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Inventor C. P. Cho
William P. Krol, Jr.

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1 Navy Case No. 77074

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3 A SQUIRREL CAGE TYPE ELECTRIC

4 MOTOR ROTOR ASSEMBLY

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6 STATEMENT OF GOVERNMENT INTEREST

7 The invention described herein may be manufactured and used
8 by or for the Government of the United States of America for
9 governmental purposes without the payment of royalties thereon or
10 therefor.

11
12 BACKGROUND OF THE INVENTION

13 (1) Field of the Invention

14 The invention relates to electric motors, and is directed
15 more particularly to an improved squirrel cage rotor for use in
16 electric motors.

17 (2) Description of the Prior Art

18 Two types of electric motors in common use are (1) the
19 permanent magnet motor, and (2) the induction motor. In the
20 permanent magnet motor, permanent magnets typically are disposed
21 in a rotor assembly which is surrounded by, or otherwise adjacent
22 to, a stator having electrical windings thereon. Application of
23 electrical current to the stator windings induces a reaction in
24 the permanent magnets of the rotor, causing the magnets to move
25 and, thereby, the rotor to turn. The permanent magnet motor
26 initially is of high efficiency, but in due course the efficiency

1 decreases, as does reliability, as the magnetic strength of the
2 permanent magnets decreases. In induction motors, the rotor
3 assembly comprises a generally cylindrically-shaped unit wherein
4 the sides of the unit are formed by a series of spaced
5 electrically conductive metal bars, extending from one end of the
6 rotor to the other. An associated stator assembly is disposed
7 around the rotor and includes electrical windings. When
8 electrical current is applied to the stator windings, the
9 electrical field provided creates eddy currents in the metal
10 bars, causing the bars to move, and thereby, the rotor to rotate
11 within the stator. Because of the cage-like configuration of the
12 rotor, it is commonly referred to as a squirrel cage rotor, and
13 motors in which such rotors are present are referred to as
14 "squirrel cage" induction motors. The induction motor is
15 reliable, rugged, simple, and inexpensive. However, the
16 efficiency of the induction motor is substantially lower than
17 that of the permanent magnet type.

18 There is a need for an induction motor having the aforesaid
19 advantages of the squirrel cage motor, but having improved
20 efficiency.

21 22 SUMMARY OF THE INVENTION

23 Accordingly, an object of the invention is to provide a
24 squirrel cage type motor rotor assembly which provides to an
25 electric motor of which the rotor is a part, the customary

1 advantages of a squirrel cage motor, but also provides
2 efficiencies approaching those of permanent magnet motors.

3 With the above and other objects in view, as will
4 hereinafter appear, a feature of the present invention is the
5 provision of a squirrel cage type electric motor rotor assembly
6 comprising first and second plates of circular configuration,
7 rigid tubes extending from the first plate to the second plate,
8 the tubes being closed at either end thereof to define enclosed
9 chambers therein, and granules of magnetic material disposed in
10 said chambers and having sufficient freedom of movement to align
11 with magnetic fields.

12 In accordance with a further feature of the invention, the
13 assembly is provided with electrically conductive solid metal
14 bars extending from the first plate to the second plate.

15 The above and other features of the invention, including
16 various novel details of construction and combinations of parts,
17 will now be more particularly described with reference to the
18 accompanying drawings and pointed out in the claims. It will be
19 understood that the particular device embodying the invention is
20 shown by way of illustration only and not as a limitation of the
21 invention. The principles and features of the invention may be
22 employed in various and numerous embodiments without departing
23 from the scope of the invention.

1 materials can serve the purpose, as can coarser grades of
2 granules. The granules 20 substantially fill the chamber 18, as
3 shown in FIG. 3, but are packed therein with a density leaving
4 them readily movable to align with magnetic fields.

