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FAN CONTROL

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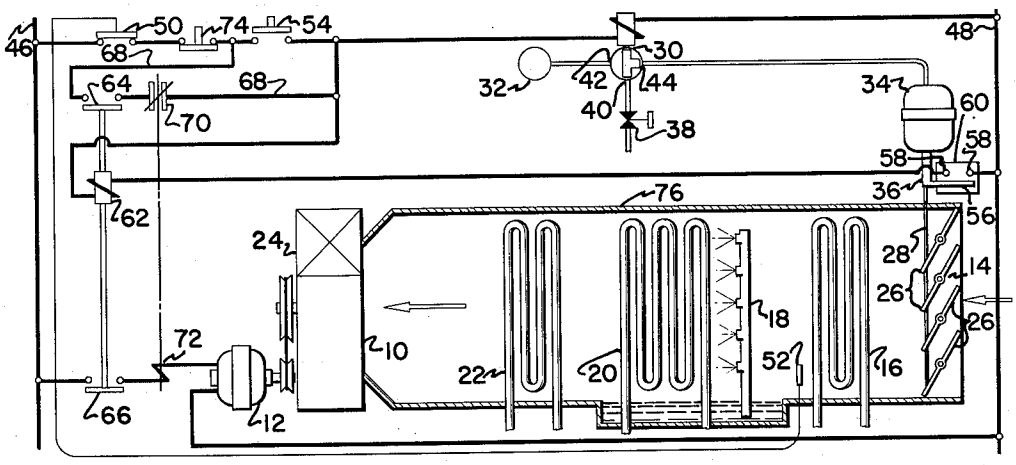


