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EXTENSION TO PATENT APPLICATION 8204120
- AN ELECTRIC POWER TRANSFER SYSTEM -
MULTI-DEGREE-OF-FREEDOM POWER TRANSFER

Introduction

The original application suggested essentially one degree-of-freedom (1DOF) power transfer whereby the motion considered would be along the locus of a line which could be straight, curved or circular. The arrangement was most favourable when moving core portions provided wiping contact with stationary core portions, so that both could be simply supported without interference of structural or re-entrant elements, which restrict motion. There is no inherent reason why the moving surfaces need be constrained to 1DOF motion, and so simple two and three DOF structures could also be built. Simple structures would tend to have limited ranges of motion, but it is possible to provide, for example, a spherical arrangement giving 2DOF where one is continuous. Many other combinations exist.

Basic Concept

Figure 1 illustrates the basic concept. A moveable core with secondary winding is part of a magnetic circuit which also comprises a back core, primary winding and extended pole-face (magnetic cross sections are shown to be square, but they could equally be circular). The mating surfaces can be aligned to provide a uniform mechanical clearance, which for spherical motion demands convex and concave surfaces. Orthogonal motion of course requires only flat surfaces. A return path from the back core to the lower part of the moveable core is assumed.

Implementation

Figure 2 shows one form of a single phase 2DOF system. The system is electrically and mechanically bidirectional, that is, either side of the air gap can be made the primary or the secondary; it is likely that the more massive structure will be the primary, stationary member. Because of the multidimensional construction of the magnetic circuit, ferrite powder would be a suitable material choice. The primary yoke could have its perimeter either circular or made up of four chords, with the inner core being circular or square respectively. To restrict motion to favourable magnetic circuits, the yoke perimeter would probably incorporate a crash bar. A single circular ring joins top and bottom yokes to return flux. Alternatively the return path could be c-shaped to allow access to more of the inner core.

If the yoke is formed into a loop, then a single phase 3DOF structure with continuous roll and limited pitch and yaw is developed, Figure 3. A three phase structure with limited roll pitch and yaw is shown in Figure 4.

Combinations can be ganged up to provide polyphase versions, with the return flux ring positioned as appropriate.

