Nov. 3, 1942. J. D. MINER, JR 2,300,957

ELECTRIC MOTOR CONSTRUCTION

Filed April 17, 1940

Fig. 1.

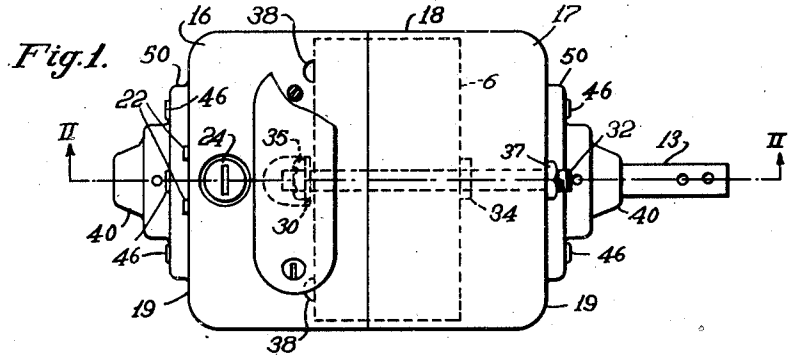


Fig. 2.

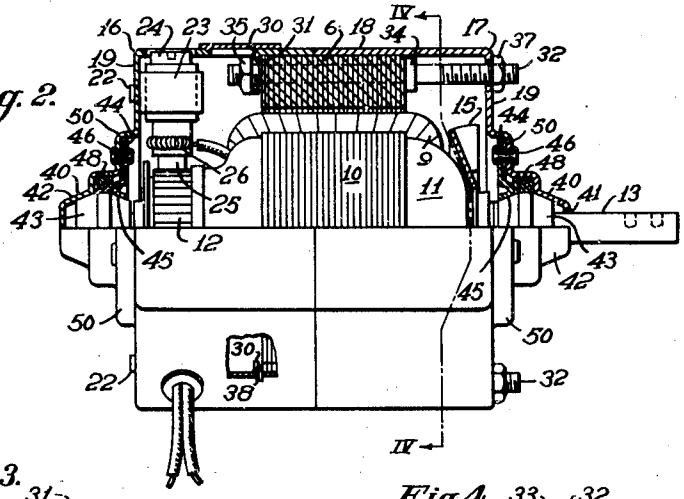


Fig. 3.

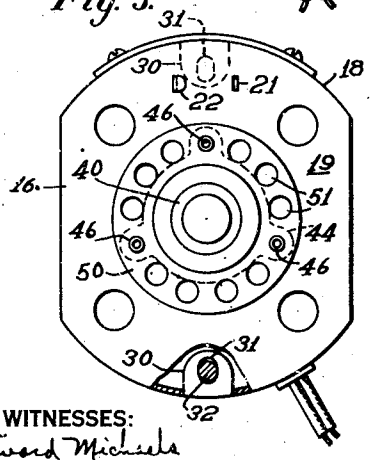
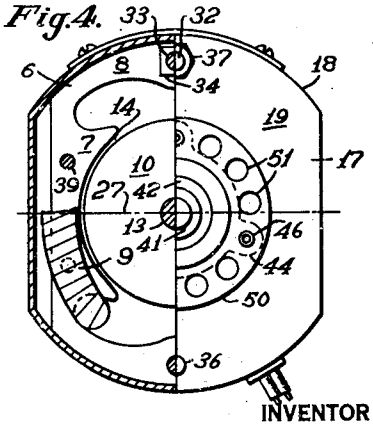


Fig. 4.



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UNITED STATES PATENT OFFICE

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ELECTRIC MOTOR CONSTRUCTION

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Application April 17, 1940, Serial No. 330,075

27 Claims. (Cl. 172—36)

My invention relates to the manufacture of small motors of the universal type, or other types in which the rotor-member is provided with a commutator.

The principal object of my invention is to provide a novel construction for such motors, so as to result in economical production in large quantities.

