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AIR CONTROL APPARATUS FOR BOILER

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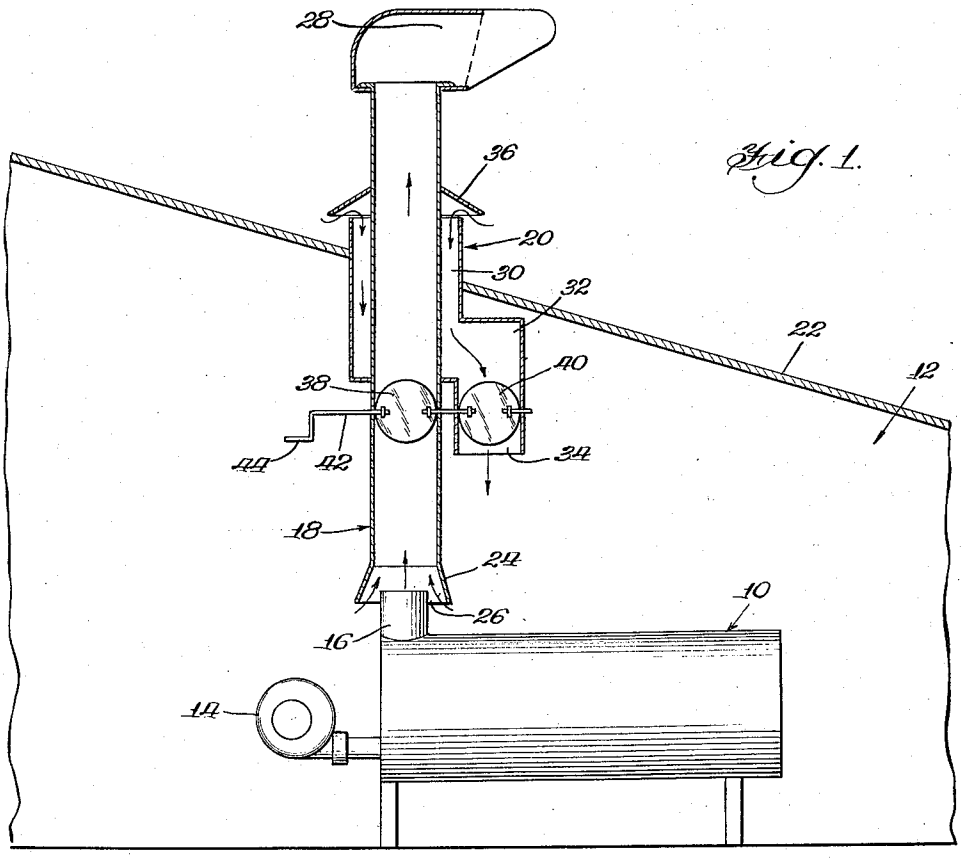


Fig. 1.

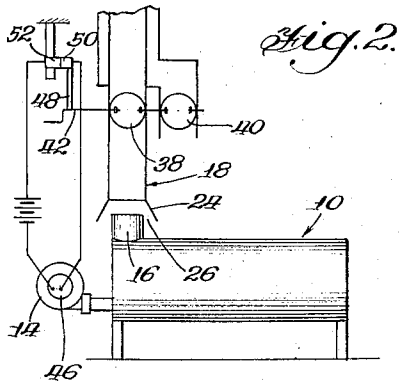


Fig. 2.

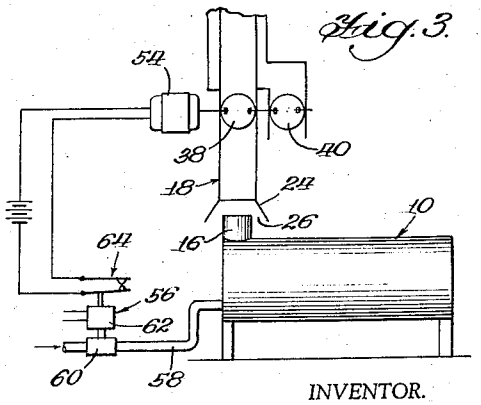


Fig. 3.

