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MAGNETIC COUPLINGS

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Fig. 2

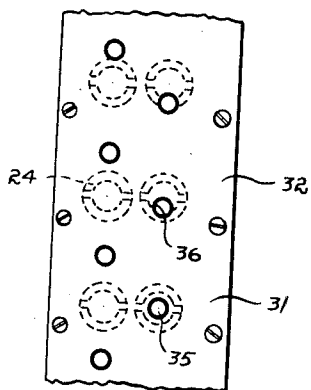


Fig. 1

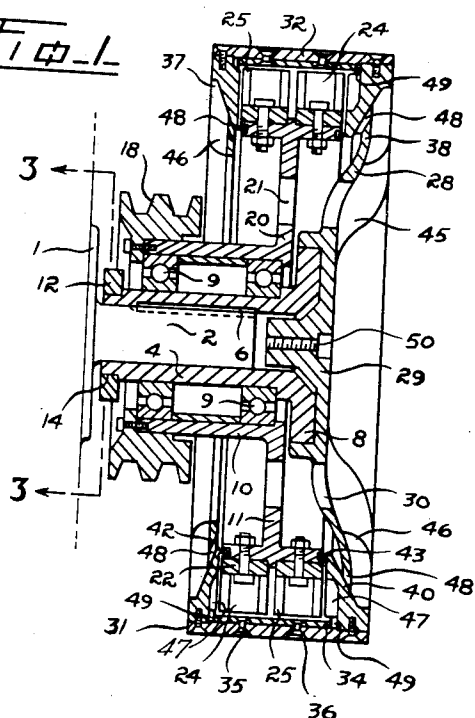


Fig. 3

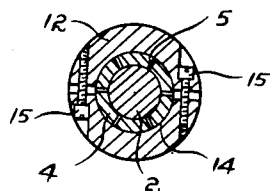
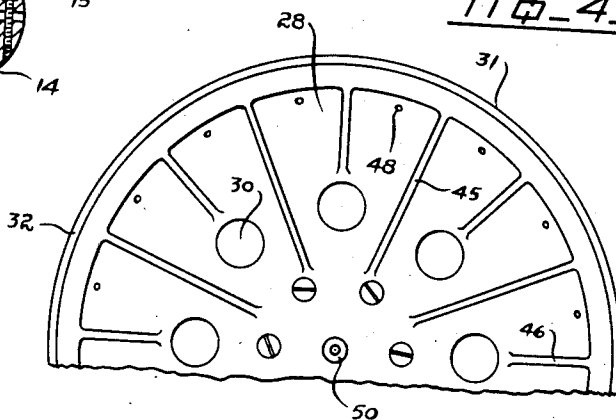


Fig. 4



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MAGNETIC COUPLINGS

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5 Claims. (Cl. 310—105)

Our invention relates to improvements in magnetic couplings.

The objects of the invention are to provide a compact eddy current type coupling using permanent magnets which is capable of transmitting industrial amounts of torque and or power within a range of 10 horsepower at 1800 revolutions per minute; to realize a predetermined slip-torque characteristic by which high efficiency can be combined with overload and stalling protection; to provide a structure whereby the full output of the motor normally driving the coupling will be converted into heat in the coupling in the event of indefinite stalling without damage to the coupling; to provide a disposition of the predominant heat producing element of the bimetallic plate surrounding the magnetic rotor close to the external surfaces of the coupling, and to provide for adequate air flow past said element to prevent undue expansion and distortion radially, so that the desired narrow air gap between magnets and bimetallic rotor may be maintained and that the torque under stalled conditions does not drop as the coupling is heated, and to provide a totally enclosed structure for the magnetic rotor to prevent contamination.

Referring to the accompanying drawings:

Figure 1 is a longitudinal sectional view of the invention.

Figure 2 is an extended fractional plan view of the copper band of the bimetallic rim showing the relative disposition of the rivets and their relation to the magnets of the rotor.

Figure 3 is a detail sectional view of the clamping washer or lock ring, taken on the line 3—3 of Figure 1.

Figure 4 is a part elevational view of the coupling carrier plate or front of the housing.

In the drawings like characters of reference indicate corresponding parts in each figure.

The numeral 1 indicates an electric motor having a drive shaft 2. Fitted upon the shaft 2 is a hollow hub 4 which is slotted at its inner end as at 5 to permit circumferential contraction of the hub onto the inner end of the shaft. A key 6 is used to secure the hub 5 to the drive shaft.

The hub 4 is flanged as at 8 and is fitted with a pair of bearings 9 which support the hub sleeve 10 of the magnetic rotor 11. The hub 4 is held against endwise movement along the shaft 2 by a split clamping washer 12 which is fitted into a groove 14 at the inner end of the hub and which is tightened thereabout by lock screws 15, see Figure 3.

