Nov. 16, 1948. H. A. EGGERT 2,454,044

DRAFT REGULATOR

Filed March 7, 1945 3 Sheets-Sheet 1

Fig. 1

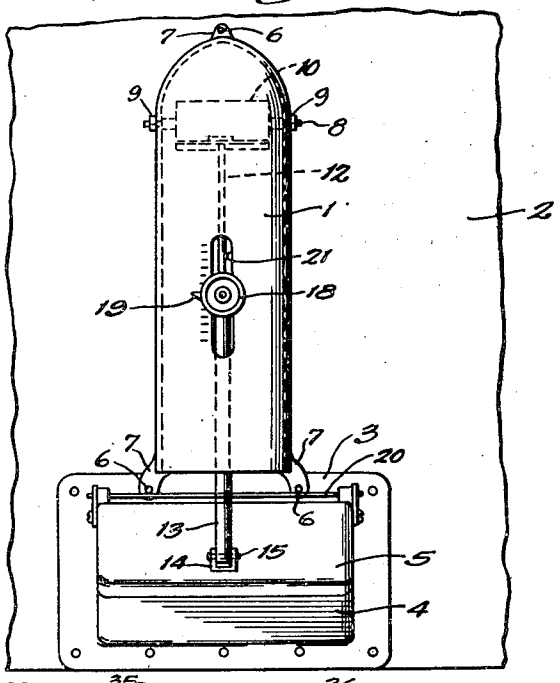
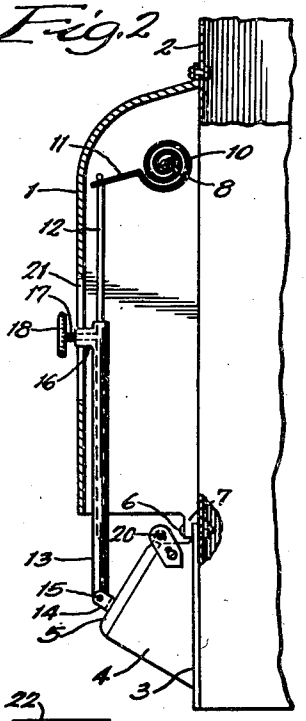


