Oct. 7, 1952 H. A. SHUMAKER ET AL 2,613,242

ELECTRIC MOTOR WITH SPLIT POLE PIECES

Filed Feb. 10, 1949 2 SHEETS—SHEET 1

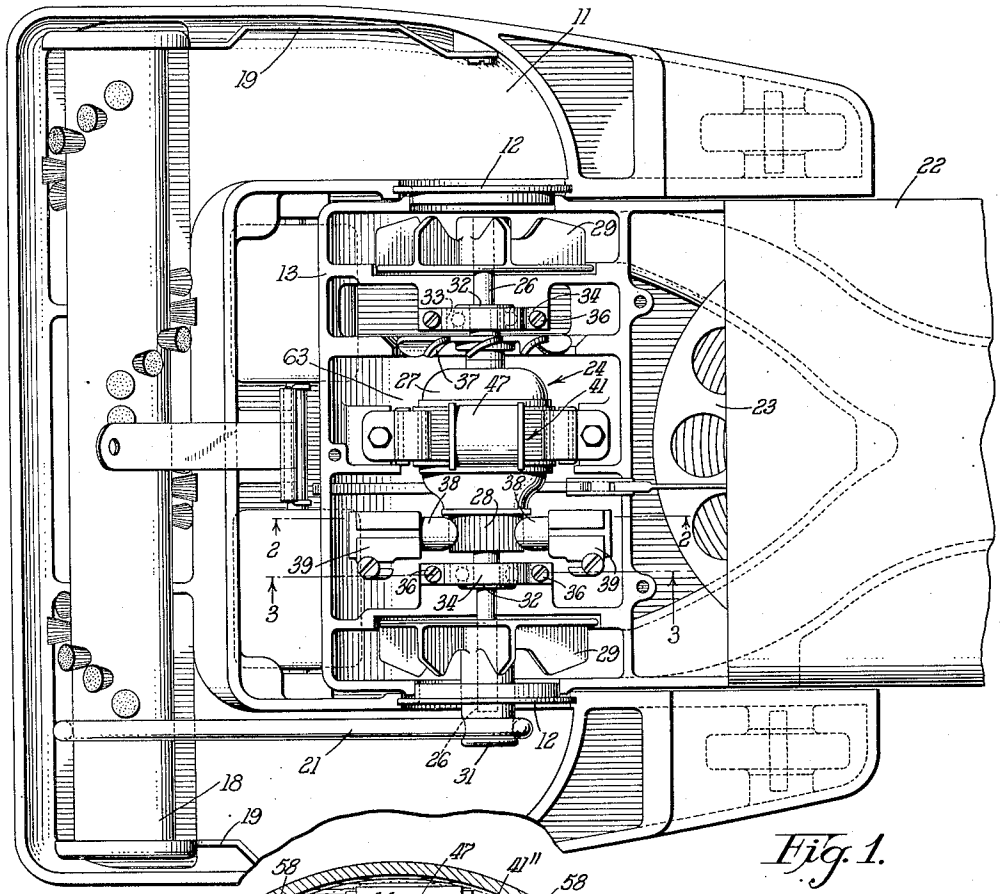


Fig. 1.

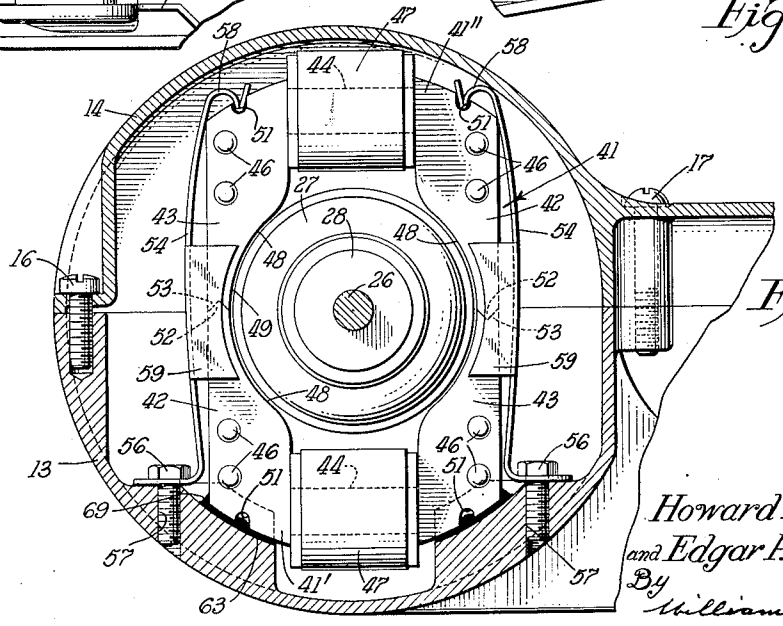


Fig. 2.

