

Sept. 11, 1962

C. J. KAYKO

3,053,028

ELECTROSTATIC FILTER

Filed Dec. 2, 1957

3 Sheets-Sheet 1

Fig. 1

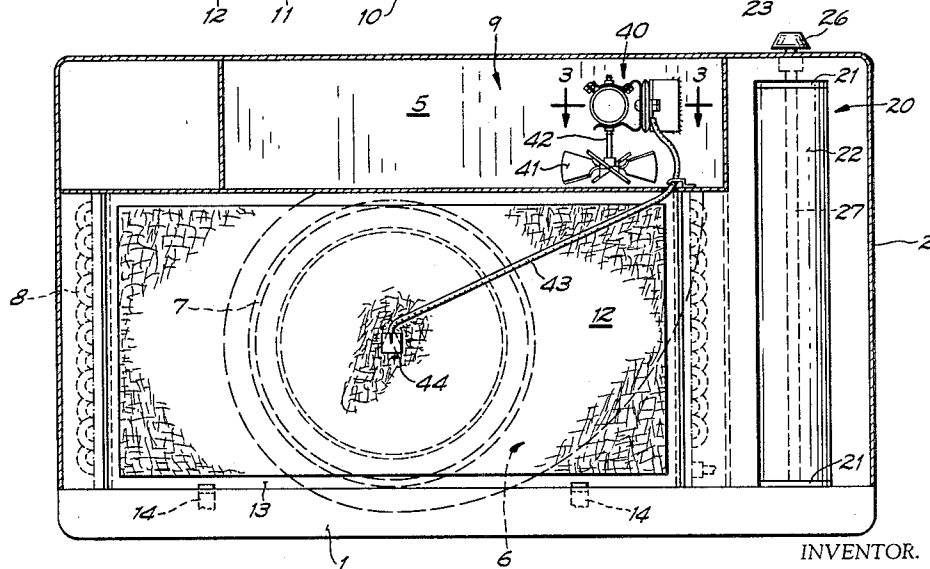
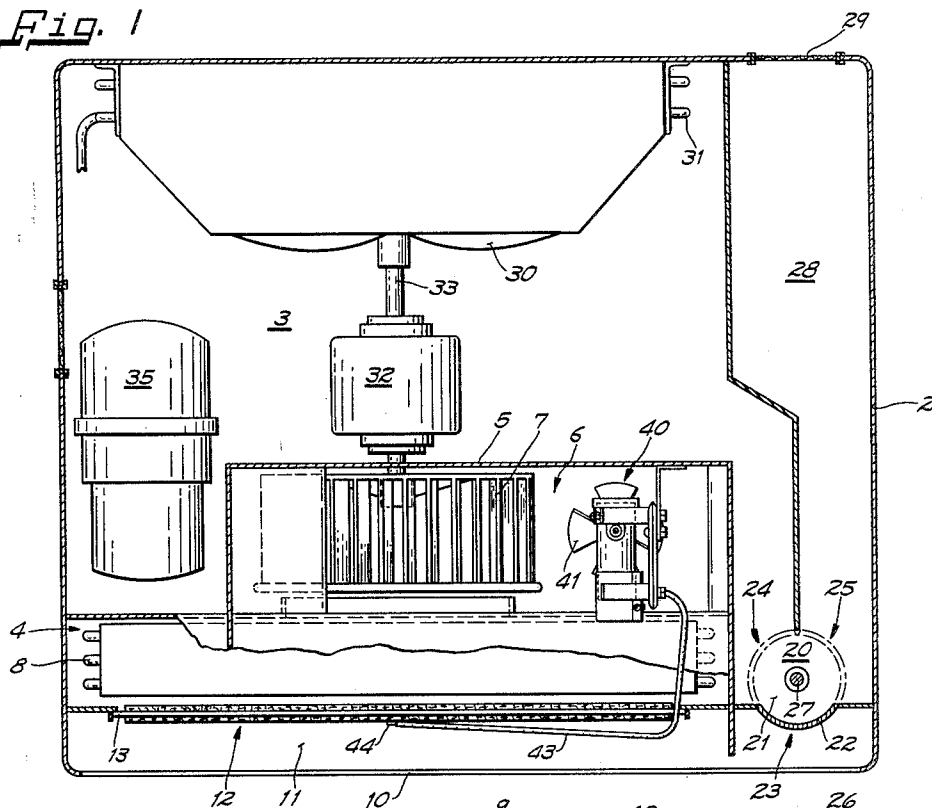


