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VARIABLE OUTPUT AIR CONDITIONING UNIT AND CONTROL
ARRANGEMENT THEREFOR
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FIG. 1

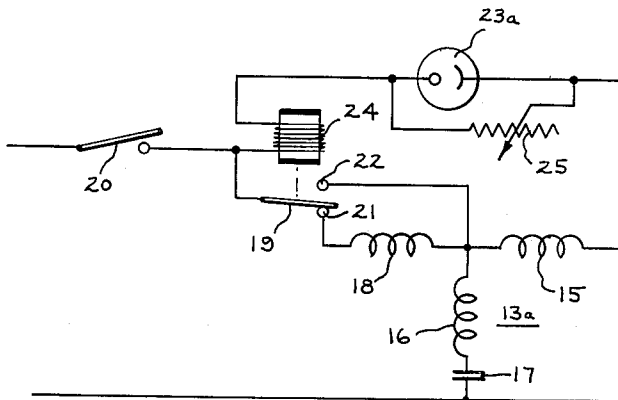
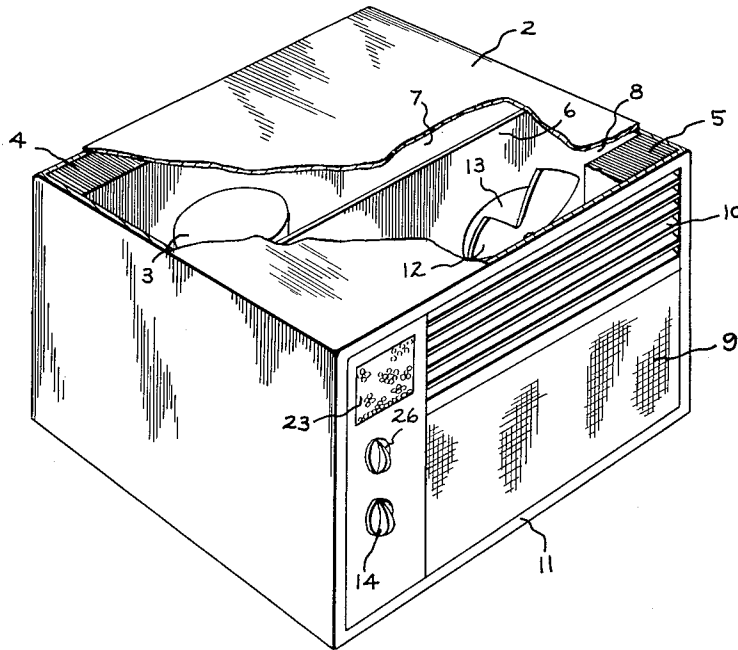


FIG. 2

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VARIABLE OUTPUT AIR CONDITIONING UNIT AND CONTROL ARRANGEMENT THEREFOR
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The present invention relates to an air conditioning unit of the type adapted for cooling a room and more particularly to an improved arrangement for automatically controlling the cooling capacity of a variable output air conditioning unit according to the normal cooling requirements of a room.

It has been noted that the cooling requirements of a room are generally greatest whenever the light intensity of the room is relatively great. For instance, during the daylight hours when the outdoor temperature is usually greater than it is at night and the cooling requirements of the room are therefore very great, the light intensity in the room is, in most cases, very high because of sunlight entering the room. At night, when a room is occupied by active persons and the cooling requirements of the room are greater than if the room were unoccupied, the lights in the room are generally on and the light intensity is, therefore, relatively great. At night, when the lights in a room are turned off, it is generally an indication that the occupants are no longer in the room or that the occupants have retired and are no longer active. Thus, it has been found possible to automatically provide greater or lesser cooling according to the normal load requirements of a room merely by making the cooling output or capacity of an air conditioner dependent upon the light intensity of the room.

Accordingly, it is an object of the present invention to provide an air conditioner, the capacity of which is controlled by the light intensity of the room to be conditioned.

It is another object of the present invention to provide an air conditioner adapted to operate at maximum capacity when the light intensity of the conditioned room is relatively great and at a minimum capacity when the room is dark or the light intensity in the room is relatively low.

A more specific object of the present invention is to provide an air conditioning unit having the operating speed of at least one of the components therein controlled in accordance with the light intensity of the room to be conditioned.

Further objects and advantages of the present 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 claims annexed to and forming a part of this specification.

