

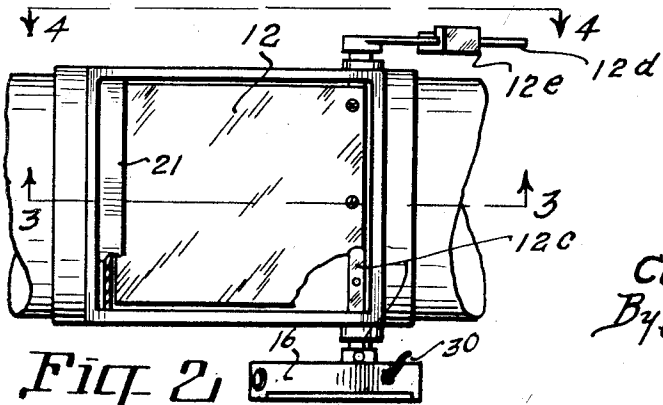
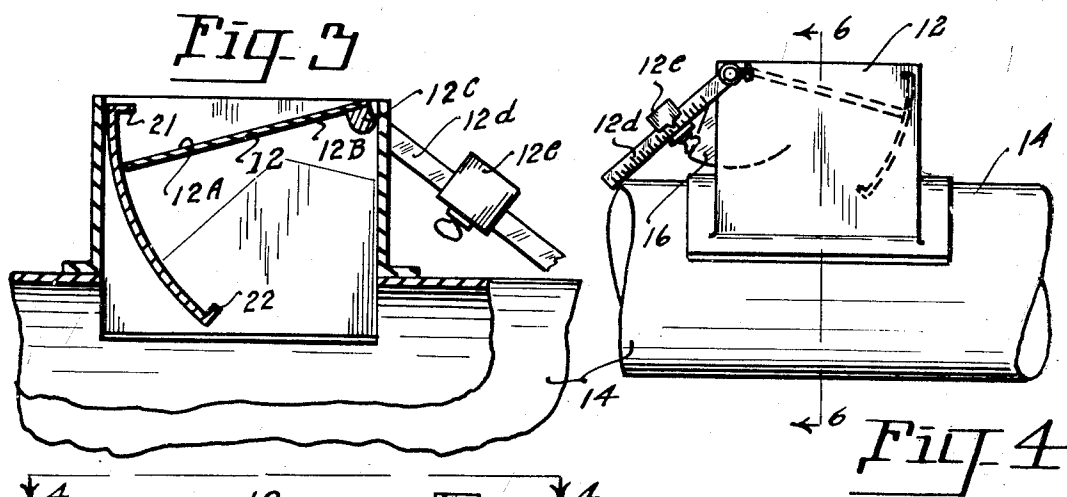
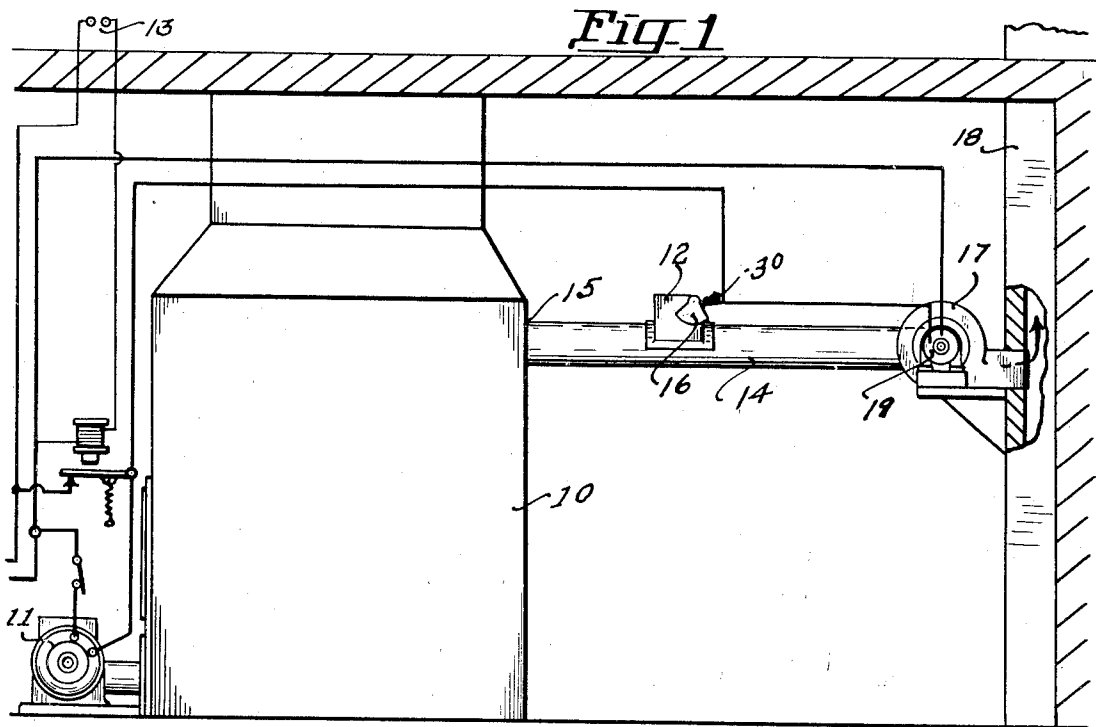
May 16, 1944.

