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AUTOMATIC OPERATING MEANS
FOR BOILER WALL BLOWERS

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2 Sheets-Sheet 1

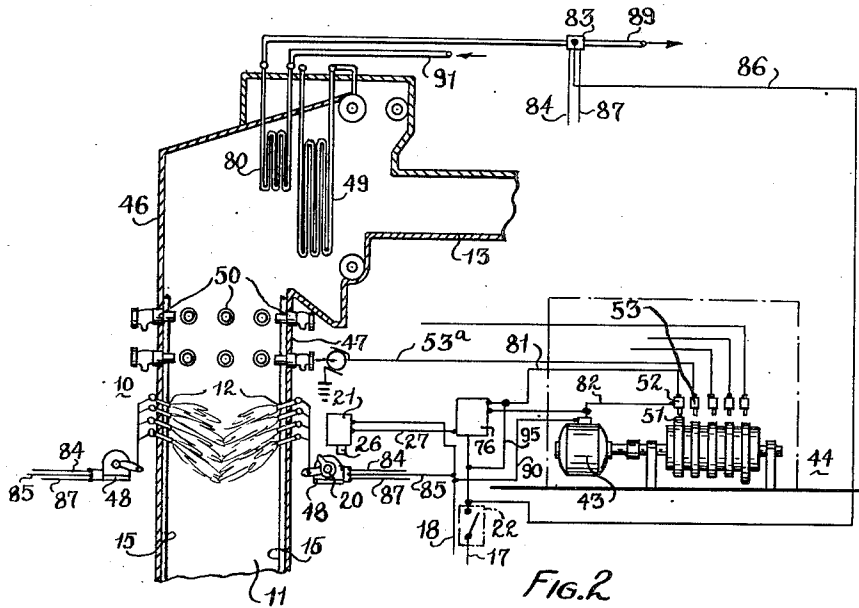


Fig. 2

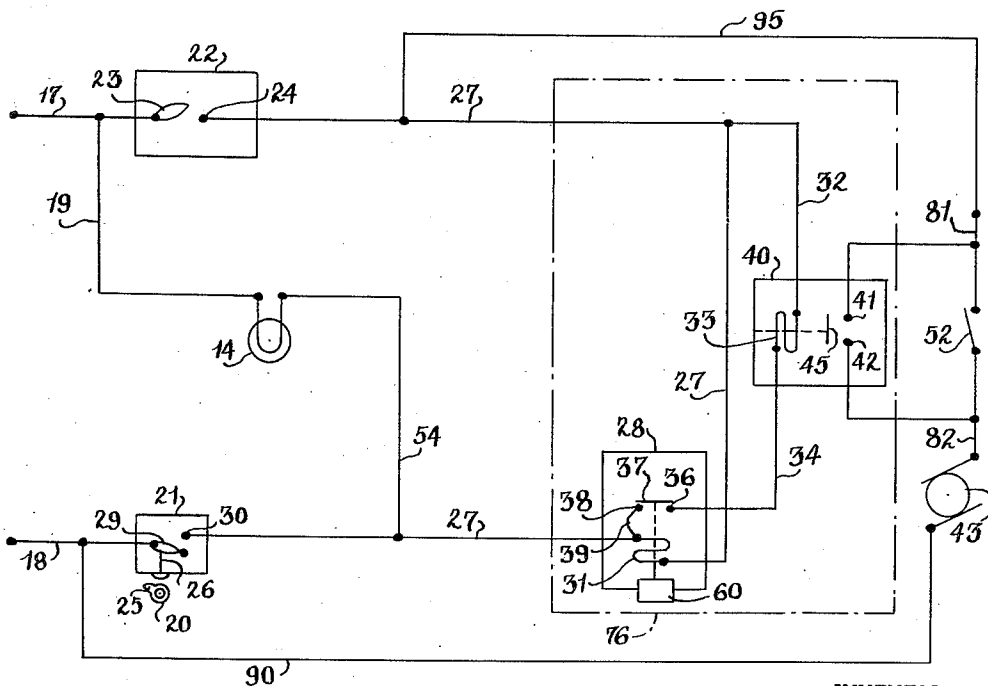


Fig. 1

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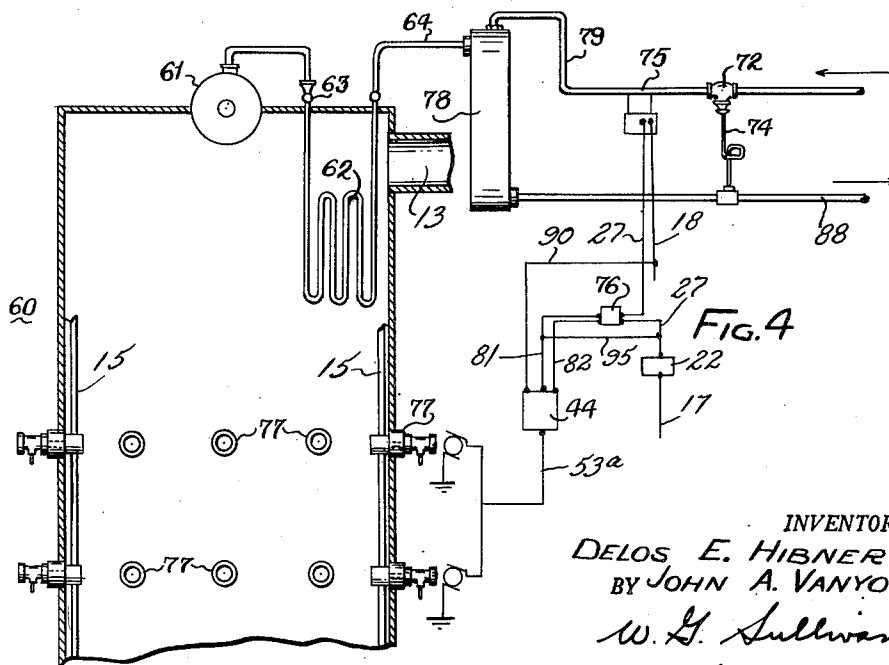
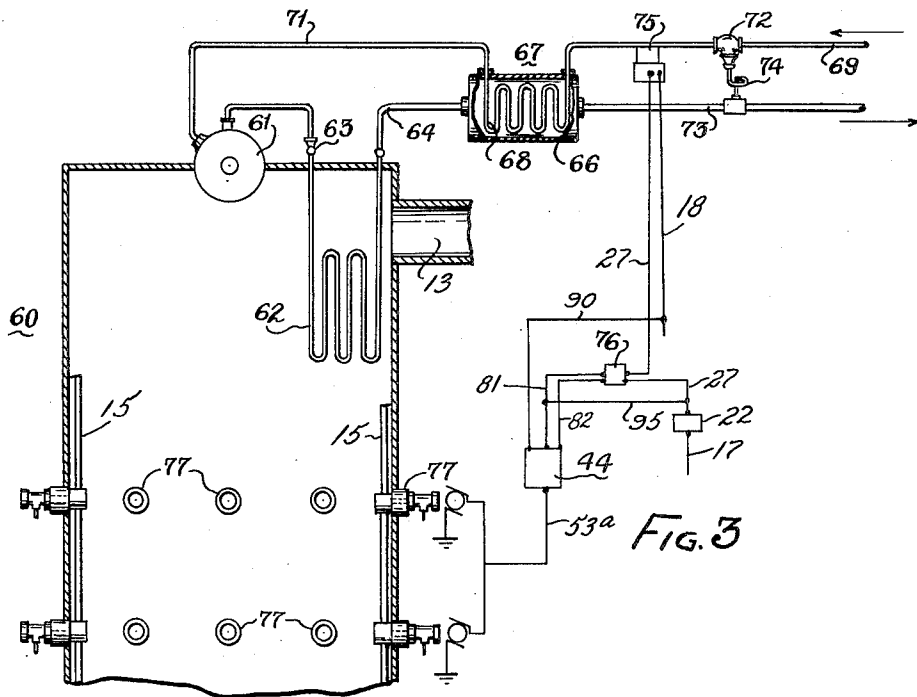
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1

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AUTOMATIC OPERATING MEANS FOR BOILER WALL BLOWERS

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5 Claims. (Cl. 122—392)

This invention relates to large capacity, high pressure type boilers provided with soot blowers, and more particularly to means for automatically operating the soot wall blowers when the steam temperature becomes unduly high due to deposits of ash in the boiler furnace.