In accordance with the present invention, there is provided an air conditioning unit adapted for conditioning the air in a room. Mounted within the unit is multi-speed motor for driving one or more of the components of the air conditioner, such as the compressor or the fans of the conditioner, in order to control the cooling output. Control means, mounted within the room to be conditioned and exposed to light within the room, include a light sensing device for changing the operating speed of the motor according to the intensity of light in the room, and thereby control the cooling output.

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

FIG. 1 is a perspective view of an air conditioning unit with portions broken away to show some of the inner components and having a light sensing means on one side thereof; and

FIG. 2 is an electrical circuit arrangement showing a two-speed motor for an air conditioner and one arrangement whereby a light sensing means may be electrically

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connected into the circuit for controlling the operation of the two-speed motor.

Referring now to FIG. 1 there is shown an air conditioner of the type commonly known as a room air conditioner which is adapted for mounting in a window or outer wall of a room with a portion thereof extending outside the room and with at least one side thereof exposed to the room. The air conditioner includes a case 2 in which is mounted a refrigeration system including a compressor 3, a condenser 4 and an evaporator 5. The case is generally divided by a barrier 6 into two sections commonly referred to as the outdoor or condenser compartment 7 and the indoor or evaporator compartment 8. Room air is circulated through the inlet and outlet openings 9 and 10 formed in the front side 11 of the casing and is circulated over the evaporator 5 in the evaporator compartment 8 for cooling the air of the room. In order to circulate room air through the evaporator compartment 8, the unit is provided with a fan 12 mounted in the evaporator compartment and driven by a motor 13 also mounted within the casing. In the embodiment of the invention shown, the motor 13 is mounted on the barrier 6 of the unit.

It will be understood that the air conditioning unit does not necessarily have to be one of those types commonly known as a window mounted air conditioner and may be one of those types mounted entirely within the enclosure and utilizing duct means for circulating outdoor air over the condensing portion of the unit or may even have a water cooled condensing unit. The only limiting requirement with respect to the air conditioning unit of the present invention is that it have a control means which is exposed to the light within the room to be conditioned. In the embodiment of the invention illustrated, the air conditioner is adapted for mounting with the side 11 exposed to the room and it is expedient to mount the controls on this side of the air conditioner. Provided on the front of the unit is a control 14 which is adapted to operate a main switch, such as the switch 20 of FIG. 2, for energizing the electrical components of the air conditioning unit. In many air conditioners the control knob 14 also operates the thermostat and permits adjustment of the temperature setting for the unit as may be desired by the occupants of the enclosure. The controls of the unit could, however, be remote from the air conditioner as long as they were found within the room to be conditioned.

In order to provide variable capacity, or cooling output for the unit, it is proposed that the compressor motor or the fan motor be of the multi-speed type, thereby permitting the motor to be operated at a plurality of different speeds to change the capacity of the unit. For purposes of explanation, the invention will be described in connection with a multi-speed fan motor for changing the cooling output of the unit. It will be understood, however, that the compressor motor of the unit could be a multi-speed motor instead of the fan motor and that the speed of the motor and thereby the capacity of the unit could be controlled in precisely the same manner as to be hereinafter explained with respect to the fan motor.

In FIG. 2 there is shown a multi-speed motor designated by the general numeral 13a. The motor 13a is provided with a main winding 15 and an auxiliary winding 16 having connected in series therewith a capacitor 17 for changing the phase of the current passing through the auxiliary winding 16 thereby making the motor self-starting. The motor, shown in FIG. 2, is a two-speed motor and includes a third winding 18 which is electrically connected into the windings of the motor whenever a higher speed operation is desired. Power is supplied to the motor circuit through the main switch 20, which is the switch normally oper-

ated by the control knob 14 on the front of the unit. When power is supplied through the switch 20, it may be directed into the motor through a switch means or relay switch 19 movable between first and second positions across a pair of contacts 21 and 22. When the contact arm of the switch 19 is electrically connected across contact 21, or in its first position, then both of the windings 18 and 15 are connected into the motor circuit to operate the motor on high speed. When the switch 19 is in its second position connected across the contact 22 only the main winding 15 is placed into the motor circuit, thus the speed of the motor is greatly reduced.

