

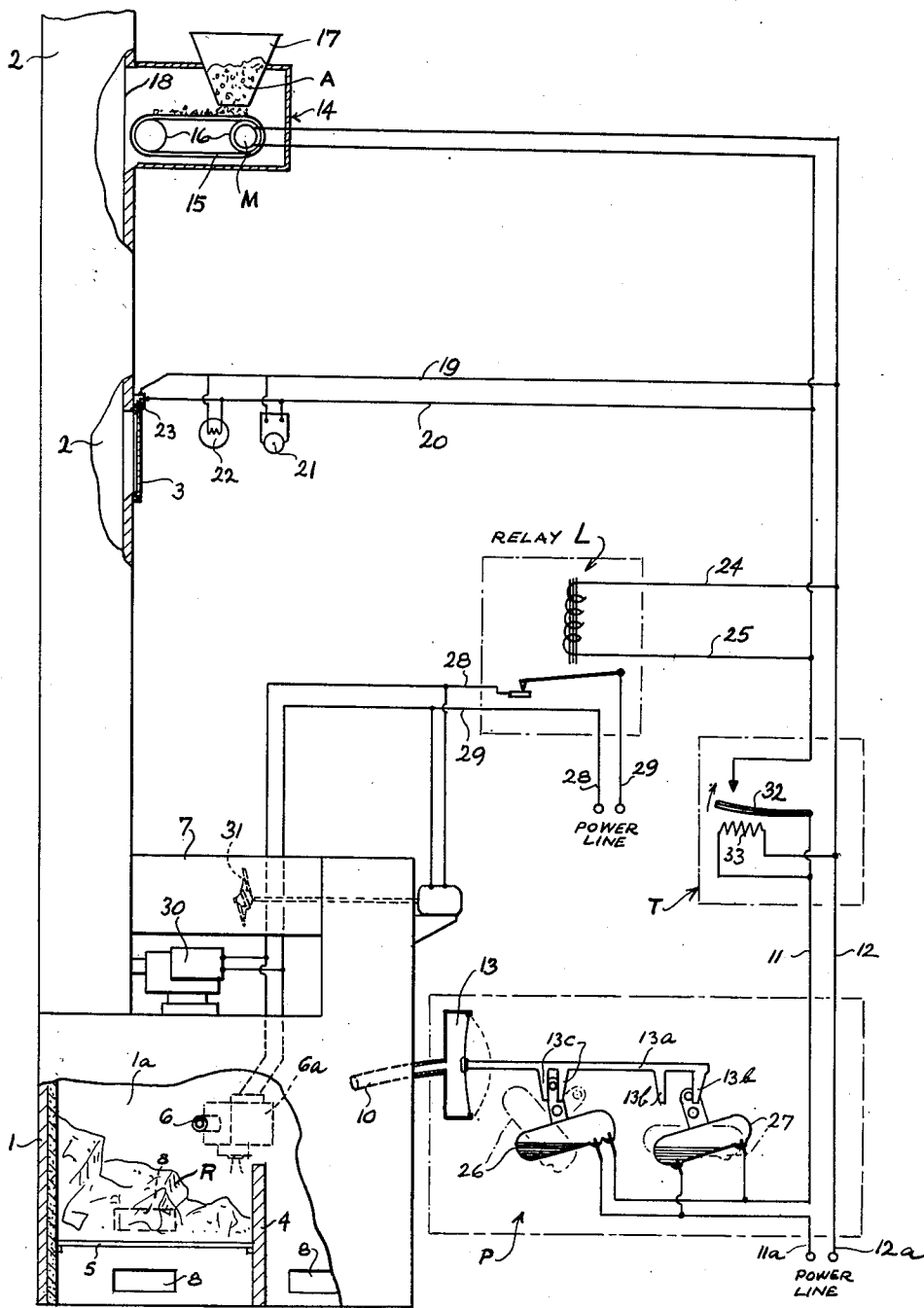
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FLUE-UNBLOCKING AND SAFETY SYSTEM FOR INCINERATORS

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FLUE-UNBLOCKING AND SAFETY SYSTEM
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This invention relates to incinerators and has particular reference to a novel system for unblocking the feeding chute of an incinerator by releasing the matter wedged in said chute, and for giving a warning that such a blocked condition exists.

