Jan. 9, 1951 A. L. PALMER 2,537,082

FLUID FUEL VALVE AND FLUE DAMPER CONTROL SYSTEM FOR FURNACES

Filed Aug. 25, 1947 2 Sheets-Sheet 1

Fig. 1.

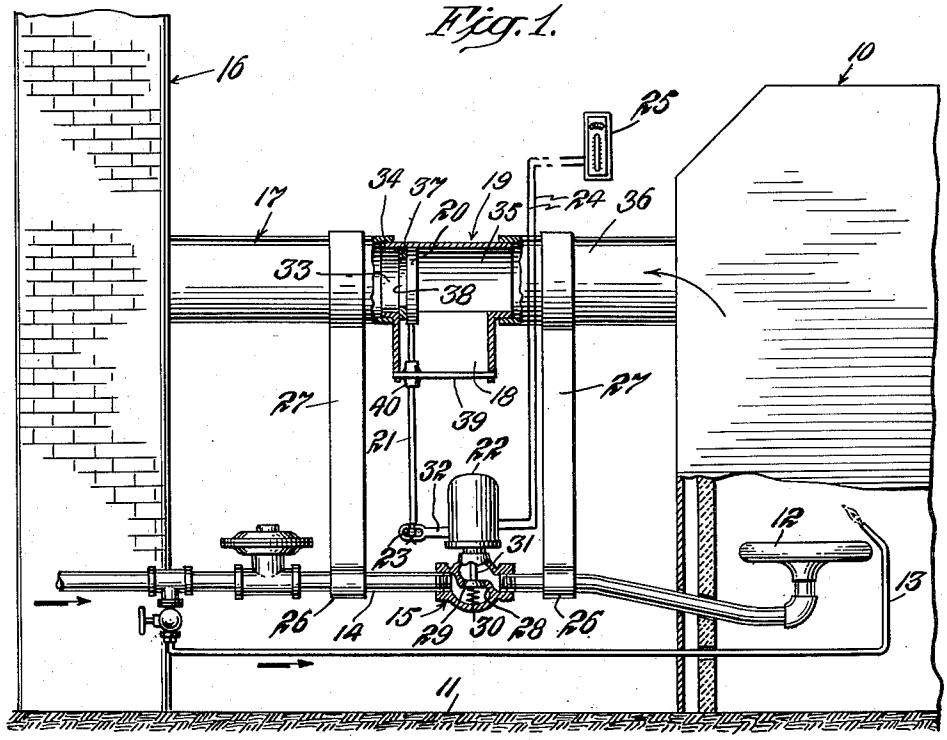
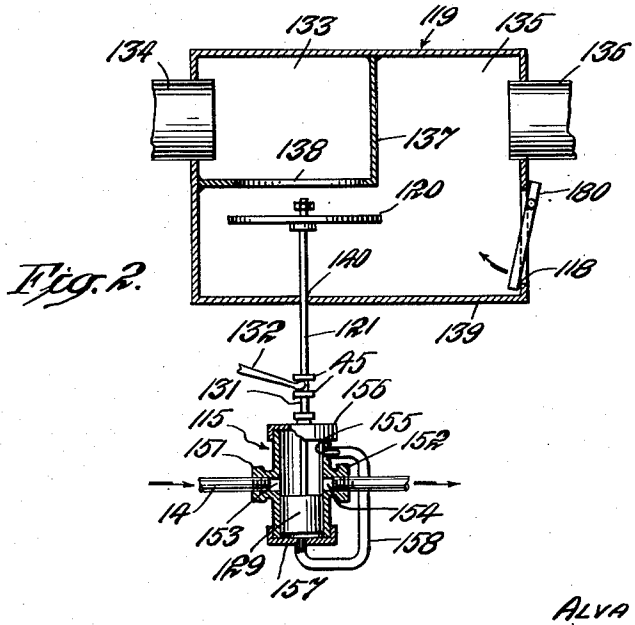


Fig. 2.