Fig. 2



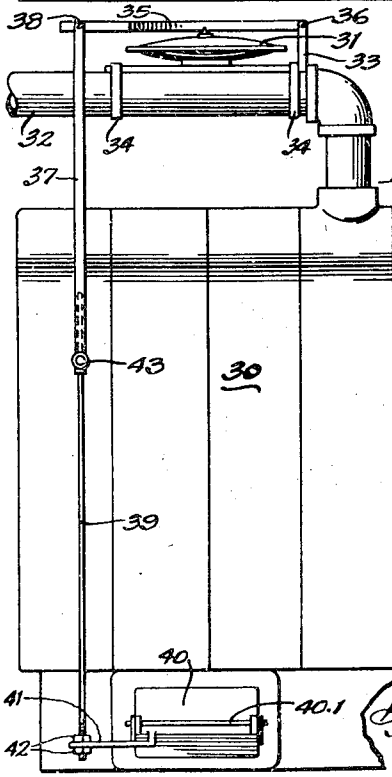


Fig. 5

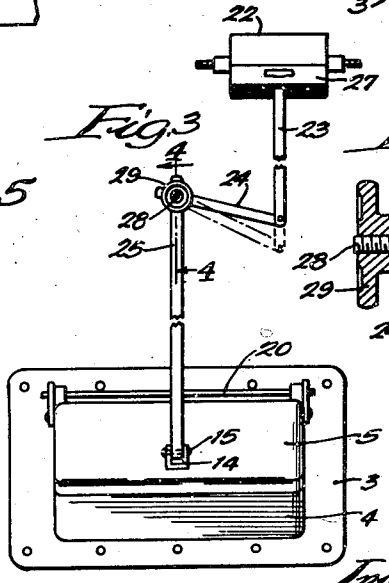


Fig. 3

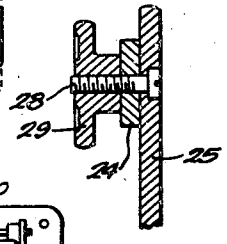


Fig. 4

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Fig. 6

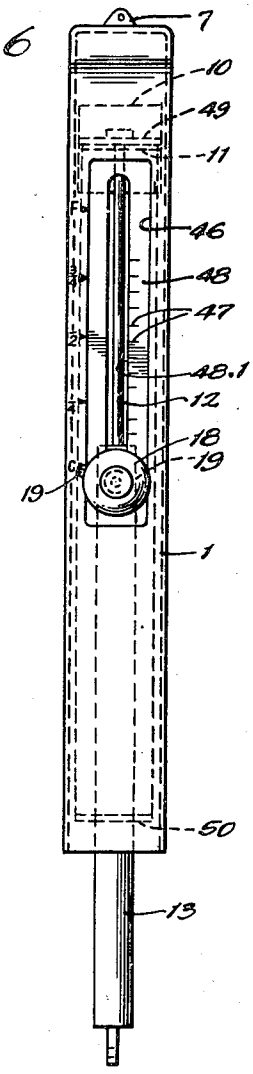
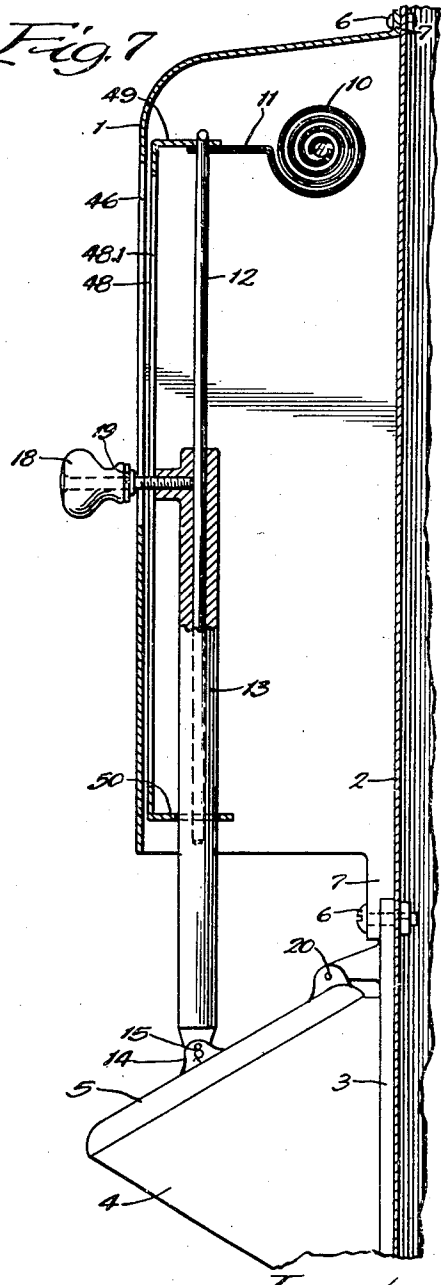