FIG. 1

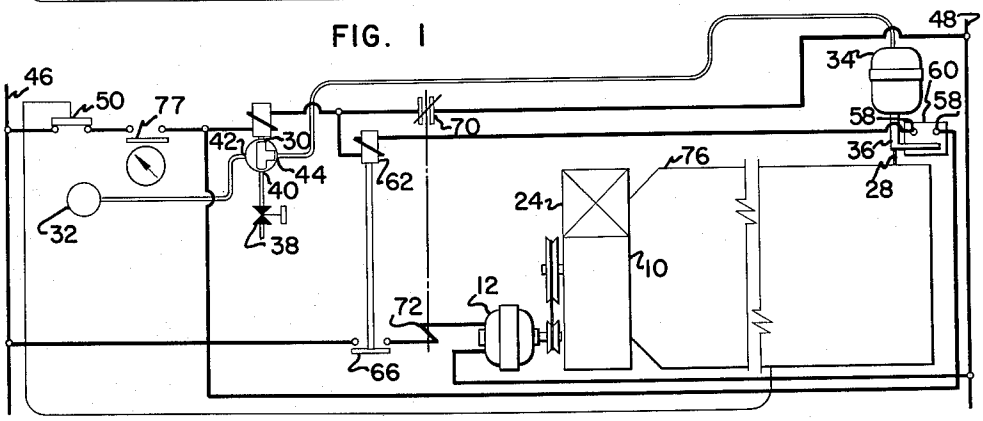


FIG. 2

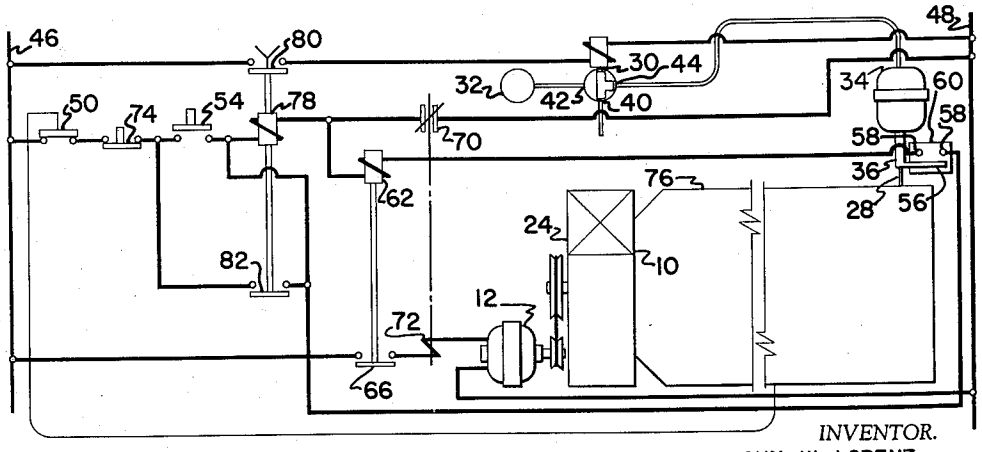


FIG. 3

INVENTOR.
JOHN W. LORENZ

BY Holmes & Andersen

ATTORNEYS

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FAN CONTROL

John W. Lorenz, La Crosse, Wis., assignor to The Trane Company, La Crosse, Wis., a corporation of Wisconsin

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This invention relates generally to fan control in a ventilation system and more particularly to an interlock control between the inlet fan and the outside air damper.

In most air conditioning and ventilating systems, the outside air dampers and the fan operate simultaneously. In other words, the damper motor and the fan motor are actuated together and also cease functioning at the same time. This causes a deleterious effect on the duct system on the low pressure side of the fan located between the fan and the fresh air dampers. On starting, the fan normally reaches peak speed before the dampers are fully open thereby causing a low pressure condition between the fresh air damper and the fan which in turn tends to collapse the duct work due to the difference between the pressure inside the duct and outside the duct. Conversely, when the fan motor and fresh air damper motor are de-energized, the fan tends to coast to a stop long after the fresh air dampers are closed. This again causes a low pressure condition in the duct work between the fan and the fresh air damper tending to collapse the duct. The simultaneous energization of the fan motor and the damper motor is also considered dangerous since a failure in the damper motor circuit would cause the dampers to stay closed and the fan suction pressure would tear up the attached duct system.

An object of my invention is to provide a ventilation control which insures that the outside air damper is open before the fan is energized.

Another object of my invention is to provide a ventilation control which insures that the fan will be stopped when the fresh air dampers close.

A third object of the invention is to provide an interlock between the fresh air damper and the fan of an air conditioning or ventilating system which is activated and de-activated by the movement of the fresh air damper to insure that the fresh air dampers are open when the fan comes on and to insure that the fan has ceased to operate when the dampers are closed.

A still further object of the invention is to provide an air conditioning or ventilating control which will allow the installer to reduce the cost of installation and equipment therein.

A fifth object of the invention is to provide an interlock control between the fan motor and the damper motor whereby the fresh air dampers will be open when the fan is started and incorporates a time delay switch so that the fan will coast to a stop before the fresh air dampers are closed when no fresh air is desired.

A still further object of the invention is to provide an interlock between the fan motor and the damper motor so that once the outside air damper has closed, the fan cannot be started until the outside air damper is reopened.

Other objects and advantages of the invention will become apparent as the specification proceeds to describe the invention with reference to the accompanying drawing, in which;

FIG. 1 is a diagrammatic view of an air conditioning system employing the preferred form of my invention;

FIG. 2 is a view similar to FIG. 1 showing a second embodiment of my invention; and

FIG. 3 is another diagrammatic view showing another embodiment of my invention.

Looking now at the drawings, like reference numbers refer to like elements in all forms of the invention.

Looking at FIG. 1, my invention is shown in conjunction with a typical air conditioning installation in which fan 10 driven by fan motor 12 draws fresh air through fresh air dampers 14, successively over a preheat coil 16, a sprayer 18, a cooling coil 20, a reheat coil 22, and then feeds the conditioned air to the space to be conditioned via fan outlet 24.

The fresh air damper 14 consists of a series of damper blades 26 connected together by a linkage member 28 or any other suitable means so that the damper blades 26 open and close in unison. Solenoid operated three-way air valve 30 connected to a source of air 32, normally at 20#, actuates damper motor which through linkage 36 opens and closes fresh air damper 14. The damper motor actuating circuit is typical of damper control circuits known in the art. Air valve 30 has an adjustable restrictor 38 connected to its normally open port 40, main air from air source 32 on its normally closed port 42, and the damper motor 34 connected to the common port 44. When solenoid three-way valve 30 is energized, normally closed port 42 is opened and air passes through the normally closed port 42 to the common port 44 and hence at the damper motor to actuate same. This causes the damper blades 26 to open. Upon de-energization of solenoid valve 30, normally closed port 42 is closed and air is bled from the common port 44 through restrictor 38 to the atmosphere and the outside air damper 14 slowly closes. Obviously, the restrictor 38 operates as a time delay since it allows the fan to coast to a stop before the dampers are closed completely.