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Fig. 3

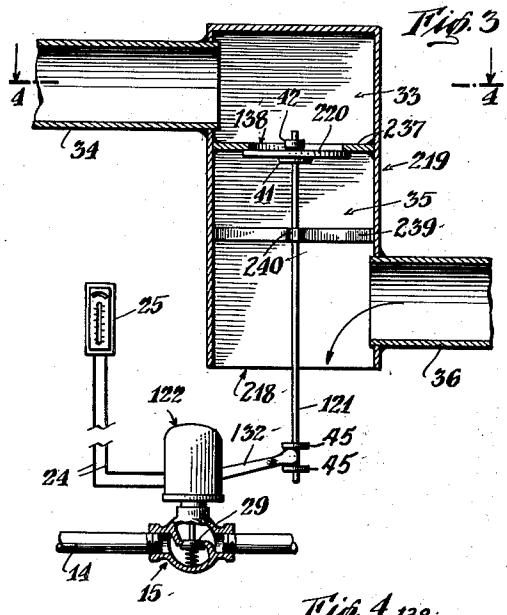


Fig. 5

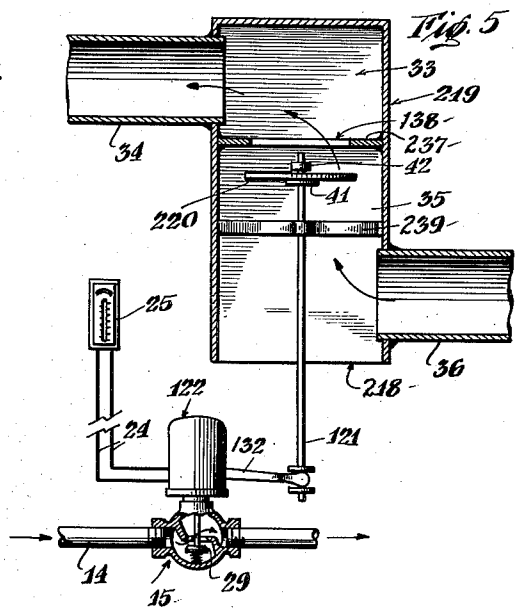


Fig. 4

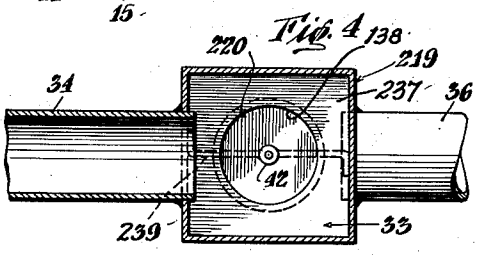


Fig. 6

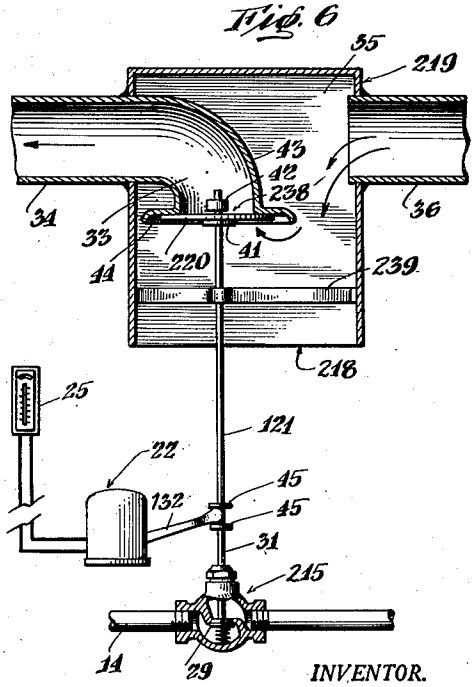


Fig. 7

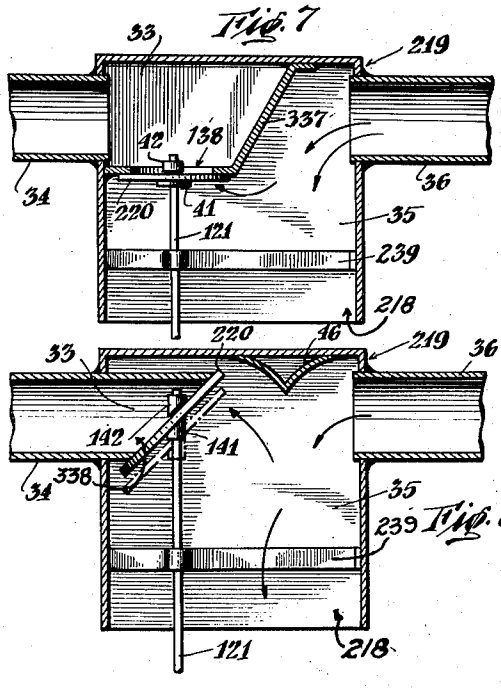


Fig. 8

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FLUID FUEL VALVE AND FLUE DAMPER CONTROL SYSTEM FOR FURNACES

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5 Claims. (Cl. 110—147)

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The present invention relates to a control system for fluid fuel-fired furnaces and a flue damper which is suitable for use therein; and the present application is a continuation-in-part of my co-pending application S. N. 454,648, filed August 13, 1942, which application is now abandoned.

A general object of the invention is the provision of such a control system which is of simple construction and readily adapted to economical commercial production and installation, which efficiently conserves fuel consumption, effectively avoids undesirable losses of heat, may be efficiently employed as a back draft diverter for gaseous fuels, and which in operation avoids the development of conditions which might tend to impair the health and endanger the lives of occupants of buildings equipped with heating systems inclusive of apparatus of the present invention.