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AIR CONTROL APPARATUS FOR BOILER

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The present invention relates to air control apparatus for a boiler in a closed room or chamber.

A boiler, and particularly a blast boiler, requires extremely great quantities of air for the combustion of the fuel utilized therein. The room in which the boiler is located is ordinarily closed, and it is difficult for that reason to obtain the necessary air for combustion purposes in the room. Various methods have been attempted for supplying and controlling the air necessary for combustion, such as opening a window or providing other openings or vents in the boiler room. However, notwithstanding the fact that such openings may provide the necessary air in the boiler room, it is important that such openings be closed when the boiler is not operating so as to prevent unnecessary cold air from entering the boiler room at those times and cooling it an objectionable extent.

In the case of a blast boiler, a blower or other air forcing means is ordinarily provided for forcing air for combustion to the boiler. If the necessary air is not provided for such type of boiler, serious difficulty is encountered in proper operation of it, and at times the burner in the boiler may actually be extinguished from lack of air.

The present invention has to do particularly with novel means for compensating for air consumed by a boiler in a closed boiler room. It has to do more particularly with means for automatically providing for fresh air to compensate for the air consumed in the combustion in the boiler. More specifically, it includes control means for permitting ingress of air to the boiler room when the boiler is in operation and the air in the room is being consumed, and for preventing such ingress of air when the boiler is not in operation.

As has been habitual in previous boiler installations, windows or other manually controlled vents have been provided for enabling sufficient fresh air for proper operation of the boiler, but when the boiler is not in operation, it becomes necessary to close the windows, but this requires additional attention on the part of the operator.

An object therefore of the present invention is to provide a fresh air inlet passage to a boiler room, together with a novel arrangement of damper means for assuring that the inlet passage is open when the exhaust flue from the boiler is open and conversely is closed at all times when the exhaust flue is closed and the boiler is not in operation, to the end that unnecessary air will not be permitted to enter the boiler room, and objectionably lower the temperature therein as when the outside air is cold.

Another object is to provide an air control arrangement in conjunction with a boiler in a closed room in which an exhaust flue is provided for carrying the exhaust gases from the boiler to the exterior, and means is provided for enabling air from the room to enter the exhaust flue in response to passage of exhaust gases therethrough, and in which an air inlet passage to the room is provided,

which includes damper means in the exhaust flue and air inlet passage conjointly controlled for opening and closing movements in unison whereby to provide for replenishment of fresh air in the room to compensate for the air therefrom passing into the exhaust flue as indicated, and cold air will not be permitted to enter into the room through the inlet passage other than that desired for replenishment of the air exhausted therefrom.

A further object is to provide, in an alternate form of the invention, an exhaust flue and air intake passage in conjunction with a boiler in a generally closed room in which damper means are provided in the exhaust flue and air inlet passage interconnected for conjoint opening and closing movements, in which the damper means is utilized for controlling the boiler in an arrangement in which the damper means must be open in order that the boiler can be operated.

A still further object is to provide, in a second alternate form, an exhaust flue and fresh air intake passage in conjunction with a boiler in a generally closed room in which damper means are provided in the exhaust flue and air inlet passage interconnected for conjoint opening and closing movements in which control means for the boiler is utilized for controlling the damper means in an arrangement in which the damper means remains closed unless the boiler is in operation.

Other objects and advantages of the invention will appear from the following detail description taken in conjunction with the accompanying drawings in which:

Figure 1 is a somewhat diagrammatic view representing a room with a boiler therein, and exhaust flue and air intake passage in section;

Fig. 2 is a partial diagrammatic view similar to the essential elements of Fig. 1, but showing a modified form of control means interconnecting the damper means and operating means for the boiler; and

Fig. 3 is also a diagrammatic view, similar to Fig. 2, but showing a second modified form of control means interconnecting the damper means and the boiler.

Referring in detail to the drawings, and particularly Fig. 1 thereof, this figure is a generally diagrammatic view of a room with a boiler therein and an exhaust flue and air intake passage of the general character noted above. It will be appreciated that the various elements making up the structure and combination described herein may be of the desired detail arrangment, the particular elements of construction not entering into the essence of the present invention.