A drive pulley 18 is mounted upon the inner end of the hub sleeve 10 in close proximity to the end of the housing of the motor 1. It will be noticed that since the work done by the pulley is delivered close to the outer bearing of the motor, there is no need for any stationary bearing beyond the end of the motor shaft and that the motor and coupling form a single unit which is exceedingly compact and which is incapable of any disalignment between the operating elements.

The hub sleeve 10 is provided with a flange 20 having vent openings 21 and an annular rim 22 to which two rows of permanent magnets 24 are secured with their poles 25 extending radially therefrom. The magnets are arranged in pairs as shown in Figure 1, with their north and south poles arranged preferably circumferentially and at any desired spacing.

An end plate 28 having an inwardly directed hub 29 is concentrically secured upon the flange 8 of the hub and is provided with a circular row of openings 30 to coincide with the openings 21 of the magnetic rotor flange 20. The end plate 28 carries an annular bimetallic rotor 31 which consists of a metallic band 32, preferably of mild steel, inside of which a copper band 34 is intimately secured by steel rivets 35. These rivets are arranged in two circumferential rows as shown in Figure 2 and the rivets of one row are staggered in respect to those of the other row and are recessed within the outer surface of the steel band 32 as at 36. The circumferential spacing of the rivets differs from the spacing of the magnets 24 so that no one magnet can be in register with two or more rivets in the bimetallic rotor 31. In addition the number of rivets in each row is equal to one more or one less than the number of magnets in a single row, so that no magnetic pulsation is set up between the drive and driven rotors.

The inner end of the steel band 32 is fitted with an internal annular flange 37 which in cross section is substantially similar to the outer peripheral portion 38 of the end plate 28. The flange 37, the bimetallic rotor 31 and the peripheral flange portion 38 form a housing 40 for the magnetic rotor 11 and serve to enclose the magnets and to keep them free from dust particles and serve as radiating members to dissipate heat generated within said housing. The inner edge of the parts 37 and 38 are provided with inturned ribs 42 which project into circumferential grooves 43 formed in the edge of the annular rim 22 of the magnetic rotor 11. The parts 37 and 38 are each provided with radiating fins 45 and 46 on their outer faces and vanes 47 on their inner faces and are also provided with circumferentially disposed vent orifices 48 through which air currents set up by the rotation of the flange 20 and the parts 37 and 38 are caused to flow to cool the housing 40 and dissipate the heat generated in said housing.

The edges of the copper band 34 are spaced from the inner face of the flange 37 and the peripheral flange portion 38 to define dilation grooves 49 into which the copper band may expand laterally while its surface remains in intimate contact with the steel band 31. The staggered arrangement of the rivets 35 and the dilation grooves overcome the tendency of the copper to buckle in expanding, which is essential in order to maintain constant torque by preventing fluctuation in the air gap between the magnets and the bimetallic rotor due to heat generated in the copper element thereof.

The boss 29 of the end plate 28 is drilled and threaded as at 50 to receive a bolt for the purpose of removing said end plate from the coupling.

The recessing 36 of the rivets 35 creates a turbulent air flow over the steel band area which adds materially in the heat dissipation from both the steel and the copper bands of the bimetallic rotor 31. By providing the annular flanges 37 and 38 as enclosing members for the rotors and providing fins 45 and 46 thereon heat is again reduced.

The staggered disposition of the rivets provide a strong mechanical binding between the copper and steel bands and reduces the tendency of the copper band to buckle radially under thermal stress due to the fact that there is only one rivet on any line parallel to the axis of the rotor, so that said band is perfectly free to expand transversely towards the dilation grooves 49, they also provide

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a good path for the magnetic flux, thus enabling high industrial amounts of torque and power transmission to be realized.

What we claim as our invention is:

1. A slip torque coupling comprising a unit having a drive rotor and a driven rotor, said drive rotor having a hub projecting to one side of said unit and adapted to be fitted to the shaft of a motor, a hub sleeve journaled on said hub, an annular rim supported in widely spaced relation from said hub sleeve, said rim being fitted with a row of circumferentially spaced magnets, a flange supported from the outer end of said hub, said flange having a bimetallic cylindrical band in close proximity to the pole pieces of the magnets, one edge of said bimetallic cylindrical band being fitted with an internal flange, said internal flange and a substantially similar portion of the first named flange forming with the cylindrical band and the magnet carrying rim a housing enclosing the row of magnets, said bimetallic band consisting of an outer element of magnetic material and an inner element of non-magnetic material, said inner element being attached to the outer element by a zig zag row of rivets, all of said rivets being a substantial distance from the edges of the band.

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2. A slip torque coupling as claimed in claim 1, wherein no two of said rivets are placed on a line extending parallel to the axis of the bimetallic band.

3. A slip torque coupling as claimed in claim 1, wherein the inner lamination of the bimetallic band is spaced from the inner and outer flanges to define dilation grooves.

4. A slip torque coupling as claimed in claim 1 wherein the rivets are at least one more in number than the number of magnets in a single row.

5. A slip torque coupling as claimed in claim 1 wherein the rivets are at least one less in number than the number of magnets in a single row.

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