Oct. 10, 1933. R. S. PEELLE 1,929,513

MOTOR FOR ELEVATOR DOOR OPERATORS

Filed Jan. 3, 1931 2 Sheets-Sheet 1

Fig. 1.

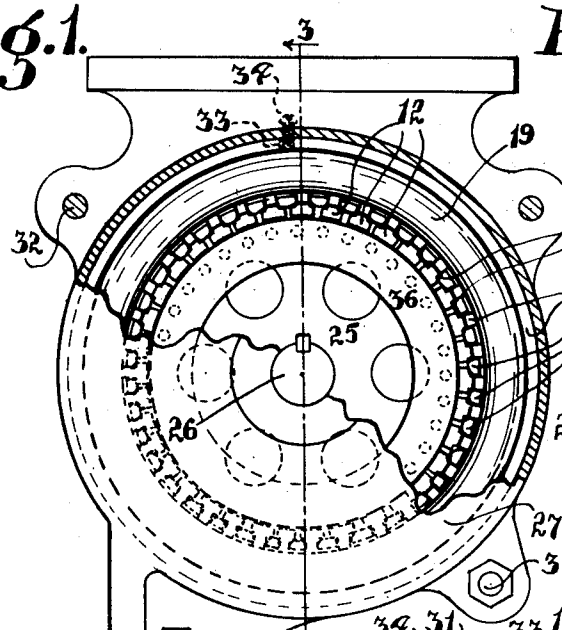
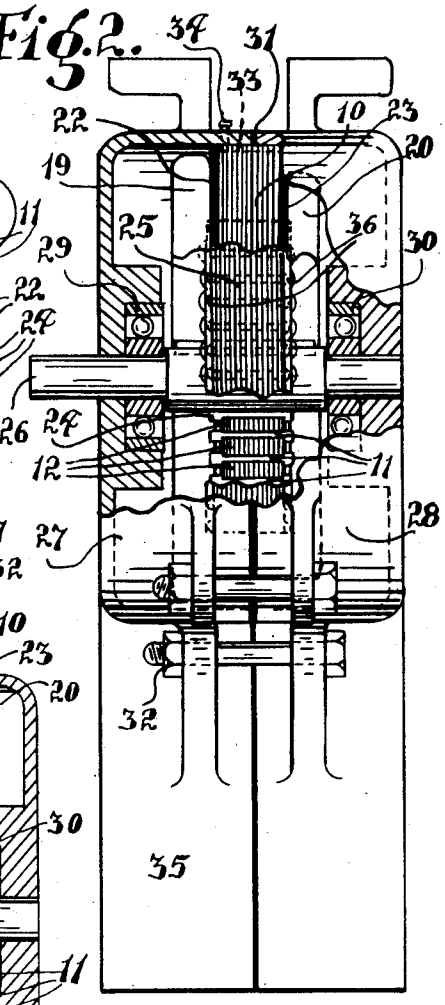


Fig. 2.



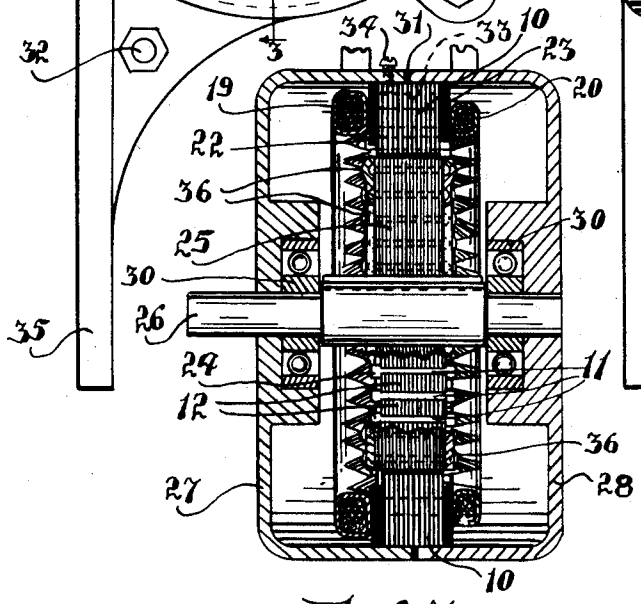


Fig. 3.

Robert S. Peelle

INVENTOR

BY Frank P. Whitemore

ATTORNEY.

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Fig. 4.

