VENTILATING SYSTEM FOR GARAGES AND SIMILAR ENCLOSED SPACES

Inventor: David J. Barber, Naples, FL (US)

Correspondence Address:
DOONAN DWIGHT MCGRAW
245 SAINT JAMES WAY
NAPLES, FL 34104-6775 (US)

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ABSTRACT

The system embodying the invention is employed to cool the interior of a normally closed area such as a garage or storage area, and/or to remove any noxious fumes or undesirable odors from inside the garage by moving outside air into the garage and providing means for that inside air and the fumes or odors in it, if any, to be removed to the outside ambient atmosphere. The system includes one or more fans installed in the upper section of the garage door, and the garage door is opened or closed by moving it in any well-known manner either by rolling it's hinged panels upward to a horizontal position from its normally-closed vertical position, or, when it is a solid door, tilting the entire garage door so that it is substantially horizontal instead of vertical and is located above the garage floor a sufficient distance to drive vehicles that will fit into the garage though the door opening. Those fans have a power cord that extends from a power supply position generally near the garage door opener that is secured to the garage ceiling and powers the garage door from its closed position to its open position, and vice versa, and that power cord is also secured to the garage door in the vicinity of the fan or fans used to move air into and out of the garage when the garage door is closed. The power cord is spring-urged to minimize its relatively free section between the power source and the place where it is secured to the garage door in the vicinity of the fan or fans where it provides power to the fan motor or motors when desired and appropriate. In the preferred embodiment the power cord is wound on a reel that is spring loaded to urge the reel in the rotational direction to wind the part of the power cord that is between the reel and the fan motor or motors, keeping the relatively free section of the power cord in tension so that it does not form any dangerous hanging loops when the garage door is moving from its open position to its closed position. There are also lesser desirable alternatives to apply a spring-loading to the power cord to keep it sufficient tension that it does not form such loops when the garage door is being opened.
ELECTRIC WALL SWITCH
POWER FOR
doors OPEN

MANUAL BYPASS SWITCH
NORMALLY ON

WALL SWITCH FOR FAN MOTORS
NORMALLY ON

TEMPERATURE COMPARATOR

SMOKE DETECTION

CO GASES
NOXIOUS GASES
HIGHER OUTSIDE TEMPERATURE
HIGHER INSIDE TEMPERATURE
HIGHER TEMPERATURE

Fig 1

Fig 2

Fig 3
DOOR OPEN WITH COIL SPRING RETURNED TO NEAR IT'S NON-TENSIONED CONDITION, BUT STILL WITH ENOUGH TENSION TO KEEP POWER CORD ALMOST STRAIGHT

Fig 9

DOOR CLOSED WITH COIL SPRING STRETCHED UNDER TENSION AND KEEPING POWER CORD ALMOST STRAIGHT

Fig 10
Fig 11  
**DOOR OPEN**  
USING COIL TENSIONED SPRING WITH PULLEY (WITH LESS TENSION)

Fig 12  
**DOOR CLOSED**  
USING COIL SPRING WITH PULLEY ROLLER (UNDER HIGH TENSION)
VENTILATING SYSTEM FOR GARAGES AND SIMILAR ENCLOSED SPACES

[0001] Priority of filing date is hereby claimed based on the U.S. provisional patent application Ser. No. 60/981,941, filed on Oct. 23, 2007, by the same inventor as the inventor named in this patent application, and entitled, “Vent-A-Garage.”

BACKGROUND OF THE INVENTION

[0002] The following U.S. patents are of sufficient interest to include them in the background of the invention herein disclosed and claimed. None of them disclose the invention herein claimed. However, they show various developments in the field of garage ventilation over many years, and are listed in numerical order, with at least the last name of the first-named inventor when there are two or more co-inventors listed, and the issue date of that patent:

1,959,918--Hochbaum. Issued May 22, 1934
2,084,807--Hueglin. Issued Jun. 22, 1937
4,175,608--Steffin and Bollwitt. Issued Nov. 27, 1979
5,626,288--Huber. Issued May 6, 1997
5,947,814--Czech et al. Issued Sep. 7, 1999
5,976,009--Achen. Issued Nov. 2, 1999
6,010,399--Lee et al. Issued Jan. 4, 2000
6,326,882--Chin and Lin. Issued Dec. 4, 2001
6,386,690--O’Brien. Issued May 14, 2002
6,958,010--Lee. Issued Oct. 25, 2005
6,979,260--Lin. Issued Dec. 27, 2005

[0003] In addition to the above patents, there were other patents and published patent applications that were cited in a search that was made prior to the filing of the above-noted provisional application, all of which was done under the auspices of a different patent attorney. None of these would have been cited at this time, but are identified here only because that search was a part of the earlier development of the background of the invention:

4,770,087--Danley et al. Issued Sep. 13, 1988

[0004] 1. Field of the Invention

[0005] The invention relates to the ventilation of enclosures, such as but not limited to, garages that are usually closed so as to admit a minimal amount of ambient atmospheric air and tending to retain odors, vapors, and hot air therein when closed. There are many types of enclosures of that type which would be substantially improved by ventilating them in accordance with the invention herein disclosed and claimed. It is herein disclosed as being for a garage, but it is understood that it can also be applied to other enclosures such as storage rooms, closets, and work areas where there is a likelihood that heat sources may be located therein that would raise the temperature of the air in the enclosure beyond that which is desirable. It also relates to the control of certain power cords that can at times otherwise be sufficiently loose or floppy to form loops that may be located in places where they are dangerous.

[0006] 2. Description of the Related Art

[0007] There are numerous patents found primarily or secondarily in the U.S. Patent and Trademark Office Class 454 relating to the general subject of ventilation of certain spaces, commonly being primarily for ventilating garages. Some typical ones in that Class include the patents listed above under the Background of the Invention.

