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COMBINED HUMIDITY AND AIR FLOW CONTROL

Filed June 24, 1963

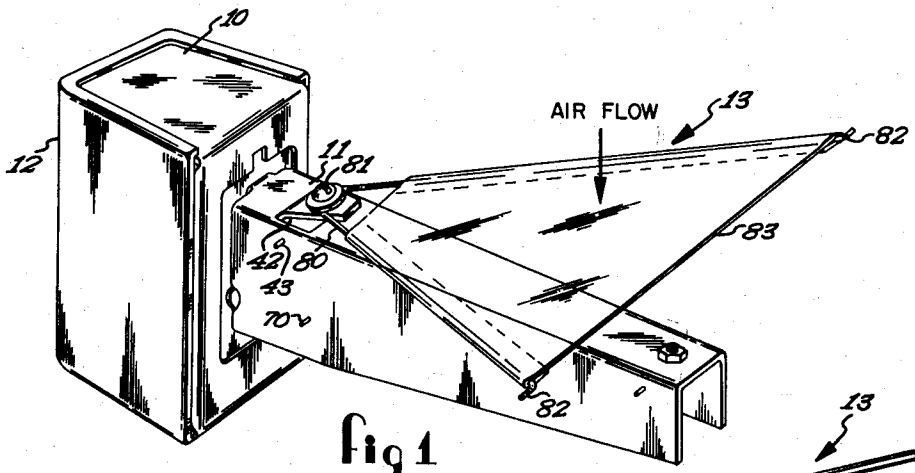


Fig 1

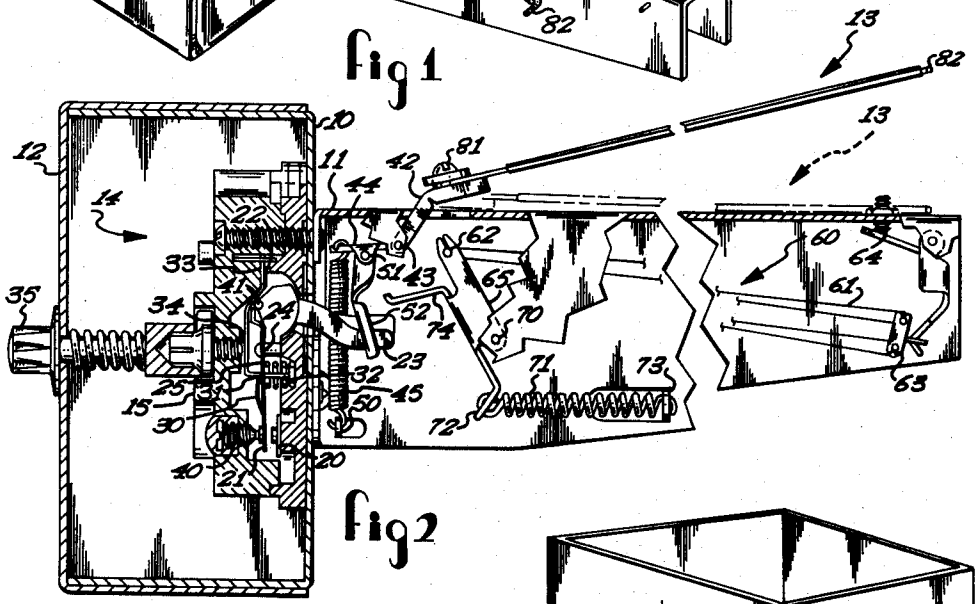


Fig 2

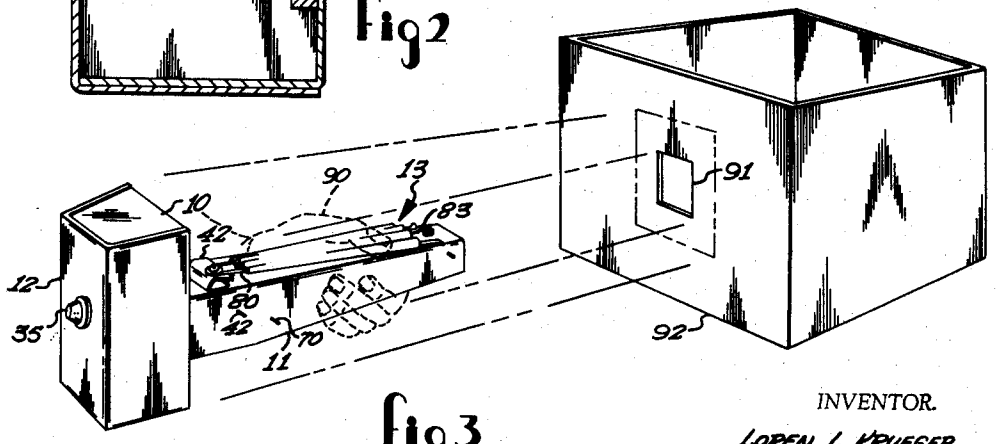


Fig 3

INVENTOR.
LOREN L. KRUEGER
BY Clyde C. Blinn
ATTORNEY

United States Patent Office

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COMBINED HUMIDITY AND AIR FLOW CONTROL

Loren L. Krueger, Minnetonka, Minn., assignor to Honeywell Inc., a corporation of Delaware

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The present invention is concerned with an improved air flow responsive device. In particular, the device comprises a sail operated control wherein the sail has a collapsible structure so that even though the sail is relatively large when extended, the sail can be collapsed to have a small size for shipping purposes and for easy installation by pushing the collapsed sail through a small hole in an air flow duct.

The use of sail switches to respond to the movement for velocity of air in an air duct or air conditioning system is broadly old. These air flow responsive devices or sail switches have a pivoted member which is connected to a large sail to operate a switch when the sail moves from a first to a second position upon the presence of air flow. In order to obtain sufficient force to operate the switch, the area of the sail is relatively large which makes such a control device quite bulky which presents a problem in the packaging and shipment of the device. In addition, when a sail switch of the type commonly known in the prior art is mounted in an air flow duct or in the plenum of a furnace, some sort of adapter plate is generally used as the size of the sail is quite large with respect to the remaining portion of the control device.