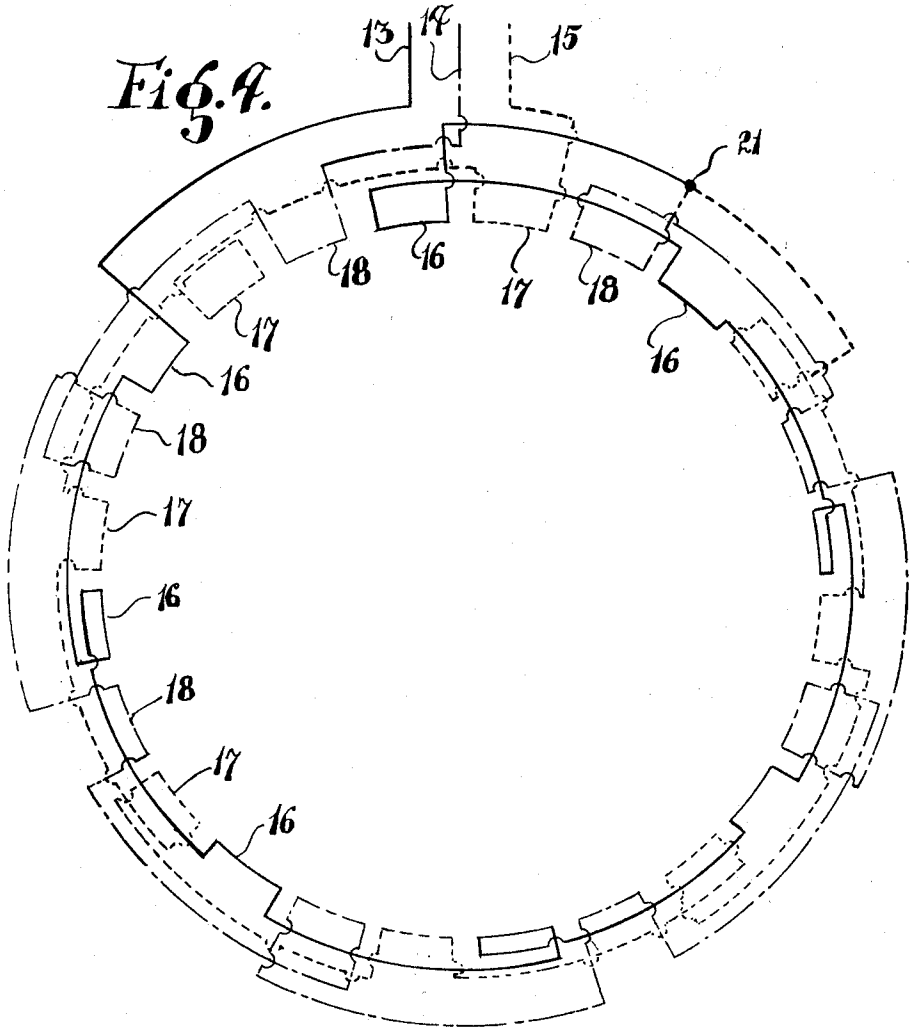
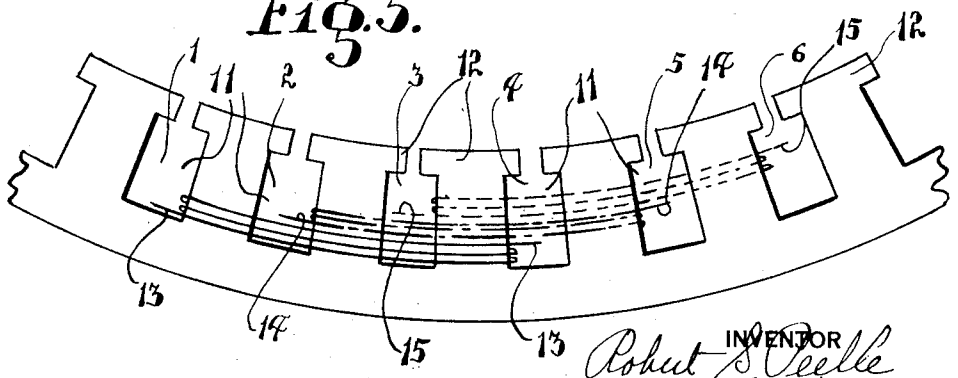


Fig. 5.