Motors of the type covered by this invention are usually provided with a primary or field-core which is built up of a stack of laminations having pole-pieces integral with the magnetic yoke, as this form of construction is the most economical for quantity-production. Motors having such a field-core construction must have their front and rear casings or housing-brackets secured on, or by means of, through-bolts or studs which must pass through stud-receiving perforations in the yoke portions of the field-core, approximately 90 electrical degrees from the center-line of the pole-pieces of the field-core, because the end-turns of the field-winding, which surrounds the pole-pieces, would stand in the way so as to prevent the location of the stud-receiving perforations in the pole-piece portions of the field-core. At the same time, the brushholders of these motors ought to be placed in the same position, approximately 90 electrical degrees from the center-line of the pole-pieces, as otherwise a longer motor-construction would be required, as well as a special, less durable, and more costly, armature-winding, as well as prohibiting a flat-sided frame-shape such as may be required because of space-limitations.

In order that the above-mentioned studs may be in alinement with the brushholders, it is necessary to provide an inwardly directed shoulder or lugs on the motor-frame, to provide an abutment for the front side or end of the field-core, and so that the front ends of these studs can terminate in said abutment, without having to extend the lugs all the way through to the front end of the front housing-bracket of the motor, thus leaving the space within the front housing-bracket free for the mounting of the brushholders. The foregoing difficulties and considerations have resulted either in the utilization of castings, for the motor-housings, or special and unnatural, and hence costly, arrangements and locations of either the studs or the brushholders, all of which results in increased costs, which are particularly to be deplored in economical production in large quantities, where even small cost-items mount up, because of the large numbers involved.

An object of my present invention is to provide a satisfactory drawn-steel shell-construction, or other sheet-metal housing, for motors of the above-mentioned type, thereby securing the known economies of drawn-steel construction without necessitating the abandonment of the most desirable positioning and spacing of the brushholders and studs.

A more specific object is to provide two sheet-metal housing-bracket shells which are generally similar in contour, one for the front end of the motor, to house the brushholders and commutator, and the other for the rear end of the motor, to house the ventilating fan, the front shell being provided with turned-in lugs for engaging the front ends of the studs. In a preferred form of construction, the front shell is also provided with a plurality of inwardly stabbed depressions for forming abutments for the front end of the field-core, in a plane spaced from the turned-in lugs, thus permitting a slight radius on the lugs, and also permitting the field-core laminations to flare out, somewhat, in the region of the turned-in lugs.

A further object of my invention is to utilize a shouldered stud which permits all of the internal parts of the stator-member to be firmly secured within the front housing-shell, thus permitting a vastly faster assembly than can be obtained when the internal parts are located by means of lugs, spacers or springs threaded on the stud, besides providing a firm clamping of the field-core, which tends to minimize motor-noise. With this construction, the rear ends of the studs, which secure the rear housing-shell, may also be utilized as rear mounting-means for the motor, if desired.

A further object of my invention is to provide an improved bearing-mounting means for supporting the spherical-type, self-alining bearings which are usually provided on motors of this type, and at the same time to provide additional clearance, at the front end of the motor, to make room for the brushholder connectors, while providing a very effective baffle for the ventilating fan at the rear end of the motor.

With the foregoing and other objects in view, my invention consists in the combinations, parts, structures and assembly-methods hereinafter described and claimed, and illustrated in the accompanying drawing wherein:

Figure 1 is a top plan view of a motor manufactured in accordance with my present invention;

Fig. 2 is a view of the same, partly in longi-

tudinal section on the line II—II of Fig. 1, and partly in elevation;

Fig. 3 is a front-end elevation of the motor; and

Fig. 4 is a rear-end elevation of the motor, with parts broken away to show a section on the line IV—IV of Fig. 2.

I have illustrated my invention as being embodied in a universal electric motor comprising a two-pole field-core which is built up of a stack of laminations 6 having pole-pieces 7 integral with the magnetic yoke-portions 8. Each of the two pole-pieces 7 carries a field-winding 9, as shown in Fig. 4. The motor is also provided with a rotor-member 10 having an armature-winding 11 terminating in a commutator 12, which is disposed on what is known as the front end of the motor. The rotor-member is mounted upon a shaft 13, so as to rotate within the pole-pieces 7 of the field-core 6, so as to be separated therefrom by an air-gap 14. The rear end of the rotor-member 10 is provided with a ventilating fan 15.

