Oct. 8, 1963 D. C. ANDERSON 3,106,175

SELF-REGULATING DRAFT PRODUCER AND EQUALIZER

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Fig. 1

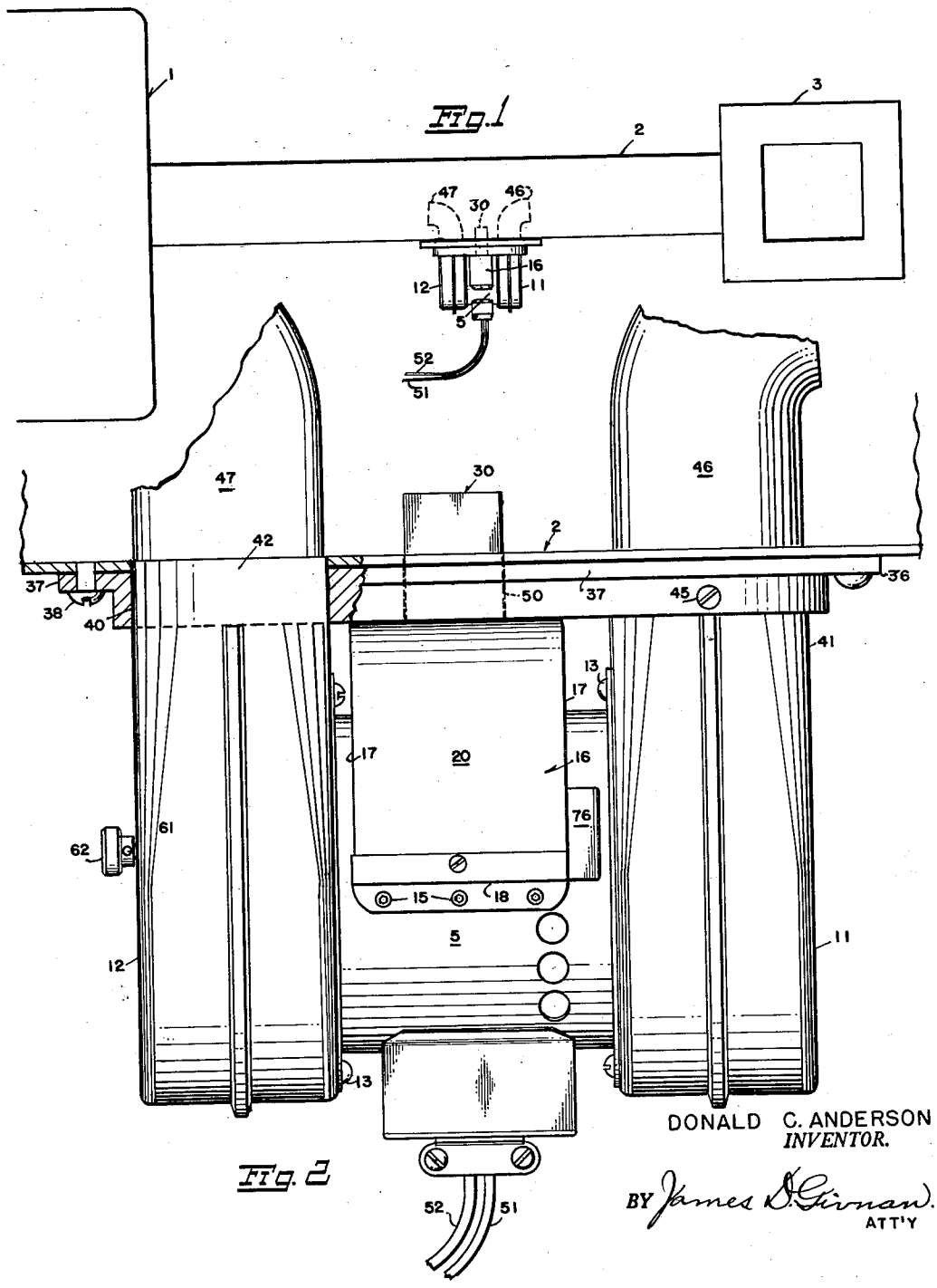


Fig. 2

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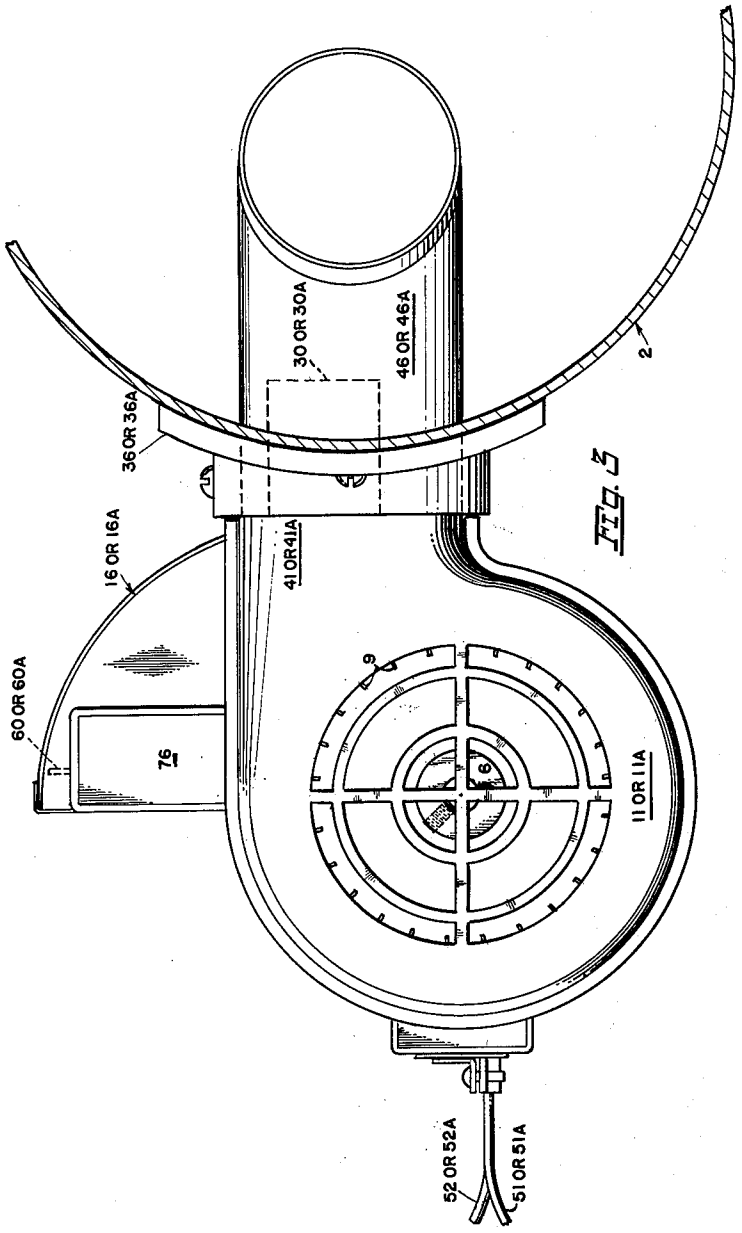