A more specific object of the present invention is to provide such a control system characterized by the provision of a flue damper in the exhaust flue between a furnace and a chimney which is mechanically operated in an efficient automatic manner so that when the fuel supply to the furnace is shut off communication between the furnace and chimney and between chimney and furnace room is also effectively reduced to a heat-conserving minimum, with such simultaneous automatic control of fuel valving means and flue damper apparatus being attained in a simple manner through the operation of means positively mechanically interlocking the two together whereby fuel cannot be supplied to the furnace when the flue is closed by the damper.

Another object of the invention is the provision of such a control system wherein fuel valving means and flue damper apparatus are so mechanically interlocked in a positive manner as to assure that failure in service of any parts, however remotely possible, will not tend to create unsafe conditions.

An additional object of the invention is the provision in such a control system of a shut-off valve in the fuel supply conduit leading to the furnace and a damper means for the exhaust flue between the furnace and a chimney, with an automatically-controlled motivating unit for substantially simultaneously opening and closing the damper and the fuel valve by mechanical means directly connected to the damper plate thereby eliminating the possibility of the damper being closed during supply of fuel to the furnace through failure of intervening linkages or mechanisms at the damper such as crank arms, etc.

A further object of the invention is the provision of a damper unit for the exhaust flue between a furnace and a chimney which is characterized by an exhaust space or compartment

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for connection to a chimney and a lead-in space or compartment for connection to a furnace with partition wall means defining those spaces or compartments from each other and having a damper opening therein whereby a shut-off damper plate may be lifted to a position substantially closing the damper opening by means mounted directly thereto which when retracted pulls and/or permits the damper plate to fall by force of gravity to an open position thereby effectively eliminating possibility of the damper blocking the flue upon failure of parts.

Still another object of the invention is the provision of such a damper unit which permits "in line" mounting of sections of flue pipe leading to and from it without undue interference by overhead structure and permits effective employment where space is limited.

A still further object of the invention is the provision in such a control system of flue damper apparatus and fuel valving means having their operating members directly tied together by a rod and the damper plate thereof mounted directly upon the rod so that both must be substantially simultaneously moved to open and closed positions without failure of the damper plate mounting tending to permit flue blockage during supply of fuel to the furnace.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the features of construction, combination of elements and arrangement of parts, which will be exemplified in the construction hereinafter set forth and the scope of the invention will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings, in which:

Fig. 1 is a diagrammatic elevational view with parts in section and broken away of a furnace installation featured by the control system of the present invention, the damper and fuel valve apparatus being shown in closed positions when no heat is demanded;

Fig. 2 is an elevational view, with parts in vertical section and broken away, of a modified form of the damper and fuel valve apparatus of the installation shown in Fig. 1, showing the damper and fuel valve in open positions resulting from a demand for heat;

Fig. 3 is a vertical sectional view of flue damper apparatus of the present invention in association with fuel valving means, showing the damper in flue-blocking or closed position and with the fuel supply conduit closed;

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

Fig. 5 is a vertical sectional view of the structure shown in Fig. 3 with both the fuel valving means and flue damper in open positions;

Fig. 6 is a vertical sectional view with parts broken away of a structure similar to that shown in Figs. 3 and 5 but with the employment of a modified form of the flue damper unit of the present invention;

Fig. 7 is a vertical sectional view of a further modified form of the flue damper apparatus of the present invention; and

Fig. 8 is a vertical sectional view of still another form of the flue damper apparatus of the present invention.

Prior to the present invention attempts have been made to conserve fuel consumption and eliminate undue heat losses in furnace installations by automatic damper control of the exhaust flue between the furnace and the chimney at the same time that fuel supply to the furnace is automatically controlled. Some such installations are characterized by the provision of back draft diverters or draft hoods in the flue between the furnace and chimney to avoid creation of back drafts through the furnace during momentary down drafts in the chimney and also to provide an emergency flue outlet in the event of chimney stoppage. Also such proposals were made in an effort to ameliorate heat losses from the furnace and from the space surrounding the furnace via the chimney during periods when the burner is not operated and, in the case of employment of gas as fuel, to permit spilling of products of combustion and heated air into the chamber in which the furnace is located, such as a basement, during chimney blockage. One such system is suggested in the United States patent to Gilliland No. 2,130,491 of September 20, 1938. Such systems, however, have been found to be commercially impractical due to the fact that many of them have been complicated and have utilized certain electrical- or gas-controlled systems wherein failure of damper operating mechanism has resulted in damper-blockage of the flue during supply of fuel to the burner and has in some cases created conditions tending to impair health and endanger life as to make necessary their abandonment. These and other difficulties of the prior art have been efficiently eliminated by the present invention.