In large capacity, high pressure type boilers, controlling the steam temperature at the boiler outlet has become an important phase of plant operation. It will be readily appreciated that if a fixed area of heating surface to superheat and/or reheat the steam is provided and a variable quantity of hot gas is passed around or in contact with the heating surface the temperature of the steam would tend to vary with the gas flow. At high load or demand the steam may have one temperature and at low loads another temperature.

Boilers of the class contemplated herein often have reheat sections as well as superheat sections. These sections are very similar in construction and purpose, the superheater heating saturated steam from the boiler drum, and the reheater heating steam that comes back from the process. For example, consider a steam turbine taking steam at 1500 p. s. i. and 1000° at the throttle. As the steam passes through the turbine its heat is converted to work and its temperature falls. If the steam can be withdrawn at some reduced pressure point, such as 400 p. s. i., and returned to the boiler, it can be reheated to 1000° and returned to the turbine to continue its work. Control of steam temperature in the reheat section is similar to the control for the superheat section and although the invention is illustrated and described in connection with a boiler having a superheat section it is not limited thereto and is equally adaptable to a boiler having a superheat section and a reheat section.

Boilers are constructed in various ways in an effort to overcome such steam temperature variation. One well known type of boiler employs tiltable burners, the burners being adapted to use pulverized coal, oil, or gas are pivoted whereby they can be tilted to direct the flame toward the top or bottom of the furnace and in this manner control the steam temperature. This control is accomplished by using a temperature sensing element associated with the superheat or reheater outlet which operates a motor to tilt the burners.

When the burners are tilted downwardly the maximum amount, and the superheated or reheated steam temperature is still excessive, means are provided for directing a spray of cooling water into the steam to further reduce the temperature. However, it is undesirable to introduce cooling water into the superheated or reheated steam outlet and the control should be effected by tilting the burners.

Other type boilers use a heat exchanger, similar to a condenser, to control steam temperature variation. The steam from the boiler superheater or reheater outlet flows over a bank of tubes and water flowing through the tubes cool the steam. Temperature control is effected by regulating the quantity of water flowing through the tubes.

2

The present invention is not directly concerned with steam temperature control means as outlined above but with means for automatically actuating the furnace wall blowers when conventional control means are ineffective to hold steam temperature variations within desired limits. Cleaning of the furnace permits conventional steam temperature control means to remain effective when a predetermined steam temperature variation is reached. For example, in burning pulverized fuel, fine particles of ash, which may be either dry or molten (slag), are deposited on the furnace walls.

The furnace walls usually comprise waterwall tubes forming part of the boiler heating surface. The deposits of soot and slag on the furnace walls are harmful in two ways. First, it prevents the water walls from absorbing heat which is their primary function and the heat not absorbed by the walls is available to increase the steam temperature in the superheater, second, slag on the water walls produces a reflecting surface which reflects the radiant heat upward into the superheater and reheater sections thereby increasing the steam temperature.

In a tilting burner type boiler, this increase in steam temperature, detected by the steam temperature control, causes the burners to be tilted downwardly to restore the temperature. In time, as the boiler becomes dirtier, the burners are tilted to the lowermost limit and then cooling water must be sprayed into the desuperheater or reheater outlet to prevent a further temperature rise. As previously mentioned, spraying of cooling water under these conditions is undesirable since, in effect, the heat and steam volume cycles are short circuited. If the blowers can be operated to blow the ash and slag from the boiler walls the clean surface can then absorb heat and not reflect it so there will be no excess heat flowing through the superheater and reheater sections, the steam temperature will fall and the cooling water spray can be shut off. Accordingly, the superheat or reheat temperature control will raise the burner to a more normal position.

According to the invention, conventional steam temperature control means are used to measure the degree or amount of slag and/or fly ash deposits on the furnace walls of a boiler. In the case of tilting burner type boilers the angle of burner tilt is a measure. When the burners tilt to a pre-determined angle or a minimum desired flame position an electric switch is actuated. This switch completes a circuit causing the motor of a sequential controller or timer to operate whereby wall blowers will be actuated in a pre-determined order. Due to the volume of blowing or cleaning medium required, it is preferred that the blowers operate one at a time or sequentially rather than concurrently. Thus, the furnace wall sections will have the deposit of slag and/or fly ash substantially reduced with the result that conventional steam temperature control arrangements can function for an extended period without the introduction of undesirable cooling spray water to a superheater or reheater section.

