Nov. 9, 1954 R. E. SMITH 2,694,136

AIR WARMING AND CIRCULATING APPLIANCE

Filed Sept. 13, 1952

3 Sheets-Sheet 1

Fig. 1

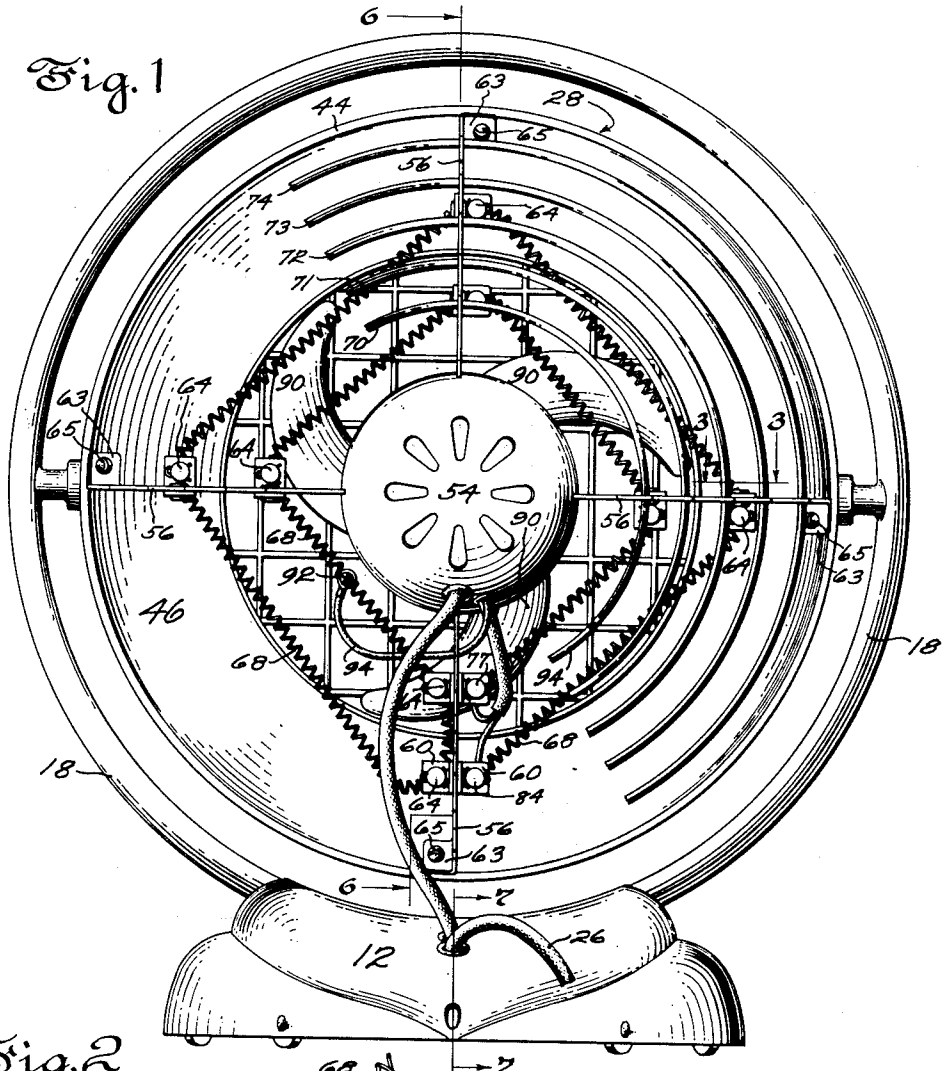
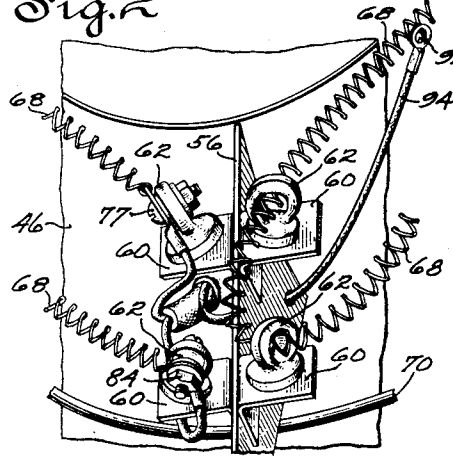