Fig. 2

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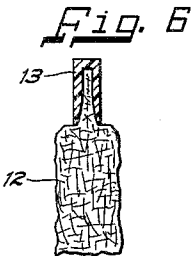
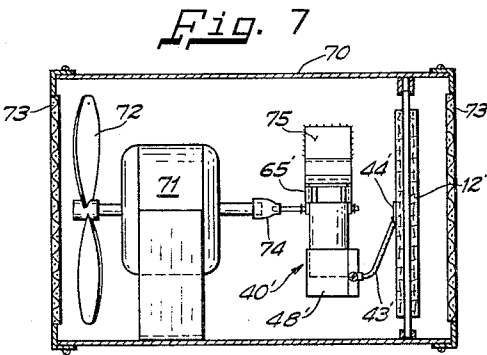
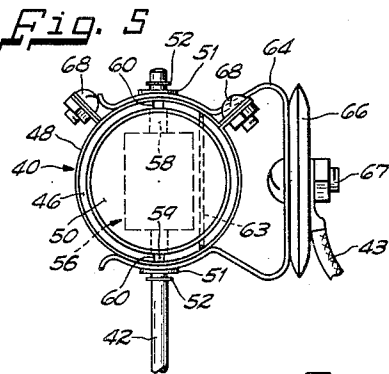
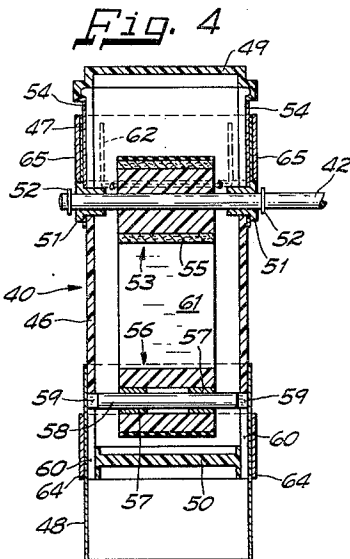
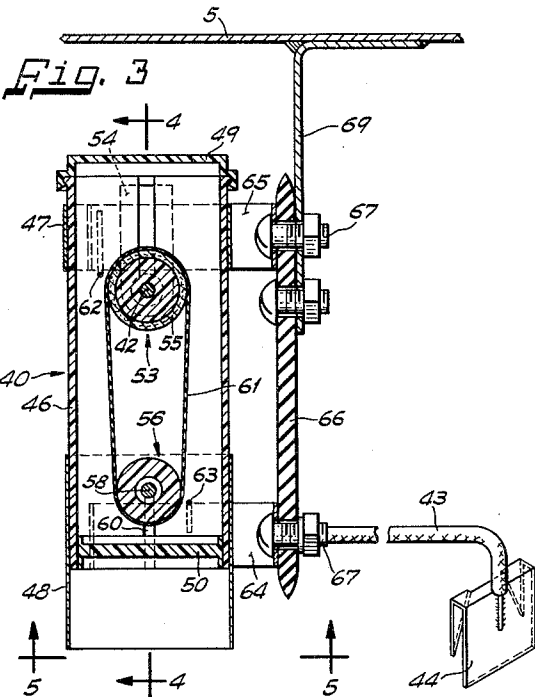
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3 Sheets-Sheet 2



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ELECTROSTATIC FILTER

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3 Sheets-Sheet 3

Fig. 8

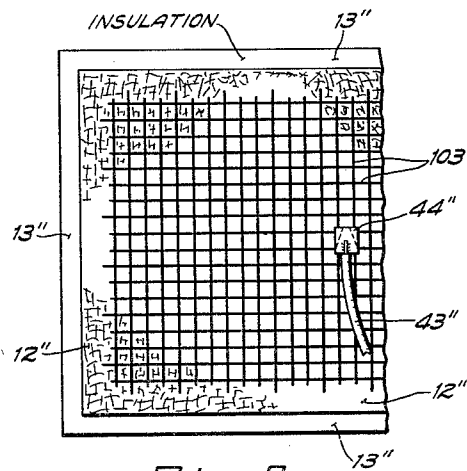
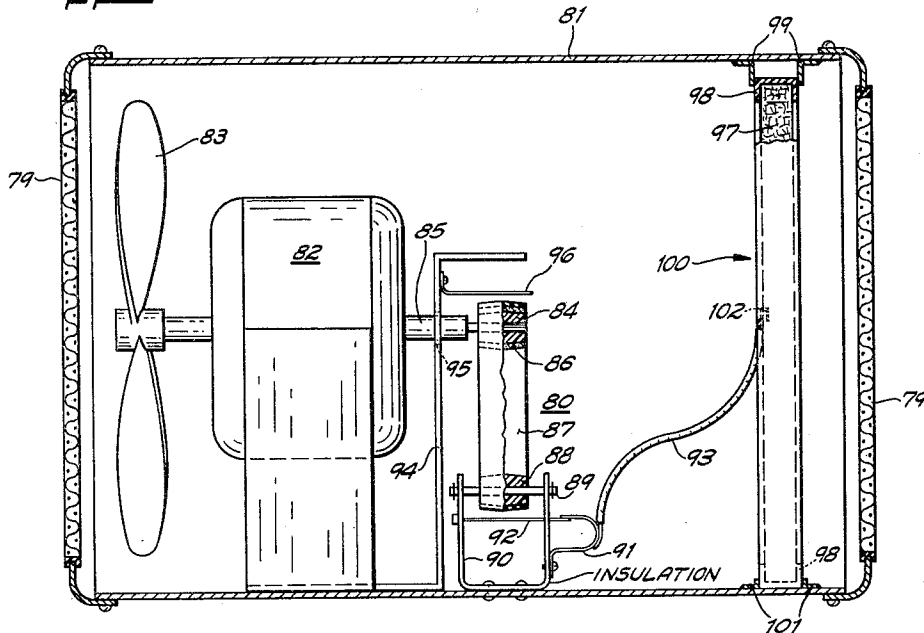


Fig. 9

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3,053,028

ELECTROSTATIC FILTER

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Filed Dec. 2, 1957, Ser. No. 700,661

15 Claims. (Cl. 55—103)

This invention pertains to an electrostatic filter for separating solid particles, constituting impurities, from air or other gases. The invention is particularly, but not exclusively, adaptable to commercial and residential air treating equipment such as air conditioners, air heating systems, window mounted fans, portable fans, and the like.