The invention relates particularly to the "single flue" type of incinerator, in which the single flue serves both as a feeding chute through which refuse is dropped, and a gas discharge flue. Incinerators of this type used in multiple dwellings generally consist of a flue or chute, about three to four square feet in cross-section, which extends from the basement of the building to the roof. At each floor, a feeding door is provided for depositing refuse into the chute, through which it drops into the incinerator furnace in the basement. This refuse is burned when the furnace is fired, the hot gases and smoke being drawn up the flue.

One of the problems encountered in the use of incinerators of this type is the frequent clogging of the flue by refuse which becomes lodged therein. Although the feeding doors are usually designed to restrict the size of the rubbish fed into the chute, they are not always effective in preventing clogging. For instance, a folded box may open up in its descent through the chute and become wedged therein. When this occurs, gases and smoke from the incinerator furnace are forced out through the access and feed openings of the furnace, as well as through the feeding doors of the chute, causing a considerable nuisance as well as possible danger.

When such clogging is detected, it is the usual practice either to ignite the clogged refuse and allow it to burn out, or else to drop a weight of some sort down the chute, which will forcibly release the blocked matter. Both of these remedies are performed manually, requiring the lapse of considerable time before the remedy becomes effective. In addition there is usually an appreciable time delay involved in discovering a blocked condition of the chute. It is therefore desirable that immediate notice of such a condition be given, and a remedy therefor applied quickly.

I therefore provide an unblocking system which includes means operatively responsive to an increase in gas pressure within the incinerator furnace or adjacent feed flue, said means being adapted to actuate an unblocking mechanism associated with the chute, and being also adapted to actuate suitable warning signals, lock the incinerator feeding doors, and/or halt the operation of auxiliary mechanism of the incinerator.

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It is an object of the invention to provide an unblocking system of the type described in which operation of the mechanism is begun automatically as soon as the draft in the incinerator is decreased appreciably by a clogged condition of the chute.

Other objects and advantages of the invention will be readily apparent in the course of the following specification when taken in connection with the accompanying drawing, which illustrates a preferred embodiment of the invention.

The drawing shows a partially schematic view of a chute unblocking and warning system as applied to a flue-fed incinerator of the single flue type. The incinerator furnace and flue are shown in side elevation and are partially broken away to reveal the inner construction thereof.

Referring to the drawing, the incinerator generally comprises a furnace 1, and a flue 2 which opens into the top of said furnace 1. Flue 2 extends vertically the height of the building in which the incinerator is installed, and extends through the roof of the building as a chimney.

The flue 2 serves the combined function of a gas discharge flue and feeding chute. For the latter purpose, a feeding door 3 of the usual type is provided at each floor of the building, these doors 3 being located vertically, one above the other. For convenience, only one of these feeding doors 3 is illustrated in the drawings. When the occupant of an apartment wishes to dispose of garbage or rubbish, he opens the respective feeding door 3 and drops the refuse down the flue 2 into the furnace 1.

The furnace 1 has an upstanding partition wall 4 which forms a refuse-accumulating chamber 1a at one end of said furnace. A grate 5 is secured to the partition wall 4 and the end wall of furnace 1, across the refuse-accumulating chamber 1a, and in parallel, spaced relationship to the floor of said chamber 1a. The flue 2, communicates with the interior of furnace 1 above chamber 1a, so that when refuse is dropped down flue 2, said refuse R will land upon grate 5, and accumulate thereon.

The furnace 1 may also be provided with an externally-located fuel burner 6a, such as an oil burner or gas burner, whose nozzle 6 extends within the interior of the furnace 1. When the burner 6a is fired, the flame discharged by nozzle 6 covers the refuse-accumulating chamber 1a so that this flame assists in the drying and burning of the refuse R accumulated on the grate 5.

A by-pass flue 7 communicates with the end

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of the furnace 1 opposite the refuse-accumulating chamber 1a. This by-pass flue 7 communicates with the main flue 2 adjacent the bottom of said flue 2. The furnace 1 may also have auxiliary blowers 30 or fans 31 to introduce a stream of air within the flue 2 or by-pass flue 7 in such a manner as to cause the gases generated by the burning refuse R to be caused to leave the furnace 1 through the by-pass flue 7 instead of rising directly up the flue 2. Such an arrangement is fully described in co-pending U. S. patent application, Serial No. 137,352, filed January 7, 1950, of which I am a co-inventor. The operation of these blowers or fans forms no part of the present invention, except insofar as their operation may be regulated by the control means of the unblocking unit.