FIG. 3

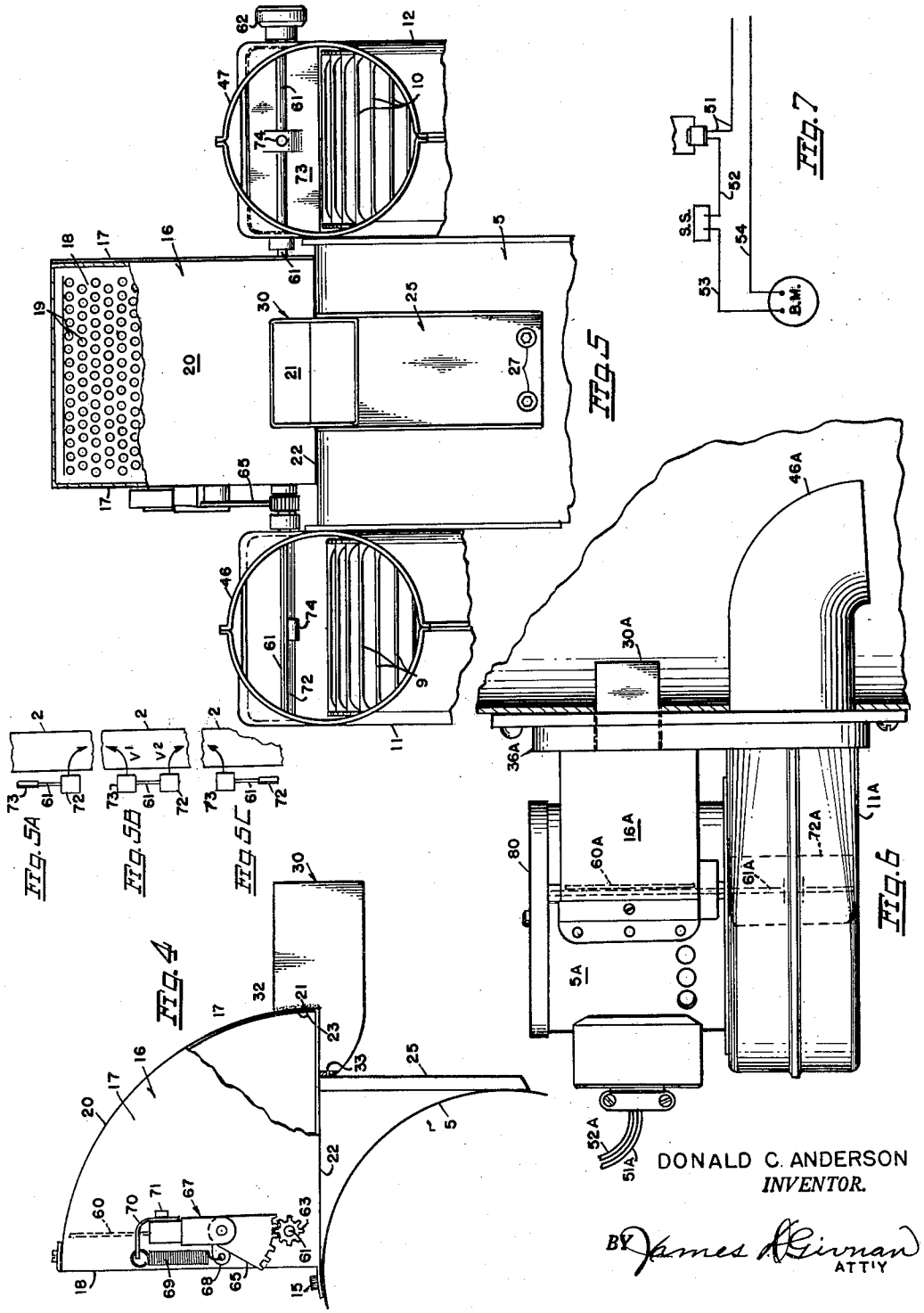
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SELF-REGULATING DRAFT PRODUCER AND EQUALIZER

Filed Feb. 9, 1962 3 Sheets-Sheet 3



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3,106,175

SELF-REGULATING DRAFT PRODUCER AND EQUALIZER

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4 Claims. (Cl. 110—160)

This invention relates generally to improvements in heat exchangers such as hot air furnaces which may be of the liquid or gaseous fuel type and as herein described embodies an oil burner whose operational cycles are controlled by a thermostatic stack-switch or other suitable temperature-sensitive control.

More specifically, the invention relates to self-regulating artificial draft producing means and natural draft equalizing means associated with a stack in communication at one of its ends with the fire box of a furnace and at its opposite end with a chimney and wherein said means is automatically responsive to combustion changes and/or chimney draft fluctuations.

Principal objects of the invention are:

To provide a unitary draft-producing and equalizing means of the character described which is of simple, highly efficient, durable, compact, and inexpensive construction, readily incorporated in or attached to a furnace stack during the installation thereof or as accessory to any existing furnace and its related stack;

To provide a unit of the character described in which there is provided novel, efficient, and entirely automatic means to induce proper air flow to the furnace to compensate for combustion changes therein and similarly from the stack into the chimney to compensate for chimney draft fluctuations, and one which will assume a neutral position to enhance normal furnace combustion and chimney draft conditions.

The foregoing and other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings, of which there are three sheets, and wherein:

FIGURE 1 is a top plan view of the invention shown applied to a stack communicatively interconnecting a furnace and a chimney.

