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2,540,178

MOTOR-DRIVEN FAN UNIT FOR USE IN VACUUM CLEANERS

Filed Nov. 5, 1947

3 Sheets-Sheet 1

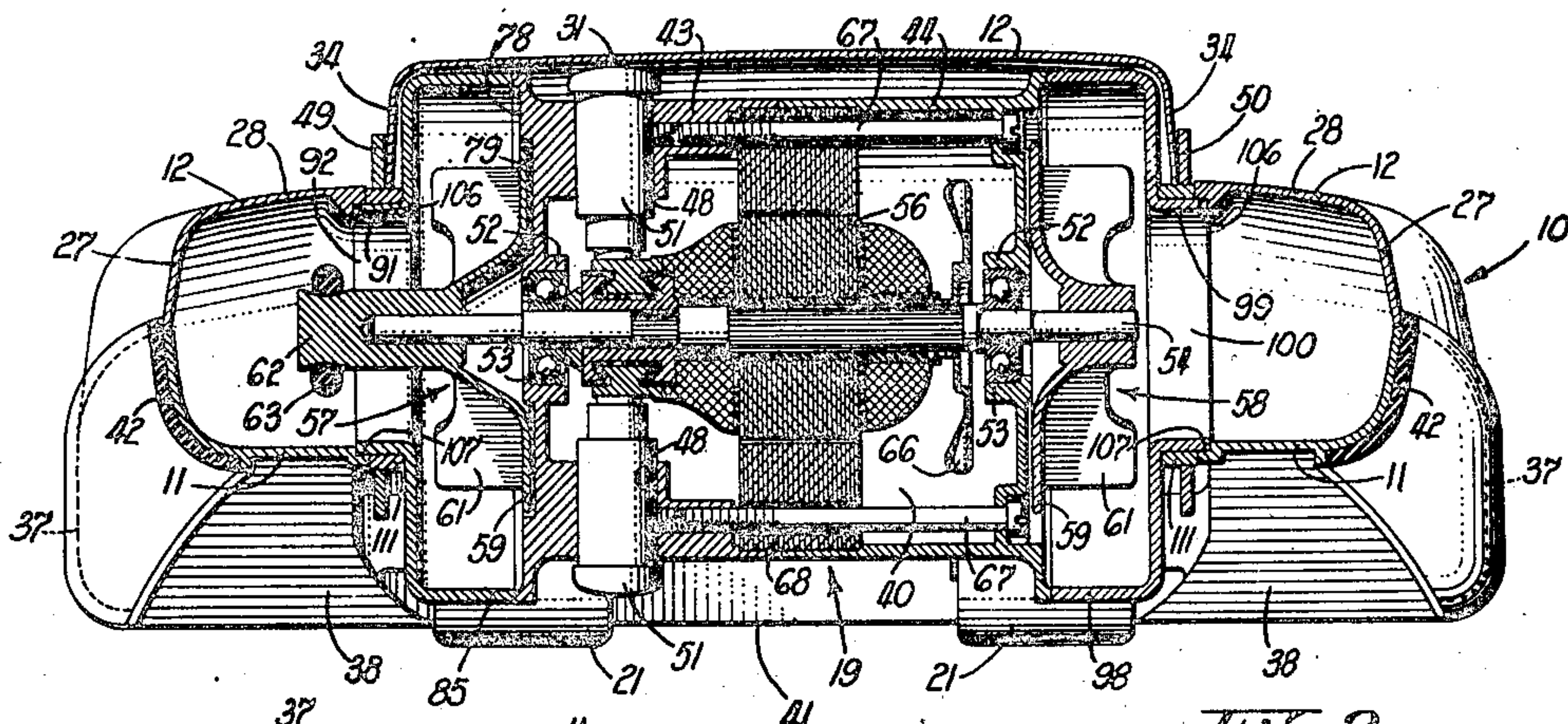


Fig. 2.