Fig. 7



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Fig. 8

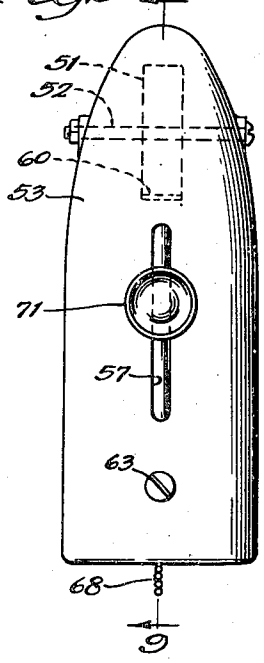
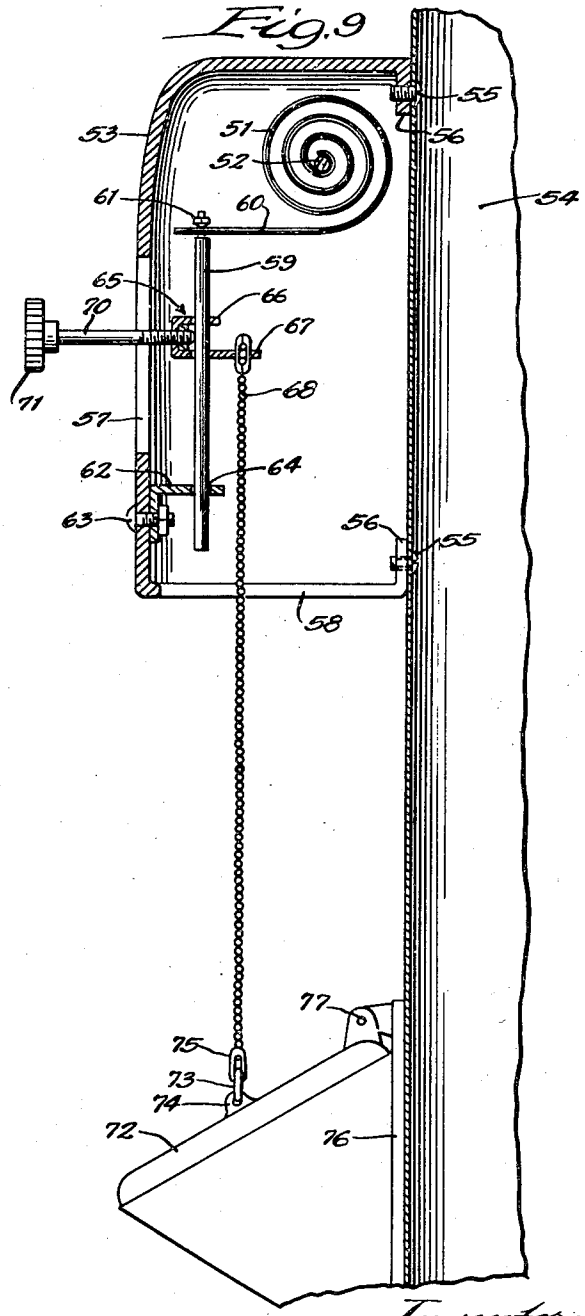


Fig. 9



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UNITED STATES PATENT OFFICE

2,454,044

DRAFT REGULATOR

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Application March 7, 1945, Serial No. 581,415

1 Claim. (Cl. 236—96)

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This invention relates to improvements in draft regulators for stoves and furnaces.

The main objects of this invention are to provide a new and improved draft regulator for stoves and furnaces; to provide a draft regulator which has a linkage element between a temperature-responsive device and the draft door whereby the draft door is opened or closed upon actuation of the temperature-control device; to provide such a linkage element which is adjustable; to provide a device of this character wherein the linkage element may be made completely inoperative at the will of the operator and without dismantling the device; to provide a device of this character wherein the connector linkage element may be so adjusted with respect to the thermostatic control device and the draft door that said draft door may be kept in fully opened position without dismantling the device; to provide an index scale for such a device; and to provide a device of this character which is simple in construction and operation, inexpensive to manufacture and which may be installed on stoves and furnaces now in use as an adjunct thereto in a very few minutes.

Illustrative embodiments of this invention are shown in the accompanying drawing in which:

Figure 1 is a front plan view of my invention shown attached to the casing or shell of a stove or furnace; the casing or shell being shown broken away.

Fig. 2 is a vertical cross sectional view of the device shown in Fig. 1 but showing the damper door and the linkage mechanism in side elevation.

Fig. 3 is a front elevational view of a modified form of linkage mechanism.

Fig. 4 is a cross sectional view taken on the line 4—4 of Fig. 3.

Fig. 5 is a front elevational view of another modified form of my invention wherein the linkage mechanism is operable through another type of a heat-responsive mechanism in the form of a gas filled wafer.

Fig. 6 is a front view of an index scale which may be employed in connection with my invention.

