Some ideas on the Coler devices.

1. Intoduction

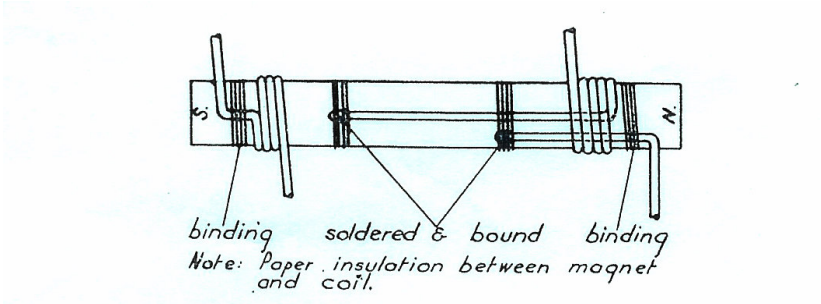
Coler's Magnetstromapparat and Stromerzeuger (hereafter called M and S machines) both used current passing through ferromagnetic material. In the case of the M machine the current passed through a permanent magnet, but in the S machine soft iron was used. Coler's explanation for these connections in regard to the S machine was "that the electron is to be regarded not only as a negatively charged particle but also as a South magnetic pole". He also claimed that "separation of the charges takes place and that these charges are magnetically polarized". At the time of his interrogation these explanations were not taken seriously, but in the light of modern spintronic theory there is some justification for Coler's beliefs. We now know that conduction electrons within magnetized ferromagnetic material become spin-polarized which is another way of saying magnetically polarized. And if there exists a magnetic field gradient within the material the polarized electrons will endure a force not due to their electric charge, but due to their magnetic dipole moment, the electrons will migrate to the position of greatest magnetic field, hence will create an anomalous voltage.

2. Basic Theory

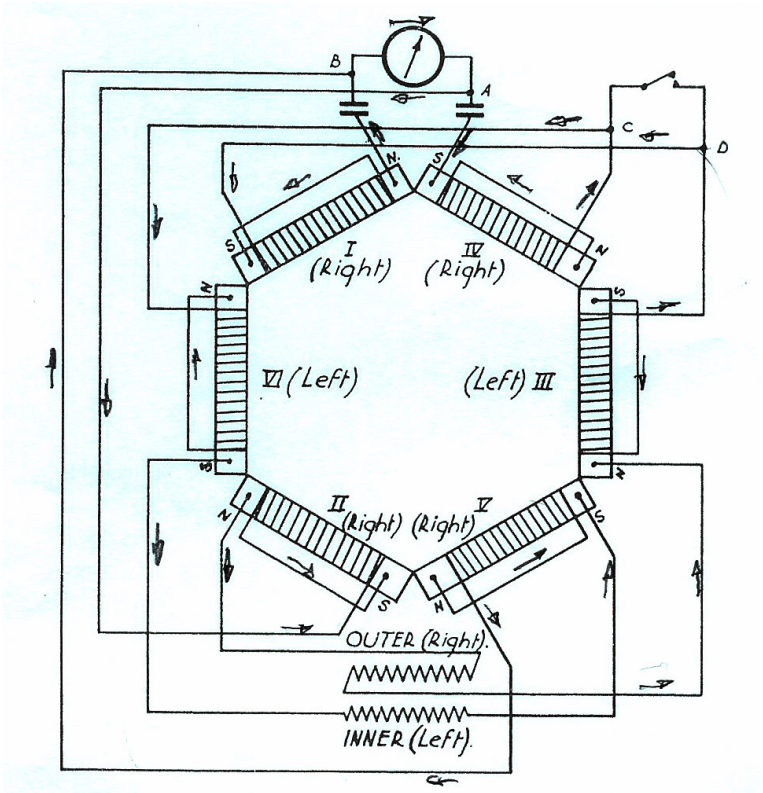
The force on a conduction electron which is spin-polarized by a longitudinally directed field within a rod lying along the x axis has a value $F_x = \mu_B \frac{dB_x}{dx}$ where μ_B is the Bohr magneton. This is equivalent to an effective electric field $E_x = \frac{\mu_B}{e}\frac{dB_x}{dx}$ where e is the electron charge. Integrating along the rod yields a voltage $V = \frac{\mu_B}{e}\Delta B$ where ΔB is the change of B between the voltage pick-off points. The ratio $\frac{\mu_B}{e}$ has a value of about 58 microvolts per Tesla. Although small, if the voltage is arranged to be alternating in value, this can be magnified by the Q of a tuned circuit. Since the polarity of the voltage is determined by the direction of the field gradient, a suitable disposition of coils around the rod driven at appropriate phases can alternate the field gradient and create the wanted alternating voltage. If those coils are connected so as to form a resonant circuit, and the circuit current passes through the rod, then there is the possibility for self-oscillation from the magnetically driven conduction electrons within the rod. Thus with the hindsight of modern spintronic theory, Coler's machines may not be as mysterious as they seem.

