HEATER FAN COMBINATION

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Application December 14, 1946, Serial No. 716,214

10 Claims. (Cl. 219—29)

Our invention relates to a heater fan combination.

Broadly, the idea of projecting air through a heating element is old and it has also been suggested to remove or de-energize the heating element so that air at substantially room temperature can be moved by fan blade action. Many such heater fan combinations are of a substantially permanent nature and have been usefully employed for their intended purpose. Attempts to apply the same general idea to portable devices have not been eminently satisfactory for a reason of reasons known to those skilled in the art. In general, portable units have either been unsuccessful as fans or as heaters or as both; or they have been relatively much more expensive than their utility would warrant or they have suffered from other defects which have rendered them commercially unacceptable and they have enjoyed only a limited sales.

The principal object of our invention is the provision of an improved heater fan combination.

Another object is the provision of such a unit which is truly portable and which will perform good service as both a fan and heater.

Another object is to produce a portable heater fan combination which can be simply and inexpensively manufactured and which can be suitably and easily used for its intended purpose.

In carrying out our invention, we produce a blower type electric air heater with a removable heater housing having a parting line outside the major diameter of the fan. Electric heater coils are mounted inside the front shell and connected to the fan motor case with a cord and plug. The air outlet in the front portion of the shell and the air inlet in the rear portion of the cover are such that air flow is restricted to approximately 25% of the volume obtained when the fan is operated as a fan and with the heater shell removed. The fan speed is reduced at least the order of about 15% when the housing is in position due to the greatly increased horse power required to pass the air through the housing, and the speed and load factors work out in such a way that substantially the same effect is obtained as if a two speed motor were employed. Structurally, the combination of fan, motor housing and fan guard are pivoted to the base, the pivot being between the guard and a pair of upstanding arms supported by the base. The motor housing projects through the rear housing and the housing is mounted outside the fan guard in such a manner that it also pivots with the remaining portion of the structure when it has been mounted in position. Thus, both the fan and entire heater are adjustable about a horizontal axis so that the air whether heated or not can be directed to a particular point desired.

Other objects and specific features of the invention will be apparent from a consideration of the following detailed description taken with the accompanying drawings.

Fig. 1 is a front elevational view of the heater fan combination of our invention with some of the parts shown in dotted lines to illustrate the position thereof and with the housing carrying the heating elements in position;

Fig. 2 is a rear view thereof;

Fig. 3 is a side elevational view, also with the housing in position;

Fig. 4 is a side elevational view similar to Fig. 3 but with the housing removed;

Fig. 5 is a front elevational view of the device with the housing removed;

Fig. 6 is an enlarged vertical fragmentary sectional view showing the housing and the manner of supporting the heating elements therein;

Fig. 7 is a fragmentary, transverse sectional view taken substantially along the line T—T of Fig. 6;

Fig. 8 is an elevational view of the motor housing and contents thereof shown removed from its support;

Fig. 9 is a vertical central sectional view thereof with some of the parts in elevation;

Fig. 10 is a perspective view of a switch employed as part of the motor housing assembly;

Fig. 11 is a fragmentary perspective view showing a fastening detail as employed at the top portion of the housing between the two parts thereof;

Fig. 12 is a fragmentary perspective view showing the construction at the side edge of the housing where it engages around the fan;

Fig. 13 is an enlarged sectional view part in elevation showing a latch arrangement employed at the bottom of the housing; and

Fig. 14 is an exploded perspective view showing the details of the latch construction.

The embodiment of the invention shown in the drawings comprises a base 16 which may be used to support the fan in a generally upright position as indicated in Fig. 4, or which may be provided with a usual type of bayonet slot (note Fig. 2) to support the fan, with or without the heater housing, from a side wall. A yoke 17 has associated with it a re-enforcing strip 18, the
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The yoke and re-enforcing strip being together secured to the base by suitable means, as by screws 18, in the manner particularly indicated in Fig. 1 and Fig. 2. The yoke 17 is shaped to form a pair of upstanding arms to the top of which are pivoted a pivot and mounting bracket 21. The pivot and mounting brackets 21 comprises simply a pair of transverse metal strips having a pair of right angular end portions 21' (see Fig. 4) through which pivot bolts 22 extend and to which such pivot bolts are preferably substantially permanently secured so that the bracket and pivot bolts move as a unit. The pivot bolts 22 also extend through the upper ends of the yoke 11 and wing nuts 23 threaded on the pivot bolts 22 can be tightened to secure the pivot and mounting bracket in substantially movable position with respect to the base.