The prior art apparatus for electric air purification in the form of electrostatic precipitators involve inducing a charge on air entrained particles by passing the air through an ionizing field and then attracting the particles so charged to oppositely charged plates located downstream. The high potentials applied to the ionizing and attracting electrodes are secured from a power-pack that draws current at low voltage from a supply line, and steps up and rectifies the same to a voltage of 15,000 volts, or even more. Because of the high potentials involved and the danger of exposing human beings to fatal shocks, and by the nature of the apparatus itself, it is necessary to carefully insulate and isolate all high voltage components from the remainder of the equipment. The insulating requirements, the presence of a high voltage transformer, the rectifying elements, and the large attracting plates, not only raise the cost, but they are also space-occupying in equipment where space is at a premium and must be used wisely.

Moreover, since the danger of electric shock is so severe, it has been the practice in connection with equipment using prior art electrostatic precipitators, to provide safety interlock switches which de-energize the power-pack and ground any accumulated charge as soon as access to the equipment is gained. This too has increased the cost of such equipment and emphasizes the hazard involved to such degree that such filters are not highly regarded for use on appliances that are contacted and serviced periodically by human beings.

The present invention provides an electrostatic filter capable of achieving the same or better air purifying results than the prior art type described above, simply, at lower cost, and with absolute safety.

Accordingly, an object of the present invention is to provide an electrostatic filter that avoids using a high voltage, high current, power-pack and thereby obviates the possibility of injuriously shocking an operator and, furthermore, eliminates the insulation problems outlined above.

A further object is to provide an electrostatic filter that employs an air permeable filter medium which is insulatingly supported and charged so as to effectively attract and hold particles of dust, lint and pollen, for example, that are carried into the filter in a gas or air stream.

Another object is the provision of a filtering scheme incorporating a filter medium and electrostatic generating means capable of charging the filter medium to a high potential that is effective for attracting particles of dirt, but which generator is so designed and utilized as to be inherently incapable of delivering currents of such mag-

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nitude as to injure or even discomfort a human being.

Another object of this invention in one of its forms is the provision of an air filtering arrangement including a propeller driven electrostatic generator that derives its operating power from an air stream and which generator is easy to remove or replace.

A further object of this invention is the provision of electrostatic filter equipment which involves applying a relatively high potential to a filter medium, but wherein the associated metal parts of the same equipment remain at substantially zero or ground potential so that there is never any danger of an operator touching the equipment being exposed to a high potential thereon with respect to ground.

Still another object of this invention is to provide an air permeable filter batt that is particularly well adapted for the purposes of the invention by reason of it being framed by a rigid insulating material that facilitates its mounting in equipment and permits its handling with less care about cracking the batt when removed for washing off collected dirt.

It is a general object of this invention to provide an effective but inexpensive electrostatic filter equipment that is adapted to being installed in various air handling appliances for removing dust, pollen, and other particles of impurity from air.

Achievement of the foregoing and other specific objects will appear from time to time throughout the course of the ensuing specification.

A preferred form of the invention is characterized by the placement in air stream of an air permeable batt or uncompact dielectric or metallic filamentary filter medium that is insulated from its support. Near the filter medium is located a small, self exciting, electrostatic generator that supplies a charge of one polarity to the filter medium and of another polarity to a conductive part of the equipment. By thus elevating the potential level of the filter medium, a potential difference is developed between it and the metal equipment parts from which the filter medium is insulated. Another metal part may consist in a screen, for example, located upstream from the filter for the purpose of charging entrained particles of impurity as they pass through or near the metal part. The particles so charged are attracted and adhere to the charged filter medium while the clean air passes through. The term "air" as used heretofore and hereafter is intended to imply any gas.

Various features of the invention will now be described in greater detail in reference to the following drawings in which:

FIG. 1 is a schematically represented plan view of a room air conditioner unit, with parts removed, and embodying the invention;

FIG. 2 is a front elevational view of the unit depicted in FIG. 1;

FIG. 3 is a sectional view of an electrostatic generator taken on a line corresponding with 3—3 in FIG. 2;

FIG. 4 is a sectional view taken on the line 4—4 in FIG. 3;

FIG. 5 is an enlarged front view of the electrostatic generator, taken from FIG. 2, with parts broken away;

FIG. 6 represents a fragment of the margin of an air permeable filter batt used in connection with the invention;

FIG. 7 illustrates how the invention may be used in

conjunction with an air circulating appliance other than an air conditioner;

FIG. 8, which is somewhat similar to FIG. 7, illustrates the invention employing modified forms of the electrostatic generator and of the filter medium assembly; and, FIG. 9 is another filter assembly modification.