The present invention is concerned with a control device having an air flow responsive sail. The sail is constructed by means of a collapsible framework supporting a thin material sail whereby the sail can be collapsed by pulling the structure together. With such a collapsible sail, the overall size of the control device can be reduced substantially to eliminate the previous extensive packaging required to contain devices of this type. The framework can be collapsed and held by some clamping means to provide a relatively compact device which can be packaged in a relatively small container. Also with such a collapsible sail, the control device can be readily installed on the job. A relatively small hole can be made in the air flow duct or in the side of the furnace plenum, and the installation of the air flow responsive device is easily acplished by holding the sail in a collapsed position and inserting the sail through the small hole. The sail then extends to a size necessary to provide the force needed upon the movement of air in the duct.

An object of the present invention is to provide an air flow responsive device having a collapsible sail.

Another object of the present invention is to provide a control device having a switch actuated by a sail made of a collapsible framework whereby the sail can be reduced to a relatively small size for packaging and installation through a small hole in an air flow duct.

Another object of the present invention is to provide a control device having humidity responsive means and a collapsible air flow responsive device for operating a switch upon the presence of a predetermined humidity and air flow.

These and other objects will become apparent upon the study of the following specification and drawing of which

FIGURE 1 is a prospective view of the control device showing the switch housing, the support housing, and the collapsible sail.

FIGURE 2 is a side cross-sectional view of the control device showing the switch mechanism, the moisture responsive element, and the air flow responsive device.

FIGURE 3 is a schematic representation of a typical

means of installing the air flow responsive device with the collapsible sail.

Referring to FIGURE 1, the main switch housing **10** has a support housing **11** connected thereto. Switch housing has a cover **12**. Associated with the support housing **11** is an air flow responsive device or sail **13** which responds to the downward flow of air.