In the case of heat exchanger type control a water flow meter is used which indicates the amount or rate of flow of water passing to the heat exchanger and when the flow reaches or exceeds a predetermined value the switch controlling the circuit for the motor operating the sequential controller is closed thereby operating the soot blowers in a pre-determined sequence.

It is a primary object of the invention to provide on a large capacity, high pressure steam boiler equipped with wall blowers and having conventional steam temperature control means, means for utilizing said control means for measuring the soot and slag deposited on the boiler furnace walls, and operating said wall blowers when the deposit reaches an undesirable amount as indicated by the control means.

3

Another object of the invention is to provide means in a boiler of the above general type having burners tiltable in response to steam temperature variations, for automatically operating the wall blowers when the burners have been tilted downwardly to a pre-determined degree.

Another object of the invention is to provide means in a boiler of the above general type having a heat exchanger whereby cooling water is flowed into the heat exchanger in response to steam temperature variations, for automatically operating the soot blowers when the rate of cooling water flow to the exchanger reaches a pre-determined maximum value.

Other objects of the invention and the invention itself will be increasingly apparent from a consideration of the following description and drawings wherein:

Figure 1 is a diagrammatic view of a conventional electrical hook-up for tilting burner type steam temperature control apparatus coupled with a hook-up embodying the invention.

Figure 2 is a diagrammatic view of a tilting burner type boiler embodying the invention.

Figure 3 is a diagrammatic view of a heat exchanger type boiler embodying the invention, and

Figure 4 is a diagrammatic view of a further embodiment of the invention.

Referring now to the drawings, and particularly Figures 1 and 2, we have illustrated in Figure 2 a conventional boiler in vertical transverse section and largely diagrammatically, the boiler being generally indicated at 10 and comprising a furnace compartment or furnace 11 provided with a plurality of tilting burners 12 adapted to heat the furnace whereby hot gases in passing to an outlet 13 will effect heat exchange with banks of steam generating tubes (not shown). The furnace walls are provided with water wall tubes 15 which are directly exposed to radiant heat of the furnace.

The burners 12 are of the jet flame type and are each mechanically connected with one or more reversible electric motors such as 48 whereby the burners may be concurrently tilted upwardly or downwardly in response to variation in steam temperature at the boiler outlet or more specifically at the superheater or reheater outlet. We preferably employ tilting burners at all four corners of the furnace and the burners may have a maximum tilt such as from 30° upwardly from a horizontal position to 30° downwardly from such position. It will be apparent that if the steam temperature at the boiler outlet is excessive that tilting of the burners downwardly will reduce the radiant heat effective for heat exchange and resultantly reduce the outlet temperature.

A superheater or superheater section is generally indicated at 49 and the hot or combustion gases in passing from the furnace 11 to outlet 13 effect heat exchange with the superheater section and in the event a reheater section is provided heat exchange will also be effected with this section. A temperature sensing and control element or device is associated with the superheater or reheater outlet and is adapted to operate reversible motor 48 to cause tilting movement of burners 12. Temperature control elements for this purpose are well known and any suitable type may be used. For example, one well known type comprises a bulb inserted in the steam outlet communicating through a tube with a chamber having a flexible diaphragm whereby expansion and contraction of a gas will move the diaphragm in correspondence with temperature variation. Through well known electrical means motor 48 is operated in reverse directions in accordance with reverse movements of the diaphragm.

In Figure 2 we have illustrated a reheater section 80 in addition to the superheater section 49 and in this instance the automatic operation of the soot blowers is controlled by the steam temperature at the reheater section outlet. The reheater section inlet 91 is connected to a low pressure point on a steam turbine or the like (not shown) wherein steam in passing through the coils of the reheater

4

section 80 will have its temperature raised and will be returned to the turbine through outlet conduit 89. A suitable temperature responsive and control element 83 is associated with outlet conduit 89 whereby mechanical movement will be effected in accordance with steam temperature variation in the conduit. Electrical leads indicated at 84, 86 and 87 extend from element 83 whereby when a pre-determined high temperature is reached a circuit will be completed through leads 84 and 86 causing motor 48 to rotate in one direction to tilt burners 12 downwardly and when a pre-determined low temperature is reached a circuit will be completed through leads 87 and 86 causing motor 48 to rotate in a reverse direction to tilt burners 12 upwardly. It will be understood that the same result could be achieved by having the element 83 associated with the outlet conduit of the superheater section 49. It will be noted that lead 86 connects control element 83 to one terminal of a switch 22 so that when this switch is closed to condition the soot blowers for automatic operation, lead 86 is connected to a power lead 17. A lead 85 extends from reversible motor 48 to a power lead 18 whereby at said pre-determined high temperature in outlet conduit 89 control element 83 will connect lead 86 with lead 84 which extends to motor 48 causing the motor to rotate in a direction to tilt the burners 12 downwardly. At said pre-determined low temperature in conduit 89 the control element 83 connects lead 86 with lead 87 which also extends to motor 48 causing reverse rotation and resultant tilting of burners 12 upwardly. It is understood that control element 83 may concurrently effect operation of several reversible motors 48.