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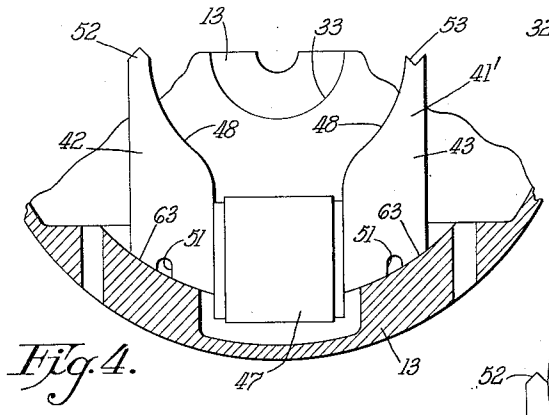


Fig. 4.

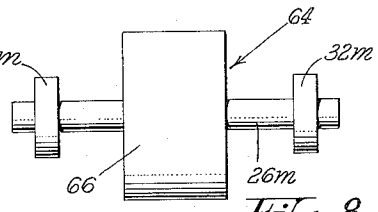


Fig. 8.

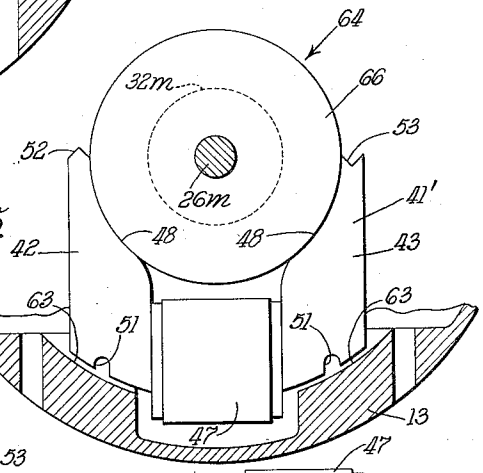


Fig. 5.

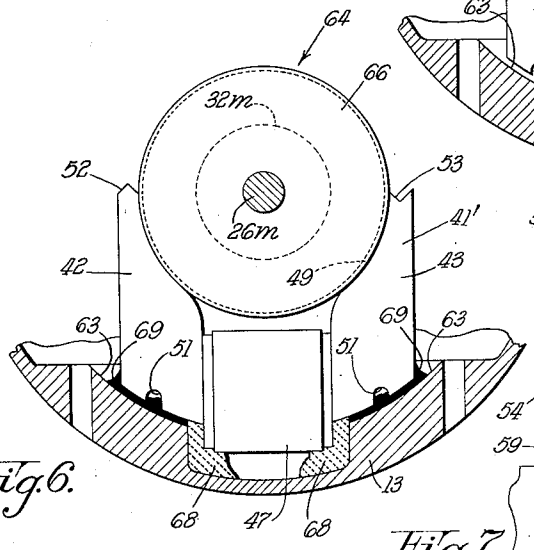


Fig. 6.