A cup shaped motor housing 24 has a front closure plate 26 secured thereto by means of a plurality of integral projections 27 whereby to form a firm engagement between the closure plate and the cup shaped housing and the entire motor housing assembly and contents are mounted into the pivot and mounting bracket 21 by securing such member and the closure plate 26 together in any suitable manner as by welding, riveting, or the like. The motor housing carries a motor, as shown generally in Figs. 8 and 9, by means of which a shaft 25 is driven, carrying fan blades 28. The fan blades are protected by a guard 31 of relatively heavy wire, the guard 31 comprising a number of wire sections secured together in the manner shown and fastened to the pivot and mounting bracket 21 by welding. To re-enforce and strengthen the lower portion of the guard, however, a vertically positioned section 31' is suitably secured to the closure plate 26 by a screw 32 or other fastening means. The arrangement shown produces a relatively very inexpensive but, in many respects, advantageous assembly of the fan portion of the device only differing from usual fan constructions in that the guard, of which the pivot and mounting bracket 21 comprises an integral part, is pivoted to the base or like support and the motor housing is secured to the fan guard assembly. By contrast in the usual construction of the prior art, the motor housing is pivoted to a base and the fan guard is secured to the motor housing. The mechanism, as so far described, is very easily assembled for manufacturing purposes as well as for service purposes. It comprises the motor housing assembly, without the closure plate 26, as one sub-assembly; the guard and parts integral therewith, including the member 21 and closure plate 26, as another sub-assembly; the base, with its yoke 17, as another sub-assembly; and the fan blades as the final sub-assembly. To assemble, the fan blade assembly is slipped into position within the guard 31, the housing 24 mounted to the closure plate 26 while at the same time suitably securing the fan blade assembly to the motor shaft and the portion of the assembly already mounted together then secured in position in relation to the base as shown in Fig. 16. The assembly may be carried out in a different order of steps than described, but it will be obvious that we have provided a compact, inexpensively manufactured, but efficient, fan device as a part of the combination of our present invention.

A or header shell or housing comprises a front shell 33 and rear cover 34 secured together in a manner to be described along a parting line 36 (see Fig. 3) which is outside the major diameter of the fan, and, indeed, just outside the major circumference of the guard 31.

While the exact position of the housing may be formed in various ways, we have found a simple inexpensive method to comprise forming a band 37 having a cross section partly shown in Fig. 6 and securing the ends of that band together at a suitable spot in their circumference, preferably coincident with the location of a latch member as will be described. A front portion 38 is suitably formed, as by a drawing operation, and is extended over the front edge of the band 37 in the manner particularly shown in Fig. 4, and the parts suitably secured together as by spot welding, low temperature brazing or the like. The front cover 39 has an opening 40 partially closed by a mesh 41, the mesh being suitably of the expanded metal type to give maximum rigidity coupled with suitable openness as desired in this particular type of installation. A plurality of guards 42 are secured in front of the mesh 41, preferably in the manner disclosed in the copending application of William H. Kitt, Serial No. 678,794, filed June 24, 1946. These guards are preferably shaped in the manner shown in section in Fig. 6 and plan in Fig. 7, so that their ends engage and are secured to the front portion 38 of the shell at opposite sides of the mesh 41.

The rear cover 43 generally is shaped like the front portion 38 with, however, a central opening 44 through which the tongue 45 projects and a plurality of air admitting openings 44 which are also preferably covered with a wire mesh similar to the mesh 41. The rear cover 43 slips over the edge of the band 37 in the manner particularly indicated in Fig. 6 and is secured thereto in the manner indicated, as the top edge of the band 37 carries an upwardly extending projection or tongue 46 (see Figs. 6 and 11) formed suitably by securing to the underside of the band a small plate 47 which carries the tongue 46, the tongue 45, therefore, projecting upwardly permanently through a slot in the band. The rear cover has a slit 48 through which the tongue 46 projects when the housing is assembled in a manner to be described.