[0008] U.S. Pat. No. 6,534,181—Wasson, issued Feb. 25, 2003, classified in U.S. Class 434, Subclass 405, and entitled, “Garage Venting Device,” is the most typical in relation to the invention herein disclosed and claimed. It shows a garage door 1 having two exhaust fans 5 and 8 installed in the upper part of that door. There are movable louvers between the fan blades and the exterior which are arranged to be opened when the fan is blowing air from the interior of the garage to the outside. The invention herein disclosed and claimed does not require louvers. A garage door opener 6 is also shown, and it is connected with the upper end of the door 1 so that, when it is actuated while the door is closed, it applies a force to the upper end of the garage door to move the door upwardly and inward as each of the several hinged door sections is guided to be moved from a vertical position to a horizontal position. The door stops its upward and inward movements once it is fully open. To close the garage door, the garage door opener 6 runs in the opposite direction and pushes the garage door outwardly and downwardly, again in guided door section movements, until the garage door is closed, at which time the garage door opener is deactuated and the door thereafter remains closed until the garage door opener 6 is again actuated, and the garage door 1 is again opened. This patent shows the basic manner in which most garage doors having hinged sections are opened and closed when garage door openers are installed. There are some garage doors that are not made in hinged sections, but tilt with their tops moving inwardly and their bottoms moving outwardly of the garage, so that they are stored horizontally, usually with a large part of their lower halves extending outside the garage itself. The invention is also applicable when such other garage doors are being used.

[0009] This patent disclosure by Wasson is deficient in giving a clear understanding of the connection of the fans and the motor(s) for the fans. In its FIG. 1, it clearly shows, and describes in the specification, the fan motor 7 as being mounted either on or immediately adjacent to the garage door opener 6. Then, somehow that is not at all explained, that motor 7 apparently connected by an unnumbered element shown only as a wavy line, to drive the fans 5 and 8 from its remote location. One can only guess how this may be done, but such possibilities are not disclosed, and they are not inherent. Therefore, such possibilities are not a fair teaching of anything that even approaches certainty. With its wavy configuration, it is not likely that it is a sheathed wire, such as at one time typically drove automobile speedometers. The patentee does say, at one point, that the motor 7 may be located where the exhaust fan itself is located, which is in the upper part of his garage door 1. This is not what is shown in the drawing, however.

[0010] Even if the unnumbered wavy element is an electrical wire or wires, and the motors are actually integral parts of the exhaust fan assemblies, that wire is obviously very loose, from its point of support at the rear of the garage door opener 6 and the location of the motors at the fans 5 and 8 with the
garage door being in its closed position as shown in FIG. 1. In that closed-door position, the distance from the motor 7 to the exhaust fans 5 and 8 is the greatest distance attained between those two points, and the unnumbered element from its connection with the element 7 and the exhaust fan 5 is shown to be very wavy and free even in that condition. When the door 1 is raised to the fully open position, the exhaust fans 5 and 8 are moved to be close to the garage door opener 6, substantially decreasing the distance between the motor 7 and the exhaust fans 5 and 8. The unnumbered element then would be even much more loose and thus be a possible danger. That loose unnumbered element becomes a hazard because it has no guidance or arrangement which prevents it from looping in various directions as the garage door is opened, and much of it may hang down so as to be subject to being damaged by any passing object from a vehicle to a ladder being carried, possibly causing a fire hazard to exist, and easily becoming fouled with something being carried and extending upwardly to the location of a loose part of the device that is unnumbered. The possible loose loop or loops of the unnumbered element could also interfere with the passage of individual persons as they may walk by the one or more vehicles often parked in the garage, particularly when they may also be carrying tools, groceries or whatever and have their vision restricted. While the persons encountering such a loop may not be physically injured, if he or she wore glasses, they could very easily be knocked off and be difficult to retrieve immediately. This could be dangerous to anyone who has such impaired vision that they cannot see without their glasses to avoid injury as they try to go on through the garage and into the house. The glasses may even be broken, further inconveniencing that person, as well as costing him or her to have them repaired or replaced.

BRIEF SUMMARY OF THE INVENTION

[0011] The invention may be incorporated into an after-market kit that can be easily installed in most of the garages built in recent years, or may be installed by an experienced installer without any of the aids provided in the kit that such installer would already have. The kit usually includes one or more basic tools that may be needed, but not owned by the homeowner installer, but may not be needed when a professional installer is used. It also contains detailed directions, and a pattern for openings that are to be cut into the upper and lower panels of a garage door. That being understood, the remainder of this summary will be directed to the system and its use by a typical installer having all of the needed tools.

[0012] The invention is a system for moving ambient outside air into a garage or similar storage area, hereafter being referred to as a garage in the generic storage area sense, to remove air that is within the garage. It has at least one electrically driven fan installed in an upper part of a garage door, control means for said at least one fan, a power cord operationally extending from the at least one fan to a fixed source of power. There is a force-exerting spring means exerting a continuous tension force on the power cord from the location of the fixed source of power to keep the power cord sufficiently taut by exertion of said tension force so that the power cord has substantially no slack. Eliminating substantially all of the slack in the power cord, its does not form any intermediate loop or loops as the garage door is being opened, or is being closed, keeping the power cord safe from accidental harm as well as keeping it from becoming a hazard while the garage door is open or closed.

[0013] More particularly, the inventive system removes air in the garage that is at a higher temperature than the outside air by pushing the cooler outside air into the garage interior and having that cooler outside air cause the hotter inside air to be forced out of the garage interior. Or, by pushing the hot air in the garage, and pulling the cooler ambient outside air in. Either mode is equally good, and each one has its own special considerations to be given.

[0014] One of the special features of the invention that has not been found in any of the prior art relating to ventilation of an enclosed space such a garage. That feature meets the need of a previously unmet need, as well as the strong desire, for safety purposes as well as neatness purposes, to control the physical location of the part of the electrical power cord extending from the fixed location of the electrical power source to the fan motor, when that motor is being moved with the garage door, whether, yet not in any way interfering with the moving of the garage door to its open or closed position or remains in one of those conditions. The fan, and therefore its motor, being mounted on the garage door, and the power cord that is extended from its fixed connection with the power source as the fan motor, is moved further and further away from stationary power connection to which the power cord is connected, when the garage door, having been in the closed position, is being moved to its open position. Without this feature of the invention, the loose power cord portion between its connection to a power source and its connection to the garage door in the immediate vicinity of the electrically powered fan or fans installed in the garage door is a relatively loose loop or so of the power cord, often hanging down or possibly being caught between two of the garage door hinged sections that allow the garage door to be moved from its vertical-when-closed position to its open position. When it is hanging down below the garage door opener mechanism area, it is also a source of possible accidents and/or injuries that can occur when the garage door is being opened. Using this important feature of the invention, the power cord is controlled in its physical aspect when the garage door is in any position, and particularly when the garage door is being opened or is open, so that it does not have a loop formed that tends to hang down and can become a dangerous hazard to itself, persons in the garage area, and vehicles parked there.