3. Coler's Magnetstromapparat

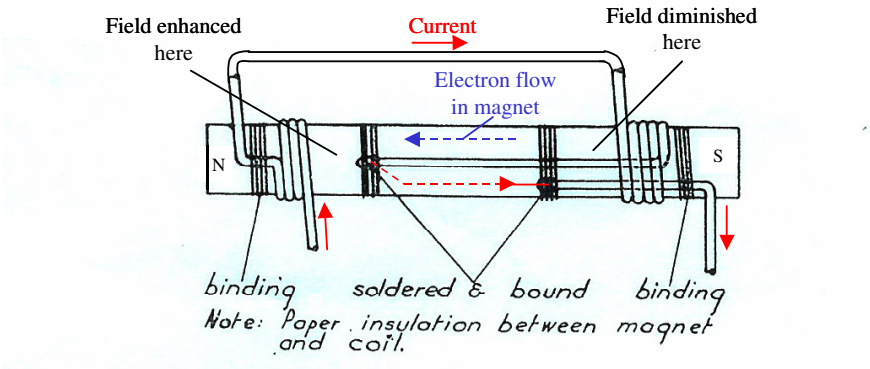
Coler's M machine used permanent magnets, which provide a permanently directed spin-polarization. The electrical connections to the magnet were not across the ends, but across the middle third of the magnet.



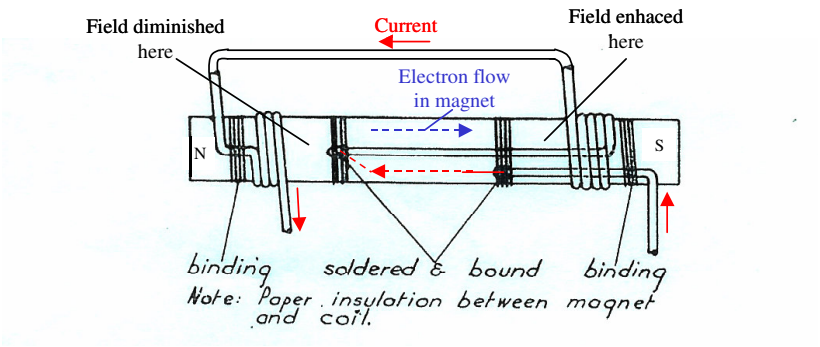
This winding diagram shows coils wound at each end, but the circuit diagram indicates a single coil wound over the length of each magnet.



Most observers assume that the winding diagram has the central region devoid of turns for diagrammatic purposes, so as to not obscure the connections to the magnet. All of the attempted replications use this assumed continuous winding. However in light of the above discussion, it now seems more sensible to have separate coils at each end. If one coil carries current to enhance the field of the PM, while the other carries current to diminish it, then there will be a field gradient along the central region that should create the anomalous voltage. The connections need modifying slightly from Coler's drawing. The following image shows the coil current flowing in one direction connected so that the field gradient drag of the conduction electrons aids the current flow.



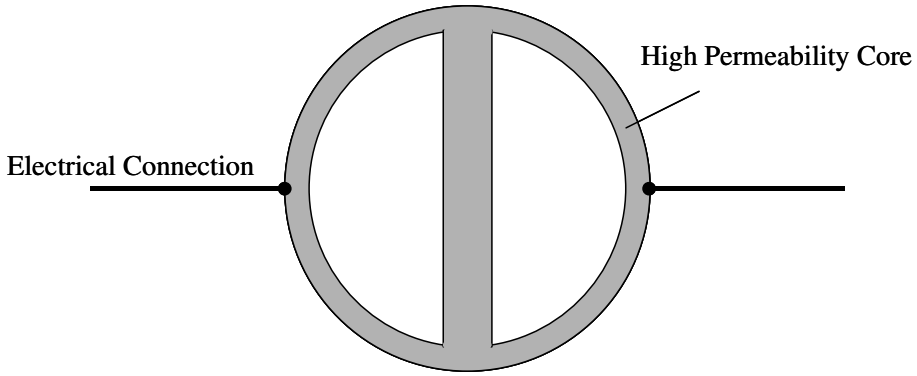
With the coil current alternating in direction, the field gradient will also alternate. Hence there will be an alternating voltage induced across that central region. The next image shows the alternate current flow where again the field gradient drag aids the flow.