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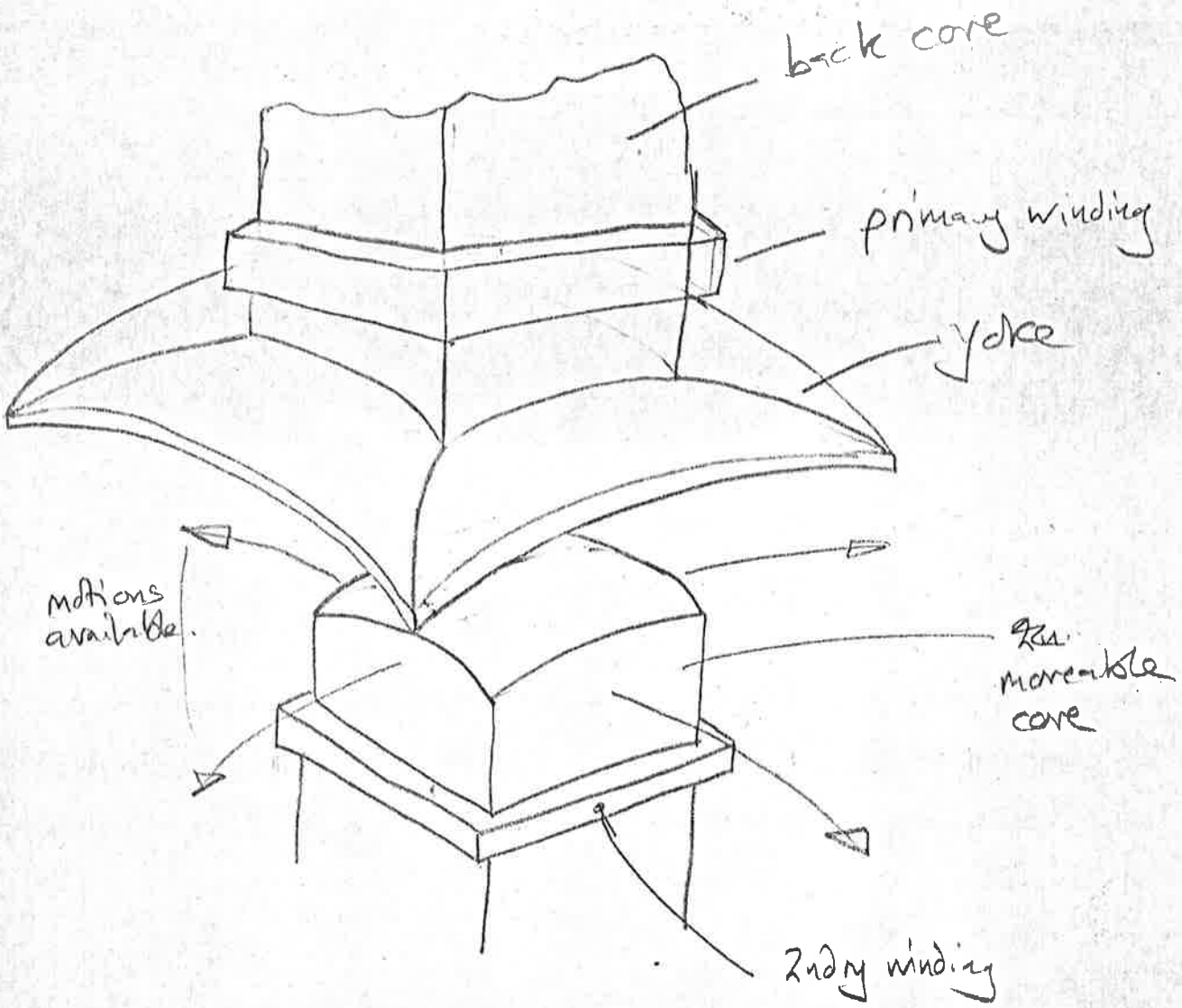

Fig 1 elemental representation of multi-degree-of-freedom power transfer.