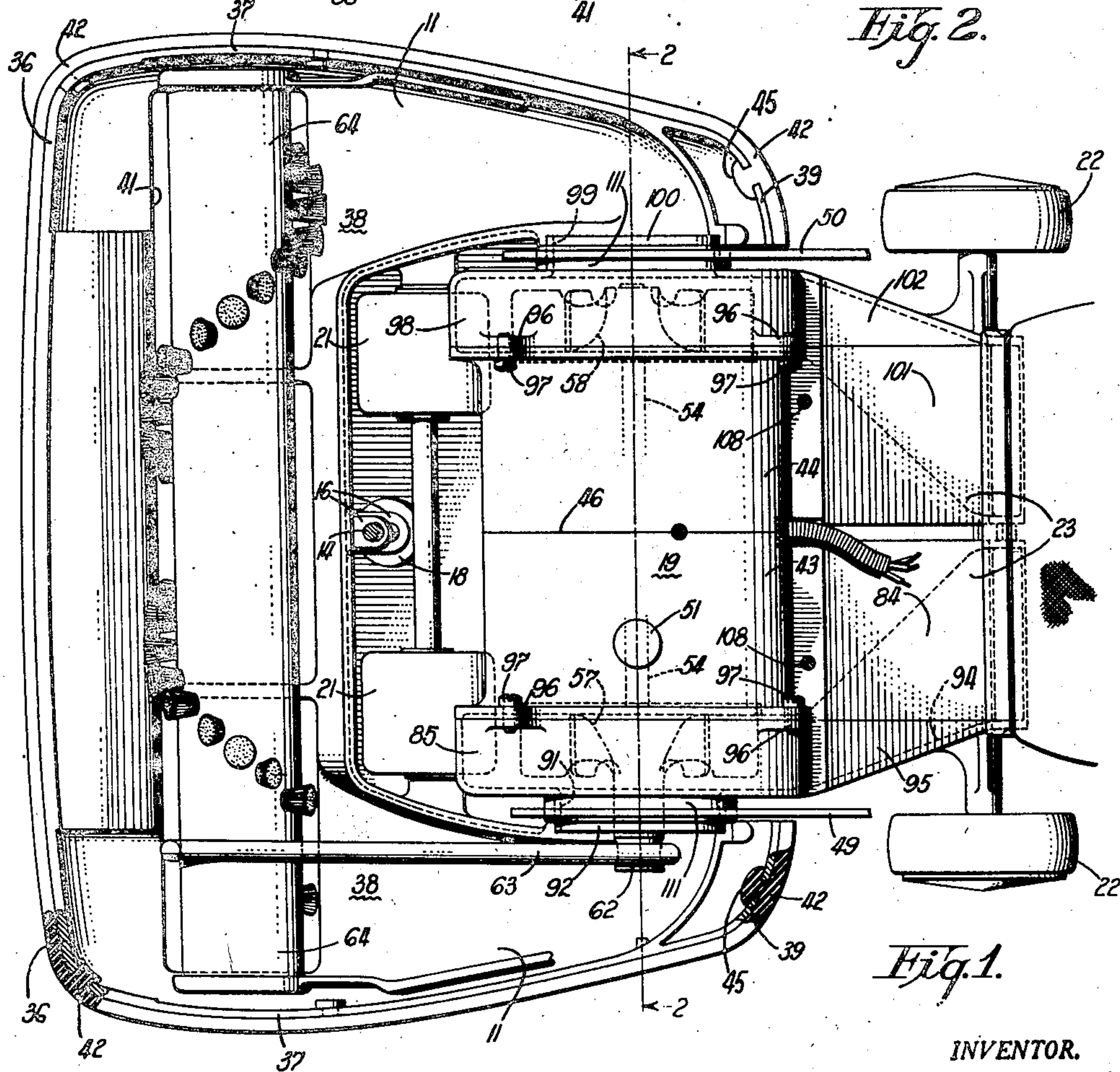


Fig. 1.