[0015] That important feature of the invention is the provision of a power cord take-up device which prevents the power cord from having loose loops in it, particularly when the garage door is open. The preferred embodiment of this feature is fully disclosed herein, as well as several alternative embodiments. The preferred embodiment employs a spring-loaded reel that is mounted on a fixed area that is vertically clear of the garage door when the garage door is in its open position. The power cord for the fans mounted in the upper panel of the garage door is wound on that reel, having its inner end connected to the source of electrical power and its outer end connected to a connector box on the upper part of the garage door, which in turn has electrical wires connecting to the fan motors. There is a spring means within the reel that continually urges the reel in the rotational direction, taking up any slack in the power cord while a closed garage door is being opened. The distance being spanned by the power cord as the garage door is being moved to its open position from its closed position becomes shorter and shorter as the garage door is being so moved. After the garage door is stopped, the power cord remains in a taut condition. Thereafter, when the garage door is being moved to its closed position from its
open condition, the power cord is being pulled by the movement of the garage door and the distance being spanned by the power cord becomes longer and longer until the garage door is in its closed position. The spring strength of the spring in the reel is such that it allows the power cord to be unraveled from the reel while still keeping sufficient tension force on the power cord to keep the slack out of it, and has sufficient strength to reel in the power cord when the garage door is being moved from its closed position to its open position. This constantly-applied tension to the power cord by the spring in the reel keeps the slack out of the power cord during opening and closing movements of the garage door, and also while the garage door is in its open or its closed position, and none of the power cord is at any time hanging in a loop that might be engaged by anything or anyone moving with such a loop in its path.

Several alternatives to using a spring-loaded reel to keep the power cord in tension that are within the purview of the invention are discussed, but the use of such a reel is definitely the preferred mode of the invention. Two such other alternatives are more simple in that a coil spring which is so arranged that it exerts a spring tension force on the power cord near where the power cord end that is connected with an electrical power source, and the other end of the power cord is secured to the connection box mounted on the garage door. The fan motor or motors each have electrical wiring connecting them with the connection box so that they are capable of receiving electrical power through the power cord when the power cord is energized with electrical power. The spring acts much like a door spring that was so common for many years, but is acting to keep the power cord sufficiently taut that there is no adverse lock in it at any time. It is not used to allow or limit the garage door to be opened and closed and held closed as such springs have done for screen doors to houses for many years. The garage door opener will open and close the garage door whether or not the power cord is fully connected to provide power to the fan motors. This first alternative has given rise to another modification where the coil spring has to have its effective length only half the length that the power cord needs when the garage door is being moved between its open and closed positions. The power cord itself is somewhat longer, and the coil spring is its movable end connected to a pulley having a roller around which the power cord extends near the location where the power cord is connected to the electrical power source. The power cord thus forms a 180° loop about the pulley roller, and the spring tension is delivered to the power cord at the loop, keeping the power cord in tension at all times as does the reel spring and the reel. The disadvantage is that they may be less expensive than the spring reel. Their disadvantages is that they have to be located well back of the point of connection of the power cord with the source of electrical power, to the full extent of the change in the effective distance of the power cord between the garage door open and closed positions for the first noted alternative and to ½ the full extent of that change in effective distance for the second noted alternative. There is a third alternative, but it is more expensive than the preferred embodiment using the spring-loaded reel. It is the provision of the power cord having integrally incorporated into it a coil spring for at least a sufficient length and spring power to be expandable to the same extent that the effective power cord length is when the garage door is moved from its opened position to its closed position, yet powerful enough to minimize slack to a sufficient extent. This third alternative spring arrangement would have some tendency to have some slack in it, particularly as the spring coils retracted as the garage door is moved from its closed position to its open position. However, that slight amount of slack would not be sufficient to cause the problem that would occur with the power cord alone, and would still protect the power cord from the dangers of the large loop slacks that could occur when no slack take-up device is used.

The controls of the inventive system include a manual switch that is normally left on, but can be opened to assure that no electrical power is delivered to the fan motor when such assurance is desired. At least one or more controls that sense one or more different conditions within the garage are most desirable, and are a common element of the system. These can include a thermostat, that senses the temperature within the garage, and one that senses the temperature of the exterior ambient air that might be pulled into the garage. There may also be sensors that sense gasoline fumes, the presence of either LNG or propane in the garage atmosphere, smoke, and the level of concentration of carbon monoxide. When any one or more of these sensed conditions reaches a predetermined level that is considered to be undesirable, the system can cause the fan motor or motors to be energized, yet to still be subject to the sensing of a higher temperature in the garage than the temperate outside of the garage to stop the fan motors. The manual control switch can always be used to stop the fan motors or prevent them from starting.

Another feature is the provision of sensors that sense the temperature within the garage and the ambient air temperature outside of the garage, and controlling the activation of the exhaust fan motor so that the fan is not energized when the garage temperature is very near to, or definitely greater than, the ambient air temperature outside of the garage, so that the garage interior is not unintentionally heated to an even higher temperature by warmer ambient air outside of the garage. Once these sensors have comparative readings showing that the air in the garage is warmer than the ambient air temperature outside of the garage, they may no longer prevent the activation of the exhaust fan motor.

There are other features found in the system as the system is installed and used, to better cool the interior of the garage and at the same time remove noxious fumes that are in the garage, instead of having very little or no release of hotter air in the garage and no substantial removal of any of the noxious fumes that may be present in a closed garage or other storage area. There may, at times the presence of certain noxious fumes that become such a potential danger that they have to be removed as safely as possible. Sensors can be provided for the more dangerous ones of such noxious or dangerous fumes as carbon monoxide, gasoline and other fuel and oil fumes, as well as more natural smells and fumes, such as those from garbage that has been stored inside the garage, or the possibility of a dead animal in the garage creating a very undesirable stench. Such sensors can cause the fans be actuated whether or not the outside air is at a higher temperature than the temperature is in the garage, or they may be either manually actuated or manually overridden when it becomes apparent that it is more desirable to circulate outside atmospheric air into and through the garage, even though it is warmer than the air in the garage at the time. It is to be understood that, when the garage door is open, it is more fully exposed to the outside air and the circulation of the outside air into the garage and the pushing inside air out, with any fumes or odors it may have, is not needed. However, if one wants to
circulate the air in the garage even when the door is open, the fans can still run, and will then push or pull the air at the top of the garage downwardly or upwardly so that the air movements can help the fumes, etc., be more easily blown out by outside wind drafts, so that the problematic inside air is still evacuated to a greater extent.