The furnace 1 contains the usual access or feed openings 8 which have doors which may be opened or closed when required in order to regulate the draft, permit the removal of ashes, enable refuse to be deposited in the furnace from the basement, etc.

It is to be understood that the invention herein is not to be limited to any specific type of incinerator or furnace. The incinerator illustrated in the drawing is shown by way of illustration only, and any other standard type of incinerator furnace may be substituted in its place.

As was previously indicated, if refuse should become wedged in the flue 2, while the refuse R is burning in the furnace 1, an annoying and dangerous situation will arise. The clogged condition of the flue 2 will, in most instances, decrease the drawing action of said flue 2, and may even prevent the hot gases and smoke from furnace 1 from rising through the length of flue 2 to the chimney at the roof. The gases and smoke become trapped in the flue 2, causing a marked reduction of the draft in furnace 1, and possibly a definite positive pressure. The gases and smoke, being prevented, or substantially prevented, from escaping through the chimney, seep through the feeding doors 3 of the flue 2, below the clogged area, and through the access doors 8 of furnace 1. As a result, the basement, as well as the hallways or apartments located below the clogged area, become filled with smoke and fumes. In addition, sparks, or even flame, are likely to escape through the feeding doors 3 or access doors 8 if these doors are opened while the clogged condition exists.

To remedy this clogged condition at its outset and before serious damage or annoyance can occur, I provide an automatic unblocking or flue-clearing system which may be incorporated in the incinerator. This system comprises a pressure-responsive unit which actuates a mechanism for dropping weighted objects down the flue 2 and at the same time actuates suitable signal devices or other mechanisms associated with the incinerator.

The pressure responsive unit includes a hollow tube 10 which extends within the interior of furnace 1 and communicates with a sensitive pressure-operated relay unit P located outside the furnace 1. The tube 10 is so located within furnace 1 that any change in pressure within said furnace will be transmitted to the pressure-operated relay unit P.

The pressure operated relay unit P includes a pressure responsive control member 13 which controls one or more electrical switches 26 and 27 which regulate electrical current through lead

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wires 11 and 12. This current is supplied from a suitable power line through leads 11a and 12a.

The pressure responsive control member 13 may be a pressure sensitive diaphragm of the conventional type which is used in connection with draft regulation in boilers and furnaces although other types of conventional type pressure operated controls may be used. The diaphragm 13 is operatively connected by a bar 13a with one or more electrical switches and is pre-set to close said switches when the diaphragm 13 changes position as a result of an increase in pressure within furnace 1, and to open said switches when the diaphragm returns to its pre-set position, thus energizing and de-energizing the relay P.

I prefer to employ a pair of mercury switches 26 and 27 of conventional and well-known type which are arranged in such a manner that one switch closes the electrical circuit at one position of the diaphragm and the second switch opens the electrical circuit at a different position or degree of movement of the diaphragm. For example, the mercury switches 26 and 27 may be pivotally mounted as shown in the drawing and may be bracketed by depending pairs of fingers 13b and 13c of the bar 13a. The pair of fingers 13b are spaced apart a greater distance than the fingers 13c so that the switch 26 is returned to its original open position before the switch 27. This mercury switch arrangement is conventional, and no claim is made to the same in itself. Actually, a single electrical switch might be used effectively, except that under certain conditions the equipment controlled by the flowing of current through wires 11 and 12 might be energized and de-energized several times in rapid succession due to rapid variation of draft conditions in the furnace, causing damage to the equipment. If, however, the pressure operated diaphragm 13 or the relay P were so constructed to provide a delay in time between the opening of the circuit and the closing thereof, a single switch may be effectively used without damage to the equipment.

The wires 11 and 12 lead to a dumping device 14 located adjacent the top of flue 2. This dumping device 14 is situated above the top-most feeding door 3 of flue 2, and is preferably on or adjacent to the roof of the building. The dumping device 14 comprises an endless belt 15 mounted on rollers 16, one or both of which is driven by an electric motor M. The wires 11 and 12 are connected to this motor M. A hopper or feeder 17 or other feeding device is mounted above the endless belt 15, said hopper 17 containing weighted articles A such as bags of coal, sandbags, rocks, stones, or the like. The wall of flue 2 contains an opening 18 adjacent the endless belt 15, so that when said endless belt is driven toward said opening, the weighted articles fed by hopper 17 on said endless belt 15 are dropped through the opening 18. The dumping device described is of simplified design. Many other types of dumping devices of conventional design would work equally well.