WITNESS

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3 Sheets-Sheet 2

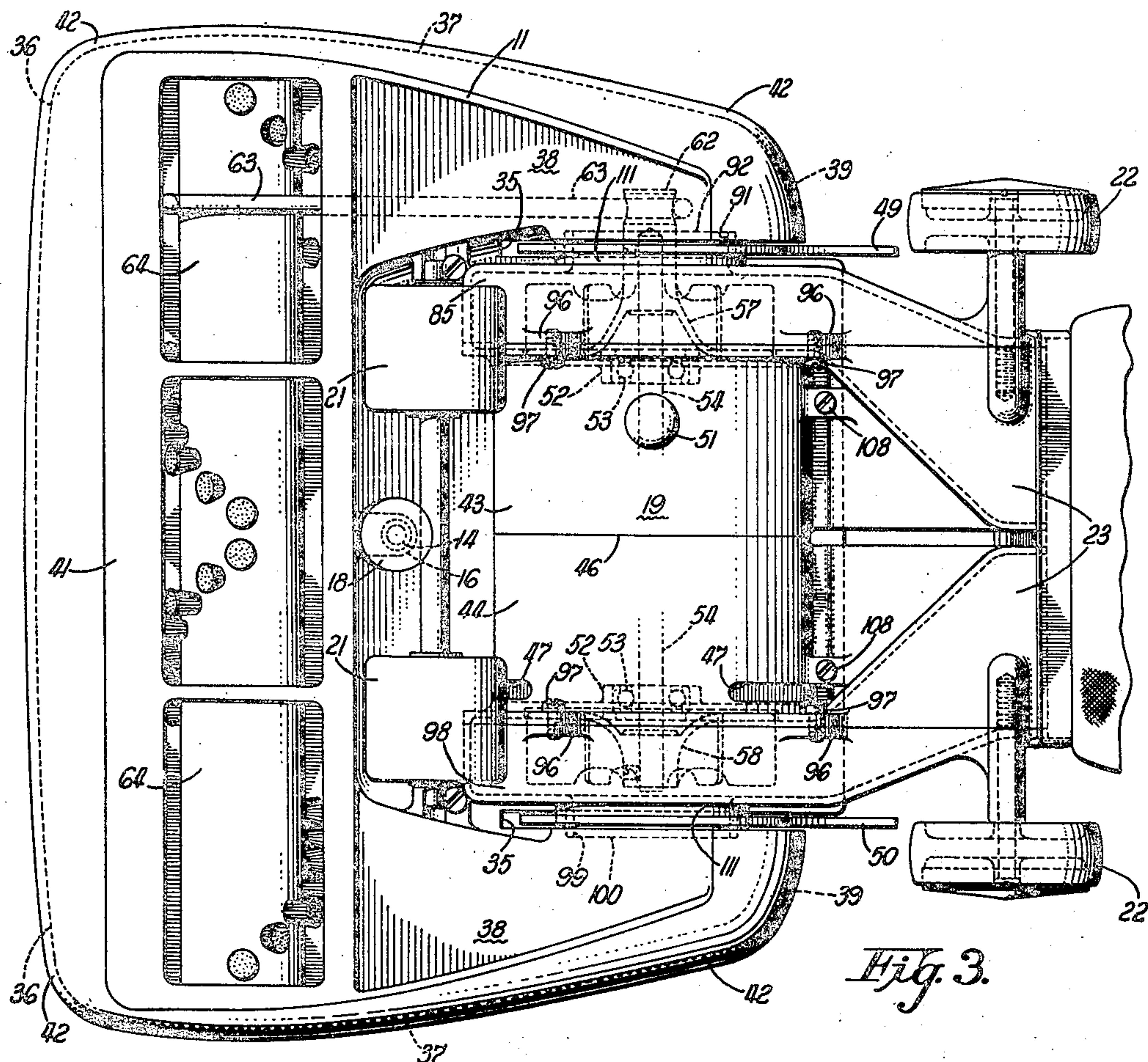


Fig. 3.