As indicated above, the invention may be variously applied but is illustrated in a room air conditioner such as that depicted in FIGS. 1 and 2. The usual decorative housing of the room air conditioning unit has been removed in those figures to show that its interior comprises a chassis or base 1 on which is supported vertical peripheral walls 2 constituting a casing. The casing is divided into two principal compartments, a heat dissipating compartment 3 and a heat absorbing compartment 4. These compartments are separated principally by a partition wall 5 that runs laterally and longitudinally to form a scroll chamber 6 for housing an air impelling centrifugal fan blade 7. Frontward of the scroll chamber is located a cooling coil assembly 8 through which air is drawn by fan 7 and expelled upwardly and forwardly out of the upper part 9 of the scroll chamber 6.

The front of casing 2 is provided with a large opening 10 through which air may be drawn into a plenum chamber 11 and passed through a filter batt 12 before proceeding through the cooling coil 8. The construction and function of the filter 12 will be described in greater detail hereinafter.

In order that the illustrative unit may be adjusted for several alternative paths of air flow, damping means are provided, which in this case take the form of a rotary damper, generally designated by the reference numeral 20. Damper 20 may be a plastic unit with circular ends 21 connected by an arcuate segment 22 adapted to be positioned in various intersecting openings 23, 24 and 25 within casing 2. A knob 26 attached to a shaft 27 is suggested for rotating the damper to its various positions.

In FIG. 1 it is seen that damper 20 is set for closing opening 23 so that the unit is adjusted for cooling and recirculating room air by drawing it in through opening 10, plenum chamber 11, filter medium 12, cooling coil 8, and centrifugal fan 7, whereupon it is expelled upwardly and forwardly through outlet chamber 9.

When the damper segment 22 is rotated along the dashed lines in FIG. 1 to a position where it closes opening 24, the unit is adjusted for drawing in fresh outside air by placing plenum chamber 11 in communication with the outside air through a passageway 28 and a screened opening 29 which leads to the outside.

When damper segment 22 is positioned to close opening 25, the unit is adjusted for recirculating room air through the agency of centrifugal fan 7 as described above and further for expelling room air into the heat dissipating chamber 3 under the influence of a condenser fan 30 which forces air through a shrouded condenser coil 31 and then to the outside.

The air conditioner unit embodies the usual double ended fan motor 32 which carries both the centrifugal circulating fan 7 and the condenser fan 30 on a common shaft 33. The unit also includes a conventional refrigerating compressor 35 whose connections and control equipment have been omitted for the sake of brevity.

The specification now proceeds with a more detailed examination of the elements which cooperate to impress the unit with electrostatic air cleaning capabilities. For this purpose attention is invited to FIGS. 1 and 2 where may be seen an electrostatic generator, generally designated by the reference numeral 40, mounted in the scroll chamber 6 in the outgoing air stream from centrifugal fan 7. The generator 40 will be described in greater detail later and it is here sufficient to note that it is provided with driving means in the form of a propeller fan 41 carried on a generator shaft 42. Fan 41 is adapted to be propelled by the air stream developed by centrifugal fan 7 and to thereby rotate the generator for

producing an electric charge that is transferred to the face of filter medium 12 by means of an insulated lead wire 43 terminating in a soldered connection on a pronged metal plate 44 that merely hooks into the filter medium 12. Note that filter medium 12 is spaced from cooling coil 8 and also insulated by other means from other metal parts so that the charge cannot leak off to any significant degree.

The generator 40 and its propelling fan 41 are preferably located lower than illustrated in order to take advantage of the higher velocity air stream that exists near the periphery of the centrifugal fan, but for the purpose of illustration and for avoiding obscurity, it has been raised to where it is plainly visible in elevation in FIG. 2. However, the generator need be assigned no specific location, and as an alternative, it may be located in heat dissipating chamber 3 with its shaft and fan 41 projected through partition wall 5 into the air stream developed by centrifugal fan 7. The generator may also be located wholly within heat dissipating compartment 3 and driven by the air stream developed by condenser fan 30 if that is expedient in a particular appliance design. To minimize leakage of charge it is preferable to locate the generator as near as possible to the filter medium 12.

The generator 40 may be coupled and driven directly from a fan motor as will be seen later. However, the arrangement for driving the generator through a propeller fan offers a silent, vibration-proof and flexible coupling, which further allows for easy replacement of the generator without dismantling or disconnecting any other part of the air conditioner unit.