Fig. 2



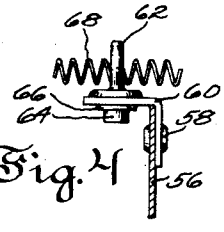


Fig. 4

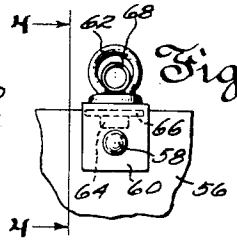


Fig. 3

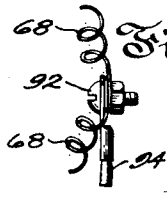


Fig. 5

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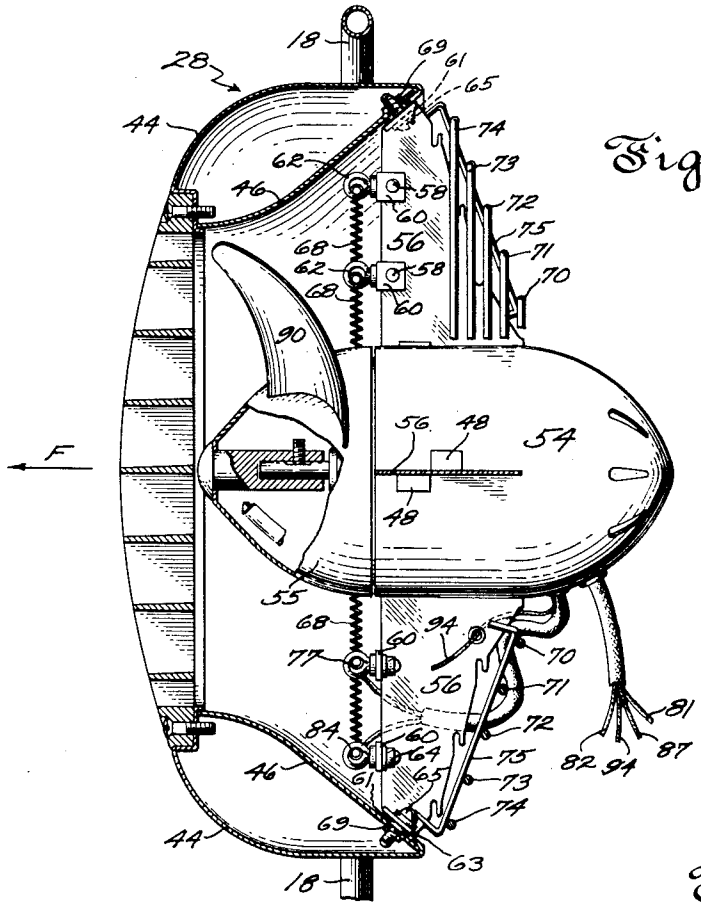
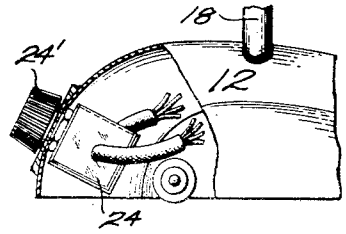