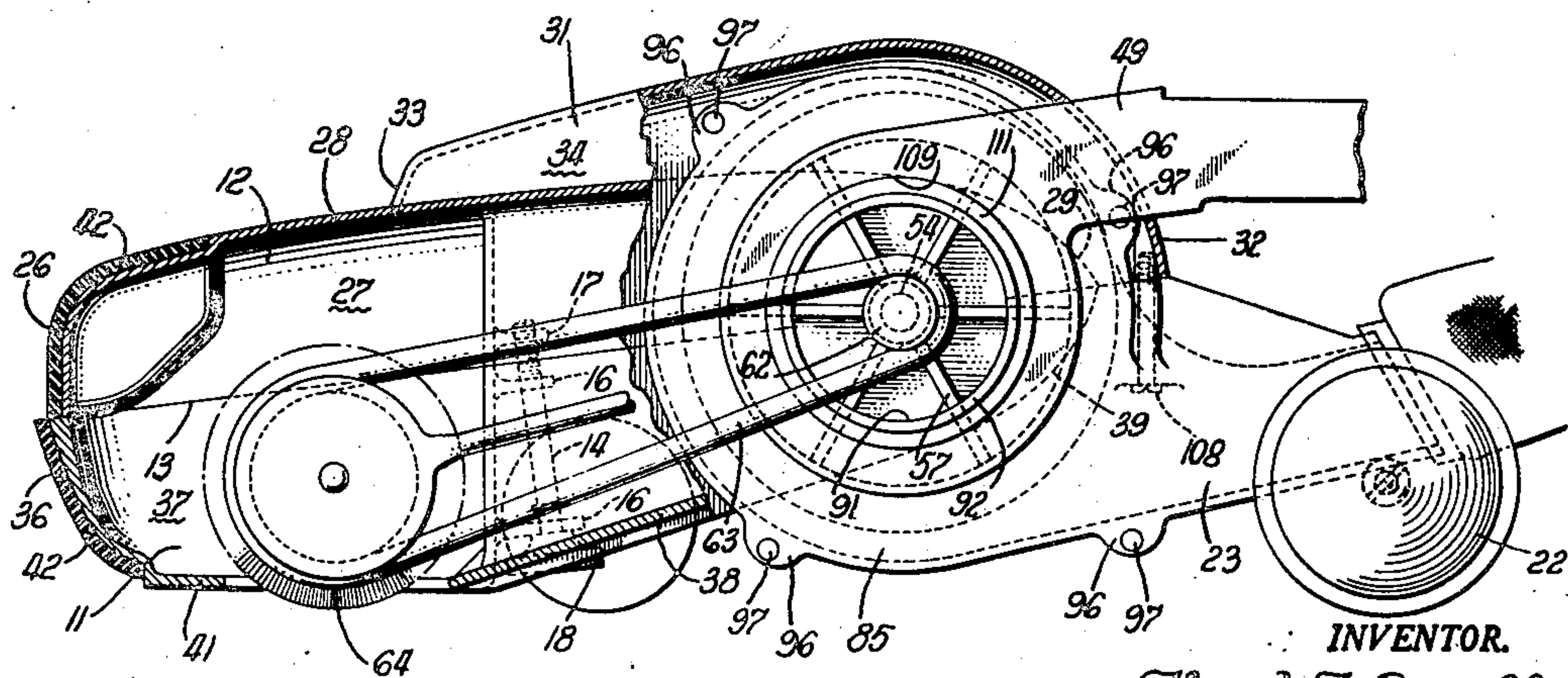


Fig. 4.

WITNESS

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MOTOR-DRIVEN FAN UNIT FOR USE IN
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Application November 5, 1947, Serial No. 784,165

6 Claims. (Cl. 230-117)

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This invention relates to electric vacuum cleaners and more particularly to an electric motor-driven fan unit especially adapted though not necessarily restricted for use in vacuum cleaners.