Fig. 7 is a vertical cross-sectional view taken through the device of Fig. 6, but showing the linkage mechanism secured to a damper door.

Fig. 8 is a front elevational view of another modified form of my invention.

Fig. 9 is a cross-sectional view taken on the line 9—9 of Fig. 8.

Referring in detail to the preferred embodiment of my invention as shown in Figs. 1 and 2 of

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the drawings, the cover plate or casing 1 of my regulator is designed to be preferably mounted at its upper end to the casing or shell 2 of a stove or furnace, and at its lower edge to the upper marginal flange 3 of the frame 4 for the draft damper door 5, so as to be disposed directly thereabove.

The casing 1 is U-shaped in horizontal cross section and is closed at its top and opened at the bottom, as clearly shown in Fig. 2. If ventilation within the interior of casing 1 is desirable, the upper closed end may be provided with louvers or slots as will be understood by those familiar with this art. The casing 1 may be secured to the shell of the stove or furnace in any suitable manner, such as by bolts 6 extending through apertures contained in the ears 7 which extend from the casing 1.

A horizontally disposed stationary shaft 8 is mounted in the upper end of the casing 1 and extends between and is secured in fixed position, against rotation, to the side walls thereof by any suitable means, such as by nuts 9. A relatively wide, spirally wound bimetallic coil 10 is anchored at its inner end to said shaft 8 in any suitable manner, whereby it becomes an integral part of shaft 8. The free end of coil 10 is bent substantially at right-angles to provide an arm 11 having an aperture therein to receive the upper end of rod 12 which projects therethrough and is securely but flexibly anchored to the arm 11 whereby upon movement of the coil 10 by expansion or contraction, due to increase or decrease in heat in the stove or furnace, the rod 12 will move upwardly or downwardly depending upon the movement of the arm 11.

The lower or free end of rod 12 is disposed within a tubular link arm 13 in a telescoping manner and is freely slidable therein. The draft door 5 is provided with a pair of upstanding ears 14 between which the lower end of tube 13 is pivotally secured. The ears 14 and the lower end of tube 13 are each provided with an aperture through which a bolt or rivet 15 extends to provide the pivotal connection. The upper end of the tube 13 is provided with an internally threaded boss 16 having a set screw 17 seated therein to secure the rod 12 in the tube 13 in the position desired by the user of the stove. The free end of the set screw 17 is provided with an enlarged head or knob 18 having a protruding portion 19 which acts as a pointer.

The draft door 5 is pivotally secured to the frame 4 by shaft 20 in the usual manner.

The face of the casing 1 is cut away to form

a vertically extending slot 21 through which the boss 16 of the tube 13 protrudes and in which slot 21 the boss 16 may shift in a vertical plane. The movement of the boss 16 corresponds to the movement of the tube 13 as is apparent from the drawings. Suitable calibrations 22 or other indicia are carried by the casing 1 adjacent one edge of the slot 21 whereby ready adjustment of the rod 12 in the tube 13 may be made according to these predetermined indicia. Such indicia are provided to indicate the burning rate desired in the stove or the relative opening of the damper door.

The rod 12 being secured to the free end 11 of coil 10 will move upwardly or downwardly depending upon expansion or contraction of the coil 10 under the direct influence of the heat in the stove or furnace. The bimetallic coil 10 is so constructed and arranged that increase in heat will cause the coil to expand while a decrease in heat will cause the coil to contract.

If the tube 13 is anchored to the rod 12 by the set screw 17, and as the draft door 5 is secured to the lower end of tube 13, both will shift according to the movement of the rod 12, induced by the action of the bimetallic coil 10.

In operation the tube 13 and rod 12 are first positioned with respect to one another and held in such position by the set screw 17. Such setting is in accordance with the amount of fuel it is desired to burn per hour in the stove. When the stove has cooled and is not burning according to the desired rate, the coil will contract, thereby shifting the arm 11 upwardly and thus also move the rod 12 and the tube 13 upwardly and open the draft door 5 to supply air to the fuel bed.