One or more warning devices or the like may be connected across lead wires 19 and 20, said wires 19 and 20 being connected to respective wires 11 and 12. As a result, these warning devices are connected in parallel with the motor M of the dumping device 14. The warning devices may consist of a bell or buzzer 21 and a signal light 22. In addition, electrical locking devices 23 on each of the feeding doors 3 may be con-

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nected across wires 19 and 20, so that when current is passed through wires 19 and 20 the feeding doors 3 are locked in closed position.

Any auxiliary equipment used in the operation of the incinerator, such as the fans 31, blowers 30, etc. previously described, and also the auxiliary burner 6a which discharges flame through nozzle 6, may be connected to a second power line by wires 28 and 29 whose current is controlled through a second relay L. This second relay L may be of the conventional solenoid type and is connected across power line 11, 12 by means of respective lead lines 24 and 25. Current flows through the leads 28 and 29 to the auxiliary equipment in the normal operation of the incinerator. When the circuit is closed through leads 11 and 12, and 24 and 25 due to a clogged condition of flue 2, the relay L is actuated, breaking the circuit of leads 28 and 29, and causing the auxiliary equipment to be shut off.

Ordinarily, during the burning operation of the furnace 1, a draft is induced in the furnace 1 and flue 2. This draft creates a negative pressure within the furnace 1. When refuse becomes wedged within the flue 2, the draft is decreased so that the pressure within furnace 1 is increased. If the flue 2 becomes completely clogged, a positive pressure may build up within the furnace 1.

Draft conditions vary in different incinerator installations depending upon the type of furnace, length of flue, surrounding atmospheric conditions, and many other factors. In a particular installation, however, it is possible to ascertain by measurement the average draft or at least the range in which the draft will vary under normal conditions. Accordingly, the mercury switches 26 and 27 controlling the current through wires 11 and 12 may be set so that they will be actuated by diaphragm 13 when the draft within the incinerator 1 decreases below the minimum normal draft.

When the draft in the incinerator is reduced by a clogged condition of the flue 2, an increase in pressure is evidenced in the furnace 1. This pressure increase is conveyed through tube 10 to diaphragm 13, causing said diaphragm 13 to actuate the mercury switches 26 and 27 when the pressure passes the pre-set level. The mercury switches thereupon close the circuit through the wires 11 and 12, causing the motor M to drive endless belt 15 in a direction to deposit the weighted articles A in the opening 18 of chute 2.

Simultaneously, the circuit is closed through wires 19 and 20, causing the bell or buzzer 21 to ring, the signal light 22 to ignite, and/or the locking means 23 to lock the feeding doors 3. The bell 21 or signal light 22 may be located at a convenient place in the building at which it can notify the building attendant immediately upon congestion of the flue 2. In place of the locking means 23, similar warning buzzers, bells, or lights may be placed at each floor near the feeding door 3 to warn the occupants of the building not to open the feeding door while the flue is blocked.

The circuit is also closed through wires 24 and 25, causing relay L to break the circuit through leads 28 and 29, shutting off the auxiliary equipment, if any.

When the weighted articles A are inserted in the flue opening 18 by the dumping device 14, these weighted articles will drop down the flue 2 and strike the refuse wedged in said flue 2. The momentum and weight of the articles A force the refuse free of its wedged position, the dumping

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device 14 continuing to operate until the refuse is freed and falls into the furnace 1. When the flue 2 becomes unblocked, it again begins to draw, and the draft within the incinerator is again built up to normal. This pressure change is transmitted to the diaphragm 13, so that said diaphragm 13 may again take its normal pre-set condition, opening the mercury switches 26 and 27 terminating the operation of the dumping device 14 and of the warning and locking devices. The auxiliary equipment is also re-actuated.

