Aug. 14, 1956 J. L. BONANNO 2,759,113

ALTERNATING CURRENT ELECTRIC MOTORS

Filed Oct. 28, 1953

Fig. 1.

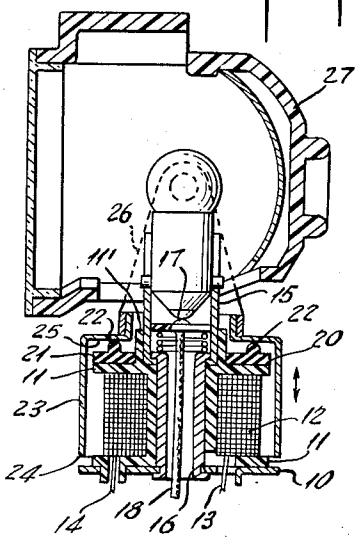


Fig. 2.

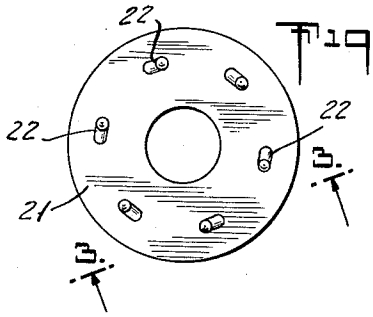


Fig. 3.

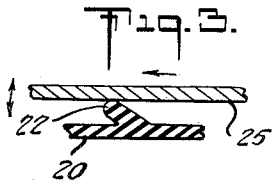


Fig. 4.

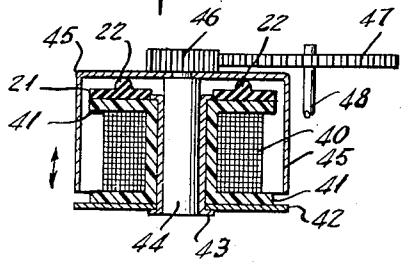


Fig. 6.

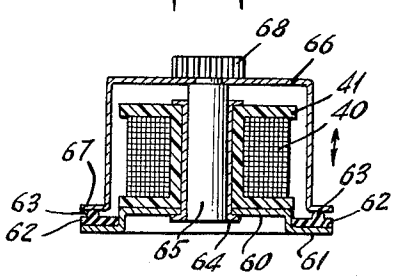
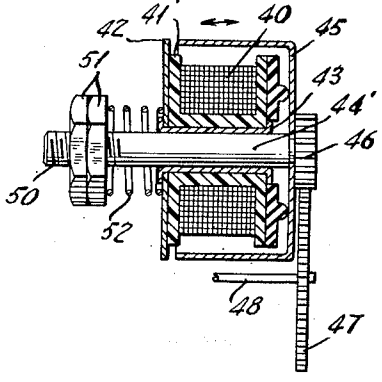


Fig. 5.



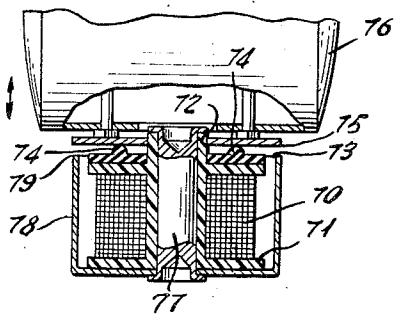


Fig. 7.

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United States Patent Office 2,759,113 Patented Aug. 14, 1956

2,759,113

ALTERNATING CURRENT ELECTRIC MOTORS

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Application October 28, 1953, Serial No. 388,743

7 Claims. (Cl. 310—20)

The present invention relates to alternating current electric motors and is more particularly directed toward electric motors suitable for developing small output for the operation of toys.

The present invention contemplates alternating current motors having a coil, an armature arranged to be attracted in the direction axial of the coil and having means to impart to the armature rotation about the axis of the coil.

