



PATENT SPECIFICATION

DRAWINGS ATTACHED

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Int. Cl.:—H 02 h 11/00

COMPLETE SPECIFICATION

Electric Motor

We, RADIO CORPORATION OF AMERICA, a Corporation organized under the laws of the State of Delaware, United States of America, of 30, Rockefeller Plaza, City and State of New York, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to alternating current motors of a type having transformer windings coupled to the motor field windings.

In electronic instruments containing alternating current (a—c) motors, such as phonographs or tape recorders, an additional winding inductively coupled to the motor field winding may be used in the power supply for the electronic portions of the instrument. Cost and space savings are realized by this arrangement since there is no requirement for a separate power transformer. However, the advantages are offset by inferior and inefficient motor performance. One reason for the degraded motor operation is that a pulsating direct current (d—c) flux is introduced into the motor iron when a power supply is connected to the additional winding.

Another problem with the combined motor transformer structure is that with a motor of a given size, there is a limited space for the two windings. Thus a relatively small wire size is required to achieve the necessary number of turns in the field winding and the additional winding. The small wire size increases the power dissipation and heat generated by motor transformer structure.

It is an object of this invention to provide an improved a—c motor transformer structure which exhibits efficient motor performance while supplying substantial power to an a—c, d—c power supply.

According to the invention we provide a combined motor transformer comprising: a motor armature; a magnetic core structure

providing a first magnetic flux path through a plurality of pole pieces and said motor armature; a field winding positioned on said magnetic core structure adapted to be connected to an alternating source of power; said magnetic core structure providing a second flux path in parallel with said first magnetic flux path, said second flux path providing a flux path for bypassing a portion of the magnetic flux created by said field winding from flowing in the flux path through said motor armature; an additional winding electromagnetically coupled to said field winding to provide an output source of alternating current through transformer action between said field winding and said additional winding, and circuit means coupled to said additional winding for causing a direct current to flow through said additional winding.

FIGURE 1 is a top view of the combined motor-transformer structure according to an embodiment of the invention;

FIGURE 2 is a side view of the motor-transformer of FIGURE 1; and

FIGURE 3 is a schematic diagram of the inter-connections between the combined motor-transformer of FIGURE 1 and associated electronic equipment.

In referring to the drawings, like reference numerals designate the same components throughout. FIGURE 1 illustrates a combined motor-transformer 10 according to an embodiment of the invention. The motor in the present example is a shaded pole motor, a type commonly used in driving phonograph turntables and tape recorders etc. The shaded pole motor of FIGURES 1 and 2 includes a substantially rectangular core or stator 12. The core 12 is composed of a stack of laminations, stamped from sheets of magnetic iron or other appropriate material, held together by rivets 14 and 16.

A leg 19 is formed at one end of the core 12 on which a coil of wire 21 is mounted. The core 12 provides a substantially circular



opening 20 for receiving a cylindrical squirrel-cage rotor or armature 22. The laminations of the core 12 have grooves 24 in diametrically opposing sides of the opening 20 forming the pole pieces for driving the armature 22. Two shading coils 25 surround each pole piece and form the auxillary phase for shaded pole motor operation.

The shaft 26 of armature 22 is journaled for rotation in the bearings 28 and 30 attached to the opposite side of the core 12 (FIGURE 2).

An electromagnetic flux path that parallels the path through core 12 is provided by a substantially rectangularly shaped shunt core member 32. The shunt core member 32 is composed of a stack of laminations of similar material to that used in the core 12 and is held together by rivets 38 and 16. The shunt core member 32 is formed with a central opening 34, and in the present example, is disposed in a plane parallel to that of core 12 with a core leg 36 underlying the core leg 19 of the core 12 (as viewed in FIGURE 2).

Both the core legs 19 and 36 are surrounded by the coil of wire 21 (FIGURE 1) which is secured on an insulating spool 42. The coil 21 includes two separate and concentric windings, the field or primary winding 44 having the input leads 48 and an additional or secondary winding 46 having the output leads 50 (FIGURES 1, 2 and 3).

The combined motor-transformer 10 is schematically illustrated in FIGURE 3 within a dashed block 52 and is shown connected with associated electronic equipment such as that found in tape recorders, phonographs, etc. The field 44 is adapted to be energized by a source of alternating current, such as that of a 115 volt 60 cycle wall socket, through an on-off switch 54 and a plug 56. The field winding 44 produces sufficient magnetic flux in the core member 12 to drive the armature 22, and also to power the secondary winding 46 through a transformer action between the two windings.

The secondary winding 46 is shown connected to a power supply 58 which includes a rectifier 60, and a filter circuit including a series resistor 62 and two shunt capacitors 64 and 66. The output of the power supply energizes an audio amplifier 68 and associated circuits which are connected to drive a loud-speaker 70 through an output transformer 72.