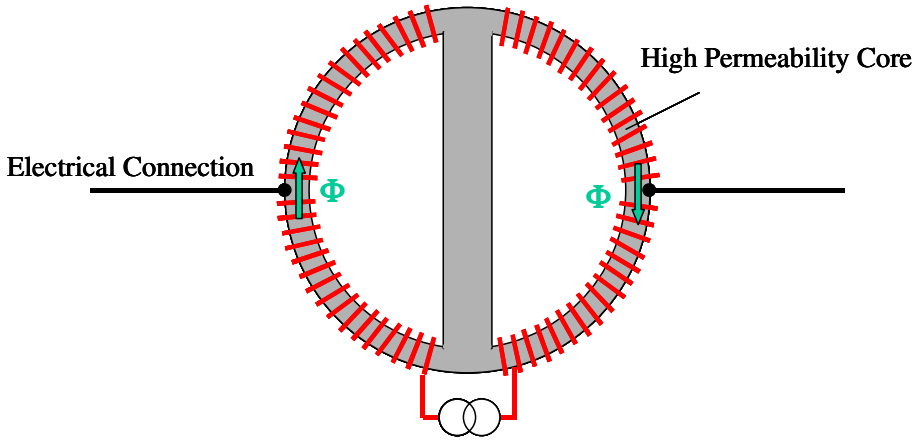
Although at first sight this offers a plausible explanation for anomalous behaviour, the currents needed to obtain sufficient field gradient to get useful voltage are too great. We need high value fields generated from low currents, and the permeability of the permanent magnet material is too low to offer any leverage (and in any case the demagnetisation factor of the rod mitigates against that). But assuming the basic principles are sound, how can we improve on this situation? The next section considers a different core geometry using high permeability soft material.

4. Another Approach.

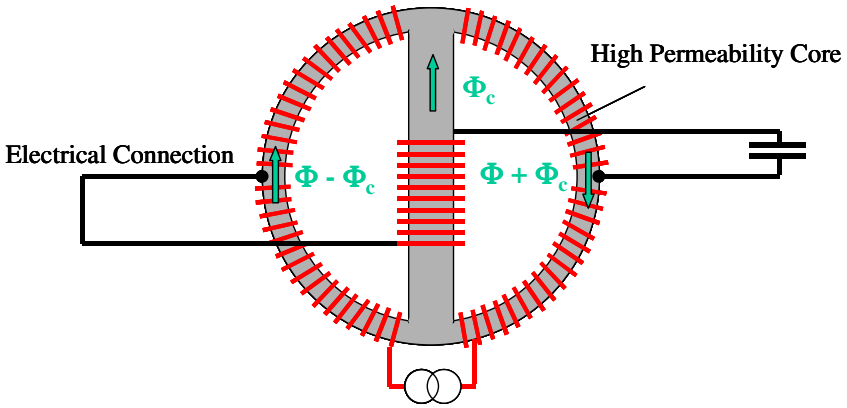
Consider the core shown in the next image. This is a ring core with another leg running diametrically across it, using high permeability conductive material such as iron. Electrical connections are made to each side of the ring core.



We now wind a toroidal coil around the ring core and feed it with DC so as to create a uniform field around the ring.



Finally we wind another coil on the central limb which when energized creates flux Φ_c that adds to the core flux on one side and subtracts on the other. We thus achieve the objective of having a field differential between the two electrical connections, thus creating the anomalous voltage.



We now connect the center coil in series with a capacitor and in series with the core connections. Since the anomalous voltage across the core now depends on the resonant circuit current which flows through the core, the core will act like a resistor and if we get the polarities right it will be a negative resistor. If that value of negative resistance exceeds the positive resistance losses of the tuned circuit, it will self-oscillate.