The electrostatic generator may be of any type, the one chosen here being entirely self exciting and of the belt type which is small and inexpensive and represents only a small part of the air conditioner cost. Referring to FIG. 3, particularly, it is seen that the generator comprises a tubular plastic housing 46 embraced on opposite ends by circular split clamping bands 47 and 48 that constitute opposite, high potential terminals of the generator. Tubular housing 46 is closed by a pressure grasping insulating cap 49 on one end and by an insert disc 50 at its other end, both of which combine to prohibit entry of dust and other contaminating material within tube 46. Referring to FIG. 4 it will be seen that propeller shaft 42 is journaled in oil impregnated sleeve bearings 51 which are pressed through appropriate apertures in opposite sides of tube 46. Fan shaft 42 is precluded from withdrawing from bearings 51 by means of snap rings 52 placed on opposite outer ends of the bearings. Fixed on shaft 42, centrally within tube 46 is a pulley 53, preferably made of an insulating material such as methyl methacrylate, a form of which is sold under the trademark "Lucite." The outer surface of pulley 53 is provided with a smooth, wool felt sleeve 55 that is attached to the pulley by a non-hygroscopic adhesive. For sleeve 55, wool felt has worked satisfactorily in a commercial embodiment, but it should be understood that other materials may be substituted therefor.

Shaft 42, bearings 51, and clamping band 47 are all at the same potential, that is ground potential, by reason of their being connected by small copper strips 54 that are perforated for passing the bearing 51 there-through and which strips run axially along the outside of tube 46 where they are embraced and clamped by band 47.

Axially remote from pulley 53 within tube 46 there is located an idler pulley 56 of a non-conducting material which may be the same as pulley 53 but without the coating being necessary. Idler pulley 56 is provided with internal, metallic, oil impregnated bushings 57 which allow the pulley 56 to idle freely on a fixed shaft 58. Shaft 58 may be anchored against ro-

tation in any suitable manner, but as here shown it is provided with flattened ends 59 that drop into the bottom of a slot 60 extending partially down each side of insulating tube 46. Pulleys 53 and 56 are connected for simultaneous rotation by a thin, flexible, charge transferring belt 61. In one form of the invention, belt 61 consists in a silicone rubber band about one-thirty-second of an inch thick, this material being chosen for its durability among other reasons. Pulleys 53 and 56 are preferably crowned to maintain belt alignment.

It is thus evident that rotation of propeller fan 41 will cause belt 61 to be driven at considerable lineal velocity whenever the air conditioner unit is operating and producing an appropriate air stream. One commercial embodiment of the invention has its generator driven at around 1500 r.p.m. Optimum generator speed will vary in each case, since it is determined by the voltage which it is desired to generate, and this may be a function of pulley size and spacing and the area of the charge transferring belt.

When pulley 53 is driven, a charge is transferred to belt 61 which is in close proximity with an electrode 62. Electrode 62 is merely a small wire positioned in close parallelism along the face of belt 61 and has its free ends bent and extending through appropriate holes in tube 46. These ends are bent along the outside of tube 46 where they may be tightly clamped by clamping band 47 to form an electrical connection. Thus, clamping band 47 is at the same potential as electrode wire 62 so the band acts as one terminal of the generator. The self excited charge of the desired polarity generated by pulley 53 is transferred to belt 61 and carried along belt 61 until the charge is collected on a nearby fixed wire 63 which is secured in the manner of electrode 62 but connected to the interior of long cylindrical clamping band 48 forming another terminal. The charge accumulates on band 48, which acts as electrical capacitance, whereupon it is conducted to the air permeable filter material 12 through the agency of lead wire 43 and clip 44.

The generator is preferably designed like a cartridge, see FIG. 5 particularly, that may be deposited in spring clips 64 and 65 spaced from each other and secured to an insulating plate 66 by means of bolts 67. Clips 64, 65 are similar to the well known fuse cartridge clips and are made of resilient metal that permits them to grip the generator about its spaced clamping bands 47 and 48, respectively.

In order to minimize electrostatic leakage due to conductivity along dirty surfaces, it is preferable to bevel the edges of the generator mounting plate 66 for shedding dust so that the insulating value of the plate will be maintained after prolonged use. It is advantageous to make the mounting plate 66 of a homogeneous material such as "Lucite" in order to avoid the effects of humidity upon its insulating qualities.

Observe particularly in FIG. 5 that clamping bands 47 and 48 are provided with radially extending flanges through which pass bolts 68 in order to effect a clamping action on tube 46. The flanges and bolts 68 are positioned for cooperating with spring clips 64, 65 by bearing against the latter and thereby preventing rotation of the generator when it is inserted in the clips. Thus, the axis of propeller shaft 42 may be pre-oriented in the factory for disposing the propeller shaft in the most effective position to be acted upon by the air stream developed in the particular model of the unit involved. Moreover, the flanges acting as stops, assure that the generator will not rotate in the clips 64, 65 due to vibration or the influential force developed by the air stream.

Filter batts 12 made of a variety of metallic and dielectric filamentary materials have functioned successfully as media to be charged electrostatically for attracting and holding particles of air entrained dirt. A filter

batt with dielectric filaments that has been found highly effective for mechanically removing particles of dirt as well as being susceptible to the electrostatic excitation is one illustrated in the United States Pat. 2,784,132, dated March 5, 1957. The material described in this patent consists in a non-matted, three dimensionally arranged body of fibres suitably bonded to each other by adhesive materials mentioned in the patent. It may be noted that applicant has successfully used filter batts composed of the trademark material "Dynel" which was obtained from the assignee of the cited patent. "Dynel" may be considered a proven, satisfactory material since it is physically tough, adequately heat-resistant, and lends itself to be washed in lukewarm suds without harm so that the filter may be cleaned periodically.

