HYBRID HOMOPOLAR

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It is not possible to understand or account for the operation of a homopolar without taking into consideration the action of the magnetic field on both parts of the circuit i.e. the stator circuit and armature circuit. The reference frame of the magnet is unimportant. There can even be multiple magnets in multiple reference frames and their effects will still add. It is even possible to adjust the geometry of stator and armature so that there is no magnet at all, the only fields being from the stator and armature currents. One can also create hybrid designs with multiple mutually interacting elements, where one armature is both the stator and magnet for the next armature, for example.

Magnetic isolation is an unfruitful concept in designing homopolar generators. The homopolar works by interlocking flux loops with the circuit loop and then breaking that interlock without a cut, or vice versa. It is largely a topological phenomenon. All shielding will do is move the cut points, and make the homopolar larger than it needs to be. Use of ferrous material to close the magnetic loop and to increase flux densities, however, provides much advantage in many homopolar designs.

Fig.1 is a cross section of a hybrid homopolar design, wherein the distinction between armature and stator circuits is erased.

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     ----- ----- ----- ----- ----- -----       -----
     |   {o)   | |   (o)   | |   (o)   |      o)   |
     |   | |   | |   | |   | |   | |   |       |   |
     |N S| |N S| |N S| |N S| |N S| |N S|       |N S|
(+)  |   | |   | |   | |   | |   | |   | ...   |   |  (-)
 |   |   | |   | |   | |   | |   | |   |       |   |   |
 --- |   | |   | |   | |   | |   | |   |       |   | ---
 | (o)   | |   (o)   | |   (o)   | |   (o)       |   (o) |
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 --- ----- ----- ----- ----- ----- -----       ----- ---
 | (o)   | |   (o)   | |   (o)   | |   (o)       |   (o) |
 --- |   | |   | |   | |   | |   | |   |       |   | ---
     |   | |   | |   | |   | |   | |   |       |   |
     |   | |   | |   | |   | |   | |   | ...   |   |
     |N S| |N S| |N S| |N S| |N S| |N S|       |N S|
     |   | |   | |   | |   | |   | |   |       |   |
     |   {o)   | |   (o)   | |   (o)   |      o)   |
     ----- ----- ----- ----- ----- -----       -----
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Fig. 1

The central shaft and bearings, which are electrically insulated from the above, and may even not be conductive, are not shown. The configuration (o) represents a ball bearing raceway. The ball bearings in the raceway have the dual function of acting as brushes. Any conductive brush/bearing combination can be substituted. The rotating circular magnets with circular central holes are neodymium or other conductive material, or might be plated or metallic disk clad ceramic magnets. The important thing to the design is that adjacent segments rotate relative to each other, which can be achieved by having the central shaft attached to alternate segments and having the others held steady in mounts, or by driving adjacent pairs in opposite directions via friction wheel, belt, gear, or other mechanical means, or any combination of means. It is also possible to move the inner set of bearings to interface with the shaft, and to make the shaft conductive in segments. There are many variations. The important thing to note is that adjacent segments rotate relative to each other.

To get the greatest amount of mutual rotation for the least amount of g forces and bearing friction, the wheels should rotate in opposite directions to each other. So, it becomes unclear as to which is the stator and which the armature, and in fact the role can be reversed by changing which rotate at what rate and at what direction. It is even possible, by eliminating one rotating element, to have an odd number of stators, and even number of armatures, or vice versa.

The power takeoff for the unit above is at the final bearings/brushes. If ====== represents the above segments as a unit, and `II` represents a magnetic flux conduit, then it is possible to place these units in series to achieve any kind of generator dimensions, and to preserve or close the magnetic circuit, as in Fig. 2 for example.

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  (+)     --------
   |      | -     | series
II=======II       | electrical
II        II      | connection
II=======II       | between
   |      | +     | units
  (-)     --------

    Fig. 2
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