In Fig. 1, a boiler 10 of standard construction and nature is provided in a boiler room 12. Details of construction of the boiler need not be entered into. The boiler 10 represented here is a blast-type boiler and includes a blower 14 of suitable kind providing air or fuel or both to the combustion chamber of the boiler. Such blast-type boiler because of size and capacity utilizes extremely great quantities of air, and consequently the problem of providing for the necessary air in the boiler room while still preventing entrance of cold air to the boiler room when it is not desired, is quite a problem. The boiler 10 is provided with an outlet stack 16 for the products of combustion, the stack 16 being in open register with a draft flue 18. The draft flue 18 is encompassed in part by an inlet flue 20, the two flues 18 and 20 extending through the roof 22 of the boiler room 12 which otherwise is sealed.

The lower end of the outlet flue 18 at 24 is preferably of greater dimensions than the outlet 16 of the boiler and spaced therefrom, providing an annular opening 26 enabling air from the boiler room 12 outside the boiler to enter into the flue or stack and be carried out therethrough to the exterior. The flue 18 may be of conventional nature, and it extends above the roof 22 to a convenient height where a wind cap 28 is provided.

This wind cap is of well known construction and is mounted on the upper end of the flue in swiveling arrangement to enable it to swing or swivel with the wind, having an opening on the leeward side by means of which the wind assists the natural draft of the flue due to its height. The details of such wind cap are well known to those skilled in the art and further description thereof need not be entered into herein. The opening **26** in the lower end of the flue or stack enables air from the boiler room **12** to pass directly through the flue in bypassing relation to the boiler, to control the amount of air passing through the boiler. The capacity of the flue due to natural conditions may be greater than that desired for proper combustion in the boiler and thus the draft of air through the boiler may be controlled by cotrolling the size of the opening **16**. If desired, barometric damper means may be provided at the opening **26** for stabilizing draft through the boiler. Such barometric damper means are well known and need not be described in detail.

The air inlet flue **20** provides a passage for fresh air from the exterior to the boiler room **12** to replenish air carried out through the flue or stack **18**. This inlet flue includes a tubular element or conduit **30** leading directly from the exterior and surrounding the exhaust flue **18**. This conduit **30** extends through the roof **22**, and at a position inwardly of the roof it has an offset portion **32** terminating inwardly in another tubular portion **34** disposed in offset relation to and parallel to the flue **18**. The inner end of the portion **34** opens directly to the interior of the boiler room. At the outer end of the flue **20**, and particularly at the upper end of the portion **30** thereof, is a shield **36** suitably mounted on the flue **18** and disposed over the outer end of the inlet element to shield the latter from rain and snow. The inlet flue **20**, by virtue of its surrounding relation to the exhaust flue, serves as a heat insulating means between the exhaust flue and the roof.

Damper means **38** and **40** of conventional kind are provided in the outlet flue **18** and inlet passage **20** respectively for controlling the flow of gases therethrough. These damper means are arranged for conjoint movement and as a convenient arrangement for accomplishing this end they may be arranged in alignment transversely and mounted on a common axis means **42** which may be in the form of a rod extending through the two conduits, namely the flue **18** and inlet flue **20**. The damper means may be in the form of circular plates suitably mounted on the rod, and upon rotation of the latter the plates are rotated between horizontal and vertical closed and open positions respectively. The outer end of the rod **42** is provided with an actuating element **44** wihich for convenience may be a crank or equivalent element effective for rotating the rod and hence the damper means.

Assuming an operating condition of the boiler, the boiler is turned on and the products of combustion or flue gases pass out through the stack **16** into the exhaust flue **18**. Operation of the boiler presupposes the damper means **38** being open in order for the flue gases to escape through the flue or stack, but if this damper means should be closed the exhaust gases from the boiler would quickly serve as a warning that the damper means was not open. The operator thereupon opens the damper means if he had not opened it theretofore, and opening of this damper means also opens the damper means **40** in the air intake flue **20**. Hence the damper means **40** in the air intake passage is open at all times that the damper means **38** is open, to provide the great quantities of air required. The air drawn out through the flue or stack **18** is replenished by that admitted through the air intake flue **20**.