In carrying out the present invention the armature is biased toward the coil with a constant force, usually gravity, and a plurality of circumferentially disposed resilient fingers tilted in a common angular direction to receive the load of the armature and the additional load due to the attraction of the armature by the coil as the flux builds up. These fingers thereupon impart a rotary impulse to the armature and, during the decay of the magnetic field, return to their normal dimension so that upon the next increase in attractive force, they again deform and again impart rotary movement to the armature.

The accompanying drawings show, for purposes of illustrating the present invention, several embodiments in which the invention may take form, it being understood that the drawings are illustrative of the invention, rather than limiting the same.

In the accompanying drawings:

Figure 1 is a vertical, sectional view through a toy search light employing one form of improved motor;

Figure 2 is a top plan view of the member carrying the resilient fingers;

Figure 3 is a fragmentary sectional view at an enlarged scale on the line 3—3 of Figures 1 and 2; and

Figures 4 to 7, inclusive, are vertical, sectional views showing the modified forms of construction.

In the form of motor shown in Figure 1 the parts are secured to a magnetizable base or plate **10**. This base carries a coil form **11** which receives a coil **12**. One terminal **13** is shown as grounded to the base **10**, the other lead to the coil is indicated at **14**. The outer normally grounded tubular member of a bayonet lamp socket is indicated at **15**. The socket and base **10** are secured together by a magnetizable tube **16**. The center contact of the lamp socket is indicated at **17** and is connected to wire **18** with suitable power source.

The upper face **20** of the coil form **11** receives a rubber-like washer **21**. This washer is provided with a plurality of circumferentially disposed rubber-like fingers **22** tilted in a common angular direction, as will be apparent from the drawings. While six fingers are shown, three or more fingers may be used.

The armature is here shown in the form of an inverted cup-shaped stamping **23** whose lower edge **24** of the armature is close to the magnetizable plate **10** so as to provide a circumferentially uniform air gap of variable length. The armature **23** has a flat upper surface **25** which rests on the resilient fingers. The armature is centered by an extension **11'** of the coil form. As shown

in Figure 1, the armature **23** carries a bracket **26** which supports a search light housing **27**. In this construction the armature with the search light provides a constant gravitational force urging the armature towards the fingers **22**, but insufficient to collapse them. The air gap between the top of the cup and the socket member **15** is fixed or constant.

When the coil is energized by alternating current, the armature is attracted downwardly, thereby compressing the fingers **22** so that these fingers, in bending down, impart an increment of turning movement to the armature. When the magnetic field decays, the resilient fingers lift the armature so that on the next increase in flux the operation is repeated. This will cause the armature to rotate, carrying the search light with it. A toy beacon (see Figure 7), suitable for a number of light beams, or any other load could be used instead of the search light body.

In Figure 4 the coil is indicated at **40**, the coil form at **41** and a magnetizable plate is shown at **42**, similar to the base plate **10** of Figure 1. These parts are held together by a tubular member **43**. The coil form **40** receives the washer **21** with fingers **22**, as above described. A shaft **44** received in the tube **43** is secured to a magnetizable armature **45** similar to the armature **23**. The shaft **44** carries a pinion **46** meshing with a gear **47** mounted on a shaft **48**. In this construction the tube **43** is preferably non-magnetizable material and the shaft **44** is preferably of magnetizable material, but if desired the tube **43** may be magnetizable and the shaft **44** made of non-magnetic material. This device will operate to rotate the armature in the manner above described. Here the load on the washer is the weight of the armature, the gear **46** and the shaft **44**.

Figure 5 shows a structure using substantially the same parts as in Figure 4, but mounted on a horizontal axis. The same reference characters are applied to the structure of Figure 5. Here the shaft **44'** is provided with a threaded extension **50** which receives an adjusting nut **51** and coil spring **52**. Here the spring tension is so adjusted as to provide a suitable load on the rubber fingers. The unit is a self contained one in which the plate **42** may be secured to an extraneous support in any desired manner.