Fig. 6

Fig. 7



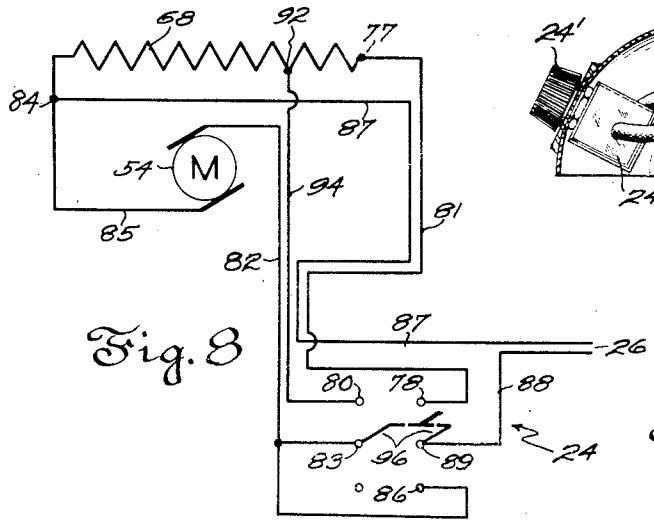


Fig. 8

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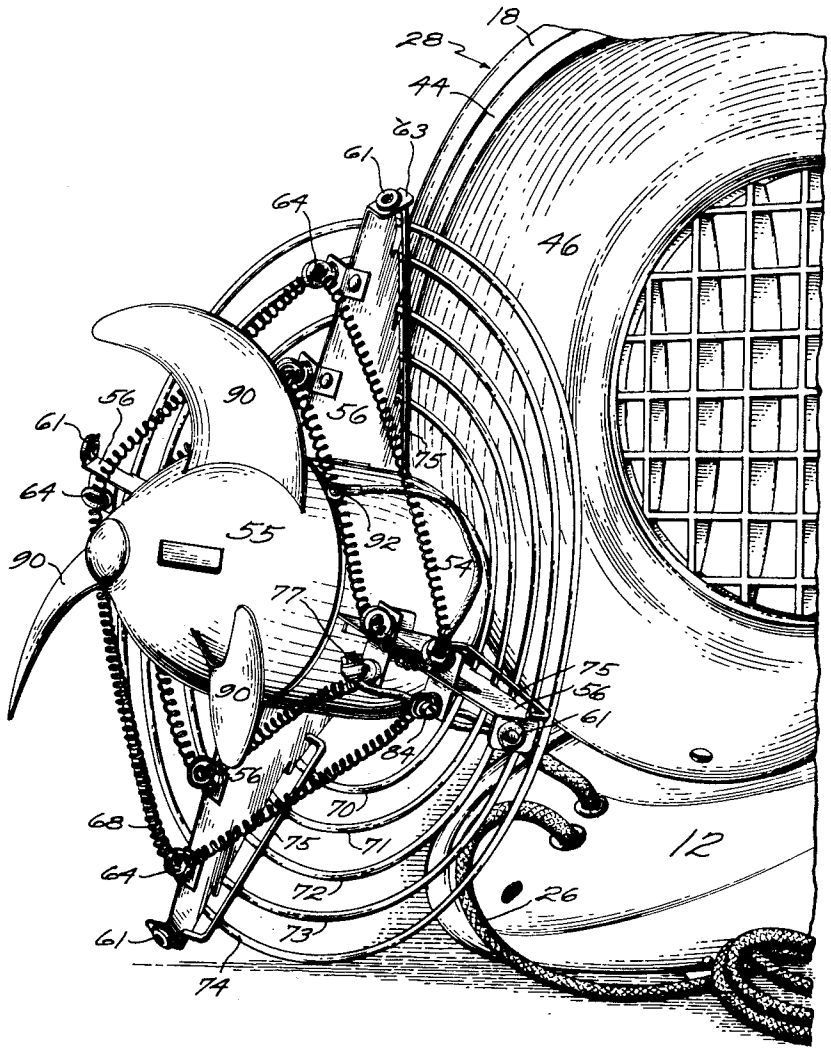

Fig. 9

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AIR WARMING AND CIRCULATING APPLIANCE

Raymond E. Smith, Hamden, Conn., assignor to The A. C. Gilbert Company, New Haven, Conn., a corporation of Maryland

Application September 13, 1952, Serial No. 309,437

3 Claims. (Cl. 219—39)

This invention relates to an air warming and circulating appliance incorporating with electric fan construction, similar to that disclosed in a co-pending application of William F. Moore, Serial No. 188,523, filed October 5, 1950, now Patent No. 2,672,280, issued March 16, 1954, an electric heating unit arranged to warm the stream of fan impelled air.

One object of the invention is so to incorporate the heating unit in the appliance that it may be inserted in and removed as a unit with the fan motor and impeller from a surrounding air conduit shell without disturbing or disassembling the latter.

Another object is to enable the fan and heater unit to be inserted in and removed from its surrounding and supporting air conduit shell through the air entrance end of such shell.

A related object is to be able to install as a unit interchangeably in the same undisturbed air conduit shell either a fan motor and impeller equipped with an air warming heater or a fan motor and impeller not so equipped.

Another object is to avoid heat transfer relationship between the heating unit and the metallic surfaces of adjacent structure from which it derives support.

Another object is to confine the support for the heating element to thin edge portions of radiating support arms that reach from the motor into fastening proximity to a surrounding air conduit shell.

A still further object is to dispose a continuous length of coiled electrical resistance wire in the path of the fan impelled stream of air in efficient heat transferring relation thereto and so as to enable the resistance coil to be tapped conveniently for placing a part thereof in electrical series with the winding of the fan motor.