A latch is provided in the bottom portion of the housing comprising the following members: A latch bar 49 (note Figs. 13 and 14) is slidable in a channel member 51, four outwardly extending ears 52 of which lie against the outside bottom surface of the band 37 and are secured together as by welding. The member 51, therefore, not only functions as a portion of a latch but also to secure the ends of the band 37 together so as to comprise an integral portion of the construction of the housing. A latch spring 53 has one end engaged over a projection 54 on the latch and another end engaging over projection 55 on the channel member 51. The spring is tensioned so as to draw the latch 49 in a left hand direction, looking at Fig. 13. A latch projection 57 is adapted to engage a projection 58 on the rear cover 34, formed thereon by the simple expedient of cutting a slit in the material comprising the rear cover 34 and partially drawing the material at one side of the slit out of the plane of the remaining portion of the cover to leave an outwardly extending projection. The rear cover 34 is secured to the front shell, therefore, by first engaging the tongue 45 through the slot 48, then bringing the remaining portion of the rear cover into engagement with the front shell and then withdrawing the latch by engag-
ing the tail piece 59 and drawing the latch member 49 backwardly against the tension of the spring 53 to engage the projection 67 over the projection 56. The spring 53 is made strong enough so that the rear cover is firmly held in position in this manner.

To hold the housing in fixed position with respect to the remaining portion of the fan assembly, the cover 34 and shell 37 are provided with edge slots 61 and 62, respectively (see particularly Fig. 12), which surround the pivot bolts 22 when the housing is assembled around the fan guard so that the two portions of the housing, namely, the band 37 and rear cover 34 are engaged and pinched between the ends 21 of the pivot mounting bracket 21 and the inside surfaces of the upwardly extending arms prising the yoke 17. Since the motor housing projects through the central opening 43 of the rear cover so as to prevent relative tipping movement between the housing and fan assembly, and the relative positions of the two portions of the device are fixed at the two pivot points, the fan and housing will always have the same relation with respect to each other, and the fan and housing can be moved as a unit to direct heated air in any desired direction.

The heating member comprising strands 63 of coiled resistance wire is secured to the heater shell in the path of air projected by the fan through the front opening 38. To support the strands 63 in position, we provide a pair of cross members 64 and 66 of generally channel shaped cross section as shown particularly in Fig. 6 and having end projections 67 (see Fig. 6) shaped to engage the inside surface of the band portion 37 of the heater shell where they are spot welded or otherwise attached to the shell. Thus, the cross members are secured in position in such a manner as to increase the strength and rigidity of the heater shell and at the same time to provide a support for the heater strands 63.

To secure the heating element in position, we provide a plurality of spool shaped resistance and refractory members 88, suitably porcelain, which, by means of screws 89, are attached to the cross members 64 and 66, for instance, in a pattern such as indicated in Fig. 1. At opposite ends of the cross member 66, we provide terminal posts 84 and 85. Strands 63 may, therefore, comprise coil sections of a continuous length of resistance wire, the ends of which are secured to the terminal assemblies 71. It will be noted that there are a greater number of turns of resistance wire at the outside portion of the opening 88 than at the center portion thereof. We have, by the means indicated, been able to regulate the coils of resistance wire to the air passing therethrough, that the air is of substantially uniform temperature as it emerges from the fan 38.

The strands 63 are supported closer together at the maximum point of maximum amount of air flow, but the heating surface at a particular point may be controlled in various ways, as, for example, by providing a greater number of coils in the strand and in other ways known to those skilled in the art. We have found a very simple manner of making the coiled strands to be grasping the central portion of a wire section with a suitable tool and twist the same while guiding the wire so that the helices are formed with opposite inclinations at the two sides of the point at which the wire is grasped. In this way, it is very simple to coil an intermediate section of a single strand and control the number of turns, thereby in a simple and inexpensive way producing a single strand with intermediate coil strand sections disposed between the fastening loops as clearly shown in Fig. 1.

The heating element is connected into the electrical circuit by means of two properly insulated lead-in wires 72 which are joined to form a single strand double conductor 73 which passes through a grommet 74 in the shell housing and leads to a suitable plug 76 for connection to a source of power in a manner which will be described.