Filter batts 12 made of interwoven filaments, such as glass fiber and others suggested in the patent, are also satisfactory for carrying out the purposes of the invention. A filter medium 12 that has worked particularly well is one comprising rather fine aluminum filaments. When such metal batts are used, it is beneficial, although not absolutely essential, that the filaments be sprayed or dipped so that they have a thin film of oil or one of the well known, sticky, commercial filter coating fluids.

From experience with different filamentary materials, it appears that a filter batt of aluminum filaments is particularly efficacious for carrying out the purposes of the invention because the metal is tough, durable, easy to wash and lends itself to adopting a higher potential charge when it is properly supported on insulating means to be explained in forthcoming paragraphs. Moreover, charge distribution over the batt is enhanced since metal filaments seem to perform in the manner of a capacitor plate, thus increasing the charge storing capacity of the electrical system. Metal filaments other than aluminum are also satisfactory from the electrical viewpoint.

For the purposes of the invention, the filter batt 12 has been given a specialized construction for facilitating its mounting in insulating relation with respect to conductive parts of an air conditioner casing, for example. This construction is observable in FIG. 6 where it is seen that the filamentary batt 12 is provided about its entire margin with plastic strips 13 that embrace a portion of the filamentary material and form a rigid frame around the perimeter of the batt. This frame may be formed by thermal setting polystyrene, for example, fused under heat and pressure on both faces of the batt's margin. This arrangement allows the filter 12 to be set into close proximity with conducting parts and to be secured easily by clips 14, see FIG. 2. The plastic frame 13 inhibits the leakage of charge from the filter medium 12, thereby maintaining the latter at the desired high potential level with respect to the casing 2 and chassis 1. Furthermore, frame 13 imparts rigidity to the filter batt and facilitates its easy handling when it is desired to renew it by washing.

The potential difference between the terminals of generator 40, and accordingly, the same potential difference between filter medium 12 and the casing 2, is comparable with that found in prior art electrostatic precipitators. Nevertheless, the invention obviates the danger of harmful electric shock found in prior art devices because the apparatus is incapable of storing and suddenly yielding a quantity of charge that would register more than a few micro-amperes; almost imperceptible when discharged through a part of the human body. Consequently, it is not necessary that apparatus embodying the inventive electrostatic filter be provided with safety means for protecting an operator against electric shock. Moreover, the low currents involved justify connecting one terminal of the electrostatic generator directly to the apparatus casing by means of a bracket 69 which supports the generator mounting plate 66 and which bracket may be spot welded to partition wall 5 to form a part of the generator circuit.

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Although it is not deemed necessary for practicing the invention to discuss the electrostatic phenomena involved, a brief allusion to this matter may be of interest. Particles of dust, lint or pollen floating in free air may be neutral, or positively, or negatively charged. Since the particles pass into casing 2 by means of opening 10 they may be looked upon as receiving an induced charge that corresponds substantially with that of the casing. The potential of the casing may be taken as zero or any positive or negative value for the sake of illustration. Due to the constant charge being delivered from the generator to the filter material, the latter will assume a potential level that differs from that of the casing and surrounding ambient, perhaps in the range of ten to twenty thousand volts. Thus, as dirt particles proceed into the casing which functions in the manner of an upstream electrode, they adopt one charge, and as they near or pass through filter material 12, they are strongly attracted by the opposite charge on the latter to which they firmly adhere.

FIG. 7 illustrates an alternative application of the invention in a room air cleaning appliance. This apparatus consists in a metal housing 70 provided with a fan motor 71 carrying a fan blade 72 for impelling an air stream through the housing. Opposite open ends of the housing are provided with screens 73. In this case, the generator 40' may be of the form previously described but driven directly from the fan motor shaft through a rubber sleeve coupling 74. The generator is also mounted in a similar manner on a bracket 75 that may be spot welded to the interior of the housing 70 so as to constitute a ground connection between one terminal of the generator and the housing. In this embodiment the charge is transferred from output terminal 48' of the generator to filter material by a lead wire 43' and a pronged electrode 44' similar to that shown in connection with discussing the previous embodiment.

The air may be circulated through the device in FIG. 7 in either direction for it is assured that the dust particles will pick up an induced charge which is opposite to the filter material 12' by reason of the air stream passing through grids or screens 73 on either end.

FIG. 7 suggests how the invention may be embodied in a portable appliance for being located in a room whose air it is desired to circulate and clean at the same time. The embodiment further suggests how the novel filter may be located in the duct of a central air conditioning or heating system. It is also contemplated that a filter and generator may be installed in individual air outlet registers that supply various rooms in a residential dwelling, for example, in which case a low wattage motor may be fitted in the duct for the sole purpose of driving the generator while the air is being circulated through the system by means of a centrally located circulating fan.

FIG. 8 represents an embodiment of the invention that is particularly suitable for central heating and air conditioning systems of large capacity. In this case the generator, designated generally by numeral 80, is modified. For illustrative purposes, the apparatus is shown as including a casing or a duct 81 having screens 79 at opposite ends and a fan motor 82 and fan blade 83 inside. The fan may induce a strong air stream through the casing in either direction.