As a practical example, the normal average draft in a specific incinerator installation may be .20 inch of water, and the draft variation range under normal conditions may be between .50 inch and .06 inch. The mercury switches 26 and 27 may therefore be set to close simultaneously when the draft in the incinerator falls below .02 inch, it being a safe assumption that at this point the draft decrease is not caused by natural phenomena, but rather by a clogged condition of the flue. The warning signals and the unblocking mechanism are therefore actuated when the draft drops below the minimum limit of .02 inch, and the auxiliary equipment of the incinerator is de-actuated. When the clogged condition of the flue has been corrected, the draft will again increase. One of the switches such as the switch 27 is, however, pre-set to open only when the draft increases toward its average reading, for example to .08 inch. At this point, the switch 27 will open, the warning signals and unblocking mechanism will be de-actuated, and the auxiliary equipment will again be actuated.

In some installations because of unnatural or unusual draft conditions, the draft in the furnace or flue may momentarily drop below the pre-set minimum level previously described even though a clogged condition of the flue does not exist. In such an instance, it is desirable to prevent the unblocking mechanism and warning signals from being actuated, and to prevent the auxiliary equipment from being de-actuated. In this type of installation, therefore, a time delay mechanism T may be provided to prevent the relay P from actuating any of the control units unless the decrease of draft in the incinerator has continued for an appreciable length of time. Such a time delay mechanism may be of any of the conventional types, and may be an electrical control incorporated in the circuit, such as a bi-metal switch 32 or the like in the line 11 which is proximate to a heater coil 33 connected across lines 11 and 12. When the bi-metal switch 32 is heated by the coil 33, it closes the circuit through line 11.

In addition, draft conditions in some installations may be such that the draft decreases below the pre-set minimum level in the absence of a blocked condition, while the incinerator is not fired. In such installations it may be necessary to include a suitable actuating unit which disconnects the pressure operated relay from the control units until the incinerator is fired.

The electrical circuit shown and described is presented by way of example only, it being obvious that equivalent types of operating systems may be substituted therefore. For instance, the pressure sensitive unit 13 may transmit its movement through a hydraulic or pneumatic circuit which may be adapted to produce the desired results, namely to indicate that the flue is clogged, to shut off any auxiliary equipment, and to free the flue of the clogged matter. The operation

of hydraulic and pneumatic systems are well-known, and need not be described in detail.

While preferred embodiments of the invention have been shown and described herein, it is obvious that numerous additions, alterations, and omissions may be made in the invention without departing from the spirit and scope thereof.

I claim:

1. In combination with an incinerator of the character described comprising a furnace and a single upright flue communicating with the top of said furnace, said flue serving as both a gas discharge flue and feeding chute, an unblocking system adapted to dislocate automatically refuse lodged in said flue, said system comprising normally dormant dumping means communicating with said flue adjacent the upper end thereof and adapted to introduce weighted material in said flue upon actuation, a pressure sensitive element communicating with the interior of said furnace and being responsive to increases of pressure in said incinerator due to a clogged condition of the flue, and means responsive to said element for actuating said dumping means.

2. In combination with an incinerator of the character described comprising a furnace and a single upright flue communicating with the top of said furnace, said flue serving as both a gas discharge flue and feeding chute, an unblocking system adapted to dislocate automatically refuse lodged in said flue, said system comprising normally dormant dumping means communicating with said flue adjacent the upper end thereof and adapted to introduce weighted material in said flue upon actuation so that the weighted material falls through said flue, a pressure sensitive element communicating with an interior portion of said incinerator other than said flue and being responsive to changes of draft within said incinerator, and means responsive to said element operatively connecting said element and said dumping means for actuation of said dumping means, said connecting means being pre-set to actuate said dumping means when the draft within incinerator is reduced below a first selected limit due to a clogged condition of said flue, and to de-actuate said dumping means when the draft within said incinerator increases above a second selected limit.

3. In combination with an incinerator of the character described comprising a furnace and a single upright flue communicating with the top of said furnace, said flue serving as both a gas discharge flue and feeding chute and having at least one feeding door, an unblocking and safety system adapted to dislocate automatically refuse lodged in said flue, and to prevent operation and use of the incinerator during a clogged condition thereof, said system comprising normally dormant dumping means communicating with said flue adjacent the upper end thereof and adapted to introduce weighted material in said flue upon actuation so that the weighted material falls through said flue, warning signal means located exteriorly of said incinerator, a pressure sensitive element communicating with an interior portion of said incinerator other than said flue and being responsive to changes of draft within said incinerator, and means responsive to said element operatively connecting said element to said dumping means and warning signal means for actuation thereof, said connecting means being pre-set to actuate said dumping means and warning signal means when the draft within said incinerator is reduced below a first selected limit

due to a clogged condition of said flue, and to de-actuate said dumping and warning signal means when the draft within the incinerator increases above a second selected limit.