INVENTOR
Robert S. Peelle
BY
Frank P. Wentworth
ATTORNEY

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UNITED STATES PATENT OFFICE

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MOTOR FOR ELEVATOR DOOR OPERATORS

Robert S. Peelle, Hollis, N. Y., assignor to The Peelle Company, Brooklyn, N. Y., a corporation of New York

Application January 3, 1931. Serial No. 506,484

8 Claims. (Cl. 172—280)

My invention relates to motors for elevator door operators, and more particularly to a motor which is capable of use within the restricted space available in an elevator shaft for its installation and of developing sufficient torque to ensure the desired ease in starting and continuing the movements of the door in opening and closing same.

Elevator doors of the type with which an operator embodying the motor of my invention may be used, are ordinarily what is known as "counterbalanced" elevator doors. This construction of door embodies two sections vertically movable in opposite directions, the two sections being connected by means of chains or other flexible connections passing about sheaves.

The doors have movement upon a guide structure, usually consisting of what is known as a "wall angle" secured to the wall within an elevator shaft and guide rails carried thereby with which shoes upon the door sections co-operate. This guide rail structure rarely extends from the wall within a shaft more than five or six inches. The sheaves above referred to are mounted upon this guide rail structure, adjacent the edge of the inwardly directed flange of the wall angle, and the construction of the motor of my invention is such as to permit it, in its entirety, to be contained within the space between the sheave and the wall, and to be mounted upon the guide rail structure in the proper relation to the sheave which it actuates. The space available between the sheave and the wall is usually between three and four inches.

Doors of the type to be operated by means of a motor as herein described, rarely have an opening movement in excess of four feet, and prior to my invention the usual practice was to provide a single motor positioned in the penthouse and selectively operative as to any of the doors in the shaft, this motor having associated therewith various control and braking devices to avoid injury to the doors by overrunning of the motor.

I have heretofore invented an operator wherein each door in a shaft has opening and closing movement imparted thereto by a motor operative upon the sheaves of that door, a control mechanism common to all of the motors in a shaft and selectively operative to limit the application of power to the motors at one door only, being provided.

In the wiring of the motor of my invention, I take advantage of the short duration of any run of the motor because of the limited opening and closing movements of the door, and am enabled to provide a type of inductive motor suitable for use in the opening and closing of such doors, but having no other field of use so far as I am aware. Not only does the special type of winding furnish adequate power for the short operation interval required, but permits the rotor, the stator and the housing to be so formed as to be brought in their entirety, within a space of between three and four inches, and to possess so little weight that the load of the motor upon the guide rail structure has no tendency to disarrange the guide rail structure in a manner to interfere with the free operation of the doors.

The invention consists primarily in a motor for elevator door operators embodying therein a stator consisting of a narrow annular, electromagnetic core having a sequence of narrow openings forming a series of poles about the inner perimeter thereof, a plurality of series of circumferentially extending overlapping field windings each winding enclosing a group of said poles, poles of each group being common to windings of each series, the windings of said series respectively being connected with different terminals of a multiple phase source of alternating current supply, and with each other, a cylindrical rotor of magnetic material substantially throughout having an uninterrupted perimeter of a width approximately that of said stator, a shaft carried by said rotor, a housing enclosing said stator and said rotor and supporting said rotor within said stator, and means carried by said housing engaging said stator to prevent movement thereof, said housing being in close engaging relation with the perimeter of said stator; and in such other novel features of construction and combination of parts as are hereinafter set forth and described, and more particularly pointed out in the claims hereto appended.

Referring to the drawings,

Fig. 1 is a side view of a motor embodying the invention with a portion of the housing broken away;

Fig. 2 is a view from the right of Fig. 1, a portion of the rotor, of the stator and of the housing being broken away;

Fig. 3 is a section on the line 3—3 of Fig. 1;

Fig. 4 is a diagrammatic showing of the electrical conditions within the motor; and

Fig. 5 is a fragmentary portion of the stator showing the manner of wiring.

Like numerals refer to like parts throughout the several views.

In the embodiment of the invention shown in the drawings, the stator 10 is of laminated construction, being formed of a series of annular

plates of electro-magnetic material having formed therein a sequence of openings and slots 11 to form a series of poles 12 about the inner perimeter of the stator ring.

In the drawings, a three-phase induction motor is shown, the lines for the different phases being shown at 13, 14 and 15. The winding of the stator is such as to produce a plurality of series of field windings, three in number, each series drawing its supply from one of the lines 13, 14 or 15. In Fig. 4 of the drawings one series of windings is indicated by the full line 16, another series by the dotted line 17 and a third series by the dot and dash line 18. In winding the stator, the wire for the windings of the series 16 is through spaced openings 11, the winding jumping two intervening openings 11 between opposite ends of the coil. The winding is circumferentially of the stator core.