Large capacity and high pressure type boilers of the type herein contemplated usually employ wall blowers disposed in the furnace walls adapted to direct a cleaning medium, such as steam or compressed air, against or along the furnace walls to cleanse the same from soot and ash deposits. These blowers are of various types but usually comprise a jet or nozzle extending into the furnace and electro-responsive valve means for admitting cleansing fluid to the jet or nozzle. When cleaning of the furnace walls is indicated an operator actuates the blowers through a manual switch. The present invention relates to means for automatically operating the wall blowers when the deposit of soot and/or slag causes a pre-determined rise in the steam temperature at the boiler outlet.

Referring now to Figure 1, conventional power leads from a suitable source are indicated at 17 and 18. A panel switch 22 is provided whereby when a switch contact arm 23 is manually actuated to engage a contact 24, the electrical control system is conditioned for automatic operation of the furnace wall blowers. Closing of switch 22 sets up three possible parallel circuits. Reversible motor 48 has a cam disc 20 operatively associated therewith, the disc having a rise portion 25 adapted to actuate a lift rod 26 and move a pivoted switch contact arm 29 into engagement with a contact 30, whereby a switch 21 is closed. It will be noted by reference to Figure 2, that cam disc 20 is staggered or out of angular relationship to the lever arm of motor 48 which operates the tilting burners whereby when motor 48 has rotated a given amount in a clockwise direction, rise portion 25 of cam disc 20 will contact lift rod 26 and close switch 21.

When switch 21 is closed due to tilting of burners 12 to their lowermost position, a circuit is completed from power lead 17 through lead 19 to a signal light 14, through a lead 54 to closed switch 21 and back to power lead 18. Thus, when the tilting burners 12 reach their lowermost tilting position and light 14 remains illuminated for an undue period it is an indication to the boiler operator that the automatic steam temperature control system is not functioning properly and an investigation should be made.

Closing of switch 21 completes a second parallel circuit through power lead 17, lead 27, solenoid coil 31,

5

and back through switch 21 to power lead 18. A third parallel circuit is completed by closing of switch 21, comprising power lead 17, leads 27 and 32, solenoid coil 33, lead 34, contacts 36 and 38 normally bridged by bar 37, a short lead 39, and lead 27 connecting through switch 21 with power lead 18. The armature or core of the solenoid including coil 31 is connected to a time delay device 60, such as a pneumatic dash pot, whereby after coil 31 is energized a period such as six seconds will elapse before bridge bar 37 is lifted to break the connection between contacts 36 and 38.

Upon current flowing through solenoid coil 33, bridge bar 45 is moved into engagement with contacts 41 and 42 thereby completing a circuit energizing a timer motor 43. Within a period such as six seconds, or a pre-determined time after coil 33 is energized, the rotation of the timer motor and its associated cam disc 51 closes switch 52 whereby power leads 81 and 82 also supply current to timer motor 43 through switch 52. Thereafter the resistance of dash pot 60 is overcome by solenoid coil 31 and bar 37 is lifted out of engagement with contacts 36 and 38 thereby breaking the circuit through solenoid coil 33. One side of timer motor 43 is connected to power lead 18 by a lead 90 and the other side of the motor is connected to lead 82. Lead 82 is connected with switch 52 and lead 81 is also connected with switch 52 and through a lead 95 is also connected to power lead 17 when manually operable switch 22 is closed. It will be noted in Fig. 1 that shunt circuit leads (not numbered) extend from leads 81 and 82 into panel 76 (grouping solenoid operable switches 28 and 40) to connect with bridging contacts 41 and 42 so that when these contacts are bridged timer motor 43 is started which effects closing of switch 52 and shortly thereafter the shunt circuit through contacts 41 and 42 is broken. Lead 27 extends from panel 76 to panel switch 21 and power lead 18 also extends to this switch. The solenoid operable bridge bar 45 is normally held out of engagement by spring means or the like and when coil 33 is energized the bridge bar is moved to the right (Figure 1) to temporarily engage contacts 41 and 42. Subsequent disengagement of the bridge bar insures that the timer will control termination of the automatic operation of the soot blowers and condition the circuits for another automatic operation.