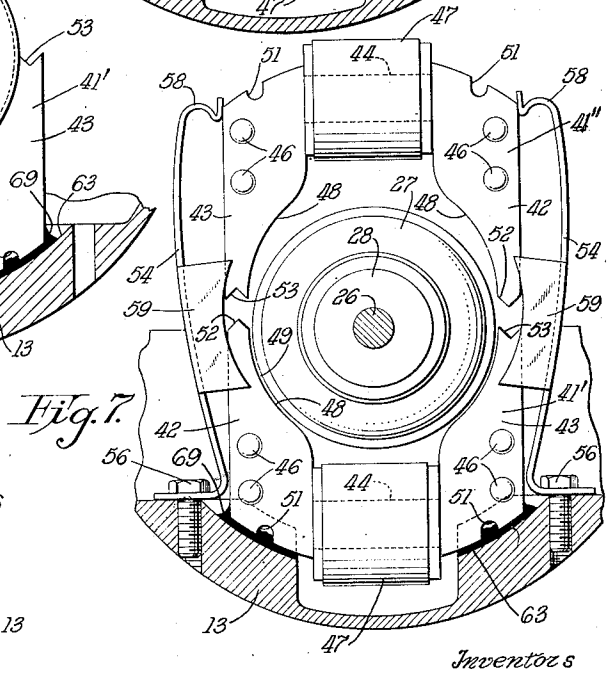


Fig. 7.

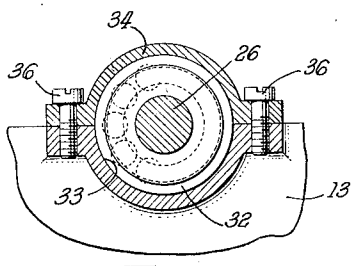


Fig. 3.

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Patented Oct. 7, 1952

2,613,242

UNITED STATES PATENT OFFICE

2,613,242

ELECTRIC MOTOR WITH SPLIT POLE PIECES

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Application February 10, 1949, Serial No. 75,552

7 Claims. (Cl 172—278)

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The present invention relates to electric motors especially adapted, though not necessarily restricted, for use in ambulatory type vacuum cleaners, and the invention has for one of its primary objects to provide an improved motor and method of constructing the same.

Another object of the invention is to provide an improved field pole clamping means for electric motors.

Another object of the invention is to provide a new and improved method of assembling an electric motor.

A still further object of the invention is to provide an improved means for accurately locating and holding the field pole pieces of an electric motor.

The invention comprises the devices, combination and arrangement of parts hereinafter described in connection with the accompanying drawings, which illustrate a preferred embodiment of the invention and in which:

Fig. 1 is a plan view of a portion of a vacuum cleaner showing the motor of this invention, part of the motor frame and vacuum cleaner shell being removed to show the internal construction,

Fig. 2 is a fragmentary sectional view taken substantially along the line 2—2 of Fig. 1,

Fig. 3 is a fragmentary sectional view taken on the line 3—3 of Fig. 1,

Figs. 4, 5 and 6 are schematic diagrams showing some of the elements shown in Fig. 2 and illustrating the method of installing the lower pole piece,

Fig. 7 is a fragmentary view particularly illustrating the method of installing the upper pole piece, and

Fig. 8 is a reduced scale view of a dummy mandrel used to position the lower pole piece.

Referring more specifically to the drawings, the invention is disclosed as embodied in an electric motor and fan unit mounted in a vacuum cleaner of the type described in patent application Serial No. 64,736, filed December 11, 1948, and having a lower casing shell 11 which is adapted to be covered by an upper casing shell, not herein shown but fully illustrated in the patent application Serial No. 64,736 supra. Held clamped by the upper and lower casing shells are flanged rings 12—12 and these rings pivotally support a split, combination motor-fan housing or frame comprising a lower, motor-fan frame member 13 and a complemental upper, motor-fan frame member 14, the upper motor-fan frame member being held to the lower frame member by screws 16 and 17.

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The vacuum cleaner, per se, is equipped with a rotary dust brush 18 supported on arms 19—19, and driven by a belt 21. A propelling handle 22 which carries a cord reel 23, as fully set forth in patent application Serial No. 64,736 supra, is secured to and pivots with the upper and lower motor-fan frames 14 and 13.

In addition to the previously described upper and lower motor frames 14 and 13, the motor-fan unit includes a unitary rotating element 24 comprising a shaft 26 carrying, at its mid-point, an armature 27 and associated commutator 28. Each end of the shaft 26 is equipped with a suction fan 29 and one end of the shaft is extended to form a driving pulley 31 for the belt 21. Adjacent each fan, the shaft carries a ball bearing 32 of which the outer race rings are each adapted to be fitted (Fig. 3) into a semi-circular bearing socket 33 formed in the lower frame 13. The ball bearings 32 are held in their respective sockets 33 by clamps 34 and screws 36. By reason of this construction, the unitary rotating element 24 may be assembled and dynamically balanced apart from the rest of the motor. The previously balanced rotating element 24 may be inserted into the lower motor frame 13 without having to balance it after it is installed. A motor cooling fan 37, of known construction, is secured to the shaft 26 at a location between the armature 27 and one of the bearings 32. Also a pair of of brushes 38—38, that may be of known construction, are supported by boxes 39—39 in such a manner as to engage the commutator 28.