The operating speed of the motor 13a is controlled by a light sensitive means 23 including as a component of the control means mounted on the front side 11 of the air conditioning unit. More specifically, the light sensing means includes a photoconductive cell 23a (illustrated in FIG. 2) which is adapted to conduct electricity when the cell is energized by light of a sufficient intensity. As may be understood upon reference to FIG. 2, when main switch 20 is closed and power is connected across the motor circuit and, when the photoconductive cell 23a is energized by light from within the room, electricity is conducted across the cell. This causes a relay solenoid 24, or other electrically energizable means connected in series with the cell, to be energized and to move the switch 19 across the contact 21. Thus, when light energizes the photo-conductive cell 23a both windings 18 and 15 are placed into the motor circuit and the motor operates on high speed. When the light intensity within the room is sufficiently reduced, or the lights are turned off, there is no longer any flow of electricity through the photo-conductive cell 23a and, consequently, through the solenoid 24 which is in series with the cell. The solenoid 24 is then de-energized and the switch 19 moves across the contact 22. Thus, when the light within the room is reduced or turned off, the switch 19 energizes the motor circuit including only the winding 15 in the motor circuit and, thus, reduces the speed of the fan motor 13a accordingly.

In order to adjust the sensitivity of the light sensing means and to permit the unit to be operated according to particular degrees of light sensitivity, there is connected in parallel with the photo-conductive cell 23a a variable resistance 25. By adjusting the variable resistance, it is possible, to obtain greater or lesser amounts of current flow through the parallel resistance circuit and thereby require lesser or greater amounts respectively of current flow across the photo-conductive cell 23a in order to attain the current required to energize the solenoid 24. For example, when the resistance in the resistor 25 is made great there will be required more electrical current flow through the cell 23a in order to energize the solenoid 24. However, when the resistance in the resistor 25 is reduced greater current flows through the parallel circuit including the resistor 25 thereby reducing the amount of current flow necessary through the photo-conductive cell 23a in order to energize the solenoid 24. Inasmuch as the current flow through the cell is a function of the light intensity sensed by the cell, it is possible to adjust the amount of current flow required through the cell and, thereby, the degree of light intensity in the room before the motor 13a is operated on high speed. In most cases it is desirable to adjust the resistance 25 so that very little light is required to cause the light sensing means to adjust the motor circuit so that it operates on high speed. In such a case the unit will generally operate on high speed at all times except when the lights in the room are off completely. In the illustrated embodiment of the invention, the variable resistance may be adjusted by any convenient means such as the rotatable control knob 26 on the front of the unit.

An advantage in having the air conditioner capacity automatically controlled by the light intensity of the room to be conditioned is that, when the light intensity is low and the unit is operating at lower capacity, the noise

level of the unit is also usually much lower. When such a unit is utilized in a bedroom, the noise level of the unit automatically reduces as the lights of the bedroom are turned off thereby creating less disturbance for the sleeping occupants. This is particularly true where the motor having its operating speed controlled by the light sensitive means is the fan motor, inasmuch as it is the fan which creates most of the noise in the majority of modern day air conditioner of the room unit type. Any reduction in fan motor speed greatly reduces the noise level of the unit.

While in accordance with the patent statutes there has been described what at present is considered to be the preferred embodiment 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 claims 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:

1. An air conditioning unit comprising a casing adapted for mounting within a room to be conditioned, at least one multi-speed motor mounted in said casing for operating the air conditioning components therein, control means for said air conditioning unit, said control means being mounted within the room to be conditioned and exposed to light conditions therein, said control means including a switch means for changing said operating speed of said multi-speed motor and a light sensitive means adapted to actuate said switch means to change the speed of said multi-speed motor according to the intensity of the light in the room.

2. An air conditioning unit, comprising a casing adapted for mounting within a room to be conditioned with at least one side thereof exposed to the room, said casing having air inlet and outlet openings for the circulation of air to be conditioned from the room through said unit, a multi-speed fan mounted in said casing for circulating room air through said openings in said casing, switch means in said unit for changing the operating speed of said multi-speed motor, and a light sensitive means mounted on the side of said case exposed to the room and adapted to actuate said switch means to change the speed of said fan motor according to the intensity of the light in the room.

3. An air conditioning unit comprising a casing adapted for mounting within a room to be conditioned with at least one side thereof exposed to the room, a refrigeration system in said casing including a compressor mounted within said casing, said casing having air inlet and outlet openings for the circulation of air to be conditioned from the room through said unit, a multi-speed motor also in said casing for driving said compressor, switch means in said unit for changing the operating speed of said multi-speed motor, and a light sensitive means mounted on the side of said casing exposed to the room and adapted to actuate said switch means to change the speed of said multi-speed motor according to the intensity of light in the room whereby the capacity of said air conditioner is varied according to the intensity of light in the room.