The motor is provided with a housing in the form of two housing-brackets or shells 16 and 17 which are made of drawn-steel or other sheet-metal construction, and are preferably of the previously mentioned flat-sided construction. These two housing-bracket shells are similar to each other, in general outlines, having only slight differences in the manner in which they are punched or perforated, to distinguish between the different functions of the front shell 16 and the rear shell 17. Each of the shells 16 and 17 is of a general cup-shape, being provided with a cylindrical portion 18 which more or less tightly embraces the field-core 6, having a sliding fit over the yoke-portions 8 thereof, and being usually spaced somewhat from the backs of the pole-pieces 7 of the field-core, in order to provide clearance for the field-windings 9, as shown in Fig. 4. The cup-shaped shells 16 and 17 also have end-walls 19.

The front housing-bracket shell 16 has a plurality of brushholder-mounting perforations 21 (Fig. 3) in its front end-wall 19, said perforations 21 being adapted to receive the bent-over ears 22 of a clamp 23 which holds a brushholder-assembly 24, illustrated as being of a well-known cartridge type. There are two brushholder-assemblies 24, each carrying a brush 25 which bears upon the commutator 12, and each having a brushholder-connector 26 which is utilized for making the proper electrical connections within the front shell 16. These two brushholder-assemblies 24 are disposed in the preferred place therefor, that is, in a plane 90 electrical degrees from the center-line 27 (Fig. 4) of the pole-pieces 7, which, in a two-pole motor, as illustrated, is equivalent to saying that the brushholders are displaced by 90 space-degrees from the field-pole center-line 27.

The cylindrical part 18 of the front shell 16 is also provided with two turned-in lugs 30 which are disposed in spaced relation to the two brushholder-assemblies 24, and in longitudinal alinement therewith. These two turned-in lugs 30 are each provided with a stud-receiving perforation 31, which is preferably elongated in a radial direction, so as to make provision for manufacturing variations in the parts, so as not to interfere with quick assembly. The lug-perforations 31 receive the respective front ends of two studs or through-bolts 32 which extend through stud-receiving perforations 33 in the yoke-portions 8 of the field-core 6. In accordance with one feature of my invention, the studs 32 are of a shouldered type, having a shoulder-forming enlargement 34 intermediate their ends. The stud-shoulder 34 abuts up against the rear side of the field-core 6. The front end of each stud 32 passes through the perforation 31 in its corresponding lug 30, and carries a nut 35 which presses against the front side of the lug.

The rear end of each stud 32 extends through a suitable perforation 36 (Fig. 4) which is provided in the end-wall 19 of the rear shell 17, and is provided with a nut 37 which engages the rear side of said rear shell 17. In this manner, the rear nuts 37 can be removed, and, if desired, also the rear shell 17, without in the least disturbing the tight connection between the field-core 6 and the front shell 16. It will be noted that the assembly of the field-core 6 and the front shell 16 may be made with the greatest ease, without the necessity for handling loose parts or spacers of any kind.

In the preferred construction of my improved motor, the front end or side of the field-core 6 does not abut up tight against the rear side of the turned-in lug 30, but is spaced therefrom by a certain distance, such as 1/32 of an inch, being held in such spaced relation to the lug 30 by means of a plurality of inwardly stabbed depressions 38 which are stabbed or pressed into the cylindrical portion 18 of the front shell 16, in order to provide core-receiving abutments in a plane which is slightly spaced, in a longitudinal or axial direction, from the plane of the two turned-in lugs 30. In this manner, I make allowance for the radius at the bend in the lugs 30, where they are bent in from the cylindrical portion 18 of the front shell 16, and I also make allowance for a slight bulging or spreading action of the primary laminations 6, which frequently do not stay pressed together as tightly in the region of the yoke-portions 8 as in the region of the pole-pieces 7 which are encompassed by the field-coil 9 and which are commonly riveted together by rivets 39 (Fig. 4).