A United States patent application Serial No. 784,167, filed November 5, 1947, by E. P. Turner, describes and claims a vacuum cleaner arranged to support a motor-fan unit between upper and lower chassis members and arranged at the same time for pivotally mounting the handle of the vacuum cleaner on trunnions formed as part of the motor-fan unit. The motor-fan unit, housed between the upper and lower chassis members, described in the above noted application, may be any one of several different types but preferably it will be a motor-fan unit having a rotary fan housing formed on both ends thereof and in which each of the fan-housings is formed with an outwardly extending trunnion that is coaxial with the motor shaft. The instant application has for one of its objects the provision of such an improved motor-fan unit which is especially adapted, though not necessarily restricted, to use in the vacuum cleaner arrangement set forth in the United States patent application Serial No. 784,167, supra.

Another object of the invention is to provide an improved motor-fan unit having a motor located in a center position and a fan on each end thereof.

A still further object of the invention is to provide an improved motor-fan unit casing having an exhaust duct, part of which is formed integral with the motor casing, and part of which is formed integral with the fan casing.

With the above and other objects in view, as will hereinafter appear, the invention comprises the devices, combinations and arrangements of parts hereinafter set forth and illustrated in the accompanying drawings of a preferred embodiment of the invention, from which the several features of the invention and the advantages attained thereby will be readily understood by those skilled in the art.

In the drawings—

Fig. 1 shows a top plan view of a vacuum cleaner embodying this invention, the top shell being broken away to show the internal construction;

Fig. 2 is a sectional view of the cleaner and taken substantially along the line 2—2 of Fig. 1;

Fig. 3 is a bottom plan view of the vacuum cleaner shown in Figs. 1 and 2;

Fig. 4 is a side elevational view of the mecha-

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nism shown in Figs. 1 and 2, parts being broken away and parts being in section to show the internal construction; and

Fig. 5 is an exploded bottom perspective view showing portions of the motor-fan unit of this invention.

In the embodiment selected for illustration, the invention is shown as applied to a vacuum cleaner having an ambulatory chassis 10 formed from a lower chassis shell 11 and an upper chassis shell 12; the two shells being joined on a line (Fig. 4) inclined slightly to the horizontal and indicated by the numeral 13. The lower shell 11 is held to the upper shell 12 by a screw 14 that is rotatably supported in a pair of bosses 16 formed integral with the lower shell 11. The threaded end of the screw 14 enters a threaded hole in a boss 17 formed integral with the upper shell 12 and the lower end of the screw 14 is provided with a knurled head 18.

A combination electric motor and fan unit 19 is supported in the chassis 10, and the vacuum cleaner as a whole is supported on front and rear wheels 21 and 22. The front wheels are rotatably supported on axles secured to the lower chassis shell 11, whereas the rear wheels 22 are journaled on axles secured to rearwardly extending exhaust ducts 23, formed as part of the motor driven fan unit 19.

The upper chassis shell 12 has a front wall 26, side walls 27, a top wall 28 and rear wall portions 29. The top wall 28 has a centrally located cupola 31 which extends above the wall 28 and, when the vacuum cleaner is fully assembled, overlies the motor-fan unit 19. The cupola 31 has a back wall portion 32 which extends a short distance to the rear of the back wall portion 29. The cupola 31 also has a front wall 33 and a pair of side walls 34. The top wall 28 of the upper shell 12, where it is adjacent the side walls 34 of the cupola 31 is apertured by a pair of long narrow slots 35. The purpose of which will appear presently. The lower chassis shell 11 is substantially U-shaped (Fig. 3) in plan view and has a front wall 36, side walls 37, a bottom wall 38 and back wall portions 39. A forward portion of the bottom wall 38 is apertured to provide a suction mouth 41. The front wall 36, the side walls 37 and the back walls 39 of the lower chassis shell 11 as well as the front wall 26 and part of the top wall 28 are covered with resilient material 42 which acts as a bumper. The bumpers (Fig. 1) are held to the chassis 10 by means of resilient buttons 45 that

are pushed through holes appropriately formed in the chassis walls.