Referring to FIGURE 2, a cross-sectional view of a switch **14** contained in housing **10** is shown. The switch is of a conventional type having a main housing **15** containing terminals connected electrically to a stationary contact **20** and a movable switch operating member or blade **21** to form a closed circuit when member **21** moves to the right to engage contact **20**. The electrical circuit is connected to the upper end **22** of member **21**. An operating lever **23** has a detent member **24** engaging switch blade **21** at a mid-position **25**. Switch blade **21** has a center portion **30** which is anchored at its upper extremity **31** on a member **32** which is adjustable to change the control point of the switch. Member **32** is firmly attached at its upper end **33** to the switch housing **15** and is contacted by a screw **34** adjusted by the control point setting knob **35** to change the control point of the switch and of the control device. Another adjustment member **40** controls the switch differential by limiting the movement of blade **21** in the left direction or in the open switch position.

Lever **23** is pivoted about a fixed pivot **41** whereby when the lever is in the downward position as shown, detent **24** pushes against blade **25** to hold the switch in an open circuit position as shown.

Air flow responsive device **13** comprises a pivotally supported collapsible frame **80** connected to member **42** which is pivoted about a pin **43** attached to support member **11**. One extremity **44** of member **42** is connected to a bias spring **45** connected between member **44** and a projection **50** on support **11** to bias lever **44** in a counter-clockwise direction about pivot **43** to hold the sail **13** upward in a position as shown. Attached to member **44** at a pivoted support **51** is a second lever **52** which engages the switch lever **23** to push the switch lever downward when the sail is in the position as shown so the contact **21** is held away from the fixed contact **20** and the switch is open. Lever **52** has an open "fork like" end to not be positively attached to lever **23**.

Upon the presence of air flow, sail **13** is moved downward to the position shown by the dotted lines and lever **52** is pulled upward against the bias spring to allow the switch lever **23** to move in a clockwise direction. The switch blade **25** moves over center of the fixed pivot point **31** to close the contacts **21** and **20** and complete an electrical circuit.

In addition to the air flow responsive device **13**, a moisture or humidity responsive device **60** which responds to the amount of moisture in the air or relative humidity comprises a plurality of lengths of moisture responsive element **61** strung between a movable support **62** and a fixed support **63** attached to housing **11** which can be adjusted by an appropriate screw **64** to change the control point. A typical moisture element is shown in the Russell N. Booth Patent 2,866,023. Lever **65** which is pivoted about pin **70** on base **11** has the movable support **62** connected at the upper end thereof. The lever **65** is spring biased in a counter-clockwise direction by a bias spring **71** connected between the lower extremity **72** of lever **65** and a projection **73** on support **11**. Another projection **74** on lever **65** engages the switch lever **23** whereby when element **61** is relaxed and lever **65** moves in a counter-clockwise direction, lever **25** is held downward in a switch open position.

The air flow responsive device or sail **13** as shown in FIGURE 1 comprises a wire structure **80** which is at-

tached to member **42** by a fastening means **81**. The wire support structure is resilient so that when the extreme ends **82** and **83** of the wire are pulled together, a sail made up of a thin sheet material **83** and held on the V shaped structure will collapse in a manner as shown in FIGURE 3. When the confining force on sail **13** is removed, the resiliency of wire **80** will cause the sail to extend as shown in FIGURE 1.