A split pole piece 41, which forms the magnetic circuit for the field portion of the motor, comprises a pair of identical U-shaped structures, having arm portions 42 and 43, and a connecting bridge 44. The U-shaped structures are designated in the drawings as lower pole piece 41' and upper pole piece 41''. The pole piece 41, as a whole, is supported by the lower motor-fan housing 13 by means presently to be described. Each pole piece 41' and 41'' is constructed from a plurality of soft iron laminations clamped together by rivets 46, in a known manner. The connecting core or bridge 44 of each U-shaped member 41' and 41'' is surrounded by and thus supports a field coil 47. Each arm 42 and 43 of the two pole pieces 41' and 41'' is cut away on a curve 48, of which the radius is slightly greater than the radius of the armature 27, thereby permitting the pole pieces to span the armature 27 with sufficient clearance to provide a proper air gap 49 (Fig. 2). The base of each arm 42 and 43 is provided with a depression 51 the pur-

pose of which will hereinafter be explained. The end (Fig. 7) of each arm 42 has a point 52, which when the two pole pieces are assembled, as shown in Fig. 2, enters a V-shaped notch 53 formed on the end of the arm 43. Reference to Fig. 2 of the drawings shows that the lower pole piece 41', when installed in the frame 13—14, is positioned with its arms 42—43 upstanding, whereas, the pole piece 42'' is inverted with its arms 42—43 depending.

The upper pole piece 41'' is held (Fig. 2) to the lower pole piece 41' by a pair of substantially Z-shaped spring clips or hold-down clamps 54—54. The lower bent end of each clip 54 is held to the lower motor frame 13 by means of a screw 56 threaded into a hole 57. The upper end of each clip 54 is fashioned into a hook 58 for engaging the depressions 51—51 formed in the upper pole piece 41''. Each clip 54, intermediate its ends, carries a U-shaped guard 59 of such size and shape as to just fit over the joint 52—53 between the upper and lower pole pieces 41'' and 41' and thus assure proper alignment of the pole pieces in a direction longitudinally of the shaft 26.

The lower pole piece 41' is located in the lower motor-fan frame 13 so as to have the cutaway surfaces 48 truly coaxial with the bearing sockets 33—33 in the lower motor frame 13 by a method which comprises placing (Fig. 4) the lower pole piece 41' in the lower motor frame 13 and resting on seat 63 therein, but with the lower core 41' below its proper position. Then placing, in the bearing sockets 33—33 of the lower half of the motor frame, a dummy unit or mandrel 64 (Figs. 5 and 8) having a shaft 26^m and a pair of bearings 32^m—32^m that are identical in size with the shaft bearings 32—32 carried on the motor-fan shaft 26. The mandrel 64 instead of having an armature secured between the two bearings 32^m—32^m, is provided with a cylindrical magnet 66, of which the diameter is larger than the diameter of the armature 27 by an amount equal to the air gap 49 normally desired between the armature 27 and pole pieces 41' and 41''. When this magnet is in place and supported by its bearings 32^m—32^m from the bearing sockets 33—33, it lifts by magnetic force, (Fig. 5) the lower pole piece 41' from the seat 63 and holds it truly coaxial with the axis of rotation of the armature 27. When this has been accomplished, the space (Fig. 6) between the lower motor frame 13 and the lower pole piece 41' is temporarily filled with clay or other suitable flowable material, as indicated at 68. When the lower pole piece 41' is properly positioned, molten metal or other suitable flowable material 69 is poured into the space between the bottom of the lower pole piece 41' and the seats 63 provided in the lower half of the motor frame 13. When the molten metal 69 has solidified, it holds the lower half of the pole piece in its proper working position coaxial with the axis of the motor shaft. The dummy mandrel 64 is then removed and replaced by the prebalanced rotating unit 24 of the motor.