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2,348,950

DRAFT CONTROL MEANS FOR FURNACES

Original Filed Sept. 30, 1941 2 Sheets-Sheet 1



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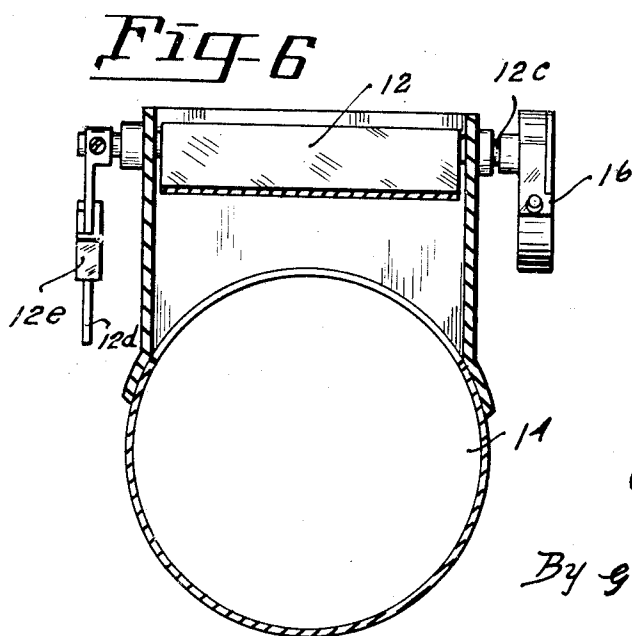
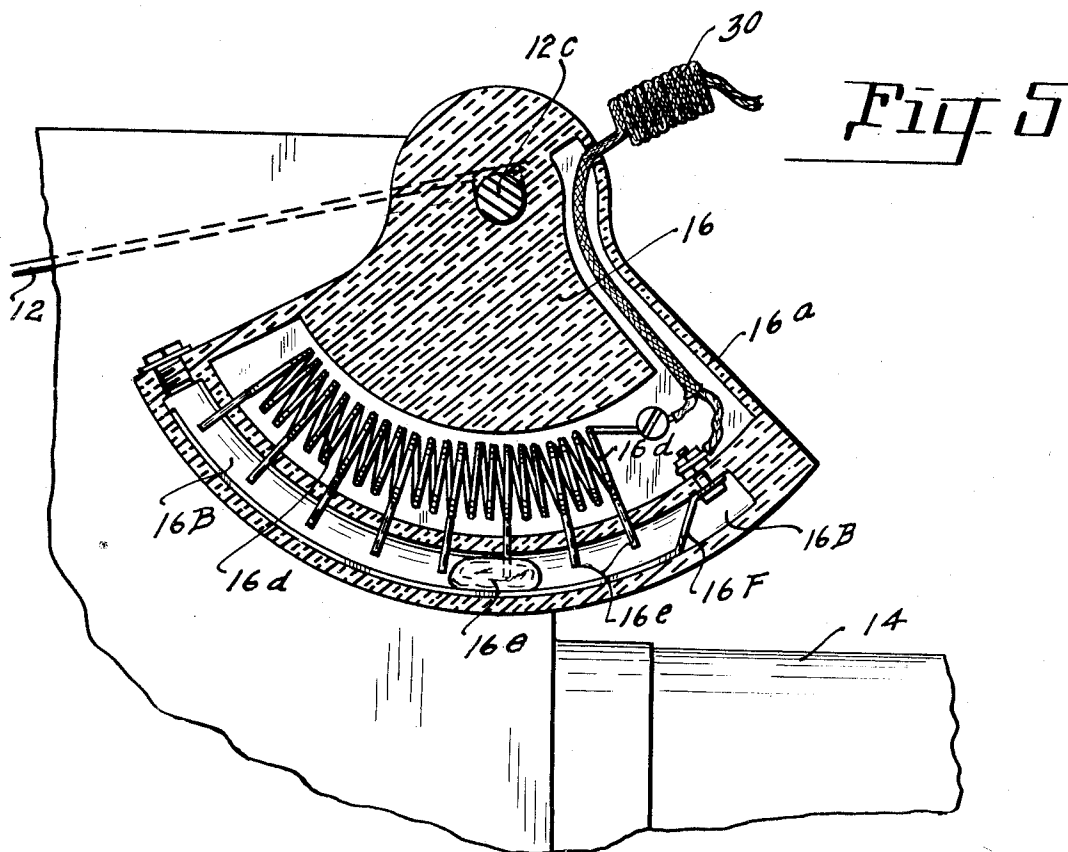
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DRAFT CONTROL MEANS FOR FURNACES