In accordance with the present invention a simple control system is provided wherein the burner of a furnace is supplied with a fluid fuel, such as oil, gas or the like, through a conduit having a shut-off valve therein. An exhaust flue for connection between the furnace and a chimney is provided with a shut-off damper means or plate and in case of employment of gas as a fuel with draft hood or back draft diverter opening. An automatically-controlled motivating unit such as a fluid-operated diaphragm mechanism, a motor unit, or the like, which may be of well known design such as that disclosed in the United States patent to Branche No. 2,037,363 of April 14, 1936, is employed to operate both the damper means or plate and the fuel valve. Interlocking mechanical means, directly connected to the damper means or plate and to the valve, are associated with the motivating or motor unit as to assure substantially simultaneous opening and closing of the damper and fuel valve. This direct connection of the damper plate to the mechanical operating means is free of intervening linkages or mechanisms at the damper, so as largely to eliminate the possibility of a disconnect between the damper plate and motor unit during service. In the preferred form, the damper unit is of a type such that the damper unit is lifted to closed position and permitted to fall by force of gravity to open position so as to assure that any possible failure of operating parts will not tend to result in damper-blockage of the flue at any time during supply of fuel to the burner. These and other features inclusive of specific structure of preferred embodiments of damper apparatus will be more fully explained hereinafter by reference to the drawings wherein like numerals refer to like parts throughout.

In Fig. 1 is shown a furnace 10 of conventional construction mounted upon a suitable support 11, such as a floor of a basement, and equipped with a conventional type of burner 12, such as that adapted for consumption of gas, and a pilot 13. The burner 12 and pilot 13 are connected to a fuel supply conduit or gas line 14. The conduit 14 is provided with a suitable shut-off valve 15.

The furnace 10 has its combustion chamber connected to a chimney 16 by means of an exhaust flue 17, through a section 19 provided with a draft opening 18, to serve as a control for the draft through the furnace appliance when connected to the chimney past an open flue damper, and also as a back draft diverter, when the flue damper is open. The section 19 constitutes a damper unit having a suitable damper plate 20 fixedly mounted, such as by welding or the like, on an upwardly extending operating rod 21. A suitable motivating means, such as an encased electrical motor-operated mechanism 22, is mechanically connected directly to the damper operating rod 21, such as by means of a laterally turned lower end 23 of the rod slidably received in an elongated slot in the end of an operating arm 32 and fastened therein by any suitable means, such as a cotter pin as shown. The arm 32 constitutes an operating member of the motivating unit 22 connected to the motor thereof in a suitable, well-known manner for translation of rotary motion to reciprocative motion. Electrical conductors 24, 24 comprise an electrical supply circuit inclusive of a source of electric power (not shown) and a thermostat or other automatic control unit 25 which may be located in the usual manner in some upper room of the dwelling or building.

Preferably the fuel supply conduit 14 adjacent the valve 15, such as at 26, 26 is suitably supported and held in fixed relation relative to the flue 17 by suitable rigid members or straps 27, 27 to avoid the possibility of change of adjustment between these two members due to sag, etc., which possibly could affect proper operation of the control system.

The valve 15 in the fuel supply conduit 14 may be a globe type lift-valve which, as is well understood, may comprise a partitioning wall 28 dividing the interior into inlet and outlet chambers provided with an aperture circumscribed by a downwardly facing seat against which a valve member 29 is biased upwardly by a helical spring 30. The valve member 29 has a stem 31 linked to the arm 32 of the encased electrical motor-operated mechanism 22 in a well-known manner and may be of a structure similar to that disclosed in the above identified Branche Patent No. 2,037,363.

The damper unit 19, as shown in Fig. 1, comprises a casing structure having an exhaust compartment 33 provided with an outlet opening de-

fined by an exhaust pipe section 34 connected to the chimney 16 and a lead-in compartment 35 having an inlet opening defined by an inlet pipe section 33 connected to the combustion chamber of the furnace 10. The casing has a draft opening 18 in a wall thereof communicating with lead-in compartment 35. Partition wall means 37 in the casing defines the compartments 33 and 35 from each other and is provided with a damper opening 38 closed off by a damper plate 20 when lifted to the position shown. A strap or bracket 39 is mounted on the casing and may carry an apertured sleeve 40 reciprocatively receiving lift-rod 21 to guide it in its up and down movement.