When the stove is burning at a rate greater than desired, the heat will cause the coil to expand and shift the arm 11 downwardly, and thus also the rod 12 and tube 13, causing the draft door to close, and cutting off the air supply to the fuel bed.

Under some weather conditions, i. e., extreme cold weather, it is desirable to keep the stove burning at a rate greater than that for which it has been set; therefore, the set screw 17 is loosened and the tube moved upwardly as far as it will go and the set screw tightened again. Since the coil has only limited expansion and contraction qualities, this operation may be successively performed until the coil has reached the limit of its expansion. It will, therefore, be apparent that the draft door will be kept open at all times when the coil has reached its limit of expansion and the tube has been shifted upwardly as high as possible, and supply unlimited quantities of air to the fuel bed.

On the other hand in mild weather, it may be desirable to keep the draft door 5 closed or inoperative with respect to the coil 10. This can readily be accomplished by loosening the set screw 17 whereby the rod 12 is freely slidable within the tube 13. It will, therefore, be apparent that no fresh air is supplied to the fuel bed through the draft door, even though the stove cools and rod 12 is drawn upward.

It is to be understood that where the draft door is incorporated in and is part of the ashpit door, my device may be mounted directly to the ashpit door at its lower end whereby the casing will be supported in a vertical plane and held therein because the casing or shell is constructed of rigid material. It can readily be seen that when the ashpit door is opened, the device of my invention will swing away from the shell of the stove about the pivotal hinge of the ashpit door where it is attached to the shell or casing of the stove. When the ashpit door is closed the device of my invention will return to its position adjacent the casing or shell of the stove.

Referring to the modified form of construction shown in Figs. 3 and 4, the linkage element between the draft door 21 and the thermostatic coil 22 comprises three rods 23, 24 and 25. The rod 23 depends from and has its upper end secured to the arm 26 (which corresponds in all details to the arm 11 of the preferred embodiment). The lower end of rod 25 is pivotally secured to the draft door 21 and both rods 23 and 25 extend in a vertical plane.

Rod 24 lies in a diagonal plane and is pivotally secured at its lower end to the lower end of rod 23, and at its upper end secured to the upper end of rod 25. This connection is in the form of a bolt 28 and nut 29 and the nut has an enlarged body to act as a handle or knob whereby the upper ends of rods 24 and 25 may be secured together by tightening the nut 29 and thus hold the rod 24 in a predetermined angular position or setting. See Fig. 4. It will now be apparent that any movement of the arm 27 will be transmitted to the draft door 21 through rods 23, 24 and 25 in the same manner as is accomplished through rod 12 and tube 13 of the preferred embodiment.

When the nut 29 is loosened the upper end of rod 24 will freely pivot about the bolt shank upon movement of the arm 27 when the coil 22 is actuated, and hence there will be no movement of the rod 25 and similarly the draft door 21, but the rods 23 and 24 will be actuated as shown by the dotted lines in Fig. 3.

This action is comparable to the action between the rod 12 and the tube 13 of the preferred embodiment, when the set screw 17 is partially unscrewed.

Referring to the illustration shown in Fig. 5, the device of my invention is shown as being employed in connection with a steam or hot water boiler 30.

In this type of installation the temperature limits are lower and permit more effective use of gas-filled wafers which are now commonly employed to regulate the draft damper door; hence, I find it convenient to clamp a wafer 31 on the top of the main riser pipe 32 leading from the boiler and extending to the radiators.

A vertically extending rod 33 is anchored at its lower end to the wafer clamp 34 and is provided with an aperture in its free end whereby one end of the horizontally extending link arm 35 is arranged to be pivotally secured thereto by any suitable means, such as by a short shaft 36. The link arm 35 is provided with an offset adjacent the free end thereof, so that this end will project beyond the outer surface of the pipe 32.