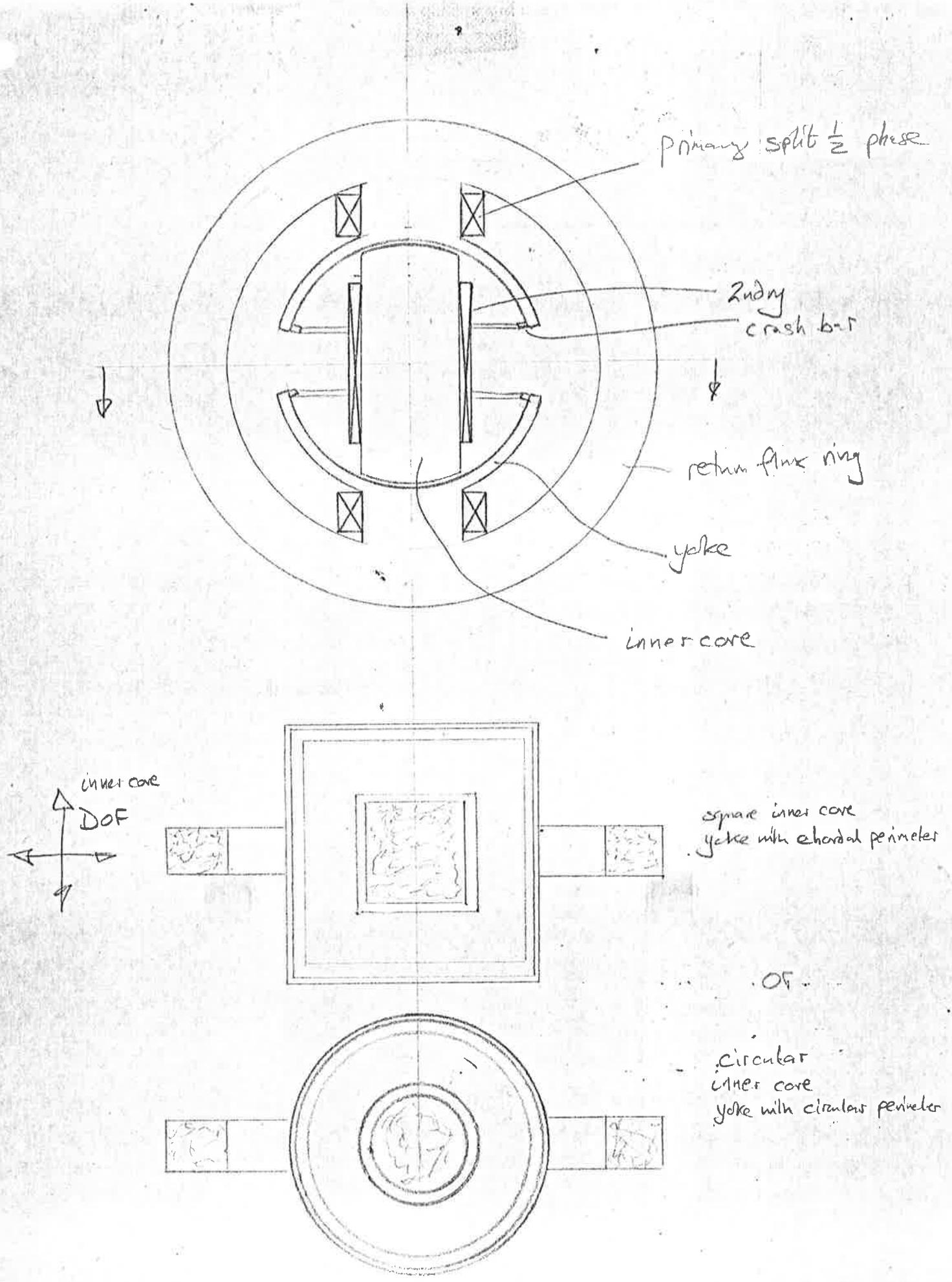

Fig 2. Single ϕ 2 DOF. inner core moves

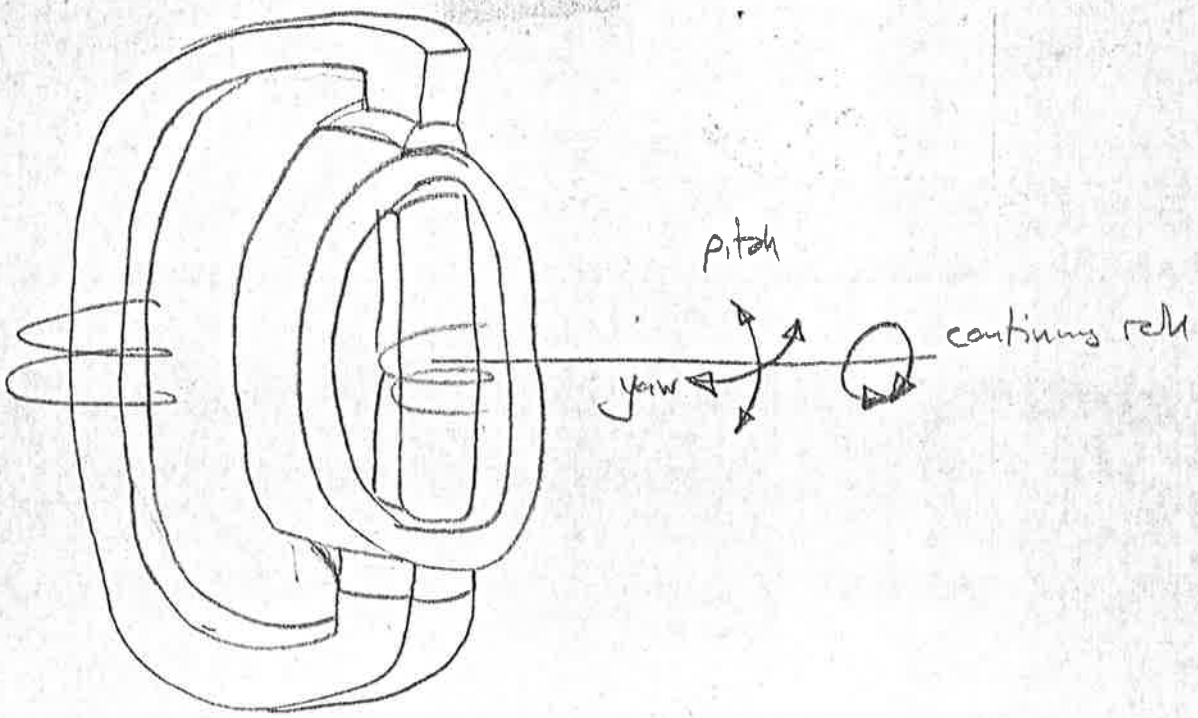