Both of the housing-bracket shells 16 and 17 have their end-walls 19 provided with central bearing-receiving bulges 40, which are alike, except for the fact that the bulge 40 of the rear bracket-shell 17 is perforated, as indicated at 41, to receive the shaft 13. Each of the bulges 40 has a tapering or inclined bearing-seating portion 42, for bearing against a rounded bearing 43 of the self-centering type. Each of the bearings 43 is further held in position by a locking-disc 44 of a flat-spring type which is so bent as to provide a tapering or inclined central bearing-seating perforation 45.

Heretofore the flat-spring locking-disks 44 of the prior art have given some trouble because they were tightly riveted to the inside surfaces of the end-wall 19, surrounding the bearing-receiving bulge 40, the difficulty arising because the first rivet which is tightened into place distorts the spring, or pushes it off-center, and holds it so tightly that it cannot subsequently center itself when the other holding-rivets are applied.

In accordance with my invention, I do not utilize rivets at all, for holding the flat-spring locking-disks 44 in operative relation to their respective bracket-shells 16 and 17, but I utilize a plurality of eyelets 46, not as rivets for tightly clamping the parts together, but as links for loosely tying the parts together in spaced relationship, so that the spring 44 is always free to center it-

self and to permit proper self-alinement of the rounded or spherical-type bearing 43. The eyelets 46 are a common form of tubular rivet or eyelet-member which is "set" or peened over by means of automatic eyeletting machines which set the eyelets or rivets to a definite length. Since I utilize machine-made drawn-steel shells, and machine-made, preformed, flat-spring locking disks 44, it is a simple matter to set the riveting or eyeleting machine (not shown) for a predetermined length of eyelet or rivet 46 so that it brings the spring 44 to the desired tension, while leaving the spring free to move radially with respect to the surface of the end-wall 19 of the housing-shells 16 or 17, as the case may be, thus permitting the spring to center itself on the spherical bearing 43, while at the same time, the spring 44 maintains its own proper position at right angles to the axis of the motor.

In the particular bearing-assembly which is illustrated in the drawing, a space is provided around the bearing 43, and within the bearing-receiving bulge 40 and between said bulge and the bearing centering-spring 44, which is filled with oil-soaked felt washers 48 for the purpose of storing additional lubricant for the bearing 43, to permit the latter to operate for as long a time as possible, without the necessity for an oiling operation.

In accordance with my invention, the end-walls 19 of the two housing-shells 16 and 17 are each provided with a second bulge 50 surrounding the bearing-receiving bulge 40, the second bulge 50 being of an annular shape because of the presence of the first bulge 40. The second annular bulge 50 has a radius sufficiently large to provide additional clearance for the brushholder-connections 26 at the front end of the motor, and to provide an effective fan-baffle at the rear end of the motor, as shown in Fig. 2. It is necessary that the second annular baffle 50 at the rear end of the motor be provided with ventilating perforations 51, as shown in Fig. 4, and it is desirable also that the corresponding annular bulge 50 at the front end of the motor be provided with similar ventilating perforations 51, as shown in Fig. 3.

In this manner, I make the most effective utilization of the identical shapes or outlines of the two housing-shells 16 and 17, whereby the front bearing is properly spaced from the brushholders, the housing-material surrounding the rear bearing is shaped to provide a baffle for cooperating with the ventilating fan 15, the front housing-shell 16 has an end-wall 19 which is utilized as a support for the brushholder-clamp 23, and the rear housing-shell 17 is provided with an end-wall 19 for providing an abutment for the rear nuts 37 of the assembly-studs 32.

While I have described and illustrated my invention in a single form of embodiment, which is at present preferred, I wish it to be understood that many changes may be made by those skilled in the art, by way of additions, omissions and alterations, without departing from the essential spirit of my invention, particularly in its broader aspects. I desire, therefore, that the appended claims shall be accorded the broadest construction consistent with their language.