These and related objects of the invention will become more apparent from the following description of a preferred embodiment of the improvements having reference to the appended drawings wherein:

Fig. 1 is a rear elevation of a fan equipped with an air heating unit constructed and electrically connected in accordance with the principles of this invention.

Fig. 2 is a perspective view drawn on an enlarged scale showing certain supporting and binding post structure for the heating element on a larger scale than in Fig. 9.

Fig. 3 is an enlarged fragmentary view of an insulative stud loop taken in section on the plane 3—3 in Fig. 1 looking in the direction of the arrows.

Fig. 4 is a view taken in section on the plane 4—4 in Fig. 3 looknig in the direction of the arrows.

Fig. 5 shows the construction of a tap connection in the resistance coil of the heater element.

Fig. 6 is a view taken in section on the plane 6—6 in Fig. 1, looking in the direction of the arrows.

Fig. 7 is a fragmentary view taken partly in section on the plane 7—7 in Fig. 1 looking in the direction of the arrows.

Fig. 8 is a wiring diagram of electric circuits incorporated in the present improvements.

Fig. 9 shows the air warming fan unit removed from its surrounding air conduit shell and turned about end for end.

The standard of the appliance may comprise any preferably hollow base 12 to which is fixed the bottom ends of a discontinuous rigid circular frame ring 18. Base 12 may be joined firmly with the frame ring 18 according to construction disclosed in co-pending U. S. application, Serial No. 195,210. Inside of base 12 there is mounted a preferably double-pole, double-throw electric snap switch 24 whose switch operating handle 24' is turnable to three positions and is accessible for manual operaiton outside of the base 12 at the front of the fan. Current supply for the fan is derived through a flexible attachment cord 26.

Pivotally mounted in angular positions maintained by detent devices on frame ring 18, as disclosed in the above said co-pending application, is an assembly comprising two readily separable inner and outer coaxial unitary structures. The inner of said structures comprises an electric motor 54 whose shaft carries the air impeller 55, and an electric heating unit 68 hereinafter described. The outer of said structures comprises a cowl 28 from which the fan assembly is supported. The circumferentially inner part of cowl 28 includes an air conduit shell 46 which forms an axially short annular tapering passageway for the air impelled through the appliance in the direction of arrow F in Figure 6. Shell 46 tapers from a relatively large air entrance at the rear of the appliance, or right end of the conduit in Fig. 6, to a minimum girth at the front of the appliance, or left end of the conduit in Fig. 6, near the tops of the fan blades 90 of the impeller 55. The outer circumferential part of cowl 28 is a casing shell 44 which may be connected pivotally to the frame ring 18 by a construction disclosed in fuller detail in a copending U. S. patent application, Serial No. 188,524, filed October 5, 1950, Patent No. 2,660,368, issued November 24, 1953.

The body of motor 54 is supported coaxially of and in rigid relation to the cowl 28 by means of four outward projecting mounting arms or fin plates 56. Each of these arms is of somewhat triangular shape and so disposed that it locates a substantial portion of the length of the motor body in outboard or rearwardly offset relation to cowl 28. Arms 56 are equally spaced angularly about the motor body to form a spider structure and are reinforced by five hoops of round wire, 70, 71, 72, 73 and 74. These hoops are of increasing diameter in the order named. The hoops are welded to four slanting support wires 75 which extend in radial planes. The bent-over ends of each support wire 75 are welded to the flat sided surface of a common fin plate 56.

Each fin plate 56 has flanges 48 at its apogee edge that are welded or otherwise fixed to the motor 54. There is inserted in a hole in the bent-over perigee end 63 of each fin plate an eyelet grommet 61 of vibration absorbing distortable resilient material. The four fin plates 56 are then removably fastened to the air conduit shell 46 by inserting holding screws 65 through the grommets 61 into screw threaded engagement with a bossed-out hole 69 in the sheet metal of conduit shell 28. Conduit shell 46 is assembled with the casing shell 44 to form the integral non separable cowl structure 28.

Thus by simply loosening or removing holding screws 65, the inner unitary structure, comprising motor 54 and impeller 55 with mounting arms 56 and the heater resistance wire 68, is readily separable as a unit from the outer unitary structure comprising cowl 28 and its supporting parts whatever form the latter may take. It is important that the overall girth of the aforesaid inner structure, including the shell reaching extremities 63 of mounting arms 56, is sufficiently smaller than the air entrance end of conduit shell 46 to enable such inner structure to be inserted in and removed from said outer structure through such air entrance end of the conduit shell, namely to or from the right in Fig. 6 without disturbing or disassembling the conduit shell in any way. See also Fig. 9.