FIGURE 2 is a view similar to FIGURE 1 on an enlarged scale with the furnace and chimney removed and with fragments broken away for convenience of illustration.

FIGURE 3 is a side elevational view of FIGURE 2, and also illustrative of a similar view of the modification shown in FIGURE 6.

FIGURE 4 is a side elevational view of a housing; means communicating the interior of the housing with the stack, and suction responsive means within the housing for controlling or actuating vanes for controlling the volumetric output of centrifugal fans.

FIGURE 5 is a rear elevational view of the unit removed from the stack and illustrating the centrifugal fans and the output control means therefor referred to in the description of FIGURE 4.

FIGURES 5A, 5B, and 5C are flow diagrams showing respectively automatically controlled flow of induced draft to the chimney only, to the furnace and to the chimney, and to the furnace alone.

FIGURE 6 is a top plan view of a modified form of unit shown secured to a fragment of the stack and adapted to function as a draft-booster within a range of automatic control settings which are infinitesimally variable, and

FIGURE 7 is a wiring diagram.

With continuing reference to the drawings wherein like references of character designate like parts, there is illustrated somewhat diagrammatically in FIGURE 1 a furnace 1 in communication through a hollow stack 2 with a chimney 3.

As is well known in furnace operation, when the burner starts, an induced draft is started simultaneously and the burner continues to operate for a few minutes under varying degrees of pressure since the chimney has not had time to reach a temperature sufficient to create a natural draft. It is also well known that as the temperature of the chimney increases so does the induced updraft which finally becomes excessive resulting in wasteful fuel consumption.

The unit or main body of this invention comprises a motor housing 5 having a motor therein (not shown) whose shaft 6 (see FIG. 3) extends outwardly from both sides of the housing and to the shaft are secured centrifugal fans 9 and 10 rotatably mounted, respectively, within housings 11 and 12 secured to the sides of the motor housing as at 13 or in any other suitable manner. Mounted to the motor housing, as at 15, is a housing 16 of quadrantal shape in side elevation having parallel vertical side walls 17, a vertical front wall 18 perforated as at 19 (see FIG. 5), an arcuate rearward wall 20 having an opening 21 therein and a bottom wall 22 having an opening 23 matching the opening 21. The housing 16 is also secured to the motor housing 5 by a vertical bracket 25 soldered at its top end to the bottom wall 22 of housing 16 and secured at its bottom end by screws 27, or the like (FIG. 5), to the motor housing. A conduit 30 is secured at its inner end by soldering 32 or the like, to the bottom portion of the arcuate housing wall 20 and similarly secured as at 33 to the top of the bracket 25 and thus surrounds the openings 21 and 23 for open communication with the interior of the housing 16 and with the interior of the stack 2 as will be seen in FIGURE 2.

For mounting the unit thus far described to the stack 2, I provide a casting 36 (see FIGS. 2 and 3) flanged as at 37 and thereby secured by means of screws or bolts 38 to the outside wall of the stack. The casting has openings 40 therethrough to accommodate the tubular discharge outlets 41 and 42, respectively, of the fan housings 11 and 12 secured in place by suitable screws 45 which also serve the purpose of securing nozzles 46 and 47 respectively to the fan housing discharge outlets 41 and 42. These nozzles, it will be noted in FIGURE 1, are directed respectively to the chimney 3 and to the furnace 1, to perform an important function of the invention as will be more fully hereinafter described.

The casting 36 is provided with another opening 50 through which the conduit 30 extends into open communication with the interior of the stack 2 as aforesaid.

One side of the fan motor, within the housing 5 (see FIG. 7), is in electrical circuit by conductor 51 with one side of a current source and the other side of the motor by conductor 52 through a stack switch S.S. and conductor 53 to one side of the burner motor B.M. having a driving connection with the fuel-air fan-blower, not shown, of the furnace 1, then back through conductor 54 to the other side of the source.

From the foregoing it will be readily apparent that in the absence of any directional control for the output of either or both centrifugal fans 9 and 10, the volume and velocity thereof within and through the stack 2 would be equal in the two directions indicated by the arrows in FIG. 5B wherein V′ is directed to the furnace and V^2 to the chimney.