4. An air conditioning unit comprising a casing adapted for mounting in a room to be conditioned with at least one side thereof exposed to said room, said casing having air inlet and outlet openings for circulation of room air through said unit, a fan for circulating room air through said openings in said casing, a fan motor mounted in said casing for driving said fan, said fan motor having a low speed operation and a high speed operation, switch means for selectively adjusting said fan motor from low speed operation to high speed operation and vice versa, and a light sensitive means mounted on said side of said case exposed to the room and adapted to actuate said fan switch means to operate said fan motor on high speed when the light in the room is of high

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intensity and on low speed when the light in the room is of low intensity.

5. An air conditioning unit comprising a casing adapted for mounting in a room to be conditioned with at least one side thereof exposed to said room, said casing having air inlet and outlet openings for the circulation of room air through said unit, a fan for circulating room air through said openings in said casing, a fan motor mounted in said casing for driving said fan, said fan motor having a low speed operation and a high speed operation, fan switch means movable between two positions, said switch means in said first position operating said fan motor at low speed and in said second position operating said fan motor at high speed, and a light sensitive means mounted on said side of said case exposed to the room and adapted to actuate said fan switch to said first position when light in the room is of low intensity and to said second position when light in the room is of high intensity.

6. An air conditioning unit comprising a casing adapted for mounting in a room to be conditioned with at least one side thereof exposed to said room, said casing having air inlet and outlet openings for circulation of room air through said unit, a fan for circulating room air through said openings in said casing, a fan motor mounted in said casing for driving said fan, a first circuit in said fan motor adapted to operate said fan at high speed, a second circuit in said fan motor adapted to operate said fan motor at low speed, fan switch means movable between a first position wherein said switch means energizes said first fan motor circuit and a second position wherein said switch means energizes said second fan motor circuit, a fan switch solenoid adapted to operate said switch means between said first and second positions, a light sensitive means mounted on said side of said case exposed to light from within said room, said light sensitive means including a photo-electric cell connected in series with said solenoid means and adapted to energize said solenoid to move said switch means into said first position when said photo-electric cell is exposed to light from said room, and a variable resistor electrically connected in parallel with said photo-electric cell and in series with said relay solenoid, said variable resistor including means for adjusting the amount of resistance and thereby the current flow through said resistor thereby to adjust the amount of current flow required through said photo-electric cell to energize said fan switch solenoid.

7. An air conditioning unit comprising a casing adapted for mounting in a room to be conditioned with at least one side thereof exposed to said room, said casing having air inlet and outlet openings for circulation of room air through said unit, a fan for circulating room

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air through said openings in said casing, a refrigeration system in said casing including a compressor, at least one motor mounted in said casing for driving said fan and said compressor, a first circuit in said motor adapted to operate said motor at a first speed, a second circuit in said motor adapted to operate said motor at a lower speed than when said motor is operated by said first circuit, switch means movable between a first position wherein said switch means energizes said first motor circuit and a second position wherein said switch means energizes said second motor circuit, a switch solenoid adapted to operate said switch means between said first and second positions, a light sensitive means mounted on said side of said case exposed to light from within said room, said light sensitive means including a photo-electrical cell connected in series with said solenoid means and adapted to energize said solenoid to move said switch means into said first position when said photo-electric cell is exposed to high intensity light from said room and to move said switch means into said second position when said photo-electric cell is exposed to low intensity light in said room so that said motor is operated on high speed when the light in said room is of high intensity and on low speed when the light in said room is of low intensity.

8. An air conditioning unit for conditioning the air within a room comprising a refrigeration system including a heat exchanger and a compressor, air circulating means for circulating air from said room over said heat exchanger for conditioning said air, at least one motor for driving said air circulating means and said compressor, at least two separate circuits in said motor adapted to operate said motor at different speeds, switch means movable to at least two different positions wherein said switch means energizes said separate motor circuits adapted to operate said motor at different operating speeds, electrically energizable means adapted to operate said switch means to said different positions, a control means for said air conditioning apparatus, said control means being mounted within said room to be conditioned and exposed to light conditions therein, said control means including a photo-electric cell connected in series with said electrically energizable means and adapted to energize said electrical energizable means to move said switch means into said different positions according to the intensity of light in the room.

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