[0020] The system may be installed in a garage or other similar enclosed area, and may be incorporated into a kit form so that all of the necessary parts, and special tools, are provided so that a person with reasonable skills can easily install it in his or her own garage.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] FIG. 1 is an elevation exterior view of a building having a garage with the garage door being closed. Elements of the invention are readily apparent such as vents installed in selected areas of the garage door.

[0022] FIG. 2 is an elevation view of the building having a garage, shown in FIG. 1, with the garage door being open and the garage being occupied with a vehicle.

[0023] FIG. 3 shows, in schematic form, controls that are required to provide a functional system, and also shows additional desirable controls that can be used in practicing the invention to provide additional safety to the garage, its contents, and the building with which the garage is associated.

[0024] FIG. 4 is similar to FIG. 3, and is a somewhat simplified schematic representation of various parts of a system embodying the invention.

[0025] FIG. 5 is a cross-section view of the garage of FIG. 1, taken in the direction of arrows 5-5 of that FIGURE.

[0026] FIG. 6 is a view of the inner side of the closed garage door, taken in the direction of arrows 6-6 of FIG. 5, with some of the system that is on the garage door being illustrated.

[0027] FIG. 7 is a cross section view similar to the view shown in FIG. 5, showing in a more likely arrangement of the various parts embodying the invention with the garage door being open.

[0028] FIG. 8 is similar to FIG. 7, with the garage door being closed.

[0029] FIG. 9 is similar to FIG. 7, showing the use of a length of a tension coil spring that is attached to the power cord to keep tension on that cord at all times, whether the garage door is being opened or closed, or remains opened or closed. The garage door is in the open position.

[0030] FIG. 10 is similar to FIG. 9, with the garage door being in the closed position, and showing that the stretched length of tension coil spring has been substantially increased as the garage door was moved from its open position to its closed position, and the power cord is still substantially straight.

[0031] FIG. 11 is similar to FIG. 9, using a pulley assembly around the roller of which the power cord is passed, with a length of a tension coil spring having one end attached to a fixed object and the other end connected to the pulley assembly. The garage door is in its open position.

[0032] FIG. 12 is similar to FIG. 11, with the garage door in its closed position.

DETAILED DESCRIPTION OF THE INVENTION

[0033] The primary usage of the invention is to remove sufficient warm or hot air from the enclosed interior space such as a garage, and replace it with cooler outside air so as to keep the interior cooler. The interior space may also be subjected to vapors that make it uncomfortable to be in an enclosure, and may even be subject, by way of example but not of limitation, to dangerous gases such as carbon monoxide; fuel vapors such as gasoline fumes; other types of fumes that are released at times when certain activities, such as mixing paint, cleaning parts with various cleaning fluids, etc., are taking place in the enclosed space. Therefore, an at least equally important usage of the invention is to remove such vapors and gases.

[0034] While the invention is shown as being installed in a garage that is attached to a residential house, it is also very useful with free-standing garages or other storage buildings. Therefore, the use of the term “garage” in the specification and the claims is to be considered to be sufficiently generic to include such garages and other storage areas in other types of buildings than just private residences. While, in its preferred embodiment, it is to be also associated with a door such as are installed with typical garages to the extent that they are referred to as garage doors, such other buildings often using these same types of doors, particularly for storage purposes, whether individually or as a group of commercial storage units. The garage door is illustrated in several of the FIGURES as having several hinged panels. It is to be understood that such door may also be a solid one that is mounted so as to be tilted from the vertical, closed, position to a substantially horizontal, open position. Even a solid door often has several panels arranged from top to bottom.

[0035] In garages, for example, there can be gasoline, diesel fuel, propane, liquid natural gas (LNG), and engine exhaust fumes that not only have undesirable odors, but also have large amounts of carbon monoxide that can be life-threatening. There are some of these fumes and odors when there is a vehicle therein powered by a gasoline engine, or a diesel engine, or a gas such as propane or LNG. At times, there may be a house trailer in a garage which is more likely to have tanks of propane or LNG to be used for heating and cooking. Sometimes, such tanks are stored in special enclosed storage places, yet are often stored in garages. These fumes or vapors are of even more concern when the garage is an integral part of a larger structure such as an office building or a residential home. Those fuels also have different characteristics. For example, propane is heavier than air, and tends to gather in the lower parts of any restricted area. LNG, on the other hand, is lighter than air, and tends to rise. It will readily disperse when allowed to do so, but is particularly dangerous when it is still contained in closed spaces. Gasoline evaporates easily, and these fumes are also not only dangerous to breathe, they can easily become ignited when there is sufficient gasoline vapor concentration at the pilot light or other flame source. Once that happens, substantially all of the gasoline vapors in the garage are so quickly ignited that there is a fiery explosion.

[0036] Often, there is a gas water heater also located in a garage. Even if it is not actively heating water, it usually has a small pilot light that is a small flame that is kept burning at all times, so that when more heat has to be applied to the water in the heater tank, the pilot light ignites the gas that is allowed to start flowing, and its heating action heats the water until it has reached a preset temperature, and then the supply of the gas is cut off, yet leaving the pilot light on. Some gases used for heating water are heavier than air, and tend to rise to the upper levels when possible. They can be in the garage area if there is a gas pipe leak in that area. This can
become an exploding bomb when such gas becomes exposed to a flame such as the pilot light, or when someone lights a cigar, cigarette, or pipe.  

[0037] It is well known that at least some of these fumes or vapors, and particularly carbon monoxide, can penetrate into parts of the building that are adjoined to the garage either by door openings, side walls or ceilings, or all of those. Such penetration has only too often resulted in the death of someone in such adjoining area. It is very common to have one or more bedrooms over a garage, with the possibility that fatal results happen to one or more occupants when the carbon monoxide becomes a fatally high concentration in such a bedroom because of a leakage or penetration. A vehicle engine may have inadvertently left running at idle while unloading groceries, for example, and after the last load is taken into the main part of the house, the driver simply forgot that the engine was still running as he or she closed the garage door. Tragically, at times, there have even been persons committing suicide by closing the garage door and purposely letting the engine idle with the production of carbon monoxide eventually reaching a fatally dangerous level. For these reasons of potential danger or discomfort, it is very desirable to remove them as much as possible, and to keep the interior space of the garage substantially free of all such bad vapors, gases and odors.