One such volume and velocity directional control in

accordance with one form of embodiment of the invention comprises essentially (see FIGS. 4 and 5) a suction responsive plate 60 swingably operable within the housing 16 and secured in any suitable manner to a rock-shaft 61 extending therethrough, through the side walls of the tubular fan discharge outlets 41—42 and provided with a finger knob 62. Secured to the shaft 61, between one wall 17 of housing 16 and the inside wall of fan outlet 46 is a spur gear 63 enmeshed at all times with a quadrant 65 pivotally depending as at 66 from a bracket 67 secured to the adjacent wall 17 of housing 16. The quadrant is attached by an arm 68 to one end of a tension spring 69 whose opposite end is attached to a bendable (and hence tension regulating) arm 70 secured as at 71 to bracket 67. Fan volume output control vanes 72 and 73 are secured as at 74 to the rock-shaft 61 and disposed respectively within the fan outlets 46 and 47. The quadrant 65 and its related parts just described are enclosed within a suitable housing 75 removably secured in any suitable manner to one side wall of the housing 16.

From the foregoing it will be seen that the spring 69 will normally hold the plate 60 in the vertical dotted line position shown in FIG. 4 and that suction through the conduit 30 into the housing 16, caused by a chimney updraft will pull the plate 60 downwardly in accordance with the amount of suction applied thereto and thus supply full draft from the fan 9 toward the chimney.

The position of the fan volume control vanes 72 and 73 relative to the suction responsive plate 60 is such that as the plate 60 is pulled downwardly as aforesaid the fan control vane 73 will be rotated toward an open position as shown in FIGURE 5 while the other control vane 72 will be swung toward a closed position.

The modified form of the invention illustrated in FIG. 6, is adapted, though not restrictively so, for dealing with chimney draft fluctuations and other variables only. Therefore, I dispense with the centrifugal fan 10, fan housing 12, and its related parts.

The remaining parts including the fan and fan housing 11A, nozzle 46A, motor and motor housing 5A, housing 16A, conduit 30A, and electrical conductors 51A and 52A are the same as those shown and described in FIGURES 1 to 5. In addition, thereto, I close one end of the motor housing 5A with any suitable type of end bell 80 and shorten the casting 36A to accommodate only the tubular outlet 46A of fan housing 11A.

In the conventional furnace-stack-chimney assembly herein shown and described, let it be assumed that .02 inch of water draft is the minimum required for most efficient furnace combustion and which would prevail during normal furnace operation in the absence of chimney down-draft or other excessive draft conditions. With the stack 2 provided with the draft producing and control means of this invention, and with the suction or pressure responsive plate 60 in a neutral position (at or near a point midway of its throw), let it also be assumed that a chimney down-draft does occur such as to lessen the desired .02 inch of water draft vacuum to any degree. Such reduction would allow spring 69 to pull the plate 60 upwardly which through the medium of the shaft 61 would move the fan volume control vane 72 to the open position shown in FIGS. 5 and 5A. The output of, depending on the severity of the downdraft, the centrifugal fan 9 would then be directed toward the chimney to dissipate or counteract the downdraft. At the same time, the fan control vane 73 also through the medium of shaft 61 would be moved toward a closed position to thus prevent reduction of draft.

In the event of chimney updraft, due to increase of combustion output from the furnace of or for any other reason, resulting in excessive heating of the chimney, a reversal of the fan output function just described would take place. That is to say, vacuum pull at the mouth of and within conduit 30 created by draft flow from furnace to chimney would enter the housing 20 and swing the plate

60 downwardly to or toward a lowered position to conversely open fan output control vane 73 and close the opposite fan output control vane 70 as shown in FIGURE 5C. This would, of course, direct the required output of fan 10 toward the furnace to maintain precisely the desired .02 inch of water draft.

Under ideal conditions where there is neither excessive chimney up-draft nor increase in furnace combustion output and the desired .02 inch of water draft prevails, the plate 60 will automatically swing to a neutral position whereby and again through the shaft 61, both fan output control vanes 72 and 73 will be opened to an extent where the output of both fans 9 and 10 will be substantially uniform and applied equally in both directions, as in FIG. 5B toward the chimney and toward the stack. The neutral or intermediate position of the plate 60 can be selected by the tension of spring 69 which can be varied by bending the arm 70 slightly upward or downward to automatically maintain the desired draft setting.

