

United States Patent

Johnson

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[54] **ELECTROMAGNETIC DEVICE WITH CAST MAGNETIC PATH**

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Related U.S. Application Data

- [63] Continuation of Ser. No. 817,655, Apr. 21, 1969, abandoned.
[52] U.S. Cl. 336/83, 310/42
[51] Int. Cl. H01f 15/02
[58] Field of Search 310/42, 43, 44, 254; 336/83

[56] **References Cited**

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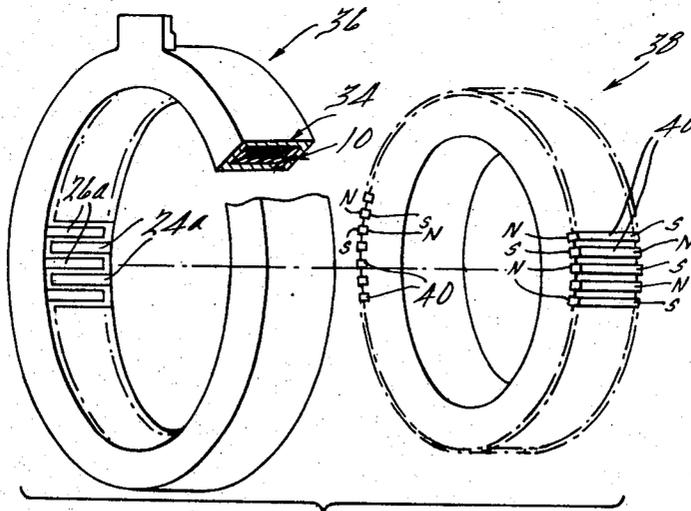
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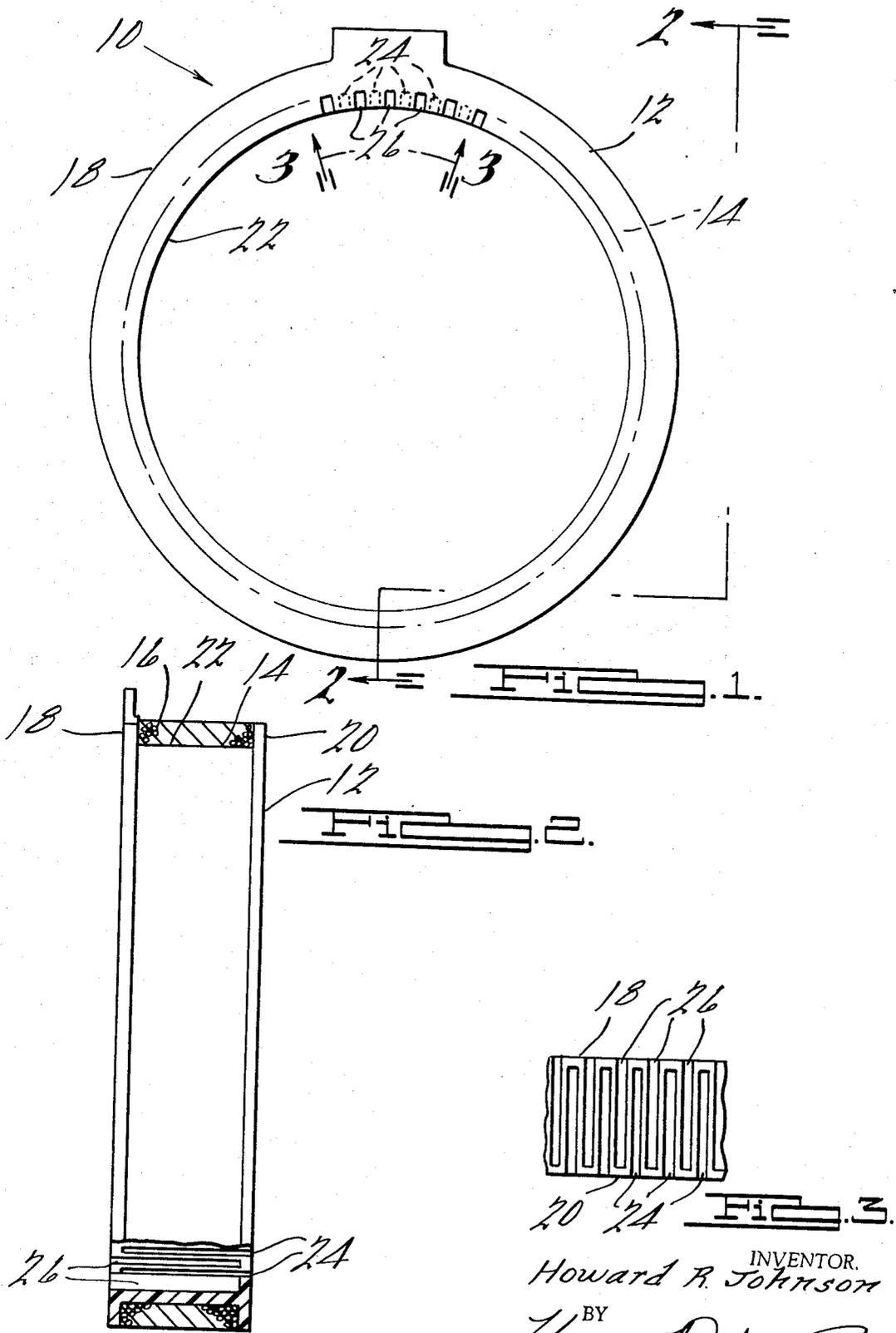
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[57] **ABSTRACT**