The electrical components of the motor portion 40 of the unit 19 are housed within two cylindrically formed cup-like frame members or end-bonnets 43 and 44, the lip-rim portions of which abut on a plane 46, which plane is perpendicular to the central axis of the motor-fan unit 19. This plane 46, as best seen in Figs. 1 and 3, also coincides with the longitudinal center line of the vacuum cleaner and the vacuum cleaner handle. The only portions of the vacuum cleaner handle shown in the drawings, forming a part of this specification, are a pair of trunnion arms 49 and 50; it being understood that the remainder of the handle can be secured to these arms. The end-bonnet 44 (Fig. 3) is provided with a pair of downwardly facing slots 47 for ventilating the interior of the motor portion 40 of the unit 19. The end-bonnet 43 is provided with a pair of opposed holes 48 (Fig. 2) for accommodating a pair of conventional brush holders 51. Each of the end-bonnets 43-44 has a concentrically apertured hub 52 and each apertured hub supports the outer race ring of a ball bearing 53; the inner race rings of the ball bearings being fixed to a shaft 54. The shaft 54 has secured to it an armature 56 and two suction producing fans 57 and 58, one at each end of the said shaft; the fans being held in place by set screws 60. Each fan has a cylindrical disc-like spider 59, a plurality of radially positioned blades 61, and the fan 57 has an extended hub 62 which provides a pulley for driving a belt 63. The belt 63 drives a dust brush 64, which may be of conventional design. A third fan 56 mounted on the shaft 54 within the end-bonnets 44 perform the usual function of ventilating the motor 40. The end-bonnets 43-44 are held together by a plurality of through-bolts 67, and when thus held support a field structure 68 that may be of conventional design.

The extreme end of the end-bonnet 43 (Fig. 5) is provided with a flange 71 a portion of the outer periphery 72 of which is in the form of a spiral. The end-face 73 of this flange, and therefore the end-face of the end-bonnet 43, is provided with a recess 74 a portion of the inner periphery 76 of which is in the form of a spiral that is concentric with the outer periphery 72. This forms an axially extending wall 77, a portion 77^a of which is in the form of a spiral. A bottom surface 78 of the recess 74 is perpendicular to the motor shaft 54 and is provided with a circular recess 79 that is concentric with the motor shaft 54, and thus concentric with the hub 52. At a position 81 on the wall 77 a tangential portion 77^b joins the spiral portion 77^a. Also, at a position 82, the wall 77 bends sharply upon itself to form a wall portion 77^c that is parallel to the tangential wall portion 77^b. Also, as at 83, the bottom wall-surface 78 drops away between the two parallel walls 77^b and 77^c, thus forming a portion of an exhaust passageway 84 bounded top and bottom by walls 77^b and 77^c and on one side by a side wall 86. These walls are all formed integral with the end bell 43. The side wall 86 is positioned at an angle to the bottom surface 78 and is also at an angle to the shaft 54. The spider 59 of the fan 57 is of such diameter and axial thickness as to be of proper size as to just rotate in the recess 79. This allows the blade 61 and the hub of the fan to be positioned above the surface 78 of the recess 74, and since the recess 74 is comparatively shallow, the blades 57 extend a considerable distance beyond

the surface or end-face 73 of the end-bonnet 43. These protruding blades are covered and housed by a cup-shaped fan casing 85 having a wall 87 composed of a spiral wall 87^a, a tangential wall 87^b and a wall 87^c that is parallel to the wall 87^b. These three walls 87^a, 87^b, and 87^c are formed integral with the fan casing 85 and are complementary to and have the same configuration as the walls 77^a, 77^b and 77^c, respectively. The inner end of the wall 87 has a surface 88 that conforms to and is matched to the surface 73 on the end bonnet 43. The outer end of the casing 85 is closed by an outer wall 89 having an opening or fan eye 91 that is concentric to the shaft 54. A trunnion wall 92 is formed concentric with and completely encircles the eye 91. The axial length of pulley hub 62 is such that it protrudes beyond the end of the trunnion 92. The wall 89, at a position indicated by the numeral 93, bends toward the surface 88 thus providing a slanting side wall 94 that is substantially though not exactly parallel to the wall 86 formed integral with the end-bonnet 43. The top wall 87^b, the bottom wall 87^c and the slanting wall 94 bound three sides of a portion 95 of the exhaust passageway from the fan 57. Both the end-bonnet 43 and the fan casing 85 have a plurality of matched fastening lugs 96 which with the cooperation of a plurality of screws 97 hold the casing 85 to the end-bonnet 43. The fan casing 85 when secured to the end of the end-bonnet 43 provides a convenient and inexpensive means for housing the fan rotor 57. It also provides an intake port or eye 91 and exhaust passageway; the latter being formed by the two portions of passageways 84 and 95. As best seen in Figs. 1 and 3, the duct or passageway 84-95 is at an acute angle to the axis end-bonnet 43 and the axis of the fan casing 85.