More specifically, generator 80 is directly related to the fan motor 82 by mounting the driven pulley 84 directly on motor shaft 85. Shaft 85 need not be a motor shaft but could be the shaft of a separately journalled fan or blower, not shown. Pulley 84 is coated, as in the previous embodiments, with a layer of felt or other pliable organic material 86, and the pulley 84 itself may again be "Lucite," for example, or other insulation.

A charge transferring belt 87 runs on crowned pulley 84 and drives an idler pulley 88 turning with a shaft 89 that is suitably journalled near its ends in a U-shaped stand 90 made of high strength insulation. Mounted on

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the side of stand 90 is a hollow metal cap 91 which receives electric charge on its inside that is collected by an electrode or fine collector wire 92 stretched across the legs of stand 90 close to the outer surface of belt 87 for picking up electric charge therefrom. Charge flows from wire 92 to the inside of cap 91 and then to its outside from which it is led off by an insulated lead wire 93 to the surface of a filter assembly 100 in the manner described previously.

The elements of generator 80 may be out in the open or they may be partially shielded by a guard plate 94 provided with a large clearance hole 95 through which motor shaft 85 passes. Plate or shield 94 serves as a dust protector and a support for a second collector wire or electrode 96 also close to belt 87 near pulley 84. Wire 96, being attached to plate 94, assumes the potential level of the casing 81; whereas, the filter 97 is at a higher potential by reason of the charge received by way of lead wire 93.

The filter assembly 100 is constructed somewhat similarly to that previously discussed except that filamentary batt 97 is surrounded by a plastic channel 98 of polystyrene, for instance. Channel 98 may completely frame batt 97 to impart rigidity thereto and to insulate it from the casing 81. The frame may be secured by advancing its upper portion between depending clip angles 99 and allowing it to drop between spaced lower clip angles 101.

The apparatus of FIG. 8 operates similarly to the other embodiments in that rotation of fan motor shaft 85 causes generation of electric charge that is dispersed in the filter batt 97 after flowing from a hooked clip 102 at the end of lead 93. Particles of dirt carried by the air stream pass through screen 79, or indeed only contact casing 81, whereupon they assume a potential level different than that of the filter batt 97. Consequently, the dirt particles are electrostatically attracted and physically held by the batt as they attempt to pass through it.

Whether the generator is running or not, and despite the extremely high potential appearing on the filter, no electrical safety precautions need be followed as far as the invention is concerned because the electric current is always held to harmless values and is so limited by leakage of charge to the casing.

FIG. 9 illustrates a modified version of a filter batt assembly that features a grid in the form of a metal screen 103 for augmenting even distribution of the electric charge over the surface and into the interior of a filamentary filter batt 12. Screen 103 may be advantageously applied to the filter batts represented in FIGS. 1, 2, 6, 7 and 8 if they comprise dielectric material rather than metallic filamentary material.

In FIG. 9 the filamentary batt 12' is surrounded by a plastic, for instance, polystyrene frame 13' that imparts rigidity to the batt and facilitates supporting it in insulating relation with metal parts of any appliance. The metal screen 103 substantially covers batt 12' but it is smaller than the window created by frame 13' in order to leave a perimetral gap between the conductive screen and the insulating frame so that leakage of charge will be inhibited. The screen 103 may be fastened to batt 12' by any suitable means such as stapling, not shown, or merely bending the ends of individual screen wires so they hook into the batt. At any rate, electric charge is transferred through lead wire 43'', which terminates in a connector-like clip 43'', and to the screen 103 which disperses it evenly over the active part of the batt. The mesh of the screen 103 is not critical; half inch mesh has been found satisfactory but others operate well. Moreover, the grid may take forms other than a screen provided air flow is not seriously impeded thereby.

Summarily, a novel electrostatic filtering apparatus has been described, involving an insulatingly supported dielectric or metallic filamentary filter medium located in an air stream and to which is supplied a high, but

safe, electric potential for attracting charged particles of dirt thereto. It has further been shown how the charge may be created through a simple self exciting electrostatic generator that is either positively driven or propelled by means of an air stream and how the generator may be mounted for convenient removal and installation without disturbing electrical connections. Moreover, the electric circuit of the invention is seen to be exceedingly simple, involving only a generator with one terminal connected to the filter medium by a single wire and another opposite terminal connected to a metal casing by means of the generator mounting bracket. The invention also contemplates paralleling generators and doubling filters where greater capacity is required.

Although embodiments of the invention have been illustrated and discussed, it will be appreciated that such disclosure is intended to be illustrative rather than limiting, for the invention has innumerable applications and is to be interpreted according to the scope of the claims which follow.

It is claimed:

1. A room air conditioner comprising a metal casing, fan means in said casing for inducing an air stream therethrough, an electrostatic generator including a propeller shaft means, propeller means adapted to rotate and thereby drive the shaft means under the influence of the air stream, an air permeable filter medium insulatingly supported in the air stream, conductive means for receiving electric charge from the generator and transferring the same to the filter medium to thereby establish a potential difference between the filter medium and the casing, whereby particles entrained in the air stream are electrostatically attracted to the filter medium when the air passes therethrough.