There are fastened by rivets 58 to the margin of each arm or fin plate 56, and close to the front edge thereof, a plurality of small sheet metal angle brackets 60 each carrying a stud loop 62 forming an eye preferably of refractory insulating material such as porcelain. The shank 64 of stud loop 62 protrudes through a hole in the angle bracket 60 and is retained by an easily removable spring wire clamp 66 of horseshoe shape which embraces and is resiliently lodged in a peripheral groove in the shank 64.

The stud loops **62** serve to support a continuous length of flexible, openly coiled resistance wire **68**, one terminal of which connects to a binding post **77** which in turn is electrically connected by an insulated lead **81** with a stationary contact **78** in the double pole, double throw electric switch **24**. The outer terminal of resistance wire **68** is connected to a binding post **84** which in turn is connected to one side of motor **54** by means of the insulated lead **85**. Binding post **84** also is supplied with current directly from the attachment cord **26** through one wire **87** thereof. The other wire **88** of attachment cord **26** connects to another stationary contact **89** in switch **24**. Motor **54** is connected to stationary contacts **83** and **86** of the switch **24**. Another stationary contact **80** of this switch is connected by lead **94** to a current tapping connection **92** on the resistance coil **68** for utilizing a portion of the latter's resistance in series with motor **54** in one position of the switch. In Fig. 8 the movable contacts of switch **24** are designated **96**.

The operation will be apparent from the foregoing description. When switch **24** is in "off" position as shown in Fig. 8 supply current is dead-ended at hinge terminal **89** wherefore no current reaches either the motor **54** or any part of the heating unit **68**. When the switch is operated by its handle knob **24'** to close contacts **86–89**, motor **54** alone will receive current directly across the power line and the fan will run at full speed for cooling while all parts of the heating unit will be dead-ended at switch terminals **78, 80**. When the switch knob is moved to a third position wherein supply terminal **89** is connected to contact **78** and contacts **80** and **83** are simultaneously closed, current to that portion of heating unit **68** which lies between connections **84** and **92** will be thrown across the supply line in shunt relation to motor **54** and the motor itself at the same time can derive its energizing current only in series with that portion of the heating unit lying between connections **77** and **92** in Fig. 8, whereupon the fan will run at reduced speed for impelling air past the heater unit thereby to be warmed and circulated for room heating purposes.

The important advantage of the present improvements in structure has already been mentioned, namely that the entire air impelling fan, its drive motor and the entire heating unit can be displaced as an integral structure from the air conduit shell for ready inspection, cleaning and repair.

The following claims are directed to and intended to cover all fair equivalents of the parts and arrangements disclosed herein which come within the inclusive meaning of the terms employed in the claims.

I claim:

1. An air warming and circulating appliance comprising a motor, an air impeller on the motor shaft, an air accelerating funnel shell surrounding said impeller, a mounting spider of skeleton construction occupying an annular space between said motor and shell including support plates radiating in the manner of fins from the motor, each of said plates having a radially innermost edge elongated in the direction of the motor axis fixedly attached to the motor, and each of said plates having two other edges respectively adjacent to and remote from said impeller spanning said annular space between said motor and shell and terminating at a radially outermost extremity of the plate, matching elements on said shell and on said plate extremities, means to fasten said elements detachably together, at least one plate bracing hoop fixedly attached to said space spanning edges of the plates that are remote from said impeller in a manner to maintain said matching elements on the plate extremities in relative positions to register respectively with said elements on the shell in the absence of said fastening means, an extent of electrical resistance wire disposed in the path of air drawn toward said impeller in the air accelerating region of said funnel shell, and holders made of electrically non-conductive refractive material mounted on said edges of said plates nearest said impeller and engaging with said resistance wire in a manner to support the same.

2. An air warming and circulating appliance as defined in claim 1, together with two closely neighboring binding posts supported by and in insulated proximity to one of the said support plates, the said extent of electrical resistance wire coursing continuously from one of said binding posts entirely about the said motor to a position near said binding posts and thereat looping to form a return bend from whence said wire courses continually to the other of said binding posts.

3. An air warming and circulating appliance as defined in claim 2, together with a branch circuit lead electrically connected to the said heating wire, one of the said fin plates containing a hole through which said lead extends for supporting constraint of said lead.

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