[0038] Referring now to FIGS. 1, 2, 5 and 6, the building 20 has an attached garage 22, defined by the side walls 24 and 26, the front wall 28, the back wall 30, the ceiling 32, and a floor 34. The garage door 36 takes up the opening 38 in the front wall 30. The garage door 36 has several hinged sections which are panels. There is an uppermost panel 40, an upper panel 48, a lower panel 42 just above a lowest partial panel 44. There are several intermediate panels 46, and there may typically be three, four, or five ones. In the drawings where a number of panels are shown, this variation in the total number of such panels is recognized. In itself, the precise number of such panels are irrelevant. There just has to be enough that are not so wide that a panel cannot easily make the approximately 90° turn from the vertical to the horizontal as the rollers at their ends follow the guide rails as the garage door is being opened, and to do the reverse when the garage door is being closed. The upper panel 48 may be an intermediate panel as well. It can be either the topmost panel, or one or even two panels below the top edge of the garage door. Some of these variations are shown in the various FIGURES. The garage upper panel 48 has two motorized fan units 48 and 50 installed in it. As better shown in FIG. 5, those fan units have electrical power wires 52 and 54 respectively connecting the fan units to a connection box 56 mounted on the inner side of a garage door panel. There are two lower vents, 58 and 60, with filters, in the lower garage door panel 42. These vents and the fan units are laterally spaced on their respective panels. Also shown in FIGS. 2 and 5 is the garage door opener assembly 62. In FIG. 2, there is an automobile 64, as being parked in the garage 22, as is common. Many garages are made wide enough to receive two such automobiles, or some are made to receive even more. The building portion 66 that is located over the garage ceiling 32 is shown in FIG. 2 as an attic, but could just as well be a bedroom or a storage area.

[0039] FIG. 5 also shows a door 68 through the wall 26, leading to the main part of the building 20. Often it is opening through the laundry room of a typical house. There are two steps 70 so that a person can easily come through the door 68 and either step up to the floor level in the house or down to the floor level of the garage. Other items shown are the reel 72, which has the power cord 100 for the fan units 48 and 50 wound on it. It is fixedly mounted on the schematically illustrated base 74 for the motor door opener and closer 62. That base is held in place by brackets 76 and 78 that are fastened to the rafters supporting the ceiling 32. There is a switch 80 that is wired to control power to the garage door opener motor 82. If the garage door opener has the garage door closed, and switch 80 is momentarily closed by someone who wants it to be opened, the motor 82 of the assembly 62 will be energized to drive the opener mechanism 84 away from the door 36, and the garage door opener mechanism will move in the direction to pull the garage door 36 open. The mechanism therefore pulls the garage upper panel to cause it to move toward the garage door opener 62. Since each panel is connected by hinges to its adjacent panel or panels, the other panels follow. The ends of the panels typically have rollers 92 that are received within tracks 94 on each side of the opening occupied by the garage door when it has been closed. These rollers 92 follow the tracks’ vertical sections 96 upwardly and around a curve to the horizontal parts 98 of the tracks. When all, or almost all, of the door panels are substantially horizontal, the garage door opener motor 82 will be disconnected from its power source 102 by switch 86 that is controlled by the attainment of the fully open position of the garage door 36. When the garage door is open, and someone desires to close it, that person momentarily engages the switch 80 again, and the motor of the assembly 62 is again energized, this time causing the opener drive mechanism 84 to be moved toward the door upper panel 40. The garage door is then pushed by the mechanism 84 to be moved to its closed position. There is another switch 88, similar to switch 86, that is controlled by the attainment of the fully closed position of the garage door 36, to disconnect the motor 82 from the electrical power source 102. That switch 88 may also make a closed power cord connection to the electrical power source 102 so that the fan units 48 and 50 may be energized, assuming that other conditions are such that those fan units are to be energized upon the closure of the garage door. At the least, the activation of switch 88 will make it possible to run the fan units 48 and 50 because the garage door 36 is fully closed.

[0040] The block diagrams of FIGS. 3 and 4 are self-identified to a great extent. However, each block, and some of the lines joining different blocks of the diagrams, will be assigned reference numbers and will be explained in more detail. In each of FIGS. 3 and 4, the block 102 represents an electric power source that is in the building 22, an exterior portion of that building being shown in FIGS. 1 and 2. Interior or cross-sectional portions of the building 22, and in particular its garage 24, are shown in FIGS. 2 and 5 through 12. This building electrical power source 102 is usually an electrical power box, wired to receive electrical power from a power company or a generator serving the building. It has either fuses or circuit breakers for various electrical circuits that serve a building such as a residence or offices or even a series of commercial storage rooms. Such an electrical power box 102 is often located in the garage of a residence having no basement, and, therefore, would likely be placed in the garage 24.

[0041] In this graphic instance, there are shown only two of the several separate electrical circuits in the building 22. One of these circuits starts with an electrical wire 104 connecting the power source of block 102 with a wall switch 80, which includes a garage-door-opener control, shown as block 108,
schematically connected with the switch 80 by wire 106, in FIG. 4. That control, when actuated, causes the motor 82 to be rotated in one direction to cause the garage door opener mechanism, shown as block 84, to be actuated to open the garage door 36 from its closed position shown in FIG. 1 to its open position shown in FIG. 2. The needed direction is sensed by the sensor 116. The garage door 36 is also shown in its closed position in FIGS. 5, 6, 8, 10 and 12, and is shown in its open position in FIGS. 1, 7, 9, and 11. The garage door opener mechanism 84 is schematically connected to an upper garage door panel, such as the upper panel 40 of the garage door 36. This connection 90 is shown in all of the FIGS. 5 through 12. However, again for simplicity, the wall switch 80 is shown as being on the garage-area side of the garage side wall 26.