2. A room air conditioner comprising a casing having heat absorbing and heat dissipating compartments each of which has inlet and outlet openings, fan means for inducing an air stream through the heat absorbing compartment, an air permeable insulatingly mounted filter medium disposed in the heat absorbing compartment in the path of air flow, an electrostatic generator means located in the heat absorbing compartment and including a generator shaft, a propeller fan carried on the shaft for turning the same under the influence of the air stream, said generator having opposite terminals one of which is in conductive relation with said filter medium to distribute the generated electric charge thereon and the other of which is presented to the air stream, said filter medium thereby attaining an electric potential different than that of the particles of impurity in the air stream so that the particles are electrostatically attracted to the filter medium.

3. A room air conditioner comprising a casing having an evaporator and a condenser compartment each of which has an inlet and outlet opening, a centrifugal fan in the evaporator compartment for developing an air stream therethrough, an air permeable filter medium and an evaporator coil located in spaced relation in the air stream on the inlet side of the fan, an electrostatic generator including a drive shaft, propeller fan means attached to the shaft and disposed for being driven by the air stream on the outlet side of the centrifugal fan to thereby effect a fluid coupling between fans, said generator having one terminal connected to the filter medium for distributing the generated charge thereon and another terminal at the potential level of the casing, whereby entrained particles passing into the casing by way of the air stream will be at a different potential level with respect to the filter medium and therefore attracted thereto.

4. A room air conditioner comprising a casing, fan means in said casing for inducing an air stream therethrough, an air permeable filter medium in the air stream, an electrostatic generator having terminals at opposite ends and a shaft extending therefrom, an auxiliary fan blade on said shaft and disposed to be driven by said

air stream, means for detachably mounting said generator in said casing, said mounting means including an insulating base and clamp means mounted thereon, said clamp means electrically engaging at least one generator terminal, a lead wire connected to said clamp means, a connector terminating said lead wire and which is detachably engaged with said filter medium, whereby both said filter medium and said generator may be easily removed and replaced.

5. In electrostatic air filter apparatus, a cartridge-like charging unit comprising insulating housing means, means within said housing means for generating an electrostatic charge, terminal means spaced from each other and affixed to the outside of said housing, said terminal means having different electric potentials and being in circuit with said generating means, and spaced stationary contacts releasably engaging said charging unit at respective ones of said terminal means and electrically connecting with said terminals and providing the sole support for said charging unit, whereby said charging unit may be easily removed or replaced in said apparatus.

6. In electrostatic air filter apparatus including a casing, a cartridge-like charging unit comprising tubular insulating housing means, means within said housing for generating an electrostatic charge, terminal means spaced from each other and affixed to the outside of said housing, said terminal means having different electric potentials and being in circuit with the generating means, an insulating member fixedly supported within said casing, contact means spaced from each other and affixed to said insulating member, said contact means releasably engaging said charging unit in the vicinity of the corresponding terminal means thereon and electrically connecting with said terminals and providing the sole support for said charging unit, whereby said charging unit may be easily removed or replaced in said apparatus.

7. The invention set forth in claim 6 including bracket means supporting said insulating member and conductively related to said casing and one of said fixed contacts to form part of a load circuit for said charging unit, the other fixed contact forming another part of said charging unit load circuit, whereby said charging unit may be inserted to open or bridge the gap between said contacts without disturbing the load circuit.

8. The invention set forth in claim 6 wherein said spaced contacts comprise substantially U-shaped clips of inherently resilient metal for grippingly receiving said cartridge-like charging unit therebetween.

9. In electrostatic air filtering apparatus including a metal casing and a filter medium insulatingly supported in a path of air flow, a cartridge-like electrostatic charging unit for said apparatus comprising a hollow insulating housing, terminal means on the outside at each end of the housing, a pair of insulating pulleys journaled for rotation within said housing, flexible belt means joining said pulleys, electrode means in proximity with the surface of said belt adjacent each pulley, said electrode means each being respectively connected to one of said terminal means, and means operatively connected with one pulley for driving the same and transferring electric charge from one terminal to another for raising the potential level of said other terminal, and means for transferring said electric charge to said filter medium.

10. The invention set forth in claim 9 wherein said flexible belt constitutes silicone rubber.

11. The invention set forth in claim 9 wherein a pliable organic material is disposed on the surface of one pulley for said belt to run thereon.

12. The invention set forth in claim 11 wherein the organic material is wool felt.

13. The invention set forth in claim 9 wherein said electrodes adjacent said belt comprise fine wires.

14. The invention set forth in claim 9 wherein said terminals comprise metal bands substantially surrounding said hollow housing for electrical engagement of said cartridge.

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15. The invention set forth in claim 14 including stationary contact clip means for receiving said cartridge in the region of said metal bands, said metal bands being provided with radially extending flange means for abutting said clip means when said cartridge is disposed therein, thereby locating said cartridge in a predetermined position with respect to said clips.

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