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FILTER OBSTRUCTION SIGNAL ARRANGEMENT
FOR AIR CONDITIONING APPARATUS
Filed Dec. 22, 1961

3,201,772

FIG. 1

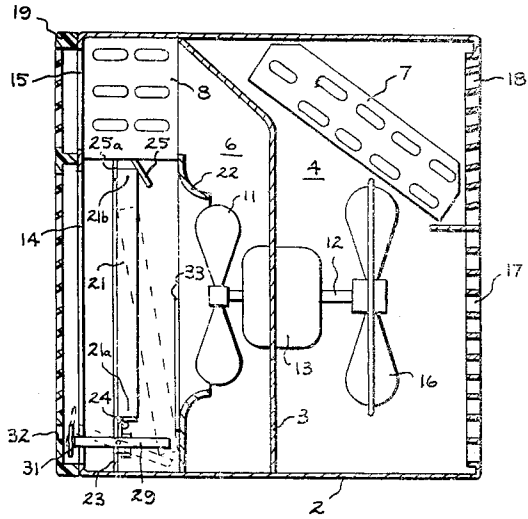


FIG. 2



FIG. 4

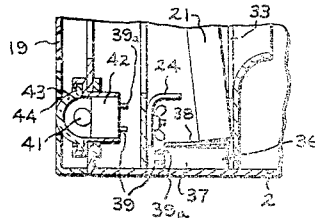
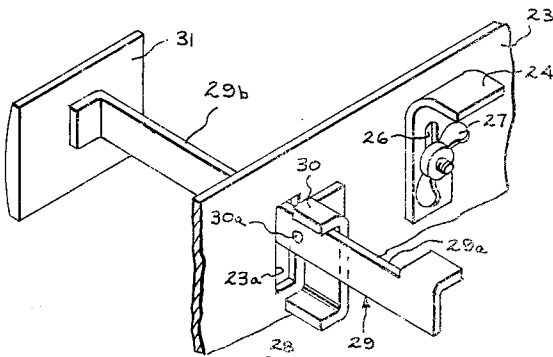


FIG. 3



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1

3,201,772

FILTER OBSTRUCTION SIGNAL ARRANGEMENT FOR AIR CONDITIONING APPARATUS

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1 Claim. (Cl. 340-239)

The present invention relates to air conditioning apparatus and more particularly to an arrangement in such apparatus adapted to provide a signal when the filter of such apparatus has become dirty and requires cleaning or replacing.

Most air conditioning devices, such as refrigeration cooling apparatus and warm air furnaces, operate much more efficiently when the air flowing into the particular device is filtered prior to entering the conditioning section of the device. Thus, in room air conditioning units or window mounted air conditioners, a filter is usually disposed on the upstream side of the evaporator or cooling unit of the apparatus. The same is usually also true in a furnace or central air conditioning apparatus.

It is well known that, when the filter of such a conditioning device becomes clogged with particles captured from the air stream, it begins to reduce the amount of air flow therethrough. In some cases the amount of air flow is reduced to such a point that it seriously hinders the efficient operation of the conditioning device and may possibly be deleterious to the operation of the device. For example, it is known that when the air flow over the evaporator of a window cooler is obstructed too greatly, the temperature of the evaporator drops to a point where it is likely to cause frost to build up thereon. In warm air heating apparatus, when the filter becomes clogged or obstructed, the reduced air flow through the heating apparatus is generally not sufficient to satisfy room temperature conditions called for by the room thermostat and this results in frequent cycling of the heating apparatus on and off and results in a great waste of fuel the heat of which cannot be usefully applied to heating air.

It is therefore desirable to provide a filter arrangement in an air conditioning apparatus which will provide some signal to the operator indicative of the fact that the filter has become obstructed or dirty and should be cleaned or replaced.

Accordingly, it is an object of the present invention to provide an air conditioning apparatus having an improved signalling arrangement adapted to indicate when the filter has been too greatly obstructed for efficient operation of the apparatus.