A suitable motor for driving the fan is mounted within the cup-shaped housing 39 and comprises a stator consisting of a coil 77 carried on a laminated core 78 secured to the cup shaped motor housing by suitable means including mounting screws 79. A suitable rotor, which is not shown in detail in the drawings, carries the shaft 28 journaled in suitable bearings 21 and 22 formed in such a manner as to act as both radial and thrust bearings. These bearings are of such a type as to receive oil from time to time and to deliver oil thereto, we provide a pair of oil tubes 83 suitably formed of plastic and having supporting terminals 84, the shanks of which extend through holes in the housing, and the flat heads of which are in part engaged by the flange of a switch 85 to hold the oil tubes in position. The supporting terminals 84 are in the nature of hollow rivets which are slightly pinched in at their lower ends as indicated to grasp the plastic tubes and produce substantially a unitary assembly. By delivering oil through the members 84, it passes the tubes 83 and flows to the bearings through apertures therein provided for the purpose. The electric switch 86 is disposed in a rectangular opening at the top of the motor housing and has spring members 87 at each side thereof so that it can be snapped into position and will be held by the springs 87 or can be snapped out of position to disconnect it from the housing. At a corresponding position, near the bottom of the motor housing, is a combination socket and terminal member 88 held in position by a pair of fastening screws 89 which engage a mounting bracket 91. As noted particularly by reference to Fig. 8, the plug 76 engages in the socket 88 to provide a source of electrical energy to the heating coils. A cord 92 is adapted to be plugged in at a suitable manner to a source of power and is suitably led into the motor housing 24 where one of its conductors 93 is connected to one side of the switch 86 and another of its conductors 94 is connected to one terminal of the coil 77. A conductor 96 leads from the opposite switch terminal to the opposite side of the coil 77, and the coil and terminals of socket or receptacle 88 are suitably connected in parallel so that when the coil 77 is energized the receptacle 88 will also be live. Thus the circuit comprises the switch 86 and coil 77 connected in series and the receptacle 88 connected in parallel with the coil so that by operating the switch 86 to “On” position both the motor and heating elements are energized if the heating elements are connected into the circuit, or if the heating elements are not connected into the circuit, then the motor will nevertheless be energized and can be operated without the heating coil. The heating element, however, cannot be heated except when the fan is operated.

At the rear of the motor housing, aligned with the coil 77, we provide a plurality of louver 97 so that some of the air moved by the fan will pass through the motor housing and be directed against the portion of the motor developing the greatest amount of heat.
It will be seen from the above description that the combination device of our present invention can equally well operate as a fan unit or heater unit and in any case is adjustable and simply and easily employed just as if it had been designed to perform only a single function. It will be noted that the top of the housing is provided with a handle 98 for easy portability when the device is used as a heater, while the guard may act as a handle to carry the fan when the heater housing is not in position. While normally the device is expected to stand on its base, it may be suitably supported, as by means of the bayonet slot 88 indicated in Fig. 2, in which case the base will lie in a vertical plane and the fan motor and heater housing (if in position) may be rotated a major portion of 90 degrees about the pivots to direct air, heated or otherwise, substantially in a horizontal direction.

If the device is to be used only as a fan, it will deliver unheated air if the plug 16 be removed, but preferably the entire housing is removed because there is a substantially greater delivery of air under such circumstances. To remove the housing, the plug is first removed, the latch at the bottom of the housing disconnected, the wing nuts loosened, and the rear cover 34 removed by first separating it at the bottom and then lifting the slot away from the tongue at the top of the housing. The cord is passed through the central opening of the rear cover and it is removed in its entirety. The front housing is then removed by merely separating it from the pivots, and the wing nuts are then tightened with the fan in suitable position for operation. The housing may be stored temporarily with the rear cover and heater shell latched together as shown in Fig. 2 in a position around the fan blades. To replace the housing, the reverse steps are employed. The wing nuts are first loosened, the fan and guard placed in the heater shell, suitably by placing the heater shell on the cap and placing the fan face downwardly in its base. The cord and motor housing then extended through the central rear opening of the rear cover, and the rear cover then latched to the housing in the intended manner. The band 31 and rear cover 34 will, automatically, be disposed between the pivot and mounting bracket 21 and yoke 17 when assembled in this manner, and when the wing nuts are fastened the assembly will be complete except for insertion of the plug 16 which is required to deliver current to the heating elements.

The combination of our invention may be constructed in various ways and the capacity may be varied. We have obtained good results by providing a construction in which approximately five hundred cubic feet of air per minute are displaced by the fan without the heater housing and approximately one hundred thirty-five cubic feet of air per minute when the heater housing is in position. The flow of air through the housing should preferably be restricted to somewhere between about 20% and 40% of that of full fan capacity without the housing and suitably about 25% when delivering values of the order described. We have found that by restricting the air intake in the manner described, the fan speed is reduced at least of the order of about 15% of full speed without the housing. In some respects this produces the same general effect as obtained by the use of a two speed motor; in other words permits obtaining several advantages without the attendant costs.