I claim as my invention:

1. An electric motor comprising: a field-core, said field-core comprising a stack of laminations having pole-pieces integral with the magnetic yokes; field-windings on the pole-pieces of the field-core; a rotor-member having a commutator at its front end; a sheet-metal front housing-bracket shell; a sheet-metal rear housing-bracket shell; a plurality of brushholder-assemblies mounted within said front shell; said brushholder-assemblies comprising brushholder-connectors disposed within said front shell; said brushholder-assemblies further comprising brushes bearing upon said commutator; said front shell having a turned-in lug spaced back of at least one of the brushholder-assemblies in longitudinal alinement therewith; said lug being provided with a stud-receiving perforation; at least one of the yoke portions of the field-core being provided with a longitudinally extending stud-receiving perforation disposed approximately ninety electrical degrees from a center-line of the pole-pieces; means for holding the front shell in place on the field-core, said means comprising a stud passing through the field-core perforation and the lug-perforation, and including nut-means for exerting a pressure between the front side of said lug and the rear side of said field-core; and means for holding the rear shell in place on the field-core.

2. An electric motor comprising: a two-pole field-core, said field-core comprising a stack of laminations having pole-pieces integral with the magnetic yoke; field-windings on the pole-pieces of the field-core; a rotor-member having a commutator at its front end; a sheet-metal front housing-bracket shell; a sheet-metal rear housing-bracket shell; two brushholder-assemblies; said front shell having a front end-wall having brushholder-mounting perforations, and each brushholder-assembly comprising a clamp having ears engaging through said brushholder-mounting perforations in the front wall of said front shell; said brushholder-assemblies comprising brushholder-connectors disposed within said front shell; said brushholder-assemblies further comprising brushes bearing upon said commutator; said front shell having a turned-in lug spaced back of each brushholder-assembly in longitudinal alinement therewith; each of the two turned-in lugs being provided with a stud-receiving perforation; each of the two yoke portions of the field-core being provided with a longitudinally extending stud-receiving perforation disposed approximately ninety degrees from the center-line of the pole-pieces; and two studs, each passing through one of the field-core perforations and through the perforation in the corresponding turned-in lug, and including nut-means for exerting a pressure between the front side of said lug and the rear side of said field-core; each of said studs comprising a rear extension; said rear shell having a rear end-wall having two perforations for receiving said rear extensions of said studs, and nut-means on said rear extensions for exerting a pressure on the rear side of the rear end-wall of said rear shell.

3. The invention as defined in claim 1, characterized by the stud-receiving perforation in said turned-in lug being elongated in a radial direction.

4. The invention as defined in claim 2, characterized by the stud-receiving perforations in said turned-in lugs being elongated in a radial direction.

5. The invention as defined in claim 1, characterized by said front shell having a plurality of inwardly stabbed depressions for forming abutments for the front end of the field-core in a plane spaced from said turned-in lug.

6. The invention as defined in claim 2, characterized by said front shell having a plurality

of inwardly stabbed depressions for forming abutments for the front end of the field-core in a plane spaced from said turned-in lugs.

7. The invention as defined in claim 1, characterized by said stud being a shouldered stud having a shoulder-forming enlargement intermediate its ends, and nuts on the respective ends, said shoulder-forming enlargement abutting against the rear side of the field-core, and said nuts abutting respectively against the front side of the lug and the rear side of the rear shell.

8. The invention as defined in claim 2, characterized by each of said studs being a shouldered stud having a shoulder-forming enlargement intermediate its ends, and nuts on the respective ends, said shoulder-forming enlargement abutting against the rear side of the field core, and said nuts abutting respectively against the front side of the corresponding lug and the rear side of the rear shell.

9. An electric motor comprising: a field-core, said field-core comprising a stack of laminations having pole-pieces integral with the magnetic yokes; field-windings on the pole-pieces of the field-core; a rotor-member having a commutator at its front end; a front housing-bracket shell; a rear housing-bracket shell; a plurality of brushholder-assemblies mounted within said front shell; said brushholder-assemblies comprising brushholder-connectors disposed within said front shell; said brushholder-assemblies further comprising brushes bearing upon said commutator; said front shell having an inwardly projecting lug spaced back of at least one of the brushholder-assemblies in longitudinal alinement therewith; said lug being provided with a stud-receiving perforation; at least one of the yoke portions of the field-core being provided with a longitudinally extending stud-receiving perforation disposed approximately ninety electrical degrees from a center-line of the pole-pieces; means for holding the front shell in place on the field-core, said means comprising a shouldered stud passing through the field-core perforation and the lug-perforation, said stud having a shoulder-forming enlargement intermediate its ends, and nuts on the respective ends, said shoulder-forming enlargement abutting against the rear side of the field-core, and said nuts abutting respectively against the front side of the lug and the rear side of the rear shell.