Another object of the present invention is to provide in an air conditioning apparatus an improved signalling arrangement adapted to take advantage of the resistance in the obstructed filter to air flow therethrough for actuating the signalling means.

Further objects and advantages of the invention will become apparent as the following description proceeds and the features of novelty which characterize the invention will be pointed out with particularity in the claim annexed to and forming a part of this specification.

In carrying out the objects of the present invention there is provided an air conditioning apparatus for an enclosure comprising a case having inlet and outlet openings through which enclosure air is circulated through the case. A filter is provided within the case and supported across the air stream circulating through the case. The filter support means is so constructed and arranged as to apply a force on the filter only around the peripheral edges thereof in order to present only a lateral frictional

2

force holding the filter against the force of the air stream flowing through the filter thereby to permit the filter to move from its support means when the resistance to air flow through the filter due to obstruction of the filter by particles captured from the air stream becomes greater than the frictional force of the support means. A weight responsive device is provided on the downstream side of the filter which receives the weight of the filter when the filter moves from its support means and actuates an indicating means calling attention to the operator of the apparatus that the filter has become obstructed by particles and needs cleaning or replacing.

For a better understanding of the invention, reference may be had to the accompanying drawings in which:

FIGURE 1 is a schematic elevational view of an air conditioning apparatus having the filter mounting arrangement of the present invention;

FIGURE 2 is a partial front view of the air conditioner of FIGURE 1 showing the signal indicator slot with the indicator in its normal position;

FIGURE 3 is an enlarged perspective view of a weight responsive means for actuating the signalling device; and

FIGURE 4 is another embodiment illustrating a weight responsive arrangement for energizing an electrical circuit having a signal light on the front of the air conditioner.

In FIGURE 1 of the drawing there is shown an air conditioning unit of the type generally known as a window mounted conditioner or room air conditioner and which is adapted for mounting in an outer wall of an enclosure. While, it is to be understood that the present invention may be applied to central air conditioning apparatus or furnace arrangements in which the filter is mounted in a duct work or plenum chamber upstream from the conditioning unit, the invention is shown and described herein as applied to a room air conditioner where its use is particularly well adapted. The room air conditioner includes a casing or housing 2 adapted for mounting in the well-known manner in an outer wall of an enclosure. The casing 2 is divided by a barrier member 3 into two separate compartments designated the condenser or outer compartment 4 and the evaporator or inner compartment 6. A condenser 7 is positioned in the upper extremities of the condenser compartment 4 and an evaporator or cooling unit 8 is located within the upper region of the evaporator compartment 6. The evaporator 8 and condenser 7 are connected in refrigerant flow relationship with a compressor (not shown) which is usually located in the condenser compartment 4.

In order to circulate an air stream from within the enclosure through the evaporator of compartment 6 for cooling the air, there is provided a fan or air moving means 11 mounted in the lower portion of the evaporator compartment and upstream from the evaporator. The fan is driven by a shaft 12 from a motor 13 mounted in the barrier member 3. Air from the room or enclosure to be conditioned is drawn through the inlet opening 14 by the fan 11 and circulated upwardly over the evaporator 8, and then discharged out the front of the case 2 through the outlet opening 15. An outdoor air stream is drawn into the condenser compartment 4 through the inlet opening 17 in the outer portion of the case and circulated upwardly through the compartment 4 over the condenser 7 and then discharged from the case through the outlet opening 18. As indicated in FIGURE 1, both of the fans 11 and 16 are powered by the same driving means or motor 13 through a common shaft 12 extending through the motor.

As may be seen in FIGURES 1 and 2, the front of the air conditioner is usually provided with a decorative front grille, generally designated by the reference numeral 19.

The front grille normally contains inlet and outlet grille-work, such as that illustrated in FIGURE 1 and designed to permit air flow therethrough but to prevent foreign objects from entering the evaporator compartment. The front grille extends completely across the front of the evaporator compartment 6 and is usually made removable in order to permit periodical access to the evaporator compartment for maintenance purposes or for removing and replacing the filter arranged therein.