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UNITED STATES PATENT OFFICE

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DRAFT CONTROL MEANS FOR FURNACES

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Original application September 30, 1941, Serial No. 412,979. Divided and this application July 4, 1942, Serial No. 449,730

6 Claims. (Cl. 236—45)

This invention relates to draft control means for a furnace, the word furnace being considered broadly.

More specifically it relates to a draft producing means capable of producing precisely predetermined draft conditions at the furnace proper under widely varying atmospheric conditions with an initial adjustment only, which is the principal object of the invention.

The invention is a divisional application of my application for Draft control means for a furnace, Serial No. 412,979, filed Sept. 30, 1941.

Another object of the invention is a suction draft apparatus for a furnace that automatically changes its mechanical effort to produce draft in accordance with the amount of effort required by present atmospheric conditions; that is to say, for example, on a windy day when gusts tend to reverse flow down a chimney, the motor driven suction draft apparatus will, by virtue of auxiliaries to be described, speed up and just meet the momentary excess load, then drop it just as quickly without noticeable fluctuation when the load disappears.

Another object of the invention is a draft sensitive member operating after the manner of the similar draft sensitive member in the previously filed application referred to, but which operates a speed changing rheostat for a motorized fan, which rheostat is frictionless and hence will move accurately and accurately change the speed of the connected motor under the small motive forces developed by the draft sensitive member without lag.

As a very considerable employment of the invention will be in connection with intermittently fired domestic type oil-burner apparatus, it is an object to arrange draft control so that when the thermostat calls for heat and closes the starting apparatus of the burner, the draft fan will start at full speed before the burner can get an oil fire going; hence there will be draft in abundance to so dilute the furnace atmosphere by indrawn air that the rumbling noise usually accompanying such start will be eliminated and "blowbacks," one of the frequently dangerous characteristics of such furnaces, will be eliminated.

The foregoing and other objects that will be apparent from the following specification, to those skilled in the art, constitute the purposes of the invention and are particularly pointed out in the claims.

I accomplish these objects in excellent degree by the preferred form of the invention delineated in the accompanying drawings which are to be

considered as diagrammatic and illustrating the principle rather than the exact form.

In the drawings:

Fig. 1 is a general organization view showing the invention connected to a hot air furnace, drawn to a smaller scale than the details to be referred to;

Fig. 2 is a plan view of the draft sensitive member indicated by the numeral 12 in Fig. 1;

Fig. 3 is a section taken on the line 3—3, Fig. 2;

Fig. 4 is a view of the structure shown in Fig. 2 viewed in the direction of the arrow shown in this view;

Fig. 5 is an enlarged view of the frictionless rheostat, to be more completely described hereinafter;

Fig. 6 is a section on the line 6—6 of Fig. 4.