A tubular link arm 37 (identical to the tubular link arm 13 of the preferred embodiment except that link arm 37 is longer) is secured at its upper end to the free end of link arm 35 by a short shaft or the like 38 to form a pivotal connection therebetween. A rod 39 (similar to rod 12 of the preferred embodiment except it is longer) is connected at its lower end to the upper end of damper door 40 by any suitable means, such as by providing threads on the end of rod 39 and inserting it through the free end of the laterally extending perforated arm 41, which arm is bent at right-angles and is integrally secured to the lower edge of damper door 40 and extends beyond the axis of the shaft 40.1 so as to transmit

a reverse action to the damper door. The rod 39 is secured thereto by nuts 42.

The other end of rod 39 is inserted in the tube 37 in the same manner as in the preferred embodiment and the tube 37 and rod 39 are likewise similarly operable since the tube 37 contains a set screw and knob or handle arrangement 43 which is identical to the set screw 17 and knob or handle 18 arrangement shown in the Figs. 1 and 2.

As the wafer expands, due to the increase in heat in the pipe 32 when the burning rate of the fire is more than sufficient to supply the maximum demand, the bearing 45 of the wafer will move upwardly, bear against the arm 35 and move the tubular link 37 in an upward direction. If the set screw 43 is tightened to make the tube 37 and rod 39 an integral unit, the rod 39 will also move upwardly to close the draft door 40 to cut off the supply of fresh air to the fire in the boiler.

When the wafer contracts from its expanded position when the burning rate of the fire is insufficient to supply the maximum demand, it will be apparent that the arm 35 moves downwardly translating such movement to the draft door 40 through the tubular member 37 and rod 39, to open the same.

If the set screw 43 is loosened so that the tubular member 37 and rod 39 are not operable as an integral unit, movement of the tubular member 37 will in no way effect the opening or closing of the draft door 40 since the tubular member 37 will merely freely ride on the rod 39 and the weight of the draft door 40 will keep it closed.

In this particular embodiment the draft door 40 is hingedly connected, as at 40.1 adjacent the lower edge of the damper frame 44.

Referring to Figs. 6 and 7, the embodiment shown is the same in all respects to that shown in Figs. 1 and 2 so far as the control mechanism is concerned, except that I have added an index scale which may be incorporated in my construction and advantageously used therewith.

In utilizing this form of index scale, I find it desirable to widen the slot 21 of Figs. 1 and 2 in the manner shown at 46 in Figs. 6 and 7 whereby to readily view the indicia 47 contained on the index scale 48 which is wholly enclosed within the casing 1. The index scale 48 comprises an elongated strip of metal or the like, bent at right-angles at both the upper and lower ends thereof to form legs 49 and 50 and contains an elongated vertical slot 48.1 through which the set screw 17 projects. The leg 49 is perforated adjacent its free edge for the reception of the upper end of rod 12, and as shown in Fig. 7 the arm lies between the upper end of rod 12 and the arm 11 of the coil 10, whereby movement of the arm 11 is translated to the scale 48. The leg 50 is also perforated adjacent the free edge thereof and the tubular member 13 is threaded therethrough and freely ridable therein. As will be apparent from the drawings, the perforations in legs 49 and 50 are in alinement whereby to maintain the rod 12 and tubular member 13 in vertical plane.

The casing 1 is provided with a series of indicia on its face adjacent the slot 46. This indicia may be as follows: "F" to indicate full opening of the damper door; "C" to denote full closing of the same; while the fractions "¾", "½" and "¼" denote intermediate positions of the damper door, with respect to the position of the knob 18 at all times.

This type of markings is very necessary in

heaters of the type where the heating unit is entirely enclosed within a shell, such as a cabinet-type heater, where the damper door is not visible.

The scale 48 measures the amount of movement of the coil 10 and because of the indicia on the scale the user of the control can readily determine the position of the leg 11 with respect to its horizontal position without visually inspecting the coil 10 and its arm 11; therefore, the user can determine how much more deflection is still available in the cycle of operation before the coil reaches its limit.