5 Referring again to FIG. 1, the improved squirrel cage rotor
6 includes the usual electrically conductive solid metal bars 22
7 extending from first end plate 10 to second end plate 12. As
8 shown in FIGS. 1 and 2, bars 22 are disposed proximate
9 peripheries 24 of first and second end plates 10, 12, and tubes
10 14 are disposed nearer center portions 26 of end plates 10, 12
11 than are bars 22. The bars 22 and tubes 14 are arranged in
12 circular fashion on end plates 10, 12 concentrically around a
13 central shaft 28 on which the end plates are rotatably mounted.
14 The circle of bars 22 is disposed concentrically with, and
15 outwardly from, the circle of tubes 14.

16 The new rotor is thus a combination of the known squirrel
17 cage rotor and a permanent magnet rotor. Upon excitation of a
18 stator adjacent the above-described rotor, the magnetically
19 active tubes 14 provide a substantially increased electrical
20 field, with substantially increased eddy currents in bars 22.
21 The result is a substantial increase in power output for a motor
22 of given size, or, for a desired output, a reduction in the size
23 of motor required. Motor efficiency is greatly improved.
24 Further, by varying the current applied to an adjacent stator,
25 the strength of the permanent magnet field may be varied,
26 providing improved control. Still further, after depletion of

1 magnetic strength of the magnetic material, the rotor still
2 functions as a customary squirrel cage rotor, increasing
3 reliability and active motor life relative to known permanent
4 magnet motors.

5 Referring to FIG. 4, there is illustrated an alternative
6 embodiment in which tubes 14 are filled with a liquid 30 and the
7 granules 20 are disposed in the liquid. The liquid 30 is of
8 substantially the same density as granules 20, such that the
9 granules are free to move in liquid 30 to self-align with an
10 applied force field.

11 Referring to FIG. 5, there is illustrated another
12 alternative embodiment in which each of granules 20 is embedded
13 in a sphere 32 of non-electrically conductive and non-magnetic
14 material, such as a plastic material.

15 There is thus provided a squirrel cage type motor rotor
16 assembly which provides to an electric motor of which the rotor
17 is a part the known advantages of a squirrel cage motor, and
18 further provides improved efficiencies approaching those of
19 permanent magnet motors.

20 It is to be understood that the present invention is by no
21 means limited to the particular construction herein disclosed
22 and/or shown in the drawings, but also comprises any
23 modifications or equivalents