The end-bonnet 44, except for being "opposite hand," is substantially of the same construction as the end-bonnet 43; the main difference being in that end-bonnet 44 accommodates the head of the bolt 67 (Fig. 2), whereas the end-bonnet 43 accommodates the threaded end thereof. The fan 58 differs from the fan 57 only in that it does not have the extended pulley hub 62. Also, in a manner similar to that previously described, a cup-shaped fan casing 98 is secured to the outer end of the end-bonnet 44. The casing 98, except for being "opposite hand" is the same as the previously described fan casing 85 and this casing 98 provides a means for housing the fan rotor 58 as well as an intake port or eye 99, a trunnion 100 and an exhaust duct formed by two portions 101 and 102. The eye 99 corresponds to the eye 91 and the portions 101 and 102 correspond to the portions 84 and 95, respectively.

The means for mounting the above described motor-fan unit in a vacuum cleaner is described and claimed in the patent application Serial No. 784,167, supra. Briefly stated, however, this is accomplished by having the two opposite trunnions 92-100 clamped between the upper and lower chassis shells 12 and 11 which for this purpose are formed with a pair of semicircular trunnion engaging surfaces 106 and 107, respectively. The motor-fan unit is additionally secured to the upper chassis shell 12 by a pair of screws 108 which pass through holes formed in the motor-fan unit.

In addition to acting as a means for positioning and supporting the motor-fan unit in the chassis 10, the two trunnions 92 and 100 pro-

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vide a means for pivotally mounting the pair of trunnion arms 49 and 50 to which the handle of the vacuum cleaner is attached. This is described and claimed in the patent application Serial No. 784,167, supra. However, it might be said that each trunnion arm 49—50 is apertured by a circular hole 109 (Fig. 4). A composition bearing-bushing 111 is press fitted into the hole 109, the internal diameter of the bushing 111 being of such a diameter as to be pivotally mounted on the outside of either the trunnion 92 or the trunnion 100 as the case may be.

From the above, it will be appreciated that this invention has provided a combination motor and fan unit comprising the following elements assembled into one complete package; (a) a motor having a shaft, (b) means for driving a belt from the shaft, (c) a pair of fans carried on opposite ends of the shaft, (d) a casing for each of the fans, (e) an intake port or eye formed in each of the casings, and (f) an exhaust duct for each fan, part of the exhaust duct being formed integral with the motor and part integral with the fan casing and the two ducts converging toward one another, (g) means both for mounting and locating the unit in a vacuum cleaner, and (h) means for pivotally mounting a handle.

The term "trunnion," as herein used, refers to the two opposite cylindrical projections or similar structures 92—100 formed on opposite sides of the motor-fan unit 19. The term "trunnion" is not intended to convey the idea that the motor-fan unit turns on the trunnions as an axis. The trunnion arms 49 and 50 rotate with respect to the trunnions, but in the preferred form of construction there is no relative rotary motion between the trunnions and the chassis shells 11 and 12.

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

1. A combination motor-fan unit adapted for vacuum cleaners comprising a pair of motor enclosing end-bonnets clamped together; a motor shaft rotatably supported in said end-bonnets; a fan secured to opposite ends of said motor shaft; a separable fan casing enclosing each of said fans and each fan casing having an eye positioned axially with respect to said motor shaft, a trunnion surrounding each of said eyes and extending axially beyond the main body of said fan casing; and a pair of exhaust ducts having walls some of which are formed integral with said end-bonnets and some of which are formed integral with said fan casings.