[0042] FIG. 4 shows that there is a garage door opener control, represented by block 108, that has an “on” position and an “off” position. Each time that switch 80 is activated, it activates the direction control 108, which changes the direction of rotation of the motor 82, depending upon whether the garage door 36 is open and is to be closed, or vice versa. It is built into the garage door opener assembly.

[0043] As shown in FIG. 6, supports 110 are provided for each fan and motor unit 48 and 50. Filters 68 can be installed in one side or the other of these supports. These air filters are also supplied in the kit. The vents 58 and 60 are in the bottom full-sized garage door panel 42, and the same hole boring tool in the kit can be used for forming the openings for these vents. Air filters 68 for the vents will also be supplied as parts of kits. They preferably are the same type of filter as those filters 68 for the fan units 48 and 50. The connection box 56 has no requirement that any opening or openings be made in a side wall or the ceiling of the garage. It is easily mounted on the upper panel 40 of the garage door 36, usually about a midpoint from the panel ends, using screws that are provided in the kit. The connection box 56 should be positioned below the point 90 where the garage door opening mechanism 84 has its end in abutting and securely mounted relation to the garage door upper panel 40, as seen in FIG. 5. There are electrical wires 84 and 86 extending from the connection box 56, one of them going to each of the motors for the fan units. The only installation requiring some change to the garage door is the need for openings to be formed through door panels for the fan set or sets located in the upper door panel 40, and the openings for the filtered vents 58 and 60 installed in the lower, full-width, door panel 42. These filters prevent the entry of insects as well as small animals when the garage door is closed, whether or not the motorized fan units 48 and 50 are operating. When provided in kit form, the invention includes, among other items, a hole saw blade of the proper size to make the openings in the garage door. When the hole saw blade is so used, the openings for vents 58 and 60 may be round. The kit may provide other tools that will make the installation easier and done correctly.

[0044] Several of the switches, sensors and controls are shown in FIG. 3, and some of them are also shown in FIG. 4. There is a wall switch 81 for the fan motors that can be manually operated to be sure that those motors cannot be energized when that switch is in its “off” position. It can usually be left in its “on” position, however, because there are also other controls and sensors that may allow or prevent those for running under various conditions that are sensed. For example the switch 114 is normally on, but is connected to receive a signal that turns it off when a sensor senses that the interior temperature in the garage is lower than the outside temperature, so that if the fan units 48 and 50 are allowed to run, they would actually cause the garage interior temperature to go higher, and that is not a desirable result. There is a normally “off” manually controlled switch 116 that can be turned on to bypass switch 114 when someone considers that action to be necessary. There is a block 118 that represents various sensors that can be employed in the system to sense and generate signals reflecting the condition sensed. For example, there are sensors 120 and 122 to sense the inside and outside temperatures of the air respectively in the garage 22 or similar storage space, and the ambient open air temperature. It is desirable to introduce outside air into the garage interior only when it is cooler that the inside air. Therefore there is a comparator 124 that receives the signals representing the two temperatures, compares the two, and sends a signal 126 to switch 114 when the comparison shows that the outside air temperature is higher than the garage’s inside air temperature, and then switch will be changed to its “off” position so that such an undesirable result cannot take place. The signal 126 can also be sent to a signal board 128 having various signal warning lights that are energized when the particular condition that they represent exists. In addition to the light 130 showing that the outside air temperature is higher than the inside air temperature. There are other sensors that may be used, and are shown in block 120. There may be sensors to sense the presence of carbon monoxide, gasoline fumes, other noxious gases, and noxious odors. They will send their generated signals to the comparable warning lights. There are warning lights 132 for carbon monoxide, 134 for gasoline fumes, 136 for other noxious gases, and 138 for noxious odors. It is to be understood that the system embodying the invention may have all, some, or none of these sensors and signals, depending on the extent that the owner of the building wants to have such installations made. The temperature control is a major one, because no one would want to heat the interior air of a garage or storage area when it is desired to keep it cooler. For that reason, the block drawing of FIG. 4 only shows that type of temperature control. It does show a vent switch, which may be used if movable louvers are provided for the vents 58 and 60 to be closed when the garage door is closed but the fan units are not to be operated. Another sensor in block 120 would be a smoke sensor 121, sensing the presence of smoke in the garage. Smoke would be an indication of a fire in there, and such a condition should be sensed, also, and when present should send a signal to switch 114 to prevent the fan units 48 and 50 from being turned on, possibly just fanning the fire, and also to the signal warning light board 128 to energize the smoke indicator light 140. This signal can also set off an audible alarm 142 because the presence of smoke in the garage should be known by someone immediately. The audible alarm can be manually turned off by the switch 142 once the alarm has alerted someone. FIG. 4 also shows a vent switch 59 which can provide power to open or close the vents 58 and 60, which are in the lower part of the garage door. This will further prevent any intrusion of debris, dust, insects and small animals when the door is closed and the fans in the upper panel of the garage door are not operating.

[0045] FIGS. 7 and 8 show the use of the reel 72 for the power cord 100. In FIG. 7, the garage door 36 is shown in its open position. The power cord 100 is therefore wound up on the reel so that all of it not so wound is in tension so that it cannot form a loose loop. In FIG. 8, the garage door 36 is shown in its closed position. The power cord 100 is extended
out in a substantially straight line, because it is still in tension from the reel 72 to the connection box 56. It cannot form any loose loops that would hang well below that straight line, and there is no danger from such loose loops. When the garage door 36 is returned to the open position, the spring in reel 72 also retracts the power cord by rewinding it on the reel, keeping sufficient tension on the power cord 100 so that it does not form any loose loops.

[0040] FIGS. 9 and 10 show the substitution of a tension spring 200 with one end of it secured to a fixed support such as the back wall 28 of the garage, and the other end connected to the power cord 100 spaced a needed distance from its end where it is plugged into a receptacle receiving electricity from the electrical power source 102 so that it always remains plugged in as the power cord is moved as the garage door 36 is moved from its open position to its closed position, shown in FIG. 10. FIG. 10 also shows the tension spring 200 stretched a distance that is equal to the distance that the end of the power cord connected to the connection box 56 moves when the garage door is moved from its open position to its closed position. When the garage door 36 is returned to the open position, the spring 200 also retracts, keeping sufficient tension on the power cord 100 so that it does not form any loose loops.