Upon cessation of the normal and intended operation of the boiler **10**, the operator as is usual, closes the draft to the exhaust flue or stack, this same operation closing the damper means **40** in the air intake flue **20**. Thus, the operator is assured that when the boiler is not in operation, the air inlet means is closed so that cold air will not uncontrollably enter into the room, as would be the case if, for example, the window should have been open and the operator forgot to close it after the boiler ceases operation. In this connection, it will be noted that there is substantial heat transfer between the outflowing exhaust gases in the flue and the inflowing cold air in the air intake, which adds to heating efficiency. However, he is assured that the boiler room will be provided with all of the air necessary to compensate for the exhaustion of air therefrom through the exhaust flue.

The arrangement herein disclosed including the opening **26** at the lower end of the exhaust flue or stack enables the passage of any necessary quantities of air from the boiler room without such air passing through the boiler, whereby the draft of the boiler can be easily and readily controlled and is not affected by the quantities of air exhausted through the flue or stack.

It is contemplated, however, that in at least certain instances, as, for example, when the exhaust flue is not high so that the natural draft provided is not so great, the outlet **16** of the boiler may be connected directly to the flue **18** without an opening such as **26** therebetween, the consideration being that the natural draft of the stack is not so great as to create excessive draft through the boiler.

Conceivably, there may be instances in which the damper means in the exhaust flue should be open before the boiler is put in operation. In such case control means may be interconnected between the boiler and the damper means to assure that the damper means will be open before the boiler can be operated. In this connection, attention is directed to Fig. 2 which includes the arrangement of Fig. 1 with certain additional control elements incorporated therein. The arrangement lends itself to interconnected control of various kinds, but I find that electrical control is one of the most convenient means of controlling the boiler in the manner intended. In Fig. 2 the blower **14** is shown provided with an electric motor **46** for driving it. The rod **42** on which the damper means **38** and **40** are mounted is provided with an arm **48** having a switch contact element **50** mounted on its swinging end engageable with another switch contact element **52** suitably mounted on a fixed element, these switch contact elements being connected in circuit with the electric motor **46** in such a way that when the switch elements **50** and **52** are in contact the circuit is closed to the motor, but when they are out of contact the circuit is opened and the motor is disabled. Thus, when the damper means are open, the boiler can be operated, and conversely so long as the damper means are closed, the boiler cannot be operated.

A different kind of situation may exist in which it would be satisfactory for the damper means to remain closed until they are opened by the operation of the boiler itself. A situation may exist in which it is not critical that the exhaust flue be opened before the initiation of the operation of the boiler, and this situation may be availed of for automatically controlling the damper means. Attention is directed to Fig. 3 which shows a construction similar to that of Fig. 1 but with means for automatically controlling the damper means in response to operation of the boiler. In this construction the damper means **38** and **40** are operated by an electric motor **54** of suitable type and connected to the rod **42** for rotating the latter. The motor **54** may be controlled by any of various control means for the boiler and one such means may take the form of a relay **56** incorporated in means for controlling the flow of fuel to the boiler. A fuel conduit **58** is arranged for supplying fuel to the boiler and it includes a control valve **60** which is operated by a solenoid **62** forming a part of the relay **56** and the armature of which not only directly actuates the valve **60**, but also switch means

64 which also constitutes a part of the relay 56 and which is placed in circuit with the electric motor 54. The damper means 38 and 40 may be normally retained in closed position by suitable spring means (not shown) and upon intiation of the operation of the boiler, valve 60 is opened and in the same operation the switch means 64 is closed for energizing the motor 54. The motor is arranged for rotating the damper means a quarter turn, and after each such operation suitable limit switches (not shown) of known kind may be provided for shutting off the motor. The damper means may be held open so long as the circuit to the motor is closed, but upon opening of the circuit, and de-energization of the solenoid 62 which in turn takes place upon cessation of operation of the boiler, the damper means 38 and 40 are automatically moved to closed position. In the utilization of the construction and arrangement illustrated in Fig. 3, the operator need not give special attention to closing and opening the damper means 38 and 40, but they are actuated automatically in response to operation of the boiler.

While I have disclosed herein certain preferred embodiments of the invention, it is to be understood that changes may be made therein within the scope of the appended claims.