2. A combination motor-fan unit adapted for vacuum cleaners comprising a pair of motor enclosing end-bonnets clamped together; a motor shaft rotatably supported in said end-bonnets; a fan secured to opposite ends of said motor shaft; a fan casing enclosing each of said fans and each fan casing having an eye positioned axially with respect to said motor shaft, a trunnion surrounding each of said eyes and extending axially beyond the main body of said fan casing; a pulley hub carried by one end of said shaft and extending beyond the end of one of said trunnions; and a pair of exhaust ducts having walls some of which are formed integral with said end-bonnets and some of which are formed integral with said fan casings.

3. A combination motor-fan unit adapted for vacuum cleaners comprising a pair of end-bonnets clamped together; a motor shaft rotatably supported in said end-bonnets; a fan secured to opposite ends of said motor shaft; a fan casing

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enclosing each fan and having an intake eye formed integral therein; and a pair of exhaust ducts each having boundary walls, some of said walls of said exhaust ducts being formed integral with said end-bonnets and other of said walls of said exhaust ducts being formed integral with said fan casings.

4. A motor-fan unit comprising a pair of concentrically apertured end-bonnets, a bearing carried in each of said apertured end-bonnets, a shaft rotatably carried in said bearings; a fan secured to each end of said shaft, a fan casing secured to the outer end of each of said end-bonnets and enclosing said fan; each of said fan casings having a concentrically positioned inlet eye, a portion of an exhaust duct extending tangentially from each of said end-bonnets, and a portion of an exhaust duct extending tangentially from each of said fan housings; said portions of exhaust ducts combining to provide a pair of exhaust ports.

5. A combination motor-fan unit adapted for vacuum cleaners comprising a pair of end-bonnets; a motor shaft rotatably supported in said end-bonnets; and each of said end-bonnets having a recess the bottom surface of which is perpendicular to said motor shaft; a fan secured to each end of said shaft; a peripheral wall spirally formed around a portion of the periphery of each of said recesses; a wall integral with each of said end-bonnets and formed tangent to each of said spirally formed wall; a second wall integral with each of said end-bonnets and formed parallel to each of said tangential walls; a side wall formed integral with and between each pair of said parallel walls, said side wall being inclined at an angle to said bottom surface and to said shaft; and a fan casing secured to the end of each of said end-bonnets and covering each of said fans, each of said fan casings having a spiral wall, a tangent wall, and a parallel wall that are complements to similar walls on said end-bonnets and said fan casing also having a slanting side wall that is substantially parallel to said side wall on said end-bonnet.

6. A combination motor-fan unit adapted for vacuum cleaners comprising a pair of cup-shaped end-bonnets the lip portions of which abut one another; a motor shaft rotatably supported in said end-bonnets, and each of said end-bonnets having a recess the bottom surface of which is perpendicular to said motor shaft; a rotary fan secured to each end of said shaft and partly positioned in said recess; a peripheral wall integral with each of said end-bonnets and spirally formed around a portion of the periphery of each of said recesses; a wall integral with each of said end-bonnets and formed tangent to each of said spirally formed walls; a second wall integral with each of said end-bonnets and formed parallel to each of said tangent walls; a side wall formed integral with and between each pair of said parallel walls, said side wall being inclined at an angle to said bottom surface and to said shaft; and a cup-shaped fan casing secured to the end of each of said end-bonnets and cupped over each of said fans, each of said fan casings having a spiral wall, a tangent wall, and a parallel wall that are complements to similar walls on said end-bonnets and said fan casing, and also having a slanting side wall that is substantially parallel to said side wall on said end-bonnet, whereby walls on said end-bonnets and said fan casings cooperate to form a pair of exhaust ducts that extend away from and at an

angle to said motor shaft and which are converged toward one another.

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