The above described system is conventional and forms no part of the invention other than to serve as one of many typical installations to which my new and improved control circuit may be applied.

In operation, the electrical control circuit is connected between electrical supply lines 46 and 48. In each embodiment a temperature control relay 50 is located in the main circuit and will open its contacts to de-energize the circuit if the temperature sensing bulb 52 located in the entering air senses a fall in temperature below a set predetermined temperature. This prevents freezing of the coils and uncomfortable conditions in the conditioned area.

Looking at FIG. 1, when start button 54 is depressed, solenoid operated valve 30 is energized and damper motor 34 starts to open fresh air damper 14. When the fresh air damper 14 has reached the open position, linkage 36 has been raised to the maximum position where contact 56 engages terminals 58 of end switch 60. When end switch 60 is closed power is fed to holding coil 62 pulling in auxiliary switch 64 and fan motor switch 66. Then start button 54 may be released since auxiliary switch 64 has completed the electrical circuit around the start button 54 and is feeding power to the holding coil 62. Located in the start button by-pass circuit 68 is an overload switch 70 responsive to an overload heater 72 in the fan motor circuit.

When the stop button 74 is depressed or if either the temperature control relay 50 or overload switch 70 kick out, the holding coil 62 is de-energized, switches 64 and 66 break contact, solenoid air valve is de-energized causing air to bleed from common port 44 through normally open port 40 through the restrictor 38 to the atmosphere thereby allowing the fresh air damper to close slowly. Note that as the fresh air damper 14 closes, contact 56 moves downwardly away from the terminals 58 in end switch 60 thereby insuring that the fan 10 may not be started until the fresh air dampers are reopened again.

The bleeding of air from the restrictor 38 to the atmosphere allows the fresh air damper 14 to close slowly in order to permit the fan to coast to a stop. Otherwise,

the damper 14 would close before the fan 10 and a negative pressure would occur in duct 76 tending to collapse it.

The second embodiment shown in FIG. 2 is very similar to that of FIG. 1. In FIG. 2, a maintained contact start switch 77 has been substituted for the push button switches 74 and 54 of FIG. 1, and the start button bypass circuit 68 has been eliminated. In the embodiment of FIG. 2, the solenoid air valve 30 is connected between the holding coil 62 and the overload switch. The operation of this circuit is the same as that of FIG. 1 except that a permanent starter is used instead of a push button starter. Mechanically, the results of the first and second embodiment are identical.

The third embodiment of my invention is also similar to the first two embodiments but provides an electrical time delay circuit to insure that the fan has ceased operation before the fresh air damper is closed. The use of the time delay circuit eliminates the use of the restrictor 38 attached to the normally open port 40 of the solenoid air valve 30.

In operation when start button 54 is depressed, power is fed to time delay holding coil 78 thereby closing time delay switch 80 and closing switch 82 to lock the circuit in so that the start button 54 may be released. The closing of time delay switch 80 energizes solenoid valve 30 which in turn passes air from the air source 32 to the damper 34 to open fresh air damper 14. As set forth above, the fresh air damper 14 opens, contact 56 makes end switch 60 thereby energizing holding coil 62 which pulls in fan switch 66 to start the fan.

Upon depression of stop button 74 or tripping of the overload switch 70, the fan holding coil 62 will be de-energized thereby opening the fan switch 66 and the time delay holding coil 62 will be de-energized. The fan will then coast to a stop but solenoid coil 30 will not be immediately de-energized since the time delay switch will not open until after a pre-determined time after depression of the stop switch 74 or opening of the overload switch 70. When the time delay switch finally opens thereby de-energizing the solenoid valve 30 to close the fresh air damper 14, the fan has coasted to a stop position thereby insuring that a negative pressure will not be set up in the duct 76 which would tend to collapse the duct. As previously set forth, the end switch 60 will open when the fresh air damper closes through preventing the fan from operating without the fresh air damper 14 being open.