There are many details and advantages in the construction of our invention which will be recogzized by those skilled in the art but which have not been fully explained because of their obviousness. It might be noted, however, that the oil tubes pass very close to the terminal screws of the switch, and by forming them of plastic the possibility of a short circuit or arcing is greatly reduced. To accomplish a manner of securing the metal terminals and holding the tubes in position is also advantageous. It should be noted, also, that the cord 13 is preferably made short enough so that it is impossible to remove the housing without first disconnecting the plug 16.

Some of the remaining details, particularly as to motor construction and the like may be made the subject matter of separate applications. The scope of the invention as directed to the combination fan and heater is defined in the claims.

What we claim as new and desire to protect by Letters Patent of the United States is as follows:

1. In a heater fan combination, a fan structure including a base, motor housing, fan blades and blade guards, operable as a fan, and a plural part heater housing entirely surrounding the fan and guards therefor, the parts being separable at a point outside the major diameter of the fan, the housing having a heating element and means to deliver current thereto, the said housing being so apertured to pass substantially less air than that normally delivered by the fan with the housing removed.

2. A heater fan as defined in claim 1 wherein said heating element is mounted on the inside front portion of the housing, and including a cord same manner as when in position around the fan blades. To replace the housing, the reverse steps are employed. The wing nuts are first loosened, the fan and guard placed in the heater shell, suitably by placing the heater shell on the cap and placing the fan face downwardly in its base. The cord and motor housing then extended through the central rear opening of the rear cover, and the rear cover then latched to the housing in the intended manner. The band 31 and rear cover 34 will, automatically, be disposed between the pivot and mounting bracket 21 and yoke 17 when assembled in this manner, and when the wing nuts are fastened the assembly will be complete except for insertion of the plug 16 which is required to deliver current to the heating elements.

The combination of our invention may be constructed in various ways and the capacity may be varied. We have obtained good results by providing a construction in which approximately five hundred cubic feet of air per minute are displaced by the fan without the heater housing and approximately one hundred thirty-five cubic feet of air per minute when the heater housing is in position. The flow of air through the housing should preferably be restricted to somewhere between about 20% and 40% of that of full fan capacity without the housing and suitably about 25% when delivering values of the order described. We have found that by restricting the air intake in the manner described, the fan speed is reduced at least of the order of about 15% of full speed without the housing. In some respects this produces the same general effect as obtained by the use of a two speed motor; in other words permits obtaining several advantages without the attendant costs.

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and blade guards, operable as a fan, and a plural part heater housing releasably secured together about the said guard along a peripheral line outside the major diameter of the fan, the housing having a heating element and means to deliver current thereto, the said housing being apertured to pass substantially less air than that normally delivered by the fan with the housing removed, said housing having a cylindrical portion rolled from sheet metal, the ends of which are spaced from each other along a meridian of the cylinder, but secured together by having a latch housing attached thereto, the housing containing a spring and latch functioning to secure separable portions of the housing together.  

9. In a heater fan combination, a fan having a support, a motor and motor housing adjustable with respect to the support, and fan blades driven by said motor, all operable as a normal air moving fan, and a housing entirely surrounding said fan blades and separable at its major diameter, said housing being apertured to permit flow of air therethrough at not more than about seventy-five percent capacity of the fan without the housing, and a heating element carried by the housing and disposed to heat substantially equally all air passing through the same.  

10. A heater-fan combination comprising a base having a pair of upstanding arms, a mounting bracket having pivot bolts extending into said arms, a motor and housing secured to said mounting bracket, fan blades driven by said motor, a guard surrounding said fan blades and secured to the mounting bracket, a housing having two principal parts secured together about substantially their major diameter outside the major diameter of the fan so as to enclose the fan blades and guard, one such housing part being apertured to permit the motor housing to project therethrough and the other carrying a heating element along the general axis of the fan, the housing being apertured to pass air equivalent to not more than about seventy-five percent capacity of the fan, the said housing being disposed between said mounting bracket and upstanding arms when in assembled relation around the fan blades, and nuts threaded on the said pivot bolts to hold the fan and housing in adjusted relation, the housing being separable and removable and the said nuts adapted to secure the mounting bracket alone when the fan is employed without the housing.  

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