In the drawings, 10 is a furnace diagrammatically illustrating any type of heating apparatus and 11 is a conventional intermittent oil burner therefor with wiring, also diagrammatic, the oil burner being under the control of a remotely situated room thermostat indicated by the numeral 13.

12 is a draft sensitive element positioned in the flue 14 connected to the furnace at 15. The element 12 will be more completely described hereinafter and may also be found in the previous applications referred to.

16 shows the position of the frictionless mercury traverse rheostat in Fig. 1; shown also in enlarged detail in Fig. 5. 17 is a suction fan positioned to draw air through the furnace and through the suction portion of the flue 14 and deliver it into the chimney 18 as shown by the arrow in Fig. 1.

19 is a variable speed motor preferably of the "universal" series wound type, the motor being under control first of the room thermostat since it is inoperative when the oil burner 11 is inoperative, and second it is under control of the mercury traverse rheostat 16, which in turn is operated by the draft sensitive element 12.

The draft sensitive element 12 is shown here to be a plate, shown in section in Fig. 3, that moves between the limit stops 21 and 22. It has atmosphere pressure on the side marked 12A and flue gas pressure on the side marked 12B. It oscillates with the shaft 12c to which is also attached the lever arm 12d equipped with a sliding weight 12e. Numeral 12 includes the housing in which the operative plate moves as described.

In this specification the words "atmosphere" and "atmosphere pressure" are used in the same sense that the same expressions are used in engi-

neering formulas, meaning the unaffected normal atmosphere pressure on any object at a given place and time.

This lever arm is also shown in Fig. 4 and will preferably have graduations. The lever arm sets at such angle, taking into consideration the fact that the rheostat 16 is also mounted on the same shaft 12c, that movement requires a gradually increasing amount of draft according to a known rate of increase.

When the same pressure exists on both sides of the plate, 12A and 12B, as when the furnace is not operating, the side of plate 12A will just contact the limit stop 21 and it will be noted that the resistance to inward motion of the plate under the influence of atmosphere increases in proportion to such movement by reason of the angular position of the lever arm 12d. This principle is used in weighing scales and is well known and is not claimed here, but only utilized so that it takes a constantly increasing pressure differential to move the plate from the limit stop 21 to the limit stop 22. The purpose of this will be understood from the explanation following.

Since the amount of actual power developed by the pressure differential within and without the flue 14 is very small, with accurately responsive movement, the rock-shaft 12c will be arranged to move with extreme ease since its purpose is to control the motor 19 by employment of the rheostat 16; and it will also be seen at once that an ordinary rheostat with its sliding contacts cannot possibly be used because there is not power enough to pull it; hence the frictionless rheostat 16 which consists of a carrier member 16a which contains a globule of mercury shown at 16b.

An electrical circuit is indicated by the coil of insulated wire marked 30, the coil diagrammatically indicating ultimate practicable flexibility so that no resistance to oscillation of the rheostat 16 will be appreciable. As diagrammatically indicated in Fig. 1, the rheostat will be in series in one of the lead wires of the motor 19.

One wire of the electrical circuit 30 is connected to the variable resistance represented by the coil 16d which has a plurality of contact points such as 16e disposed within the tube 16B.

The other wire of circuit 30 is continued as the electrical contact 16F and it will be immediately seen that when the furnace is standing idle, the pressure within the flue 14 will tend to equalize with atmosphere pressure in a very short time; hence the plate 12B as shown in Fig. 3 will approach the limit stop 21 as shown, turning the rheostat for high speed of the motor.

When the next thermostatic start occurs, the motor will get away to a fast start, inducing a draft through the connected furnace before any oil fog has appeared from the nozzle of the oil burner, because there is always a lag of one or two seconds before the oil pump, which is always a part of such burners, can build up the required pressure. Draft will be immediately established in accordance with the predetermined setting of the adjustment 12e.

Backfiring and rumbling are the results of relatively great or small explosions of oil fog or smoky oil gas caused by delay in ignition. Employment of a natural draft hook-up means that during the time such explosive action could occur, there is little or no draft because the chimney and the connecting flue are not hot; hence accumulations of combustible can become rich

enough to promote the necessary flame propagation to cause explosive action if the oil atomizer injects fuel for only a matter of seconds before ignition by the flaming arc takes place. Atomizers and flaming arc igniters are in all cases a part of intermittent type oil burners, are well understood and need no illustration or description.