In order to remove particles from the air circulating through evaporator compartment 6, a filter 21 is disposed a short distance behind the inlet opening 14. The filter 21 is arranged entirely across the opening or scroll leading to the fan 11 such that any air circulated through the scroll 22 into the fan must previously pass through the filter 21. This filter may be any of the well known types now on the market so long as it is substantially rigid in structure so that it may support itself on its mounting structure. The filter of the present embodiment is provided with an outer peripheral frame which rigidly supports the filtering material across the inlet opening 14. The filter material may be formed of any of the well known filtering materials such as foamed plastic, fiberglass, which may be each secured to the frame in any manner well known in the filter art.

Means are provided in the front of the case 2 for mounting the filter 21 above the bottom of the case 2. As may best be seen in FIGURE 3, these means include a supporting bracket or panel 23 extending upwardly from the bottom of the case 2 and disposed substantially across the front of the unit behind the opening 14. Adjustably positioned on the mounting bracket 23 is a spring support means, which in the illustrated embodiment, comprises at least one and preferably two or more leaf spring members 24 having slotted openings 26 therein for attaching the spring members to the support panel 23. The leaf spring member 24 may be vertically adjusted with respect to the panel 23 merely by loosening the wing nuts 27, raising or lowering the spring member and again tightening the wing nuts. The lower end of the filter 21a rests on the spring support 24 directly behind the panel 23. The upper end of the filter 21b is adapted to fit through the opening 14 (seen only in FIGURE 1) and within the channel formed between the retaining members 25 and 25a extending downwardly from the structure supporting the evaporator 8. Downwardly extending support 25 is best arranged at an angle with respect to the plane of the filter in order to permit the filter to be loosely retained at its upper end 21b thereof. The spring means or spring member 24 exerts a force upwardly along the plane of the filter but, as will be noted in FIGURE 1, there is nothing to prevent the filter 21 from being pulled inwardly toward the fan 11 when the resistance to air flow through the filter becomes great enough to overcome the lateral frictional force exerted on the peripheral edge of the filter by the spring means 24. Thus, while a force is exerted on the outer peripheral edge of the filter in the plane of the filter, there is very little force other than the lateral frictional force exerted by the spring means 24 for preventing the filter from being pulled inwardly by the force of the air stream on the filter as it flows toward the fan 11.

It should be mentioned that the spring support member or members 24 may be adjusted by means of a wing nut 27 and the slot 26 to provide varying amounts of pressure in the plane of the filter 21. However, it is desirable that the bottom edge of the slot 26 be so disposed as to prevent the spring catch 24 from being moved into a position to exert so great a pressure as to prevent the filter 21 from being moved from its mounting means even though the filter becomes greatly obstructed by particles. Thus, when the resistance to air flow through the filter overcomes the lateral frictional force exerted by the spring members 24, the filter 21 is moved inwardly away from vertical supporting means.

A space 28 is provided on the downstream side of the filter 21 which is adapted to receive the filter as it moves from its mounting support. Within the space 28 in the lower portion of the case 2 is provided a weight responsive means adapted to actuate an indicator device on the front of the case whenever the filter 21 falls into the space 28. More specifically, as may be seen in FIGURES 1 and 3, there is provided a pivot bar 29 which is mounted through a hole 23a formed in the support panel 23 and supported by a bracket 30 and pivot pin 30a. Bracket 30 is suitably attached to the panel 23 by welding or other means well known in the art. One lever arm 29a of the bar 29 extends into the space 28 beneath the filter 21 and the opposite or front lever arm 29b extends toward the front of the case 2. Attached to the front end of the lever arm 29b is an indicia carrying plate or means 31 which may be moved upwardly or downwardly with respect to the front of the case or with respect to the front grille 19. As may be seen in FIGURES 1 and 2, the front of the case is provided with a slot 32 through which may be seen indicia on the plate 31. The pivot arm 29 in its normal position is weighted on the pivot or lever arm 29b so that the pivot bar 29 is normally disposed as in FIGURE 1 with the lever arm 29a pivoted up and the lever arm 29b pivoted down. As may be seen in FIGURE 1, when the arm is in its normal position the indicia received through the slot 32 on the front of the unit indicates that the filter is clean. However, when the filter 21 is moved from its mounting support, it drops into the space 28 onto the arm 29a and pivots the front end or lever arm 29b upwardly with respect to the slot 32 on the front of the case. Whenever the filter 21 moves the arm 29a to the downward position, shown in dotted lines in FIGURE 1, the indicia on the plate 31 discloses that the filter is dirty. This will be apparent from the front view of the slot 32 and plate 31 as indicated in FIGURE 2.