[0041] FIGS. 11 and 12 show a modification of the spring setup in FIGS. 9 and 10. The spring 300 is considerably shorter than spring 200. One of its ends 306 is connected to a suitable fixed element schematically shown as element 308. The movable end 310 of spring 300 is connected to the yoke 312 of a pulley 302, which has a roller 304 rotatably mounted within the yoke 312 so as to be rotatable. The power cord 100 is located so that its movements, one movement of the rotatable movement of the pulley roller in one direction being obtained by the force of the spring 300 as the door is being opened, and the other movement, in the opposite direction, being caused by the force of the spring as the door is being closed. The power cord has about a 180° bend in it that bends around the pulley roller. That bend allows the pulley yoke 312, and therefore the end of spring 300, to have to move only ½ the distance that the end of spring 200 in FIGS. 7 and 8 has to move during each door opening and each closing movement. Otherwise, it works in the same manner as spring 200. It also keeps some tension on the power cord 100, whether the garage door 36 is open as shown in FIG. 11 or is closed as shown in FIG. 12. That continuous tension exerts on power cord 100 prevents that power cord from falling down in one or more loose loops as the garage door 36 is being moved from its closed position to its open position, thus eliminating a potentially dangerous condition.

1. A system for operatively moving ambient outside air into a garage or similar storage area, hereafter being referred to as a garage in the generic storage area sense, and for operatively removing air that is within the garage while replacing that air with air from outside the garage, said system having first vent means set in the upper part of a garage door and second vent means set in the lower part of the garage door, at least one electrically driven fan installed in at least one of said vent means sets, control means for controlling the operation of said at least one fan, and a power cord operatively extending from said at least one fan to a fixed source of power, and a force-exerting means exerting a tension force on the power cord from the location of the fixed source of power to keep said power cord sufficiently taut by exertion of said tension force so that said power cord has substantially no slack so that its does not form any intermediate loop or loops as the garage door is being opened, or is being closed, keeping said power cord sage from accidental harm a well as keeping it from becoming a hazard once the garage door is open.

2. The system of claim 1, said system being more particularly for removing air in the garage interior that is at a higher temperature than the temperature of the air outside of the garage by pushing cooler outside air into the garage interior through one of said vent means and having that cooler outside air that is pushed into the garage interior through the other of vent means then causing hotter inside air to be pushed out of the garage interior.

3. The system of claim 2 in which the outside air is pushed into the garage interior by said at least one fan located at least vertically closely adjacent to the top of the garage door and the garage inside air is pushed out of the garage interior through the vent means adjacent to the bottom of the garage door, the garage door having vents at least horizontally closely adjacent to the bottom area of the garage door for that purpose.

4. The system of claim 1, said system being more particularly for removing air in the garage that is at a higher temperature than the outside air by pulling hotter inside air through one of said vent means set to the outside of the garage interior with said at least one fan located in one of said vent means and, because the air pressure in the garage is then less than the outside air pressure, to also pull cooler outside air into the garage interior through the other of said vent means set, thereby having the effect of having cooler air in the garage interior.

5. The system of claim 1, said force-exerting means being a spring means that continually exerts a tension force on said power cord tending to move said power cord.

6. The system of claim 2 which has a reel that is mounted on a fixed area that is vertically clear of the garage door when the garage door is in its open position, said power cord being wound on said reel and said reel having said spring means therein which urges said reel rotatorily toward taking up any slack in said power cord while the garage door is being opened and the distance spanned by said power cord becomes shorter, to hold said power cord with any slack in it being taken up, and to allow the power cord to be unrolled from said reel when the garage door is being closed while still keeping sufficient tension force on said power cord to keep the slack out of said power cord.

7. The system of claim 1, said power cord having said spring means formed as a coil spring integrally located therein which is normally closely coiled when in its free position, and which is stretched to spread the coils thereof increasingly further apart to increase the effective length of said coil spring and allow said power cord to be concurrently stretched sufficiently to maintain its power relation to the at least one fan and the power source when the garage door is being moved to its closed position from its open position, and to retract said power cord by decreasing the spacing of the coils of said coil spring and thus decrease the effective length of the power cord, keeping said power cord from forming one or more loose loops during the opening of the garage door and while the garage door remains in its open position.

8. The system of claim 1 in which said spring means is a coil spring having a short natural, unstretched, length and having a first end operatively attached to a fixed device and a second end operatively attached to said power cord near said power cord end that is electrically connected with an electri-
cal power source, said coil spring being stretched from its natural unstretched length to at all times be applying a tension force to said power cord and being capable of increasing its effective length while maintaining a tension force on said power cord as said power cord is extended in its overall effective length extending from said power cord end operatively connected with the electrical power source, so that there is no loose loop of said power cord formed when the garage door is being opened, keeping said power cord from being either a danger to itself or to something else that may become engaged by any such loop if such a loop is allowed to be formed while the garage door is opening.

9. A system in which an enclosed space such as a garage or other storage area has outside atmospheric air replacing the atmospheric air in said garage or other storage area and moving the inside air out of said garage or other storage area, said fan means being installed on a garage door that has a closed position and an open position, and a power cord for said fan means having a first end and a second end, said power cord being used in that system wherein said first end thereof is relatively fixed and the said second end thereof is movable for a distance from a first position that is near said first end to a second position that is substantially further away from said relatively fixed first end when the garage door is moved from its open position to its closed position, and said power cord second end being moved back toward said power cord relatively fixed first end when the garage door is being moved from its closed position to its open position, said power cord being capable of loosely forming one or more loose loops when said second end is being moved back toward said first end should no tension force being applied to said power cord, and means keeping said power cord sufficiently taut to prevent the formation of one or more loose loops, said means keeping said power cord taut being a spring-loaded arrangement tensionally pulling on said power cord as the garage door is being opened to keep said power cord from becoming loose between said ends so as to form one or more loose loops that are potentially dangerous.

10. The system of claim 9, said means keeping said power cord sufficiently taut to prevent the formation of one or more loose loops, said means keeping said power cord taut being a reel having a coil spring, said reel being mounted on a substantially fixed area that is clear of the garage door when the garage door is in its open position, said power cord being wound on said reel and said coil spring which urges said reel rotationally toward taking up any slack in said power cord while the garage door is being opened and the distance spanned by said power cord become shorter, to hold said power cord with any slack in it being taken up, and to allow the power cord to be unrolled from said reel when the garage door is being closed, still keeping the slack out of said power cord.