4. An unblocking and safety system according to claim 3 in which each feeding door of the incinerator is provided with a lock, and the pressure sensitive means is operatively associated with said lock to lock said lock automatically when the draft in said incinerator is reduced below said first selected limit, and unlock said lock when the draft increases above said second selected limit.

5. In combination with an incinerator having a furnace and a single upright flue communicating with the top of said furnace and serving as both a gas discharge flue and feeding chute, a control system comprising a pressure sensitive unit communicating with the interior of said furnace and being responsive to pressure changes within said furnace, normally dormant dumping means communicating with said flue and being adapted to introduce weighted material in said flue adjacent the upper end thereof upon actuation, and to release said material within said flue, to clear said flue of clogged matter therein, warning signal means, and safety means to prevent further operation of the incinerator, means responsive to said pressure sensitive unit operatively connecting said unit to said dumping, warning, and safety means for simultaneous actuation thereof, said connecting means being pre-set to actuate said dumping, signal, and safety means when the pressure within said incinerator increases above a first selected limit due to a clogged condition of said flue, and to de-actuate said dumping, signal, and safety means when the pressure within the incinerator decreases below a second selected limit.

6. A control system according to claim 5 in which the incinerator has auxiliary firing equipment and the incinerator flue has at least one feeding door, said safety means including a lock on said feeding door which is normally unlocked during operation of the incinerator and means to shut off said auxiliary firing equipment and lock said lock when the pressure within said incinerator increases above said first selected limit.

7. In combination with an incinerator having a furnace and a single upright flue which serves both as a gas discharge flue and feeding chute communicating with the top of said furnace, an unblocking system adapted to automatically dislocate refuse lodged in said flue, said system comprising normally dormant dumping means communicating with the upper interior of said flue and adapted to introduce weighted material therein, an electric circuit for actuation thereof, switch means interposed in said circuit and being normally open to interrupt the flow of current to said dumping means, and pressure sensitive means communicating with the interior of said furnace and being responsive to changes of draft within said incinerator, said pressure sensitive means being operatively associated with said switch means to close said switch means when the draft within said incinerator decreases below a selected limit due to a clogged condition of the flue.

8. An unblocking system according to claim 7 in which said electrical circuit also includes warning signal means located exteriorly of said incinerator which are operated when the switch means are closed.

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9. In combination with an incinerator having a furnace and a single upright flue which serves as both a gas discharge flue and feeding chute and communicating with the top of said furnace, an unblocking system adapted to automatically dislocate refuse lodged in said flue, said system comprising normally dormant electrically operable dumping means communicating with the interior of said flue adjacent the upper end thereof and adapted to discharge weighted material down said flue, an electrical circuit connecting said dumping means to a source of electric current for actuation thereof, switch means interposed in said circuit and being normally open to interrupt the flow of current to said dumping means, and a pressure sensitive diaphragm which communicates with the interior of said furnace and is responsive to changes of draft within said incinerator, said diaphragm being coupled to said switch means for closing said switch means when the draft within said incinerator decreases below a first selected limit due to a clogged condition of the flue, and for opening said switch means when the draft within said incinerator increases above a second selected limit.

10. In combination with an incinerator having a furnace, a single flue which serves as both a gas discharge flue and feeding chute, and an auxiliary

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fuel burner, said flue and auxiliary burner being operatively associated with said furnace, a control system comprising a pressure sensitive unit communicating with the interior of said furnace and being responsive to pressure changes within said furnace, and control means regulating the operation of said auxiliary fuel burner, said pressure sensitive unit being operatively connected to said control means whereby said auxiliary burner is de-actuated when the draft within the furnace is decreased to a pre-set level, below the normal draft range of the incinerator due to a clogged condition of said flue.

11. A control system according to claim 10 in which the pressure sensitive unit is adapted to actuate said fuel burner when the draft within the incinerator increases to a pre-set level within the normal draft range of the incinerator.

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