The boiler or furnace side walls are indicated at 46 and 47 and have water wall tubes 15 associated therewith in a conventional manner. Wall blowers 50 are mounted in the furnace walls and these blowers may be of any suitable and well known type wherein streams of cleaning fluid may be directed interiorly of the furnace 11 to remove ash and/or slag deposits from the furnace walls. The cleaning fluid may be either steam or compressed air and each blower has a valve associated therewith controlling admission of cleaning fluid to the furnace. The valves illustrated are electro-responsive and are adapted to be opened when a motor or the like is energized. As previously explained, due to the volume of cleaning medium required it is preferred that the blowers be operated sequentially and a sequential controller or timer, generally indicated at 44, effects this result. As the timer motor 43 continues to rotate, switches such as 53 are successively closed by the cams completing circuits energizing the electro-responsive means for the blower valves and the circuits will be opened by the timer switches under control of the cams after a pre-determined period. After all the blowers have been actuated cam disc 51 permits switch 52 to open and the controller stops. When timer cam 51 is rotating its rise and fall portions will close and open switch 52 in a conventional manner. The timer switches such as 53 controlling the blower circuits are actuated in a similar manner. It is understood that the electro-motive means or motors adapted to actuate the blowers 50 have a permanent connection with one side or line of a power source (shown grounded in Figure 2). The other side electro-motive means is permanently con-

6

nected to one terminal or contact of its associated timer switch, such as 53, by a lead 53a. The other timer switch contact is permanently connected with the other side or line of the power source. Thus when the switch arm actuated by its associated timer cam bridges the switch contacts the electro-motive means controlled by said timer switch is energized for a predetermined period.

Cleaning of the furnace walls as described permits the water walls to absorb a greater amount of heat and resultant decreases the heat available to increase the steam temperature in the superheater or reheater. Secondly, removal of slag from the water walls prevents or reduces the reflection of radiant heat upwardly into the superheater and reheater section thereby reducing the steam temperature in these sections. Thus, the reduction in temperature acting on the steam temperature control causes motor 48 to tilt burners 12 upwardly to a more normal position. It will be noted that under these conditions or when the tilting burners are raised switches 21 and 40 are open and the system is again conditioned for automatic operation of the blowers when the furnace again becomes dirty as indicated by movement of burners 12 to their lowermost position and the previously described cleaning operation will be repeated. For panel mounting, switches 28 and 40 are preferably grouped and the group is generally indicated at 76.

The blowers illustrated are used to clean the wall surfaces of the combustion chamber and the hot ash in this zone or area is in molten form so that the wall blowers function to remove slag rather than soot but it is understood that the invention relates primarily to the automatic operation of blowers in a boiler when movable means reach a pre-determined position caused by deposits of slag and/or soot and it is understood that the term wall blowers or soot blowers covers the broad function of removing deposits. Although we have illustrated the controller cams as actuating switches in the circuits for the electro-responsive means operating the blower's valves it will be apparent that fluid means such as compressed air lines can be substituted for the electrical circuits whereby the controller cams will actuate pilot valves or the like controlling the admission of fluid to fluid motors operating the blower valves.

Referring now to Figure 3, a modification of the invention is shown, wherein a heat exchanger type boiler is disclosed. In this embodiment the boiler is generally indicated at 60 and comprises the usual setting supporting an upper steam drum 61. A superheater is indicated at 62 having an inlet 63 and an outlet pipe 64 communicating with the drum 66 of a condenser or heat exchanger, generally indicated at 67. Drum 66 has a helical form tube coil 68 therein having one end connected to a cooling water conduit 69 and its opposite end connected to an outlet conduit 71 extending to steam drum 61. A valve 72 in conduit 69 controls the flow of cooling water to condenser 67. A steam delivery conduit 73 extends from drum 66 and means 74 responsive to the temperature of steam in conduit 73 is operatively connected to valve 72 whereby the flow of cooling water to drum 66 will vary in accordance with temperature variation in steam outlet conduit 73. Any well known means may be employed for operating valve 72 responsive to temperature variation. For example, a bulb may be inserted in conduit 73 which connects with a line leading to a diaphragm whereby the diaphragm and resultant the opening of valve 72 will be controlled responsive to the contraction and expansion of a gas in the line or responsive to the steam temperature in conduit 73.