10. An electric motor comprising: a two-pole field-core, said field-core comprising a stack of laminations having pole-pieces integral with the magnetic yoke; field-windings on the pole-pieces of the field-core; a rotor-member having a commutator at its front end; a front housing-bracket shell; a rear housing-bracket shell; two brushholder-assemblies mounted within said front shell; said brushholder-assemblies comprising brushholder-connectors disposed within said front shell; said brushholder-assemblies further comprising brushes bearing upon said commutator; said front shell having an inwardly projecting shoulder-forming means spaced back of said brushholder-assemblies and having stud-receiving perforations in longitudinal alinement with the respective brushholder-assemblies; each of the two yoke portions of the field-core being provided with a longitudinally extending stud-receiving perforation disposed approximately ninety degrees from the center-line of the pole-pieces; and two shouldered studs, each passing through one of the field-core perforations and through the corresponding perforation in said shoulder-forming means, each stud having a shoulder-forming enlargement intermediate its ends, and nuts on its respective ends, said shoulder-forming enlargement abutting against the rear side of the field-core, said nuts abutting respectively against the front side of said inwardly projecting shoulder-forming means and the rear side of said rear shell.

11. The invention as defined in claim 1, characterized by said front and rear shells being similar to each other in general outlines, and each having an end-wall provided with a central bearing-receiving bulge having a tapering or inclined bearing-seating portion, the end-wall of each shell having a second annular bulge surrounding its bearing-receiving bulge, and the rotor-member having a fan at its rear end, said second annular bulge having a radius sufficiently large to provide additional clearance for the brushholder-connectors at the front end of the motor and to provide a fan-baffle at the rear end of the motor, the annular bulge in at least the rear shell being perforated for air-circulation in conjunction with said fan.

12. The invention as defined in claim 2, characterized by said front and rear shells being similar to each other in general outlines, and each having an end-wall provided with a central bearing-receiving bulge having a tapering or inclined bearing-seating portion, the end-wall of each shell having a second annular bulge surrounding its bearing-receiving bulge, and the rotor-member having a fan at its rear end, said second annular bulge having a radius sufficiently large to provide additional clearance for the brushholder-connectors at the front end of the motor and to provide a fan-baffle at the rear end of the motor, the annular bulge in at least the rear shell being perforated for air-circulation in conjunction with said fan.

13. The invention as defined in claim 1, characterized by said front and rear shells being similar to each other in general outlines, and each having an end-wall provided with a central bearing-receiving bulge, a bearing mounted within each of said bulges, the end-wall of each shell having a second annular bulge surrounding its bearing-receiving bulge, and the rotor-member having a fan at its rear end, said second annular bulge having a radius sufficiently large to provide additional clearance for the brushholder-connectors at the front end of the motor and to provide a fan-baffle at the rear end of the motor, the annular bulge in at least the rear shell being perforated for air-circulation in conjunction with said fan.

14. The invention as defined in claim 2, characterized by said front and rear shells being similar to each other in general outlines, and each having an end-wall provided with a central bearing-receiving bulge, a bearing mounted within each of said bulges, the end-wall of each shell having a second annular bulge surrounding its bearing-receiving bulge, and the rotor-member having a fan at its rear end, said second annular bulge having a radius sufficiently large to provide additional clearance for the brushholder-connectors at the front end of the motor and to provide a fan-baffle at the rear end of the motor, said annular bulges being perforated for air-circulation in conjunction with said fan.