Figure 6 illustrates a modified form of construction utilizing the same coil **40** and coil form **41**. Here the base **60** has a flange **61** which supports a rubber-like disk **62** with fingers **63**. The plate **60** is of magnetizable material and is secured to the coil form by a tube **64**. The tube **64** receives a shaft **65** which is secured to a cup shaped armature member **66**. The armature member **66** has a flange **67** which bears on the deformable fingers **63** and is drivingly connected with a gear **68**. The tube **64** is preferably made of non-magnetic material and the shaft **65** of magnetic material, but this can be reversed if desired.

The form shown in Figure 7 employs a coil **70** and coil form **71** with upwardly extending tubular guiding element **72** similar to the extension **11'** in Figure 1. The coil form receives the rubber-like ring **73** with fingers **74** as above described. These fingers support a magnetizable disk **75** which is here shown as supporting a beacon **76** adapted to emit light beams in two directions when a lamp bulb is carried within it.

A magnetic core member in the form of a rod **77** extends through the coil form and is secured to it and to a cup shaped magnetizable member **78**, whose upper edge **79** is close to the magnetizable armature **75**.

It will be understood that while the units shown in Figures 6 and 7 are illustrated in a form of construction suitable for using gravity as the biasing force for the armature, that these units can be constructed for operation on a horizontal axis by utilizing constructions

analogous to that of Figure 5 in which the biasing is obtained by a spring. While the drawings show the rubber fingers facing the armature, the washers may be used with the fingers facing the other way.

Motors such as shown herein have been found well suited for developing the small amount of torque necessary to operate beacons, search lights and other toy or exhibition devices where small torque and relatively low speeds is required. The magnetic circuits shown herein are very efficient due to the use of a rigid armature and the employment of a fixed and a variable air gap.

Since it is obvious that the invention may be embodied in other forms and constructions within the scope of the claims, I wish it to be understood that the particular forms shown herein are but several of these forms, and, various modifications and changes being possible, I do not otherwise limit myself in any way with respect thereto.

What is claimed is:

1. An electric motor comprising a coil, a magnetizable core in the coil, a magnetizable plate at one end of the coil, a magnetizable cup which receives the coil and has its peripheral edge adjacent the plate to provide a narrow variable air gap, means to fixedly secure one of the second and third mentioned magnetizable elements to the coil, means to mount the other of said second and third magnetizable elements for rotation about the axis of the coil and for movement in an axial direction with fixed air gap with respect to the core, and a resilient member between the coil and the rotatable element and provided with circumferentially disposed resilient fingers tilted in a common direction and depressable upon building up of magnetic flux to impart a turning movement to the rotatable part.

2. An alternating current motor comprising a coil form, a coil carried by the coil form, a magnetizable core extending through the coil, a magnetizable disk carried at one end of the coil form, a magnetizable cup about the coil form with its edge spaced from the disk to form a variable air gap, one of the variable air gap forming magnetizable parts being fixed relative to the coil form, the other being movable, the closed end of the cup being adjacent the other end of the coil form and at a substantially constant distance from the coil to form an air gap of substantially constant length, means biasing the cup toward the disk with a constant force to shorten the variable air gap, and a ring of rubber-like material provided with a plurality of circumferentially disposed resilient fingers tilted in a common angular direction, the fingers being disposed in a position relative to the coil axis to assume said force and to be distorted when the magnetizable parts are attracted toward one another and thereby impart turning movement to the armature with increase of magnetic flow and adapted to regain their normal position with decay of the magnetic field.

3. The alternating current motor of claim 2 wherein the coil axis is vertical and the armature is gravity biased.

4. An alternating current motor as claimed in claim 2, wherein the resilient fingers are disposed in a position to bear against the closed end of the cup.

5. An alternating current motor as claimed in claim 2, wherein the resilient fingers are disposed between the periphery of the cup and the disk.

6. An alternating current motor as claimed in claim 2, wherein the cup forms the movable armature and the disk is fixed to the coil form.

7. An alternating current motor as claimed in claim 2, wherein the cup is fixed to the coil form and the disk is movable.

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