From the foregoing it will be readily apparent that with the plate 60 in the up position where it will be at the beginning of the furnace burning cycle when the chimney has not reached an up-draft creating temperature the output of fan 9 will be directed toward the chimney to create such draft. (FIG. 5A.)

The adaptation of the modified form of the invention shown in FIGURE 6 as a draft-booster will function automatically and just as effectively in response to chimney draft fluctuations as that of its counterpart shown and described in the other form of the invention. The suction responsive plate 60A, when in the dotted line up position shown in FIGURE 6, will have rotated the fan output control vane 72 into the open position similarly shown to direct the output of the fan in the fan housing 11A toward the chimney.

While I have shown particular forms fo embodiment of my invention, I am aware that many minor changes therein will readily suggest themselves to others skilled in the art without departing from the spirit and scope of the invention. Having thus described my invention what I claim as new and desire to protect by Letters Patent is:

1. A draft control attachment for a combustion heater comprising in combination, a combustion heater, a chimney, a stack, said stack communicatively interconnecting said heater with said chimney, said attachment comprising nozzles in communication with the interior of the stack with their outlets directed respectively toward the heater and toward the chimney, power driven fans communicating with said nozzles, vanes for controlling the output of said fans, stack pressure and draft responsive means carried by the attachment and operatively connected to said fan output control vanes for selectively supplying the output of the fans in either of said directions within said stack.

2. A draft control attachment for a combustion heater, comprising in combination,

a combustion heater,

a chimney,

a stack,

said stack communicatively interconnecting said combustion heater with said chimney,

said draft control attachment comprising a housing,

a motor within the housing,

fan housings carried by the motor housing,

fans within said fan housings driven by said motor,

nozzles opening into the interior of the stack directed respectively to said chimney and to said heater and in communication with said fan housings,

vanes controlling the output of said fans to the interior of the stack,

means responsive to furnace stack and chimney draft fluctuations carried by the motor housing,

said draft responsive means comprising a housing in open communication with the interior of said stack,

a suction-responsive plate hingedly mounted within

said housing and sensitive to said draft fluctuations, and

means operatively connecting said draft-sensitive plate to said fan output controlling vanes to control the output of said fans and the flow thereof in either or both of said directions within said stack.

3. A device for selectively controlling vacuum and/or pressure conditions within a stack interconnecting a combustion heater with a chimney, comprising in combination,

a combustion heater,

a chimney,

a stack,

said stack communicatively interconnecting said combustion heater with said chimney,

a motor housing and a motor therewithin,

fan housings carried by the motor and having tubular discharge outlets,

centrifugal fans disposed within said fan housings and having a driving connection with said motor,

means mounting said device to said stack with said tubular discharge outlets in communication with the interior thereof,

nozzles disposed within the stack in open communication with said fan discharge outlets and directed respectively toward the combustion heater and toward the chimney,

interconnected fan volume output control vanes within said fan discharge outlets operable as a unit for alternately or simultaneously controlling the output of said fans,

a housing carried by said motor housing and in open communication with the interior of said stack,

a plate hingedly mounted within said housing responsive to chimney draft fluctuations and changing combustion pressures from said heater,

means operatively connecting said plate to said fan output control vanes for controlling simultaneous or alternate output of said fans.

4. A draft control for a combustion heater, comprising in combination,

a combustion heater,

a chimney,

a stack,

said stack communicatively interconnecting the combustion heater with the chimney,

a motor housing and a motor therewithin,

two fan housings carried by the motor housing and each having a tubular discharge outlet,

a centrifugal fan disposed within each of said fan housings and having a driving connection with said motor,

means mounting said motor housing and the fan housings to said stack with said tubular discharge outlets in communication with the interior of the stack,

two nozzles disposed within the stack in open communication with said discharge outlets and directed respectively toward the combustion heater and toward the chimney,

fan volume output control vanes within said discharge outlets operable as a unit for selectively controlling the output of said fans and directing the same to the chimney only, to the furnace and to the chimney, and to the furnace alone,

a housing carried by the motor housing and in communication with the interior of said stack,

means disposed within said housing operatively connected to said fan ouptut control vanes and responsive to chimney draft fluctuations and changing heater combustion pressures for controlling the output of said fans and the directional flow thereof.

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