The embodiment shown in Figs. 8 and 9 is a more simplified form of construction than those shown in the other drawings. Here the inner end of the coil 51 is secured to a stationary shaft 52, which is in the form of a bolt and anchored between the side walls of the housing 53. The housing 53 is anchored to the stove or furnace shell 54 by any suitable means such as by machine screws 55 threaded into the internally threaded flanges 56. The housing 53 is also provided with an elongated slot 57 in its face, while the bottom of the housing is open as indicated by the numeral 58.

The member 59, which may be either a rod, a tube or the like, extends in a vertical plane within the housing 53 and is secured at its upper end to the arm or leg 60 of the coil 51 by any suitable means as will be understood. In the drawing I have shown member 59 as being a rod having its upper end turned down and threaded for the reception of a nut 61.

It is to be noted from Fig. 9 that this connection is a loose or flexible one whereby the member 59 will remain substantially in a vertical plane regardless of movement of the leg 60. The lower end of member 59 is held in position by means of a perforated angle bracket 62 which is anchored on the inner face of the housing 53 by any suitable means such as by bolt 63. The diameter of the perforation 64 in the angle bracket 62 is slightly larger than the diameter of member 59 whereby the member 59 is freely slidable therein upon movement in a vertical plane of the member 59.

A U-shaped locking member 65, comprises a pair of legs 66 and 67, the leg 67 being longer than leg 66 whereby the upper end of the flexible chain 68 may be secured to the free end thereof, by any suitable means, and spaced far enough away from member 59 and the bracket 62 so as to be free and clear thereof.

Each of the legs 66 and 67 contains an aperture which apertures are alined, whereby the member 59 may extend therethrough and be freely slidable therein as the diameter of the leg apertures are slightly larger than the diameter of the member 59. It is to be noted, that the apertures in the legs 66 and 67 and aperture 64 in the bracket 62 are in alinement with each other so that the member 59 will always remain in substantially a vertical plane, see Fig. 9.

A nut 69 is inserted in the member 65 and preferably integrally secured thereto whereby to receive the threaded shank of the set screw 70 which extends through the slot 57, so that an enlarged head or knob 71 is without the housing. The knob 71 provides a handle for manipulating the locking member 65.

The lower end of chain 68 is secured to the damper door 72 by any suitable means such as by threading a ring 73 through the perforated boss 74 of the damper door 72 and securing the

chain 68 to the ring 73 by the usual chain latching connector 75. The door 72 is hingedly connected to the damper door frame 76 by pivot bolt 77 in the usual manner.

The operation of the device of this embodiment is the same in principle as in the devices of the other embodiments shown and described herein, but in this device I have eliminated the telescoping members and in place thereof have substituted the flexible chain 68 and locking member 65 and obtain the same results as described with reference to the other devices disclosed herein.

As will be apparent, especially from Fig. 9, the damper door 72 is directly connected to the locking member 65, wherefore any movement of the locking member will be imparted to the damper door except when the locking member is in the position shown in Fig. 9 and the movement of the locking member is downward.

The movement of the locking member 65 is effected either by tightening the set screw 70 whereby to lock the legs 66 and 67 of the member 65 to the rod 59, and thereby make the rod and member 65 an integral unit, so that all movement of the arm 60 of coil 51 will be translated to the rod 59 and hence to the damper door 72; or by loosening the set screw 70 and manipulating the member 65 by hand. This latter movement is usually performed to "set" the control for desired performance. This "setting" is accomplished in the same manner as in the other embodiments disclosed herein.

It is to be understood that some of the details set forth may be altered or omitted without departing from the spirit of the invention as defined by the following claim:

I claim:

In a regulator device for stoves and furnaces having a draft door and an outer housing, a regulator unit cover secured to said housing and having an elongated slot therein, a stationary shaft secured in the upper end of said cover, a thermostatic coil having one end thereof secured to said shaft, a rigid telescoping linkage means secured at one end to the free end of said coil and at the other end to said draft door, and locking means extending through said slot in the cover and movable therealong and secured to one of said telescoping linkage means whereby the length of said telescoping linkage is variable at the will of the operator and a scale along said slot to indicate the adjustment of the linkage.

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