Obviously, I have provided a new and novel control system which inter-connects the fan and damper motors so that it is impossible to operate the fan without having the fresh air damper open. This inter-lock between the fan and fresh air damper prevents the collapsing of the duct work in which the fan and damper are installed.

Although I have described specifically the preferred embodiments of my invention, I contemplate that changes may be made without departing from the scope or spirit of my invention and I desire to be limited only by the scope of the claims.

I claim:

1. A ventilation system comprising: a fan, a fan motor connected to said fan, a duct system connected to said fan, means forming an air inlet opening in said duct system on the inlet side of said fan, a damper member operably associated with said air inlet opening, a damper motor connected to said damper member to open and close said damper member upon energization and de-energization of said damper motor, control means connecting said damper motor and said fan motor to energize said fan motor when said damper member has opened a predetermined distance, and a solenoid operated three-way air valve with a normally open port, a normally closed port, and a common port connected to said damper motor, and a restrictor connected to said open port whereby air will bleed from said common port through said restrictor to slowly close said damper when said solenoid operated air valve is de-energized.

2. In a ventilation system having a fan, a fan motor connected to said fan, a duct system connected to said fan, means forming an air inlet opening in said duct system, a damper member operably associated with said air inlet opening, a damper motor connected to said damper member to open and close said damper member, means for energization and de-energization of said damper motor; the improvement comprising a first electrical circuit means, a second electrical circuit means, switch means in said first circuit, means connected to said damper motor to close said switch means when said damper member has been opened a predetermined distance by said damper motor, a holding coil in said first circuit in series with said switch means, and a fan motor switch in said second circuit connected in series with said fan motor and mechanically connected to said holding coil in said first circuit whereby closing of said switch means by the opening of said damper will energize said holding coil thereby closing said fan motor switch to start said fan.

3. In a ventilation system having a fan, a fan motor connected to said fan, a duct system connected to said fan, means forming an air inlet opening in said duct system, a damper member operably associated with said air inlet opening, a damper motor connected to said damper member to open and close said damper member upon energization and de-energization of said damper motor, a solenoid operated three-way valve with the common port connected to said damper motor and with a restrictor connected to the commonly open port; the improvement comprising, a first electrical circuit, a second electrical circuit, a third electrical circuit, the solenoid of said solenoid three-way valve being in said first circuit, switch means in said second circuit adapted to be closed upon opening said damper means connected to said damper motor to close said switch means when said damper member has been opened a predetermined distance by said damper motor, a holding coil in said second circuit in series with said switch means, and a fan motor switch in said third circuit connected in series with said fan motor and mechanically connected to said holding coil in said second circuit whereby upon energization of said solenoid coil said damper motor will open said damper member a predetermined distance thereby closing said switch means and energizing said holding coil to start said fan motor.

4. In a ventilation system having a fan, a fan motor connected to said fan, a duct system connected to said fan, means forming an air inlet opening in said duct system, a damper member operably associated with said air inlet opening, a damper motor connected to said damper member to open and close said damper member upon energization and de-energization of said damper motor; the improvement comprising, a first electrical circuit, a second electrical circuit, a third electrical circuit, damper motor energizing means in said first electrical circuit, a time delay switch in series with said damper motor energizing means, switch means in second circuit adapted to be closed upon opening said damper means connected to said damper motor to close said switch means when said damper member has been opened a predetermined distance by said damper motor, a holding coil in said second circuit in series with said switch means, a fan motor switch in said third circuit connected in series with said fan motor and mechanically connected to said holding coil, and a time delay holding coil in said second circuit in series with said holding coil and said switch means and mechanically connected to said time delay switch whereby upon de-energization of said holding coil and said time delay holding coil the damper motor energizing means will stay energized until said fan has coasted to a stop thereby insuring that the fan will cease to operate before the damper member closes.

5. The structure of claim 4 wherein said damper motor

energizing means is a solenoid operated three-way air valve with the solenoid coil in series with said time delay switch.

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