In the drawings, Fig. 5, I have shown a segment of the stator embracing six openings 11, these openings being indicated by the numerals 1, 2, 3, 4, 5 and 6.

It will be noted that the winding connected with the line 13 is through the openings 1 and 4 and spans the poles adjacent the openings 2 and 3; that the winding from the line 14 is through the openings 2 and 5 and spans the poles adjacent the openings 3 and 4, and that the winding from the line 15 is through the openings 3 and 6 and spans the poles adjacent the openings 4 and 5.

It will be understood that the wire of each series of windings must be insulated from the wire of the other two series of windings, and that as a result of the formation of the overlapping fields secured by the method of wiring above referred to, a very substantial portion of the wire and the insulation thereof will be positioned upon opposite sides of the stator, as indicated at 19 and 20. Each of the wires after the series of windings have been formed, have their ends brought together and electrically connected as indicated at 21 in Fig. 4 of the drawings.

With the manner of wiring the stator above described, highly desirable results are secured because the stator in its entirety may be made of a width of less than two inches.

Notwithstanding that with the construction described the motor will become heated so rapidly as to result in the burning out of its windings after a very short run, it has special advantage when used in connection with an elevator door operator, or in any other similar relation, wherein the operation of the motor is required only for a few seconds time and thereafter remains idle for a sufficient period to permit it to cool.

With a field produced by means of a construction as above described, the motor is capable of instantly developing a very high torque, compared to its size, and may be so designed as to have a very low speed. The main advantage, however, is that the motor may be made of very narrow width, and when once installed, requires no attention since there are no parts requiring lubrication.

The sides of the stator are provided with plates 22 and 23 of insulation.

The pole pieces 12 are held apart by means of pegs 24 of insulating material, gaps being present between the faces of adjacent pole pieces.

Freely rotatable within the stator is a cylindrical rotor or armature 25 formed of laminated, electro-magnetic material having an uninterrupted perimeter so formed as to permit the attachment of a shaft 26 thereto.

The housing of the motor consists of two cupped members 27 and 28, each supporting a ball bearing 29 and 30 for the shaft 26. These two sections are insulated from each other, either by means of an air gap or insulating material at 31, and are drawn together by means of tie bolts 32.

The construction and arrangement of the members 27 and 28 of the housing is such as to accurately center the rotor in relation to the stator and to hold the latter immovable in relation to the housing and the rotor because of the circular form of the housing, its engagement with the outer perimeter of the stator and the keying of the stator to the housing by means of a slot 33 in the core of the stator and a set screw 34 carried by the housing. It is essential that the stator should be fixed in its relation to the housing and the configuration of the latter may be widely varied and still secure this result.

In the form of the invention shown, the members 27 and 28 of the housing are provided with flanges 35 to facilitate the mounting of the motor upon the guide rail structure of the doors in an elevator shaft.

In a commercial embodiment of the invention, the shaft 26 of the rotor carries a three-toothed gear which is meshed with a gear carried by the sheave having 54 teeth over which the connection with the door sections pass. This sheave is approximately six inches in diameter so that with an opening or closing movement of the door of from four to five feet, the sheave is required to be turned only about three times. Consequently, only approximately fifty revolutions of the motor are required to accomplish the full opening or closing of the door. The motor speed is approximately nine hundred revolutions per minute (R. P. M.). Hence, the operating interval of the motor required is only about 3⅓ seconds. Consequently, the development of heat is no material factor and with ordinary use, there is little or no danger of the wiring of the motor burning out. The motor, as shown in the drawings, is for use with a 60 cycle, 220 volt, 3 phase alternating current source. It may readily be adapted, however, to other potentials and other cycles.

In the operation of the motor, I take advantage of the well known principles of polyphase alternating-current induction motors with a rotating field effect in a fixed stator and in which the current may be so controlled as to reverse the rotating field effect. The armature or rotor is without windings and the detailed construction of the various parts entering into the motor is such as to secure compactness, lightness of weight, high torque and low speeds. The electrical conditions are such as would preclude the use of the motor under any conditions and for any purpose where power is applied thereto for more than a very short interval. Even with the short run required of the motor, heat will begin to develop, but overheating is impossible except as a result of deliberate abuse of the door operating mechanism.

While the door operating mechanism and the construction of the doors themselves form no part of the invention, I have referred to same at length because the sole utility of the motor resides in its adaptability to use with such or an equivalent mechanism, the operation of which necessitates a very short run of the motor, a light load and a very limited space within which the motor may be installed.