The preferred method of installing the upper pole piece 41'' is indicated in Fig. 7, wherein the spring clips 54—54 are shown sprung sufficiently to allow the upper pole piece 41'' to be shoved down between the hooks 58—58. It will be apparent that when the points 52—52 engage the notches 53—53 that the hooks 58—58 will enter the depressions 51—51 in the upper pole piece 41'', as shown in Fig. 2. When this has been accomplished, the other motor parts including the brushes 38, the brush boxes 39, the belt 21, upper motor frame 14 etc. can easily and quickly be installed.

Electrical conductors for connecting the cord reel 23 to an external source of electric power, to the brushes 38—38, and to the field coils 47—47 of the motor are not shown and, it will be understood that any proper and well known electrical connections may be used.

Having thus set forth the nature of the invention, what we claim is:

1. A split frame electric motor comprising a lower frame, a lower pole piece supported by an internal portion of said lower frame, an upper pole piece identical in form to said lower pole piece, a pair of spring clips carried by said lower frame, and a hook on the upper end of each of said spring clips, said hooks engaging said upper pole piece and thereby holding said two pole pieces together.

2. A split frame electric motor comprising a lower frame member, a U-shaped pole piece supported from said lower-frame member and having a pair of upstanding arms, an armature rotatably supported from said lower-frame member and positioned between said upstanding arms, a U-shaped pole piece having depending arms resting on the upstanding arms of said lower pole piece, a pair of spring clips secured to said lower frame, a hook on the upper end of each of said spring clips, said hooks engaging said upper pole piece, a pair of U-shaped guards carried by each of said spring clips, said guards spanning the arms of said pole pieces, and an upper frame member secured to said lower frame member.

3. A split frame electric motor comprising a lower-frame, a complemental upper-frame secured to said lower-frame, an armature enclosed by said frames and rotatably supported by said lower-frame, a pair of identical pole pieces having matching pin and notched ends and thereby fitted together and arranged to encompass said armature, and means for securing both of said pole pieces to the lower frame, including a pair of Z-shaped spring clips secured to said lower-frame and engaging said upper pole piece.

4. A split frame electric motor comprising, a lower frame member, a U-shaped lower pole piece having one pin ended arm and one notch ended arm, a thermoplastic material interposed between the bottom of said lower pole piece and said frame member, an inverted U-shaped upper pole piece having one pin ended arm and one notch ended arm placed upon said lower pole piece, and hooks carried by said lower frame member and engaging said upper pole piece; whereby said pole pieces are clamped to said lower frame member.

5. A split frame electric motor, comprising, a separate lower-frame member, a separate U-shaped lower pole piece carried by said lower frame member, an inverted U-shaped upper pole piece placed upon said lower pole piece, said upper pole piece being identical with said lower pole piece and hold-downs having lower portions secured solely to said lower frame member and having upper portions engaging solely said upper pole piece, thereby forcing said upper pole piece against said lower pole piece, and said lower pole piece against said lower frame member.

6. A split frame electric motor, comprising, a separate lower-frame member, a separate U-shaped lower pole piece carried by said lower frame member and having a pair of upwardly

extending arms, a point on the end of one of said arms and a notch on the end of the other of said arms, an inverted separate U-shaped upper pole piece having a pair of downwardly extending arms, a point on the end of one of said downwardly extending arms and a notch on the end of the other of said downwardly extending arms, said upper pole piece being identical with said lower pole piece and being placed upon said lower pole piece, and hold-downs having lower portions secured solely to said lower frame member and having upper portions engaging solely said upper pole piece, thereby forcing said upper pole piece against lower pole piece, and said lower pole piece against said lower frame member.

7. A split frame electric motor, comprising, a separate lower-frame member, a separate U-shaped lower pole piece, an inverted separate U-shaped upper pole piece having a pair of depressions in one end thereof and placed upon said lower pole piece, said upper pole piece being identical with said lower pole piece, and means having one end secured to said frame member and

having the other end entering said depressions in said upper pole-piece and thereby holding both of said pole pieces to said lower-frame member.

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