An electromagnetic device utilizing a coil and having a cast magnetic path around the coil and a method of manufacture.

4 Claims, 5 Drawing Figures





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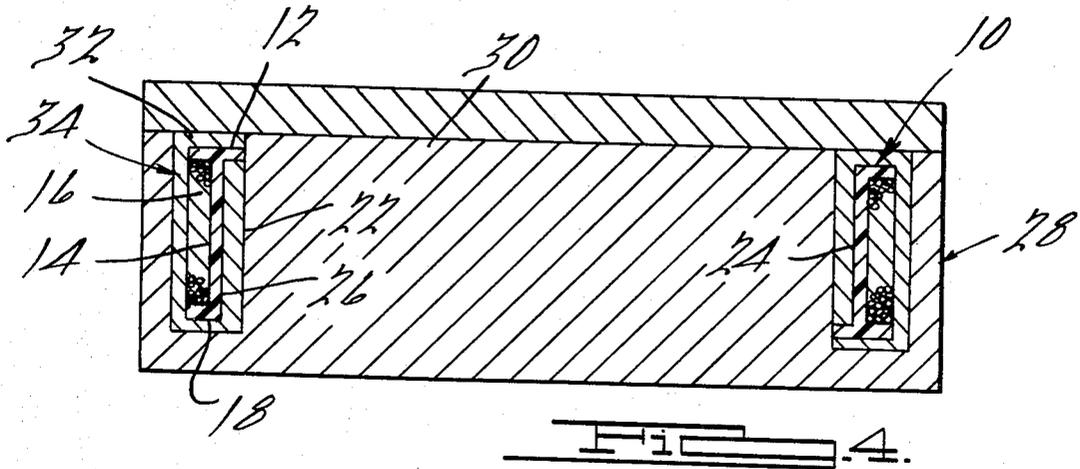


FIG. 4.