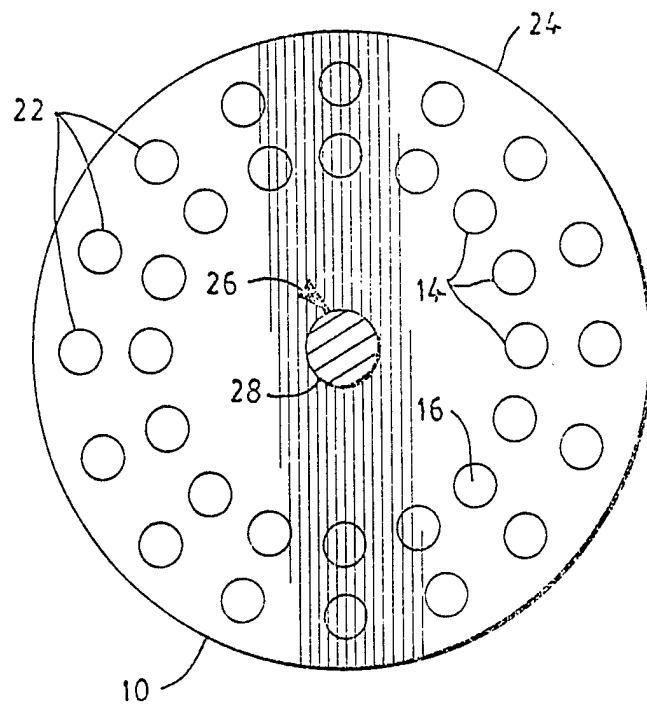
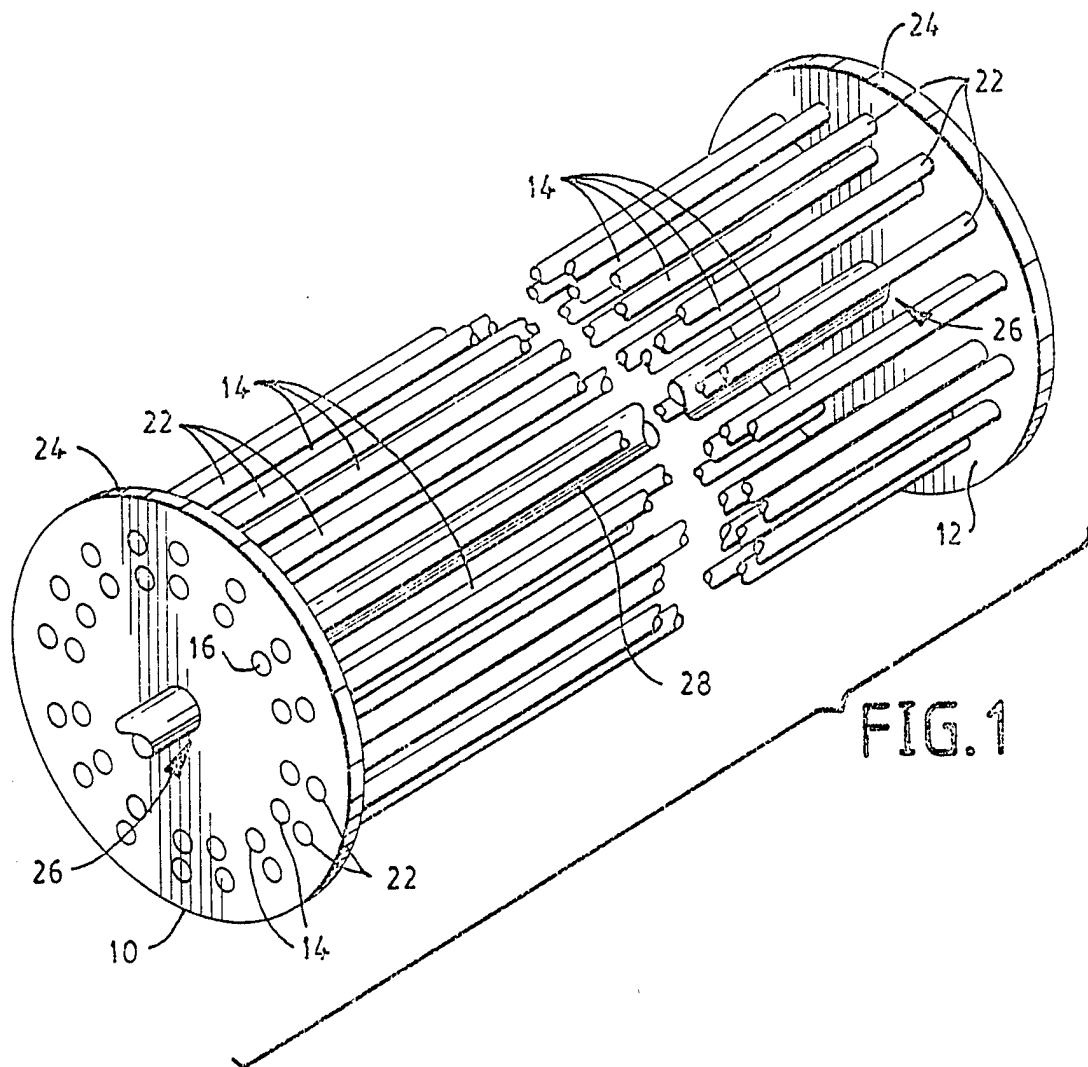
1 Navy Case No. 77014

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3 A SQUIRREL CAGE TYPE ELECTRIC

4 MOTOR ROTOR ASSEMBLY

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6 ABSTRACT OF THE DISCLOSURE

7 A squirrel cage type electric motor rotor assembly includes
8 first and second end plates of circular configuration, rigid
9 tubes extending from the first plate to the second plate, the
10 tubes being closed at either end thereof to define enclosed
11 chambers therein, and granules of magnetic material disposed in
12 the chambers, the granules being packed therein with a density
13 leaving them readily movable to align with magnetic fields.