At the time the damper plate 20, valve 15 and motivating unit 22 are assembled relative to each other, the damper plate and the valve member 29 are adjusted to positions relative to each other so that when the valve member is lifted to the valve closing position shown the damper plate is lifted to flue-blockage position shown. Upon demand by the thermostat unit 25 for additional heat, the damper plate 20 will be lowered by its rod 21 to uncover at least a portion of the damper opening 38 simultaneously with lowering of valve member 29 by its stem 31 to open fuel valve 15, both by action of the motivating unit 22, and both the damper plate and the fuel valve member will be moved or lifted together by the motivating unit to closed positions when demand of the thermostat device for additional heat has been satisfied. This support of damper plate 20 by lift-rod 21 without the presence of any intervening linkage substantially eliminates possibility of failure and should connection between the lift-rod 21 and the motivating unit 22 fail for an unexpected reason it will be seen that by force of gravity the damper plate will fall and/or remain in an open position avoiding blockage of the flue at any time including periods when fuel is supplied to the burner.

In the above described system, during periods of shut-off of fuel supply the flue 17 will be substantially blocked by the damper plate 20 thus preventing chimney draft from unnecessarily drawing off heat from the furnace 10 and from the surrounding air in the basement through the furnace and via the draft hood or back draft diverter opening 18. Upon the closing of the fuel supply conduit 14 by the valve 15 heated gases which may pass off from the furnace for a short time thereafter will be diverted by the damper plate 20 through the draft opening 18 thereby conserving this additional heat that otherwise would be drawn up through the chimney and wasted. This direct mechanical interlocking between the damper plate and the fuel supply valve prevents the flue from being blocked at any time during supply of fuel to the burner.

If fuel oil is to be used it will be understood that the apparatus should be modified to avoid spilling into the air surrounding the furnace any obnoxious gases of combustion. Thus the usual one-way butterfly valve may be employed to close a draft opening against reverse flow of gases with that draft opening serving to control the draft through the furnace appliance when connected to the chimney past an open flue damper. In such an installation the retention of the mechanical interlock between the damper and fuel valve may be had by providing for delayed closure and preceding opening of the damper relative to the fuel valve, such as, for example, by use of a piston valve in the fuel line when a reciprocating type of damper, such as illustrated herein is employed.

In Fig. 2 is shown an example of such an embodiment of the invention.

As indicated in Fig. 2, the damper unit 119 may comprise a casing having therein partition means 137 dividing its chamber into an exhaust compartment 133 and a lead-in compartment 135. A section 134 of the exhaust flue is let in through a wall of the casing for communication with exhaust compartment 133 and is intended to be connected to the chimney and another section 136 of the flue is let in through another wall of the casing for communication with the lead-in compartment 135 and is intended to be connected to the combustion chamber of the furnace. The partition means 137 has a damper opening 138 therein providing communication between the compartments 135 and 133 and portions of that partitioning means circumambient of the damper opening may provide a downwardly-facing damper seat. An outside wall of the casing has a draft opening 118 therein, communicating with the lead-in compartment 135, to serve as a draft relief and, as is usual in fuel oil installations and others where gases of combustion of fuel and fumes therefrom are obnoxious, such draft opening is provided with a gravity-biased pivoted butterfly plate 180 so pivotally mounted as to permit draft-relieving passage of air into the chimney through that draft opening rather than up through the furnace appliance, but to prevent passage of gases from the furnace and its flue outward into surrounding air, as shown.

In the apparatus of Fig. 2 a laterally extending damper plate 120 is mounted upon the upper end of a lift-rod 121 which is slidably extended down through a hole 140 in the bottom 139 of the casing with that bottom structure thus serving as means for guiding the lift-rod in reciprocative movement, as does the bracket 39 of the structure of Fig. 1. The lift-rod 121 is preferably made integral with a valve stem 131 and carries fixed thereto a pair of spaced-apart flanges or plates 45, 45 between which is located the rounded ends of a fork on the end of operating arm 132 of a motivating unit (not shown in this figure but elsewhere depicted as in Fig. 6).

A piston valve 115, as shown in Fig. 2, may comprise well-known structure having a casing 150 provided with internally threaded inlet and outlet fittings 151 and 152 into which sections of fuel supply conduit 14 are anchored. The fittings 151 and 152 have their inlet and outlet ports 153 and 154 communicating with a cylindrical chamber 155 capped off at both ends by apertured caps 156 and 157 with the valve stem 131 slidably mounted through a gland on cap 156 in a substantially fluid-tight manner. A cylindrical piston 129 is mounted on the lower end of the stem 131 and closely fitted in chamber 155 for reciprocating movement therein. A by-pass pipe 158 connected into cap 157 and a side wall of the upper end of the casing 159 connects both ends of the chamber 155 on opposite sides of piston 129 for the well-known purpose of relieving pressure to assure ease of operation of the piston valve.