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

1. In a control system for venting products of combustion from and for regulating the supply of air to the combustion chamber of a boiler or similar heating device disposed within a sealed walled enclosure and which device draws its combustion air from a low position in the enclosure, said heating device having an exhaust stack leading from the combustion chamber and terminating within the enclosure, an outlet conduit providing a draft flue in open register with said stack and defining therewith an annular draft opening for the draft flue, an air intake conduit having a portion thereof encircling the outlet conduit in heat transfer relationship and defining therewith an annular air inlet flue, said outlet conduit and the surrounding portion of the air intake conduit passing through one of the enclosure walls in sealing relation thereto at a high region of the enclosure with said surrounding portion of the intake conduit serving to thermally insulate the outlet conduit from said enclosure wall, said air intake conduit having a second portion thereof offset laterally from and substantially parallel to said outlet conduit, said second offset portion of the air intake conduit having open communication with the interior of the enclosure at a high region of the latter, a damper plate disposed within the outlet conduit, a damper plate disposed within said offset portion of the air intake conduit, and means operatively connecting said damper plates for movement in unison between respective closed and respective open positions.

2. In a control system for venting products of combustion from and regulating the supply of air to the combustion chamber of a boiler or similar heating device disposed within a sealed wall enclosure, a blower operatively connected to said combustion chamber for supplying combustion air thereto from a low position in the enclosure, an electric motor for said blower, a circuit for said motor, an exhaust stack for said heating device leading from the combustion chamber and terminating within the enclosure, an outlet conduit providing a draft flue in open register with said stack and defining therewith an annular draft opening for the draft flue, an air intake conduit having a portion thereof encircling the outlet conduit in heat transfer relationship and defining therewith an annular air inlet flue, said outlet conduit and the surrounding portion of the inlet conduit passing through one of the enclosure walls

in sealing relation thereto at a high region of the enclosure with said surrounding portion of the intake conduit serving to thermally insulate the outlet conduit from said enclosure wall, said air intake conduit having a second portion thereof offset laterally from and substantially parallel to said outlet conduit, said second portion of the air intake conduit having open communication with the interior of the enclosure at a high region of the latter, a damper plate disposed within the outlet conduit, a damper plate disposed within said offset portion of the air intake conduit, means operatively connecting said damper plates for movement in unison between respective closed and respective open positions, a switch in said motor circuit including a fixed contact and a cooperating movable contact operatively connected to said damper plates and movable bodily therewith in unison, said movable contact being positioned relative to said damper plates for engagement with said other contact when said damper plates are in their open position and for disengagement therefrom when said damper plates move away from their open position toward their closed position.

3. In a control system for venting products of combustion from and for regulating the supply of air to the combustion chamber of a boiler or similar heating device disposed within a sealed wall enclosure and which draws its combustion air from a low position in the enclosure, a fuel line leading to said combustion chamber, a normally closed solenoid-actuated valve disposed in said fuel line, an exhaust stack leading from the combustion chamber and terminating within the enclosure, an outlet conduit providing a draft flue in open register with said stack and defining therewith an annular draft opening for the draft flue, an air intake conduit having a portion thereof encircling the outlet conduit in heat transfer relationship and defining therewith an annular air inlet flue, said outlet conduit and the surrounding portion of the intake conduit passing through one of the enclosure walls in sealing relation thereto at a high region of the enclosure with said surrounding portion of the intake conduit serving to thermally insulate the outlet conduit from said enclosure wall, said air intake conduit having a second portion thereof offset laterally from and substantially parallel to said outlet conduit, said second portion of the air intake conduit having open communication with the interior of the enclosure at a high region of the latter, a normally closed damper plate disposed within said offset portion of the air intake conduit, a normally closed damper plate disposed within the outlet conduit, means operatively connecting said damper plates for movement in unison, an electric motor operatively connected to said damper plates and operable upon energization thereof to move said damper plates to open positions, a circuit for said motor, a switch including a pair of normally open contacts in said circuit, and a solenoid operatively associated with both said valve and contacts and operable upon energization thereof to open said valve and close said contacts whereby fuel is admitted to said combustion chamber while at the same time said motor is energized.

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