The d-c through the secondary winding 46 due to the rectifying action of rectifier 60, produces a pulsating d-c flux in the associated core. Without the attached shunt core 32, all the d-c flux flows through the core 12 thereby deleteriously affecting the operation of the motor. The addition of the shunt core member 32 provides a low reluctance flux path in parallel with the flux path of the core 12 thereby reducing the total amount of d-c flux that travels through the core 12 and armature 22, by a ratio dependent upon relative reluctances

of the two flux paths.

Since the shunt core 32 diverts a portion of the magnetic flux generated by the field winding 44, the motor design must be such that the field winding provides more flux than for a motor without the shunt, in order that the flux density through the armature 22 remains the same. To increase the amount of flux generated by the field winding 44, the number of turns of the winding 44 is reduced. The decrease in number of field winding 44 turns results in a decrease in the number of turns of the secondary winding 46 to keep a given transformer turns ratio. This in the total number of winding turns provides for extra space thereby enabling the use of wire having a larger diameter. For example, without the shunt core member 32, the field winding 44 required 1600 turns of a number 30 wire while the secondary winding 46 required 300 turns of number 27 wire.

With the shunt core member 32 the number of primary turns is reduced to 1200 turns of number 29 wire (larger diameter) while the secondary winding is reduced to 225 turns of number 24 wire (larger diameter). With the lower resistance windings (fewer turns of larger wire) permitted by the shunt 32 the motor efficiency was found to increase to 77% from 58% for a motor without a magnetic shunt but similarly loaded. There is less power dissipated in the lower resistance windings and accordingly the motor-transformer 10 operates at a lower temperature for a given amount of power output thereby reducing the heat dissipation problems associated with the design of an instrument using the motor-transformer.

WHAT WE CLAIM IS:—

1. A combined motor transformer comprising: a motor armature; a magnetic core structure providing a first magnetic flux path through a plurality of pole pieces and said motor armature; a field winding positioned on said magnetic core structure adapted to be connected to an alternating source of power; said magnetic core structure providing a second flux path in parallel with said first magnetic flux path, said second flux path providing a flux path for by-passing a portion of the magnetic flux created by said field winding from flowing in the flux path through said motor armature; an additional winding electromagnetically coupled to said field winding to provide an output source of alternating current through transformer action between said field winding and said additional winding, and circuit means coupled to said additional winding for causing a direct current to flow through said additional winding.

2. A combined motor transformer as claimed in Claim 1, wherein said field winding and said additional winding are on a common portion of said magnetic core structure.

3. A combined motor transformer as claimed in Claim 1, wherein said magnetic core struc-

decrease



opening 20 for receiving a cylindrical squirrel-cage rotor or armature 22. The laminations of the core 12 have grooves 24 in diametrically opposing sides of the opening 20 forming the pole pieces for driving the armature 22. Two shading coils 25 surround each pole piece and form the auxiliary phase for shaded pole motor operation.

The shaft 26 of armature 22 is journaled for rotation in the bearings 28 and 30 attached to the opposite side of the core 12 (FIGURE 2).

An electromagnetic flux path that parallels the path through core 12 is provided by a substantially rectangularly shaped shunt core member 32. The shunt core member 32 is composed of a stack of laminations of similar material to that used in the core 12 and is held together by rivets 38 and 16. The shunt core member 32 is formed with a central opening 34, and in the present example, is disposed in a plane parallel to that of core 12 with a core leg 36 underlying the core leg 19 of the core 12 (as viewed in FIGURE 2).

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The secondary winding 46 is shown connected to a power supply 58 which includes a rectifier 60, and a filter circuit including a series resistor 62 and two shunt capacitors 64 and 66. The output of the power supply energizes an audio amplifier 68 and associated circuits which are connected to drive a loudspeaker 70 through an output transformer 72.

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of the two flux paths.

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2. A combined motor transformer as claimed in Claim 1, wherein said field winding and said additional winding are on a common portion of said magnetic core structure.

3. A combined motor transformer as claimed in Claim 1, wherein said magnetic core struc-

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decrease



ture comprises a first motor core member providing said first magnetic flux path, and a second core member coupled to said first core member providing said second flux path.

- 5 4. A combined motor transformer as claimed in Claim 3, wherein said first and second magnetic core members each comprise a stack of iron laminations, said first magnetic core member defining two apertures therein, said
10 first aperture having a substantially cylindrical shape for insertion of a motor armature and providing the field poles for motor operation, said second aperture providing a portion of said magnetic core for winding a coil thereabout, and said second magnetic core member
15 defining an aperture therein for providing a portion of said second magnetic core member for winding a coil thereabout, said portions of said first and second core members being posi-

tioned in overlying relation to provide a common magnetic flux path. 20

5. A combined motor-transformer as claimed in Claim 1 wherein said circuit means includes a rectifier coupled to one end of said additional winding and adapted to cause a
25 direct current to flow therethrough.

7. A combined motor-transformer arranged substantially as herein described with reference to Figures 1 and 2 and adapted to power associated electronic equipment substantially as
30 herein described with reference to Figure 3 of the accompanying drawing.

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