In operation of the apparatus shown in Fig. 2, with the damper plate 120 lifted to close damper opening 138 and the piston valve member 129 lifted to cut off communication between inlet and outlet ports 153 and 154, when heat is demanded by a thermostatic control the motivating unit operates arm 32 to lower the damper plate 120 and valve member 129 to the positions shown in

Fig. 2. Fuel will then flow from inlet port 153 through chamber 155 to outlet port 154 to be supplied to the burner in the combustion chamber of the furnace by conduit 14. Upon initial downward motion of the lift-rod 121 damper plate 120 will be immediately separated from its seat to uncover damper opening 138 to provide communication between the flue inlet section 136 and flue outlet section 134. However, the valve 115 will not be opened until some time later when the elongated piston 129 thereof is finally lowered to a position where its top end begins uncovering inlet and outlet ports 153 and 154. Thus, opening of the damper precedes opening of the fuel valve and the damper plate 120 and the fuel valve piston 129 will eventually be lowered to the full opened positions shown in Fig. 2.

With the fuel valve 115 open and the damper plate 120 uncovering damper opening 138 as shown in Fig. 2, gases of combustion will pass from inlet flue section 136 through lead-in compartment 135, the damper opening 138 and outlet compartment 133 to exhaust flue section 134 and thence to the chimney. When sufficient heat has been supplied, as demanded by the thermostatic control, the motivating unit operating arm 32 will lift damper rod 121 and valve stem 131 so that the top portion of the valve piston 129 will first cover inlet and outlet ports 153 and 154 of the valve 115 thereby closing the latter and shutting off flow of fuel to the burner while damper plate 120 is still an appreciable distance below its seat adjacent damper opening 138. Further lifting of rod 121 and stem 131 will finally bring the damper plate 120 up to seating position to close damper opening 138 while maintaining the valve 115 closed.

This delayed action of the apparatus shown in Fig. 2, i. e., opening of the damper 120 before opening of the fuel valve 115, assures that as soon as fuel is supplied through the latter to the burner resulting gases of combustion will be permitted to pass through the damper unit 119 to the chimney. Also upon closing of the fuel valve 115, the damper 120 will remain open for a short time so that gases of combustion, which may be still flowing from the combustion chamber, will be permitted to pass through the damper opening 138 to the chimney. Then, after such time as will assure substantially complete exhaustion of all gases of combustion from the combustion chamber through the damper unit 119 to the chimney, the damper 120 will be closed with maintenance of closure of the fuel valve 115 so that thereafter passage of heated air through and from the furnace to the chimney will be prevented so that heat will be conserved. Such action permits efficient employment of structure of the present invention in connection with the fuel burning heating devices.

In Figs. 3, 4 and 5 a preferred form of damper unit is shown. This consists of a casing 219 formed by outside wall means providing a chamber interiorly thereof which in the case of a gas furnace has the bottom thereof left open at 218 to provide a back draft diverter opening. The interior of the casing 219 or the chamber therein is divided into an exhaust space or compartment 33 which communicates through an opening in the wall or top of the casing with a section 34 of the flue pipe leading to the chimney; and a lead-in space or compartment 35 which communicates through an opening in an opposite wall of the casing with a section 36 of flue pipe leading from the furnace. A partition wall means 237 in the casing defines the spaces or compartments 33 and 35 from each other and is provided with a damper opening 138 with the bottom face of that wall adjacent the damper opening providing a damper seat thereabout. Suitable bracing means for reciprocatively guiding the lift-rod 121 is mounted within the casing and may comprise a bracket member 239 secured at opposite ends to opposite outside walls of the casing in the lead-in compartment 35 and provided with an apertured guiding boss 240 reciprocatively receiving the lift-rod 121.

The upper end of the lift-rod 121 in the structure shown in Figs. 3, 4 and 5 has an abutment plate 41 securely mounted thereon and a damper plate 220 rests upon the abutment with an aperture therein receiving the end of the lift-rod, although if desired the damper plate may be fixed to the lift-rod. A collar 42 mounted on the rod 121 above the damper plate 220 completes the direct connection between the latter and the lift-rod 121. It will be noted from Figs. 3 and 5 that preferably the space between abutment plate 41 and collar 42 is slightly greater than the thickness of the damper plate 220 and the diameter of the aperture in the damper plate receiving the end of the rod is also preferably greater than the diameter of the rod to provide for accurate seating of the damper plate against the seat of the wall 37 about the damper opening 38.