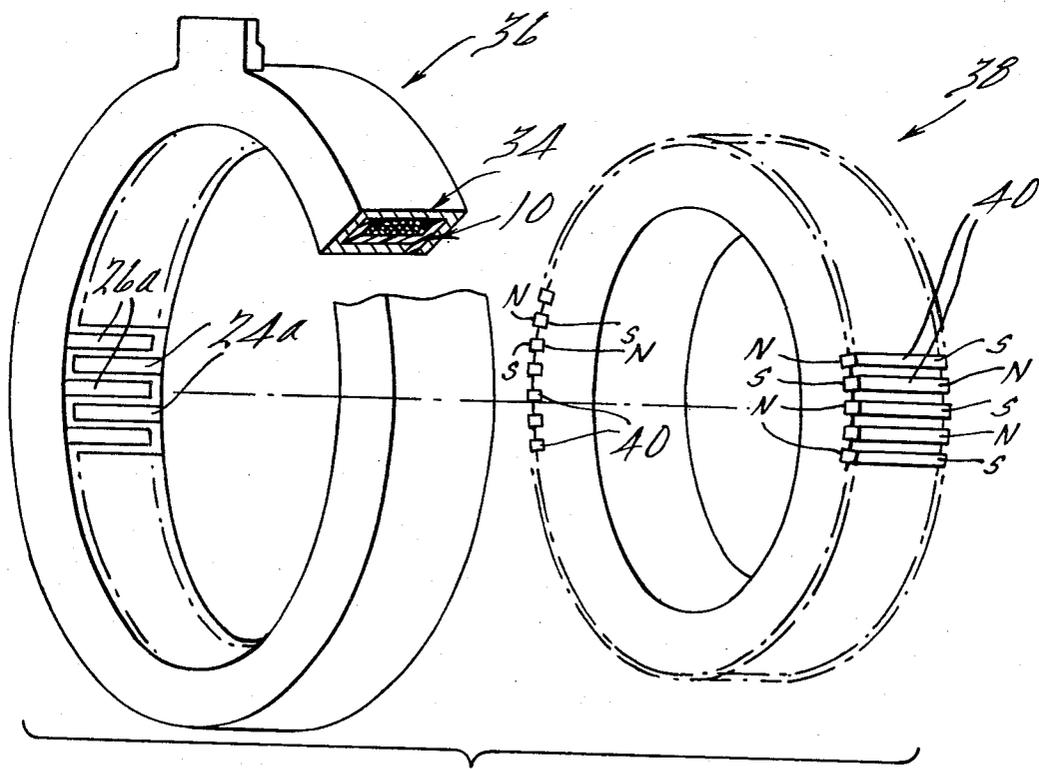


FIG. 5.

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ELECTROMAGNETIC DEVICE WITH CAST MAGNETIC PATH

This application is a continuation of Ser. No. 817,655 filed Apr. 21, 1969 and now abandoned

SUMMARY BACKGROUND OF THE INVENTION

The present invention relates to electromagnetic apparatus including a coil with the coil having a cast magnetic path and a method of manufacturing the same.

In the past, electrical devices, such as generators, utilizing a coil have had magnetic paths provided by relatively expensive or complex constructions. In the present invention, the coil is wound and supported in a bobbin and the structure of the magnetic path is cast around the coil. This structure can be cast with precision whereby further machining is not required or at least is minimal. Therefore it is an object of the present invention to provide a new and improved coil assembly construction and method for electrical apparatus.

The present construction has been found to be particularly useful in the construction of electrical generating devices used as speed sensors for skid control systems. Therefore it is another object to provide a novel coil assembly construction and method for use in electrical generating devices.

FIG. 1 is a side elevational view of a coil and bobbin assembly for use in the present invention;

FIG. 2 is a partial sectional view of the assembly of FIG. 1 taken substantially along the lines 2—2;

FIG. 3 is a view of the assembly of FIG. 1 taken generally in the direction of lines 3—3;

FIG. 4 is a view depicting the formation of the cast magnetic path around the coil and bobbin assembly; and

FIG. 5 is a pictorial, exploded view of the final formed coil assembly in a generator assembly.

Looking now to FIGS. 1-3 a coil and bobbin assembly 10 includes a plastic, annular bobbin 12 having an annular, radially outer channel 14 and a coil 16 circumferentially wound in the channel 14. The channel 14 is defined by a pair of radially outwardly extending flanges 18 and 20 and an annular ring portion 22. The ring portion 22 has a first plurality of axially extending grooves 24 (extending from the flange 20) and a second set of axially extending grooves 26 (extending from flange 18). Grooves 24 and 26 are located alternately relative to each other around the circumference of the ring portion 22.