Operation

As shown in FIGURE 2, the switch is in an open position, and the sail **13** is in the upper position as would be the case with no air flow. Upon the placement of the support member **11** in an air environment such as in the duct or plenum of a furnace, air flow downward against sail **13** would result in movement of lever **42** in a clockwise direction about pin **43** to lift lever **52**. Since lever **52** has an open forked shape at the bottom, switch lever **23** will not move upward under the spring force of blade **21** as long as the moisture responsive device responds to the humidity level or relative humidity above a certain value and projection **74** is in a position to hold the switch lever **23** downward. Assuming that the humidity of the air is below some predetermined value, the element **61** would then contract and pivot lever **65** in a counterclockwise direction to lift member **74**. The switch lever **23** is free to move upward and operate the switch by allowing the detent **24** to remove the pressure from blade **25** so the blade could snap over center and close the circuit between blade **21** and contact **20**. If for any reason, the air flow against sail **13** would stop, lever **52** would be effective to push the switch lever **23** downward and open the switch even though the moisture level as sensed by element **61** would be below the value required. With this type of control, a humidifier in a furnace could be controlled to bring about the addition of moisture to the air; however, the humidifier would not operate as long as there was no air flow.

With the collapsible sail **13** as shown in FIGURE 1, many advantages are gained. As the size of the sail is generally large compared with the remaining part of the control device including the support structure **11** and the switch housing **10**, the packaging of such a control device heretofore has been relatively expensive. With the collapsible sail **13**, the sail can be reduced to a relatively small size commensurate with the size of support member **11**. In this manner, the packaging problem is greatly reduced and the cost of any package or carton holding the control device is much lower.

During the installation of the air flow responsive device, by means of a suitable clamp or a person's hand **90** as shown in FIGURE 3, the sail **13** can be held in a collapsed manner and the support housing **11** of the control device can be inserted into a relatively small hole **91** of an air flow duct **92**. In this manner, the installation of the control device does not require special mounting brackets for covering existing large holes heretofore necessary to install a sail operated control device. When the support housing **11** is inserted into duct **92**, the removal of the confining force on sail **13** allows the sail to snap out into a position as shown in FIGURE 1 except the sail is inside duct **92**.

While I have shown the invention in one particular embodiment, the intention is to limit the scope of the present invention only by the appended claims in which I claim:

1. In a combined moisture and air flow responsive control device,

a switch mounted in a switch enclosure and having an operating lever protruding from said enclosure,

a base member attached to and extending from said switch enclosure, said lever extending into one end of said base member,

a moisture responsive element mounted in said base member,

a first lever pivotally attached to said base member at said one end to engage said operating lever,

means connecting said element to said base member and said first lever whereby said switch is operated when the moisture level of air surrounding said element is of a selected value to change the length of said element to a predetermined value,

a collapsible metal framework formed by a V shaped length of resilient wire,

a flexible material supported by said framework, said wire providing a bias means to extend said framework and said material to provide a sail,

second lever means attached to said base member and pivotally connecting said framework to be supported by said base member,

and means connecting said second lever means to said operating lever for operating said switch upon the presence of a predetermined amount of air flow.

2. In a control device,

a base,

a control element support,

means connecting said support to said base, said support being adapted to be inserted into a hole in an air flow passageway,

a lever pivotally attached to said base,

switch means operable upon movement of said lever to a predetermined position, said switch means being attached to said base,

a humidity responsive element mounted on said support,

means connecting said element to said lever whereby said element moves said lever to operate said switch means upon the humidity of the air being a predetermined value,

a support structure pivotally connected to said support,

a thin flexible material supported by said structure to form a sail,

and means connecting said structure to said switch means to override the effect of said humidity element on said switch means, said structure being collapsible to lay adjacent said support whereby said support including said humidity element and sail are adapted to be inserted into the hole and then said sail extends to be effective upon the presence of air flow to operate said switch means.

3. In an air flow responsive device,

a base,

an electrical switch device to be operated upon the presence of air flow mounted in said base,

a collapsible structure movably mounted on said base and connected to said electrical switch device, said structure comprising a V shaped length of wire mounted with the free ends of said wire extending outward,

and a thin flexible material connected to said V shaped wire forming a sail to respond to air flow to operate said device when said sail moves as air impinges on said material, said sail can be collapsed to reduce the size of said sail during transportation and installation by pulling said free ends of said wire together.

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BERNARD A. GILHEANY, *Primary Examiner.*

ROBERT K. SCHAEFER, *Examiner.*