In the structure shown in Figs. 3, 4 and 5 with the flue section 36 connected to the furnace and the flue section 34 connected to a chimney and with the fuel valve 15 in the fuel conduit 14 closed as shown in Fig. 3, the damper plate 220 will be held by the lift-rod 121 in closed position substantially to block passage of combustion gases and heated air from the furnace to the chimney and, in the case of gas fuel, these hot gases and relatively large volumes of heated air will be permitted to spill through the opening 218 into the room in which the furnace is installed. However, when the thermostat unit 25 demands more heat, it initiates operation of the motor unit 122 causing the valve member 29 to be pushed away from its seat permitting flow of fuel to the burner, which condition is depicted in Fig. 5: and, at the same time, the end of the arm 132 is lowered forcing and/or permitting the lift-rod 121 and the damper plate 220 to move or drop to the open position permitting passage of combustion gases from the flue section 36 through the lead-in space 35, damper opening 138, exhaust space 33 and the flue section 34 to the chimney as indicated by the arrows. This direct mounting of the damper plate on the operating member or lift-rod and the provision for these members to fall by force of gravity to the open position have a merit similar to that or like characteristics of the structure shown in Fig. 2. Possibility of failure of connection to the damper plate is substantially eliminated and in the unlikely eventuality that such failure does occur the damper will "fail safe" and likelihood of sticking due to accumulative or accidental presence of soot or foreign matter or objects is avoided.

In many buildings overhead boiler room space is restricted and for this reason it may be desirable to mount the flue sections leading to and from the damper unit "in line." Such structures are proposed in Figs. 6, 7 and 8. As shown in Fig. 6, the end of the flue section 34 leading to the chimney may be extended to within the

casing 219 and turned downwardly at 43 to provide the exhaust space or compartment 33. The lower end of the flue section 34 may be belled or flared outwardly such as at 44 about its open end 238 serving as a damper opening, to provide a seat for the damper plate 220 circumambient of the damper opening. The so-shaped end of the flue 34 also provides baffling which may be desired in the case of a chimney back draft "in line" mounting of the flue sections 34 and 36. The walls of the downturned end 43 of the flue section 34 also provide the partition wall means in the casing 219 defining the lead-in space or compartment 35 from the exhaust space or compartment 33 with the open end 238 of the flue section serving as the damper opening in this wall means.

Attention is particularly directed to the fact that in the structure proposed in Fig. 6 the lift-rod 121 and the rod 31 connected to the valve member 29 are made as an integral member with suitable spaced apart collars or plates 45, 45 mounted thereon to receive therebetween the end of the arm 132 of the motor unit 222. Thus there is a mechanical interlock between the valve member 29 and the damper plate 220 by means of direct connection of those two elements to a single rod 121—31. This structure further eliminates possibility of unsafe failure of the flue-fuel control mechanism.

In Fig. 7 is shown a structure wherein similar "in line" mounting of the flue sections 34 and 36 is had by providing a partition 337 to define lead-in space or compartment 35 and exhaust space or compartment 33 and with a portion thereof serving as a baffling as indicated. Another possible modification of the damper unit of the present invention is that shown in Fig. 8 wherein the end of the flue section 34 is projected through a hole in a side wall of the casing 219 to form partition wall means dividing the casing chamber into exhaust space or compartment 33 and lead-in space or compartment 35. By cutting off the end of the pipe 34 at an angle to the vertical, such as 45°, the resulting edge of the flue pipe provides a downwardly-facing damper seat about the open end thereof serving as a damper opening 338. In such case the damper plate 220 is angularly mounted directly on the lift-rod 121 by suitably spaced apart collars or abutment members 141 and 142 having damper plate-engaging faces also angularly arranged as indicated. In this structure as in the modification shown in Figs. 5 to 7, inclusive, the damper opening 338 is substantially closed by lifting the damper plate 220 by means of the lift-rod 121 and is lowered to open position, shown in dotted lines in Fig. 8 by force of gravity or by rod 121. Suitable baffling may be, if desired, provided at 46.

It will thus be seen by direct connection of the damper plate to its operting member and mechanical interlock between the damper and the fuel valve in addition to the other features of the invention described above that the indicated objects, notably safety, among others, are efficiently attained. Wherever herein direct connection between the damper means or plate and its operating member and the fuel control means, or between other elements, is referred to, it is to be understood that indirect connection through intervening mechanism such as crank arms and additional linkage and bearings thereof is intended to be excluded.

Since certain changes may be made in the above construction and different embodiments of the invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described as come within the scope of the appended claims, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a control system for a furnace, a damper unit for the exhaust flue to be mounted therein between the furnace and a chimney exteriorly of the furnace comprising a casing having flue inlet and outlet openings in side walls thereof at substantially the same level and the bottom thereof open to provide a back draft diverter opening, wall means in said casing defining with the casing walls an exhaust compartment in communication with the outlet opening and a lead-in compartment in communication with the inlet and diverter openings, said wall means having a damper opening therein providing communication between the compartments, said damper opening facing upstream of the passage for flow of gases through said unit from said flue inlet opening to said flue outlet opening, a substantially vertically disposed lift-rod, means in said casing for guiding said lift-rod in reciprocative movement through the diverter opening, and a shut-off damper plate mounted directly on said lift-rod on the upstream side of said damper opening to be lifted thereby substantially to close the damper opening on its upstream side.

