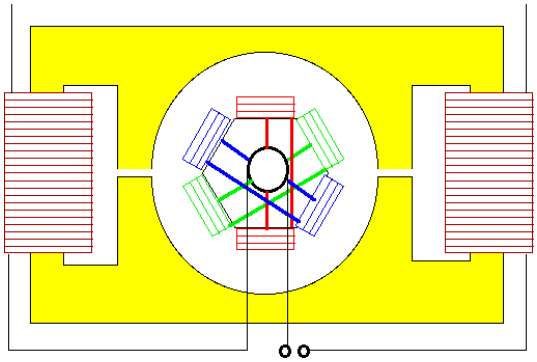
This involves a torus made of several laminations of steel plate. Around this (divided into a multiple of EIGHT sets of windings) are the induction coils that will produce the magnetic field. The rotor consists of THREE pairs, (or a multiple thereof), of windings. The chief problem with a Gramme Ring is that in order for it to begin generating electricity the field winding must first be energised, (“excited”), from an external source. Once the field has begun to establish itself -then electricity generated from the rotor is then fed back into the field windings and the loop continues. What stops the entire device from exploding as the field increases thus generating electricity in a short circuit manner is that power can now be drawn off from the dynamo thus weakening the field. The Gramme Ring is very efficient, however what limits it, is the need for an external “exciter” power supply, the devices need to interrupt the flow from the rotor to the field windings, and the fact that it cannot supply power until moving above a certain rotational velocity.



The familiar Lucas Dynamo and the black box regulator with its magnetic cut outs are an example of a Gramme Ring system

The Manchester.

The Manchester varies from the Gramme Ring in that it is “self exciting”. Initial magnetic flux is provided by large heavy permanent magnets which act in the same polarity as that generated by the field windings. The Manchester has one (or two) sets of field windings. While not as efficient as the Gramme Ring it does have the advantage of generating electricity directly from the initial movement of the rotor.

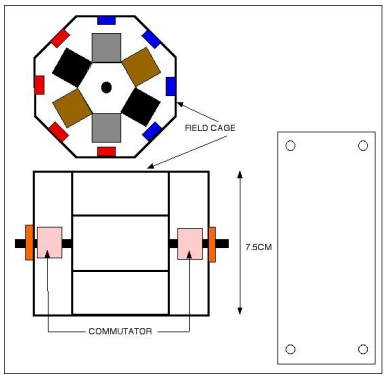


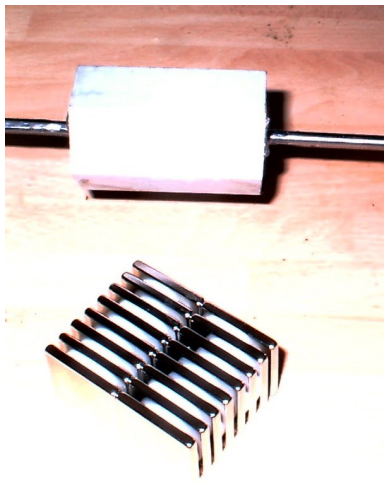
Modern Designs.

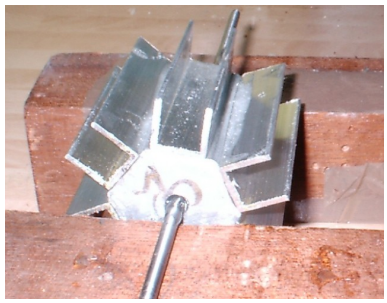
Modern designs may be seen to be a direct descendent of the Manchester type -but negating the use of the field windings. Very high magnetic fields can be produced using modern Rare Earth magnets. It is quite easy to purchase 1 inch square Neobium Iron Boron (NIB) magnets with field densities of 0.125 Tesla for no more than £2 each...

WARNING: on no account should sub Tesla magnets be used by, or near, anyone with a heart pacemaker.

Constructing an equivalent of a Gramme Ring cage to house sub Tesla magnets is simple welding. The magnets will self adhere (!) but epoxy should be used to stabilise their positions in the cage. At these field densities it is possible for the skin to to be very painfully “nipped” by the magnets -so keep them well away(!) The rotor can be produced from Aluminium hexagon section with Aluminium channel screwed to it.







The rotor winding are wound onto steel laminations and then epoxied to the aluminium channel. The commutators are made from split sections of copper tube on tufnel rod. The gaps between the sections of the commutators build up with epoxy.