A motor, embodying the invention, in its entirety will occupy a space but little over three

inches in width, eight or nine inches in height, and five or six inches in length, and this space may be reduced by changing the details of the housing without sacrificing the possible maximum power of the motor.

The overlapping of the series of field windings, contributes toward the development of the desired torque instantly with the application of power to the motor, and the maintenance of such torque. This construction also contributes toward the development of a low speed in the motor.

The rotor or armature 25 adjacent the perimeter thereof is provided with plates 36 of non-magnetic material.

The plates forming the core for the field windings of the stator, and also the plates forming the rotor and the non-magnetic shield plates carried by the latter, may be riveted or otherwise secured together in the desired close contacting relation.

By the construction heretofore described, I am enabled to produce a motor which may rate as high as ¼ of a horse power, which will weigh only a few pounds including the housing, and which will be very narrow in width. These requirements grow out of the necessity for mounting the motor in its entirety upon the guide rail structure adjacent the sheave which it is to actuate, and the limited space in an elevator shaft available for this purpose. Such requirements I have found can be met only by sacrificing in the motor many of the conditions which are generally recognized as being essential to an electric motor and such sacrifice is possible merely because the conditions of use of the motor require only a short run of the motor.

By producing a motor having low speed and high torque, I am enabled to secure a satisfactory door operation within the small time interval herein referred to. With a motor constructed as herein described, little or no power is required to arrest movement of the door sections in either direction or to impart movement thereto in either direction, as even while power is applied to the motor, the armature may be freely turned in either direction by the manual application of force to either of the door sections.

It is not my intention to limit the invention to a motor having the precise dimensions or constructed precisely as herein described, it being apparent that such may be varied without departing from the spirit and scope of the invention.

Having described the invention, what I claim as new and desire to have protected by Letters Patent, is:—

1. A motor for elevator door operators embodying therein a stator consisting of a narrow annular, electro-magnetic core having a sequence of narrow openings forming a series of poles about the inner perimeter thereof, a plurality of series of circumferentially extending overlapping field windings, each winding enclosing a group of said poles, poles of each group being common to windings of each series, the windings of said series respectively being connected with different terminals of a multiple-phase source of alternating current supply, and with each other, a cylindrical rotor of magnetic material substantially throughout having an uninterrupted perimeter of a width approximately that of said stator, a shaft carried by said rotor, a housing enclosing said stator and said rotor and supporting said rotor within said stator, and means carried by said housing engaging said stator to prevent movement thereof, said housing being in close engaging relation with the perimeter of said stator.

2. A motor for elevator door operators embodying therein a stator consisting of a narrow annular, electro-magnetic core formed of a plurality of plates having a sequence of narrow openings therethrough forming a series of poles about the inner perimeter thereof, a plurality of windings each passing through spaced openings in and circumferentially of said plates and across intermediate openings whereby each winding encloses a group of said poles, and poles of each group are common to windings of each series, the windings of said series respectively being connected with different terminals of a multiple-phase source of alternating current supply and with each other, and the windings of the several series being electrically connected, a cylindrical rotor of magnetic material substantially throughout having an uninterrupted perimeter of a width approximately that of said stator, a shaft carried by said rotor, a housing enclosing said stator and said rotor and supporting said rotor within said stator, and means carried by said housing engaging said stator to prevent movement thereof, said housing being in close engaging relation with the perimeter of said stator.

3. A motor for elevator door operators embodying therein a stator consisting of a narrow annular, electro-magnetic core formed of a plurality of plates having a sequence of narrow openings therethrough forming a series of poles about the inner perimeter thereof, a plurality of windings each passing through spaced openings in and circumferentially of said plates and across intermediate openings whereby each winding encloses a group of said poles, and poles of each group are common to windings of each series, the windings of said series respectively being connected with different terminals of a multiple-phase source of alternating current supply and with each other, and the windings of the several series being electrically connected, a cylindrical rotor formed of a plurality of plates of magnetic material substantially throughout having an uninterrupted perimeter, and of a width approximately that of said stator, a shaft carried by said rotor, a housing enclosing said stator and said rotor and supporting said rotor within said stator, and means carried by said housing engaging said stator to prevent movement thereof, said housing being in close engaging relation with the perimeter of said stator.