2. In a control system for a furnace, a damper unit for the exhaust flue to be mounted therein between the chimney and the furnace exteriorly of the latter comprising, in combination; a unitary casing structure distinct from any furnace structure and formed by outside wall means providing a chamber interiorly thereof; partition wall means in said casing structure dividing the chamber into an exhaust compartment and a lead-in compartment; said outside wall means having an outlet opening communicating with the exhaust compartment and adapted for connection to an imperforate chimney flue for passage of gases to the chimney only from the exhaust compartment, an inlet opening communicating with the lead-in compartment and adapted for connection to a furnace exhaust flue, and a diverter opening in the bottom of said casing structure communicating with the lead-in compartment to provide a back draft diverter passage; a lift-rod; and means supported by said casing structure for guiding said lift-rod in up and down reciprocative movement through the diverter passage; said partition wall means including a downwardly facing damper seat circumambient of a damper opening for communication between the compartments, and a shut-off damper lift plate mounted directly on and carried by said lift-rod and adapted substantially to close the damper opening when lifted by said rod substantially into contact with said seat.

3. In a control system for a furnace, a damper unit for the exhaust flue to be mounted therein between the chimney and the furnace exteriorly of the latter comprising, in combination: a unitary casing structure distinct from any furnace

structure and formed by outside wall means providing a chamber interiorly thereof; partition wall means in said casing structure dividing the chamber into an exhaust compartment and a lead-in compartment; said outside wall means having an outlet opening communicating with the exhaust compartment and adapted for connection to an imperforate chimney flue for passage of gases to the chimney only from the exhaust compartment, an inlet opening communicating with the lead-in compartment and adapted for connection to a furnace exhaust flue, and a diverter opening in the bottom of said casing communicating with the lead-in compartment; a substantially vertically disposed lift-rod projecting into said casing through the diverter opening; and means in said casing for guiding said lift-rod in reciprocative movement; said partition wall means having a damper opening facing said lead-in compartment for downstream flow of gases from the latter to said exhaust compartment, said partition wall means including a shut-off damper lift plate mounted on the upstream side of said damper opening directly on and carried by said lift-rod, said plate being adapted substantially to close the damper opening on its upstream side when lifted by said rod.

4. In a control system for a furnace, a fuel supply valve and damper assembly comprising, in combination: a unitary casing structure distinct from any furnace structure and formed by outside wall means providing a chamber interiorly thereof; partition wall means in said casing structure dividing the chamber into an exhaust compartment and a lead-in compartment; said outside wall means having an outlet opening communicating with the exhaust compartment and adapted for connection to an imperforate chimney flue for passage of gases to the chimney only from the exhaust compartment, an inlet opening communicating with the lead-in compartment and adapted for connection to a furnace exhaust flue, and a draft opening communicating with the lead-in compartment; a valve for a furnace fuel-supply conduit having a valve member; an automatically-controllable motivating unit connected to said valve member for moving the latter successively between an open position and a closed position; a substantially vertically disposed lift-rod connected directly to driven means of said motivating unit and extending directly to said casing and projecting into the latter through the bottom thereof; means supported by said casing for guiding said lift-rod in

reciprocative movement; said partition wall means having therein a damper opening facing said lead-in compartment for downstream flow of gases from the latter to said exhaust compartment; and a shut-off damper lift plate mounted on the upstream side of said damper opening directly on and carried by said lift-rod and directly connected through said rod to the driven means of said motivating unit and valve member, said lift-rod being so connected to the driven means of said motivating unit as to cause it to lift said damper plate to a position substantially closing the damper opening on its upstream side when said valve member is moved from open position to closed position by said motivating unit,

5. In a control system for a furnace, a damper unit for the exhaust flue to be mounted therein between the furnace and a chimney exteriorly of the furnace comprising a casing formed by outside wall means having therein flue inlet and outlet openings and a draft opening lower than the inlet opening, partition wall means in said casig defining with said outside wall means an exhaust compartment in communication with the outlet opening and a lead-in compartment in communication with the inlet and draft openings, said partition wall means having therein a damper opening facing said lead-in compartment for downstream flow of gases from the latter to said exhaust compartment, a substantially vertically disposed lift-rod reciprocatively projecting into said casing through the bottom thereof, means for guiding said lift-rod in reciprocative movement through the casing bottom, and a shut-off damper plate mounted on the upstream side of said damper opening directly on said lift-rod to be lifted thereby substantially to close the damper opening on its upstream side.

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