Fig 3 simple ϕ 3DOF

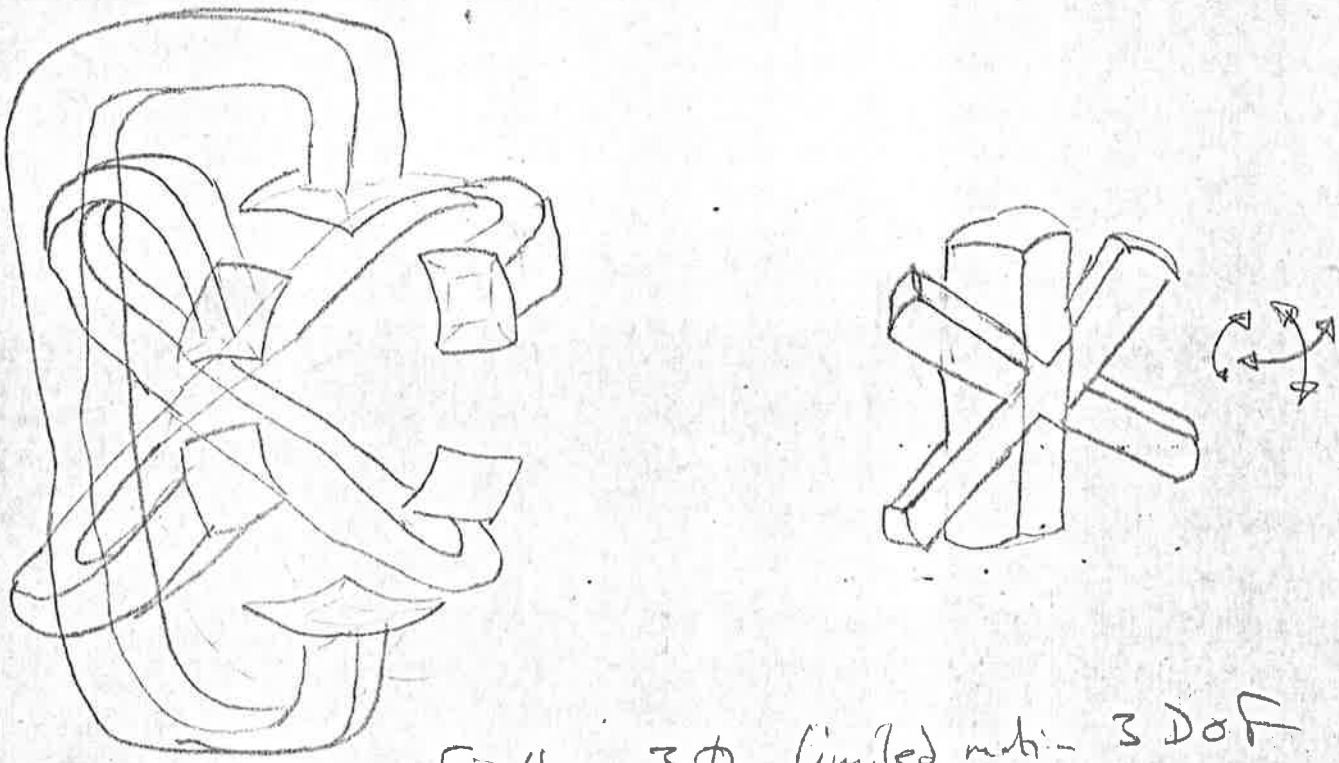

Fig 4 3ϕ limited motion 3DOF