In order to prevent the filter 21 from being drawn into the fan 11 as it is moved from its filter supporting means, a plurality of upright bars 33 are provided on the upstream side of the fan 11. Upright bars 33 extend across the region or space 28 and hold the filter out of the scroll 22 thereby preventing the filter from in any way encountering the fan 11. Obviously bars of other configuration or other means such as a wire screen extending across the opening in this region could be used for this same purpose.

Referring now to FIGURE 4 there is shown a second embodiment of the present invention in which the filter 21 is adapted to be removed from its supporting means in substantially the same manner as described with respect to the above arrangement. In this arrangement, however, the weight responsive means for actuating the indicating means on the front of the unit is a weight responsive switch means generally designated by the reference numeral 36. The switch means comprises spring loaded switch arm 38 which may be depressed by the weight of the filter 21 in the manner shown in FIGURE 4. In its normal position the spring loaded switch arm 38 is moved upwardly away from the switch box 37 so that the weight responsive switch 36 is not completed through an electrical circuit including conductor lines 39 and 39a leading to a signal or indicator light 41 in a socket 42 mounted in the front of the case. The light 41 is connected in series across the power supply by means of the weight responsive switch 36 which completes the circuit from a source of electrical power connecting with the switch box 37 when the weight of the filter 21 depresses the spring loaded switch arm 38 as shown in FIGURE 4. A plastic or glass cover 43 may be provided over the light 41 to provide a pleasing appearance through an opening 44 in the front grille 19 to provide a signal when the filter 21 has moved from the mounting support. The glass or plastic cover 43 also serves to protect the light 41. It will be understood that

a light is not the only means which may be energized when the electrical circuit, including the weight responsive switch 36, is energized. For example, a bell could be energized by the circuit thereby providing a warning to the operator of the apparatus that the filter is dirty and should be replaced.

While in accordance with the patent statutes there has been described what at present is considered to be the preferred embodiments of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and it is, therefore, the aim of the appended claim to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

An air conditioning apparatus for an enclosure comprising a case, air inlet and outlet openings in said case through which enclosure air is circulated through said case, air moving means mounted in said case for circulating a stream of enclosure air through said case, a filter, support means in said case for supporting said filter in a substantially vertical position across said air stream circulating through said case, said support means comprising means for retaining the upper edge of said filter against horizontal movement from said support

means adjustable spring members engaging the outer periphery of said filter to apply a force on said filter substantially along the plane thereof thereby presenting only a lateral frictional force against the force of said air stream flowing through said filter so that the bottom edge of said filter may move from said support means when the resistance to air flow through said filter due to obstruction of said filter by particles captured from said air stream becomes greater than said frictional force of said support means, an open space on the downstream side of said filter adapted to receive said filter as it moves from said support means, a weight responsive device in said open space adapted to receive the weight of said filter when said filter moves from said support means into said space, an indicating means actuated by said weight responsive device for signalling when said filter has moved from said support means thereby calling attention to the operator of the apparatus that said filter has become obstructed by particles.

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NEIL C. READ, *Primary Examiner.*