A conventional flow switch 75 is operatively associated with conduit 69 whereby at a pre-determined maximum rate of flow the switch will be closed to complete a circuit including the switches 28 and 40 grouped as indicated at 76. Switches 28 and 40 control operation of controller 44 for wall blowers indicated at 77. In other words, the circuit is the same as shown in Figure 1 ex-

cept the flow switch 75 is substituted for the cam operated switch 21 and the wall blowers are operated in response to a pre-determined maximum flow of cooling water to a heat exchanger rather than in response to a predetermined lowermost position of tilting type burners. Flow switches of this type are well known and may comprise a restricted orifice in conduit 69 which creates pressure differential between the upstream and downstream sides of the orifice whereby when the rate of flow and resultantly the pressure differential reaches a predetermined value a diaphragm will be moved sufficiently to close the switch.

Referring now to Figure 4, we have shown a further modification of the invention generally similar to the modification of Figure 3, but wherein instead of using a heat exchanger to lower the temperature of steam from the superheater or reheater, cooling water is directly sprayed into the steam issuing from the superheater or reheater. In this embodiment, the outlet conduit 64 of the superheater 62 communicates with the vessel 78 of a steam temperature reducing device, the vessel being adapted to have cooling water sprayed thereinto from a supply line 79. Steam at reduced temperature is delivered from vessel 78 through a conduit 88. Any suitable means for spraying cooling water into superheated or reheated steam may be used but a preferred device is illustrated and described in a co-pending application of Francis W. Bunting, Serial No. 291,005, filed May 31, 1952, now Patent 2,710,745. In this embodiment the circuit is the same as illustrated in Figure 1 except that a flow switch is substituted for cam operated switch 21.

A brief description of the operation of the embodiments illustrated will now be given. It will now be understood that the primary function of the arrangements disclosed is to automatically operate wall blowers when a rise in the temperature of steam delivered from the superheater or reheater of a boiler indicates that an excess amount of heat is being delivered to the superheater or reheat sections of the boiler. As pointed out, this condition is primarily due to insufficient heat being absorbed by the water wall tubes and undue reflection of heat upwardly into the superheater or reheat sections from these walls. Cleaning of the water walls by operating the wall blowers will largely correct this condition and prevent use of excess cooling water to lower or keep the steam temperature in these sections within a desired range.

In the embodiment illustrated in Figures 1 and 2, the switch 22 is manually closed to set the circuit for automatic operation of the wall blowers when the burners are tilted to a predetermined lowermost position. Upon the burners reaching said position switch 21 is closed thereby actuating time delay relay 28 which in turn closes switch 40 whereby the circuit for drum controller motor 43 is energized. As soon as controller 44 starts to rotate a holding contact maintains switch 52 closed although relay 28 and switch 45 open after a short period. Thereafter switch 52 is under control of controller 44. As the controller rotates the blowers are successively actuated until the controller completes its cycle whereupon switch 52 opens and the circuit is restored to its original condition unless switch 21 has not been opened and in that event the signal light will remain on indicating that the wall blowers are not operating properly or an examination of the boiler is warranted. In this embodiment the soot blowers are automatically operated responsive to the tilting of the burners to a pre-determined position.

In the embodiment of Figure 3, the same general arrangement is used but the wall blowers are automatically operated responsive to a pre-determined maximum rate of flow of cooling water to a condenser or heater exchanger associated with the superheater or reheater.

In the embodiment of Figure 4, the wall blowers are also operated automatically responsive to cooling water flow but the water is sprayed into or admixed directly with the superheated or reheated steam.

In all embodiments it will be noted that the blowers are automatically operated in response to means reaching a pre-determined position. In the case of tilting burners the said position is the lowermost position of the burners and in the embodiments of Figures 3 and 4, the pre-determined position is the position at which the diaphragm or the like of flow switch 75 closes the switch. The term "section" is intended to cover either a superheater section or a reheater section or both and in the case of a reheater section (Figures 3 and 4) the inlet 63 might be connected to a low pressure point of a turbine and the conduits 73 or 88 to a high pressure point of the turbine. The wiring diagram illustrated in Figure 1 applies to all three embodiments of the invention but in the modifications illustrated in Figures 3 and 4 the flow switches 75 are adapted to connect lead 27 with power lead 18 to start the controller 44 as explained in connection with cam operated switch 21.