When draft apparatus according to this disclosure is used, the draft always starts first as explained, and the furnace atmosphere is diluted by entering fresh air at the burner and adjacent thereto; hence never becomes rich enough to explode and the characteristic oil burner smell, always present in the furnace room where natural draft is used, will be absent.

The amount of electrical energy required to operate the fan is so small that the extra cost of current is insignificant and if a squirrel-cage type of suction fan is used, which I recommend, the impedance it offers to natural draft flow when stopped will save much more residual heat in the furnace between firings to pay for its operation when running.

In the foregoing specification and also in some of the claims, as well as in Fig. 1, the draft sensitive apparatus controlling the rheostat is shown in the section of smoke-pipe between the suction fan and the furnace. While that location is a good one, it is to be understood that any portion of the flue, the combustion chamber of the furnace proper or in fact any part of the system directly under the influence of the suction developed by the fan, will serve well as a location for the draft sensitive member.

In practice there will be many more steps or speed changes in the rheostat than the eight shown in the drawings, in which they were limited in number for clarity.

Having fully described my invention and explained the principle as required by statute, what I claim as new and desire to secure by Letters Patent, is:

1. In draft control apparatus for a furnace, a flue, a suction fan arranged to induce sub-atmosphere pressure in the furnace and a part of the flue adjacent thereto, a variable speed electric motor connected to the fan, a draft sensitive member positioned in the sub-atmosphere area, a counterbalance therefor, said counterbalance arranged to yield proportionately to the amount of pressure drop in the flue, a speed changing rheostat connected to and movable with said draft sensitive member and operative electrical connections between the rheostat and the fan motor.

2. In draft control apparatus for a furnace, a flue, a motorized suction fan arranged to induce sub-atmosphere pressure in the furnace and a part of the flue adjacent thereto, a variable speed motor connected to said fan, a pivotally mounted draft sensitive plate member positioned in the sub-atmosphere pressure area, a counterbalance for said plate attached thereto to yield proportionately to the amount of pressure drop in the flue below atmosphere pressure, a speed changing mercury traverse rheostat connected to and movable proportionally with said draft sensitive member and operative electrical connections between the rheostat and the fan motor.

3. In draft control apparatus, a flue, a draft sensitive plate member positioned in a wall of said flue, said plate being adapted to move inwardly toward the axis of the flue under influence of atmosphere pressure when pressure with-

in the flue is lowered by suction, means biasing said plate towards atmosphere, said means yieldable in proportion to pressure differential between the inside and outside of the flue, electric operated induced draft producing means connected to the flue and electrical control means movable by said draft sensitive plate effective upon movement thereof to diminish the effectiveness of the said draft producing means proportionately to movement of the draft sensitive plate.

4. A furnace draft apparatus comprising a furnace, a flue connected thereto, a suction fan positioned to draw atmosphere through the furnace and the flue, a variable speed electric motor operatively connected to the fan, a mercury traverse rheostat in the motor circuit, a draft sensitive member positioned in a wall of the flue between the furnace and the fan, one side of said member being under influence of external atmosphere pressure, the other side exposed to flue pressure, counterbalance means fixing the movement thereof proportionately to pressure differential, and a transmission between the draft sensitive plate and the rheostat.

5. Draft control apparatus for furnace and electrically operated intermittent oil burner of the character described, comprising a flue, electric

motor operated induced draft means connected to said flue, a draft sensitive plate of the character described mounted for movement under influence of suction created by said induced draft means, counterweight means for said draft sensitive plate arranged to permit movement thereof in proportion to applied suction, a speed changing rheostat for the draft motor arranged to move concurrently with said plate and vary the speed of the motor by influence of movement of said plate and an electric circuit for said rheostat and its controlled motor connected to and dependent for energy upon the same electric source that operates the intermittent oil burner.

6. Draft control apparatus for an intermittent electrically operated oil burner furnace comprising a draft pipe, an electric motor driven fan positioned to induce draft therethrough, a draft sensitive plate positioned to be under influence of suction produced by said fan, a speed changing rheostat for the fan motor made responsive to movement of the draft sensitive plate and an electric circuit for the fan motor connected to and dependent upon electric operating circuit means of the electrically operated oil burner for energy.

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