15. The invention as defined in claim 1, characterized by said front and rear shells being similar to each other in general outlines, and each having an end-wall provided with a central bear-

ing-receiving bulge having a tapering or inclined bearing-seating portion, a rounded self-centering-type bearing mounted within each of said bulges, a flat-spring locking-disk disposed on the inside of each bulged end-wall and having a tapering or inclined central bearing-seating perforation for engaging its associated bearing, and holding-means for securing each flat-spring locking-disk to its associated end-wall, the end-wall of each shell having a second annular bulge surrounding said holding-means for the flat-spring locking-disk, and the rotor-member having a fan at its rear end, said second annular bulge having a radius sufficiently large to provide additional clearance for the brushholder-connectors at the front end of the motor and to provide a fan-baffle at the rear end of the motor, the annular bulge in at least the rear shell being perforated for air-circulation in conjunction with said fan.

16. The invention as defined in claim 2, characterized by said front and rear shells being similar to each other in general outlines, and each having an end-wall provided with a central bearing-receiving bulge having a tapering or inclined bearing-seating portion, a rounded self-centering-type bearing mounted within each of said bulges, a flat-spring locking-disk disposed on the inside of each bulged end-wall and having a tapering or inclined central bearing-seating perforation for engaging its associated bearing, and holding-means for securing each flat-spring locking-disk to its associated end-wall, the end-wall of each shell having a second annular bulge surrounding said holding-means for the flat-spring locking-disk, and the rotor-member having a fan at its rear end, said second annular bulge having a radius sufficiently large to provide additional clearance for the brushholder-connectors at the front end of the motor and to provide a fan-baffle at the rear end of the motor, the annular bulge in at least the rear shell being perforated for air-circulation in conjunction with said fan.

17. The invention as defined in claim 1, characterized by said front and rear shells each having an end-wall provided with a central bearing-receiving bulge having a tapering or inclined bearing-seating portion, a rounded self-centering-type bearing mounted within each of said bulges, a flat-spring locking-disk disposed on the inside of each bulged end-wall and having a tapering or inclined central bearing-seating perforation for engaging its associated bearing, and means for holding each flat-spring locking-disk in a predetermined spaced relation to the end-wall of its associated shell.

18. The invention as defined in claim 2, characterized by said front and rear shells each having an end-wall provided with a central bearing-receiving bulge having a tapering or inclined bearing-seating portion, a rounded self-centering-type bearing mounted within each of said bulges, a flat-spring locking-disk disposed on the inside of each bulged end-wall and having a tapering or inclined central bearing-seating perforation for engaging its associated bearing, and means for holding each flat-spring locking-disk in a predetermined spaced relation to the end-wall of its associated shell.

19. The invention as defined in claim 1, characterized by said front and rear shells each having an end-wall provided with a central bearing-receiving bulge having a tapering or inclined bearing-seating portion, a rounded self-centering-type bearing mounted within each of said bulges, a flat-spring locking-disk disposed on the inside of each bulged end-wall and having a tapering or inclined central bearing-seating perforation for engaging its associated bearing, and a plurality of link-means for holding each flat-spring locking-disk in a predetermined spaced relation to the end-wall of its associated shell.

20. The invention as defined in claim 2, characterized by said front and rear shells each having an end-wall provided with a central bearing-receiving bulge having a tapering or inclined bearing-seating portion, a rounded self-centering-type bearing mounted within each of said bulges, a flat-spring locking-disk disposed on the inside of each bulged end-wall and having a tapering or inclined central bearing-seating perforation for engaging its associated bearing, and a plurality of link-means for holding each flat-spring locking-disk in a predetermined spaced relation to the end-wall of its associated shell.

21. The invention as defined in claim 1, characterized by said front and rear shells each having an end-wall provided with a central bearing-receiving bulge having a tapering or inclined bearing-seating portion, a rounded self-centering-type bearing mounted within each of said bulges, a flat-spring locking-disk disposed on the inside of each bulged end-wall and having a tapering or inclined central bearing-seating perforation for engaging its associated bearing, and a plurality of eyelets for holding each flat-spring locking disk in a predetermined spaced relation to the end-wall of its associated shell.