Next the structure for the magnetic path is cast around the coil and bobbin assembly 10 in the manner shown in FIG. 4. The assembly 10 is located in a die 28 (diagrammatically shown) with the die 28 including a spindle 30 on which the radially inner surface of the ring portion 22 of the bobbin 12 closely nests. The remainder of the die 28 defines a housing 32 which is spaced from the remaining portion of the coil and bobbin assembly 10. Next a mixture of ferro magnetic powders and a resin carrier is injected into the die 28 to fill the spaces remaining around the coil and bobbin assembly 10 including the grooves 24 and 26. It has been found that a mixture of 86 percent spherical ferro (iron) powder and 14 percent resin provides a satisfactory construction. The high concentration of iron is desirable to provide good magnetic structure 34 which substantially completely encircles the coil and bobbin assembly 10 and provides a good magnetic path around the coil 16. As shown in FIG. 5, the coil and bobbin assembly 10 and cast structure 34 comprise a stator assembly 36 which is used with a rotor assembly 38. The rotor assembly 38 is concentric with stator assembly 36 and includes a plurality of magnets 40 located circumferentially such that one magnet is in radial alignment with each of the fingers 24a and 26a (defined by that portion of magnetic structure 34 located in bobbin grooves 24 and 26). Alternate ones of magnets 40 are of opposite polarity. Thus on rotation of rotor assembly 38

such that the north poles of magnets 40 are in line with fingers 24a and south poles are in line with fingers 26a flux will travel in one direction through structure 34 around coil 16; upon further rotation the north poles will be in line with fingers 26a and south poles will be in line with fingers 24a resulting in flux traveling in the opposite direction through structure 34 around coil 16. The alternate flux reversals around coil 16 through magnetic structure 34 will result in an alternating current being generated in coil 16. The result is an inexpensive stator assembly 36 having good electrical characteristics.

While the structure and method of the present invention have been shown and described in conjunction with a stator construction, features of the invention are applicable to other electromagnetic devices.

While it will be apparent that the preferred embodiment of the invention disclosed is well calculated to fulfill the objects above stated, it will be appreciated that the invention is susceptible to modification, variation and change without departing from the proper scope or fair meaning of the invention.

I claim:

1. A stator for an assembly of a rotor and stator comprising: an annular bobbin of high reluctance material having a plurality of grooves located to confront said rotor and defining spaced bobbin projections with each projection having a surface confronting said rotor, a coil wound on said bobbin, and a unitary integral structure comprising a composition of powdered material generally having a low reluctance and a bonding agent for said powdered material, said unitary structure being cast around said bobbin and said coil so as to at least partially encapsulate said bobbin and said coil to define a magnetic path about said coil, being cast in said grooves so as to substantially completely fill said grooves to define a plurality of fingers with each finger having a surface confronting said rotor, being cast to define path means which magnetically connects said fingers to said magnetic path about said coil, and being cast to provide smooth and continuous surface confronting said rotor comprising said surfaces of said bobbin projections confronting said rotor and said surfaces of said fingers confronting said rotor.

2. The stator of claim 1 with alternate ones of said fingers defining magnetic paths in opposite directions around said coil.

3. The stator of claim 1 with said powdered material comprising a high ratio of iron powders.

4. A stator for an assembly of a rotor and stator comprising: an annular bobbin of high reluctance material having a plurality of grooves located to confront said rotor and defining spaced bobbin projections with each projection having a surface confronting said rotor, a coil wound on said bobbin, and a unitary integral structure comprising a composition of powdered material generally having a low reluctance and a bonding agent for said powdered material, said unitary structure being cast around said bobbin and said coil so as to at least partially encapsulate said bobbin and said coil to define a magnetic path about said coil, being cast in said grooves so as to substantially completely fill said grooves to define a plurality of fingers with each finger having a surface confronting said rotor and pair of ends, being cast to define path means which magnetically connects one end of each of said fingers to said magnetic path about said coil, and being cast to provide smooth and continuous surface confronting said rotor comprising said surfaces of said bobbin projections confronting said rotor and said surfaces of said fingers confronting said rotor, said bobbin including a portion adjacent the other end of each of said fingers so as to interpose a high reluctance between said other end of each of said fingers and said magnetic path about said coil.

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