4. A motor for elevator door operators embodying therein a stator consisting of a narrow annular, electro-magnetic core formed of a plurality of plates having a sequence of narrow openings therethrough forming a series of poles about the inner perimeter thereof, a plurality of windings each passing through spaced openings in and circumferentially of said plates and across intermediate openings whereby each winding encloses a group of said poles, and poles of each group are common to windings of each series, the windings of said series respectively being connected with different terminals of a multiple-phase source of alternating current supply and with each other, and the windings of the several series being electrically connected, a cylindrical rotor formed of a plurality of plates of magnetic material substantially throughout having an uninterrupted perimeter, and of a width approximately that of said stator, shield

plates of electro-nonmagnetic material adjacent the perimeter of said rotor, a shaft carried by said rotor, a housing enclosing said stator and said rotor and supporting said rotor within said stator, and means carried by said housing engaging said stator to prevent movement thereof, said housing being in close engaging relation with the perimeter of said stator.

5. A motor for elevator door operators embodying therein a stator consisting of a narrow annular, electro-magnetic core having a sequence of narrow openings forming a series of poles about the inner perimeter thereof, a plurality of series of circumferentially extending overlapping field windings, each winding enclosing a group of said poles, poles of each group being common to windings of each series, the windings of said series respectively being connected with different terminals of a multiple-phase source of alternating current supply, and with each other, a cylindrical rotor of magnetic material substantialy throughout having an uninterrupted perimeter of a width approximately that of said stator, a shaft carried by said rotor, two cupped members adapted to receive and enclose said stator and said rotor, a bearing carried by each of said members for said rotor shaft, means securing said members together, and means carried by one of said members and engaging said stator to prevent movement thereof, said cupped members being in close engaging relation with the perimeter of said stator.

6. A motor for elevator door operators embodying therein a stator consisting of a narrow annular, electro-magnetic core having a sequence of narrow openings forming a series of poles about the inner perimeter thereof, a plurality of series of circumferentially extending overlapping field windings, each winding enclosing a group of said poles, poles of each group being common to windings of each series, the windings of said series respectively being connected with different terminals of a multiple-phase source of alternating current supply, and with each other, a cylindrical rotor of magnetic material substantially throughout having an uninterrupted perimeter of a width approximately that of said stator, a shaft carried by said rotor, two cupped members adapted to receive and enclose said stator and said rotor, a bearing carried by each of said members for said rotor shaft, means securing said members together, and said stator having a slot in the perimeter thereof, and a set screw carried by one of said members and adapted to enter said slot to prevent movement thereof, said cupped members being in close engaging relation with the perimeter of said stator.

7. A motor for elevator door operators embodying therein a stator consisting of a narrow annular, electro-magnetic core formed of a plurality of plates having a sequence of narrow openings therethrough forming a series of poles about the inner perimeter thereof, a plurality of windings each passing through spaced openings in and circumferentially of said plates and across intermediate openings whereby each winding encloses a group of said poles, and poles of each group are common to windings of each series, the windings of said series respectively being connected with different terminals of a multiple-phase source of alternating current supply and with each other, and the windings of the several series being electrically connected, a cylindrical rotor formed of a plurality of plates of magnetic material susbstantially throughout having an uninterrupted perimeter, and of a width approximately that of said stator, a shaft carried by said rotor, two cupped members adapted to receive and enclose said stator and said rotor, a bearing carried by each of said members for said rotor shaft, means securing said members together, said stator having a slot in the perimeter thereof, and a set screw carried by one of said members and adapted to enter said slot to prevent movement thereof, said cupped members being in close engaging relation with the perimeter of said stator.

8. A motor for elevator door operators embodying therein a stator consisting of a narrow annular, electro-magnetic core formed of a plurality of plates having a sequence of narrow openings therethrough forming a series of poles about the inner perimeter thereof, a plurality of windings each passing through spaced openings in and circumferentially of said plates and across intermediate openings whereby each winding encloses a group of said poles, and poles of each group are common to windings of each series, the windings of said series respectively being connected with different terminals of a multiple-phase source of alternating current supply and with each other, and the windings of the several series being electrically connected, a cylindrical rotor formed of a plurality of plates of magnetic material substantially throughout having an uninterrupted perimeter, and of a width approximately that of said stator, shield plates of electro-nonmagnetic material adjacent the perimeter of said rotor, a shaft carried by said rotor, two cupped members adapted to receive and enclose said stator and said rotor, a bearing carried by each of said members for said rotor shaft, means securing said members together, said stator having a slot in the perimeter thereof, and a set screw carried by one of said members and adapted to enter said slot to prevent movement thereof, said cupped members being in close engaging relation with the perimeter of said stator.

ROBERT S. PEELLE.