22. The invention as defined in claim 2, characterized by said front and rear shells each having an end-wall provided with a central bearing-receiving bulge having a tapering or inclined bearing-seating portion, a rounded self-centering-type bearing mounted within each of said bulges, a flat-spring locking-disk disposed on the inside of each bulged end-wall and having a tapering or inclined central bearing-seating perforation for engaging its associated bearing, and a plurality of eyelets for holding each flat-spring locking-disk in a predetermined spaced relation to the end-wall of its associated shell.

23. A motor having a stationary part having housing-means, a rotatable part associated therewith, said rotatable part having a commutator at its front end and a fan at its rear end, said housing-means including a plurality of brushholder-means for supporting a plurality of brushes bearing upon said commutator in the front portion of said housing-means, said brushholder-means including brushholder-connectors disposed within the front portion of said housing-means, said housing-means further including front and rear end-walls which are similar to each other in general outlines, each end-wall being provided with a central bearing-receiving bulge, a bearing mounted within each of said bulges, each end-wall having a second annular bulge surrounding its bearing-receiving bulge, said second annular bulge having a radius sufficiently large to provide additional clearance for the brushholder-connectors at the front end of the motor and to provide a fan-baffle at the rear end of the motor, the annular bulge in at least the rear end-wall being perforated for air-circulation in conjunction with said fan.

24. A motor having a stationary part having housing-means, a rotatable part associated therewith, and two rounded self-centering-type bearings for the rotatable part, said rotatable part

having a commutator at its front end and a fan at its rear end, said housing-means including a plurality of brushholder-means for supporting a plurality of brushes bearing upon said commutator in the front portion of said housing-means, said brushholder-means including brushholder-connectors disposed within the front portion of said housing-means, said housing-means further including front and rear end-walls which are similar to each other in general outlines, each end-wall being provided with a bearing-receiving bulge having a tapering or inclined bearing-seating portion for receiving one of said bearings, a flat-spring locking-disk disposed on the inside of each bulged end-wall and having a tapering or inclined central bearing-seating perforation for engaging its associated bearing, and holding-means for securing each flat-spring locking-disk to its associated end-wall, each end-wall having a second annular bulge surrounding said holding-means for the flat-spring locking-disk, said second annular bulge having a radius sufficiently large to provide additional clearance for the brushholder-connectors at the front end of the motor and to provide a fan-baffle at the rear end of the motor, the annular bulge in at least the rear end-wall being perforated for air-circulation in conjunction with said fan.

25. A motor having a stationary part having housing-means, a rotatable part associated therewith, and two rounded self-centering-type bearings for the rotatable part, characterized by said housing-means including two end-walls, each provided with a bearing-receiving bulge having a tapering or inclined bearing-seating portion for receiving one of said bearings, a flat-spring locking-disk disposed on the inside of each bulged end-wall and having a tapering or inclined central bearing-seating perforation for engaging its associated bearing, and means for holding each flat-spring locking-disk in a predetermined spaced relation to its associated end-wall.

26. A motor having a stationary part having housing-means, a rotatable part associated therewith, and two rounded self-centering-type bearings for the rotatable part, characterized by said housing-means including two end-walls, each provided with a bearing-receiving bulge having a tapering or inclined bearing-seating portion for receiving one of said bearings, a flat-spring locking-disk disposed on the inside of each bulged end-wall and having a tapering or inclined central bearing-seating perforation for engaging its associated bearing, and a plurality of link-means for holding each flat-spring locking-disk in a predetermined spaced relation to its associated end-wall.

27. A motor having a stationary part having housing-means, a rotatable part associated therewith, and two rounded self-centering-type bearings for the rotatable part, charcterized by said housing-means including two end-walls, each provided with a bearing-receiving bulge having a tapering or inclined bearing-seating portion for receiving one of said bearings, a flat-spring locking-disk disposed on the inside of each bulged end-wall and having a tapering or inclined central bearing-seating perforation for engaging its associated bearing, and a plurality of eyelets for holding each flat-spring locking-disk in a predetermined spaced relation to its associated end-wall.

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