11. The system of claim 9, said means keeping said power cord sufficiently taut to prevent the formation of one or more loose loops, said means keeping said power cord taut being a coil spring integrally located in said power cord which is normally in its free position closely coiled, and which is stretched to increase the effective length of said coil spring and allow said power cord to stretch sufficiently to maintain its power relation to the at least one fan when the garage door is moved to its closed position from its open position, and to retract said power cord by decreasing the effective length of the power cord, keeping said power cord from forming one or more hanging loops during the opening of the garage door and while the garage door remains in its open position.

12. The system of claim 9, said means keeping said power cord sufficiently taut to prevent the formation of one or more hanging loops, said means keeping said power cord taut being a coil spring having a short natural length and having a first end operatively attached to a fixed device and a second end operatively attached to said power cord near said power cord end that is electrically connected with an electrical power source, and being capable of increasing its effective length as the power cord is extended in its overall effective length extending from said power cord end operatively connected with the electrical power source, so that there is no loose loop of said power cord formed when the garage door is being opened, keeping said power cord from being either a danger to itself or to something else that may become engaged by any such loop if such a loop is allowed to be formed while the garage door is opening.

13. A kit for installing a ventilation system to be used in conjunction with an enclosed space such as a garage that is opened to the outside atmosphere by opening a door that is moved vertically and horizontally from its closed position to its open position by a door opener when access to that space is needed, and the door is moved from its open position to its closed position so as to close the enclosed space from the outside atmosphere when the door opener is actuated to move the door from a substantially horizontal position to a substantially vertical position, said kit comprising:

- at least one fan having an electric motor, said fan with its motor being mounted on a support member for installation in an opening in the upper part of the door;
- a device for creating the opening in the upper part of the door through which said at least one fan and said support member for said fan is mountable;

said at least one fan motor selectively running said fan in accordance with sensed conditions of the atmosphere within the closed space and the atmosphere outside of the enclosed space, and when running with the door closed normally causes cooler air from the outside being brought into the interior of said closed space so that the interior of said closed space is cooled;

- a connector box adapted to be secured to the door, said connector box having an electrical power receptacle thereon and at least one wire extending therefrom and leading to said fan electrical motor to provide electrical power thereto;

- a power cord having one end adapted to be connected to an electrical current power source and its other end adapted to be operatively connected to said at least one fan electrical motor through said connector box, the overall length of said power cord being sufficient to maintain such connection between the electrical current power source and said connector box when the door is in its closed position and to require a lesser overall length when the door is in its open position, leaving a middle part of said power cord likely to become a hazard because it may become temporarily located well away from a substantially horizontal and straight line between said power source and said connector box when the door is in its open position, and tensioning means operatively acting on said power cord to tension said power cord and thus maintain said power cord location to be on a substantially straight line extending between and beyond
said power source and to said at least one fan motor connector box, once said kit is installed, so that there is no loosely located part of said power cord between said electrical power source and said connector box creating a possible hazard if it were to be loosely located.

14. The kit of claim 13, in which said tensioning means operatively acting on said power cord to tension said power cord includes spring means adapted to tension said power cord to substantially eliminate the possibility of said power cord having a loose section that may be a hazard when said power cord is attached to an electrical power source and the connector box for said at least one fan motor with a substantially longer effectively-required power cord length when said than the minimum power cord effective length that exists when said door is fully open.

15. The kit of claim 13, said spring means including a reel that is adapted to be mounted on a fixed area that is clear of the garage door when the garage door is in its open position, said power cord being wound on said reel and said reel having said spring therein which urges said reel rotationally toward taking up any slack in said power cord while the garage door is being opened and the distance spanned by said power cord become shorter, to hold said power cord with any slack in it being taken up, and to allow the power cord to be unrolled from said reel when the garage door is being closed, still keeping the slack out of said power cord.

16. The kit of claim 13, said power cord having a coil spring integrally located therein which is normally in its free position closely coiled, and which is stretched to increase the effective length of said coil spring and allow said power cord to stretch sufficiently to maintain its power relation to said at least one fan when the garage door is moved to its closed position from its open position, and to retract said power cord by decreasing the effective length of the power cord, keeping said power cord from forming one or more loose loops during the opening of the garage door and while the garage door remains in its open position.

17. The kit of claim 13 in which said tensioning means is a coil spring having a short natural unstretched length and having a first end operatively attached to a fixed device and a second end operatively attached to said power cord near said power cord end that is electrically connected with an electrical power source, and being capable of being stretched, increasing its effective length as the power cord is extended in its overall effective length extending from said power cord end operatively connected with the electrical power source, so that there is no loose loop of said power cord formed when the garage door is being opened, keeping said power cord from being either a danger to itself or to something else that may become engaged by any such loose loop if such a loose loop is allowed to be formed while the garage door is opening.

18. The kit of claim 13, further including control means for selectively electrically connecting and disconnecting said power cord from the electrical current power source; said control means comprising:

a first thermostat adapted to sense the temperature of the air in the enclosed space, and

a second thermostat adapted to sense the temperature in the outside air immediately beyond the door;

said thermostats being so connected to control the electrical connection between said electrical power source and said at least one fan motor to keep said electrical power source disconnected from said at least one fan motor when the temperature inside said enclosed space and sensed by said first thermostat is less than the outside air temperature sensed by said second thermostat, and an “on-off” switch connected to permit the electrical connection between said electrical power source and said at least one fan motor only when the door is at least substantially closed.

19. The kit of claim 18, said control means also including a garage door-position sensor switch which includes an “on-off” switch positioned so that said door-position sensor switch is in its “on” position only when and while said door is at least substantially closed;

said “on-off” switch having a manual “off-on” override for overriding said switch’s “off” position when the electrical connection between and said electrical source and said at least one fan motor is desired even when the door position is not substantially closed, and for overriding said switch’s “on” position when it is desired that the electrical connection between said electrical source and said at least one fan motor be connected even though the sensed door position is sensed as being more open than other than being substantially closed.

20. The kit of claim 17, said control means also including a first manual override switch for said thermostats so that said thermostats can be rendered ineffective to manually interrupt the electrical connection between said electrical source and said at least one fan motor, and that electrical connection can selectively be interrupted and established independently of said thermostats.