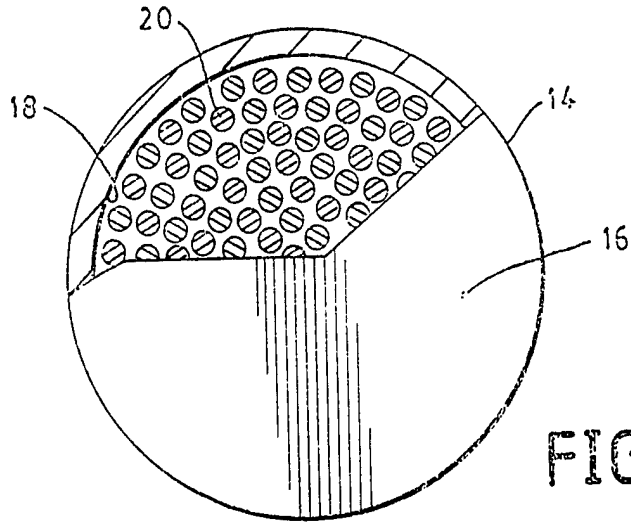


FIG. 3

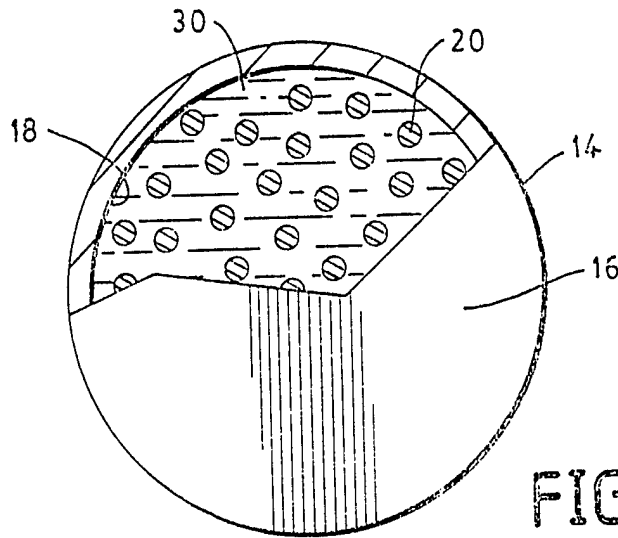


FIG. 4

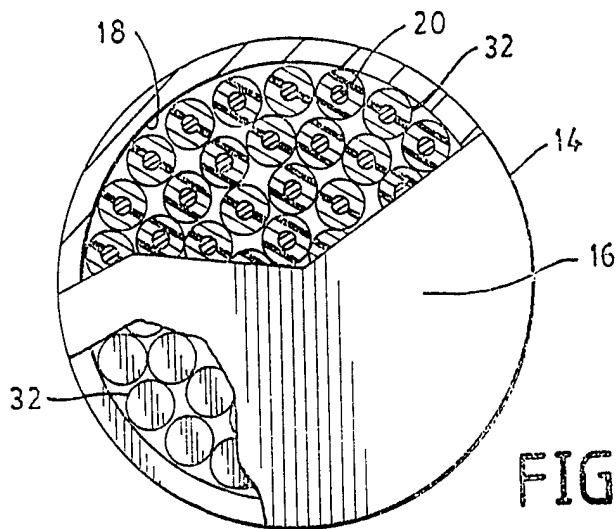


FIG. 5