As previously explained, the wall blowers 50 may be of any suitable type operable either by electrical or fluid means but due to the high temperature encountered in the boiler furnace we preferably employ retractable type blower units. The furnace area at which the blowers are installed is very hot, the gas temperatures may exceed 2500° F., and the blower element would burn up if left continuously in the furnace. Accordingly, a preferred type of blower comprises a sleeve disposed behind the water wall tubes having an axially slidable blower element therein which is normally in retracted position. The following action takes place when the drum controller 44 makes proper contact, the blower element is extended into the furnace, the valve controlling the blowing or cleaning fluid is opened, the blower element is rotated to sweep relatively clean a circular area such as ten feet in diameter, the valve closes, and the blowing element is retracted. In practice, each wall blower is operated by two motors (electric or pneumatic) with one motor extending the blower element into or retracting it from the furnace. The other or second motor rotates the blower element. It will be noted that in all three embodiments means are provided for sensing the temperature of steam leaving the boiler or in the steam outlet conduits or which are responsive to such temperature as the element 83 associated with the steam outlet conduit 89 of Figure 2 and the means 74 associated with the steam outlet conduits 73 and 88 of Figures 3 and 4. Also control means are provided responsive to the temperature sensing means for reducing the steam temperature and normally holding the steam outlet temperature within a desired range or below a pre-determined value. In the embodiment of Figure 2 the control means are the motor operated tiltable burners 12 which are actuated under the control of element 83 in response to the temperature of steam leaving the boiler or in conduit 89 to vary the effective heat in the boiler furnace. In the embodiments of Figures 3 and 4 the control means are the valves 72 which vary the rate of cooling water flow to reduce the steam temperature and normally hold the steam temperature below a desired value, the valves being under control of means 74 which are responsive to the temperatures in outlet conduits 73 and 88. However, when the temperature control means have been actuated a pre-determined amount such as the burners 12 being tilted downwardly to a position 30° from horizontal and the valves 72 being opened an amount to provide a pre-determined maximum rate of cooling water flow the soot blowers are operated in the manner described since the steam temperature control means are no longer effective to hold the temperature below a desired value without cleaning of the furnace.

Although we have shown and described a preferred form of the invention we contemplate that numerous and extensive departures may be made therefrom without departing from the spirit of the invention and the scope of the appended claims.

What we claim is as follows:

1. In a boiler having soot blowers and a control system therefor, means for automatically operating the soot blowers in response to the condition of the boiler furnace as indicated by the heat absorbed by the steam leaving the boiler, said means comprising the combination of a steam outlet conduit communicating with the boiler, means sensing the temperature of steam in said conduit, control means responsive to said sensing means for normally reducing the temperature of the steam in said conduit, and blower control means responsive to the temperature controlling means for actuating the soot blowers when the temperature controlling means have been actuated a pre-determined amount to reduce the steam temperature in said conduit and are ineffective to reduce said temperature.

2. In a boiler having soot blowers and a control system therefor, means for automatically operating the soot blowers in response to the condition of the boiler furnace as indicated by the heat absorbed by the steam leaving the boiler, said means comprising the combination of a steam outlet conduit communicating with the boiler, means sensing the temperature of steam in said conduit, control means responsive to said sensing means for reducing the temperature of steam in said conduit and normally effective to hold said temperature below a pre-determined value, and blower control means responsive to the temperature controlling means for actuating the soot blowers when the temperature of steam in said conduit reaches said pre-determined value.

3. The boiler soot blower control system as described in claim 1 and wherein the blower control means com-

prises electromotive means adapted to actuate the blowers and a timer adapted to control energization of the electromotive means, and the steam temperature controlling means is adapted to effect operation of the timer.

4. The boiler soot blower control system as described in claim 1 and wherein the blower control means comprises electromotive means adapted to actuate the blowers and a timer adapted to control energization of the electromotive means, the steam temperature controlling means comprises tiltable burners for heating the boiler furnace, and the timer is adapted to be operated when the burners tilt to a pre-determined position.

5. The boiler soot blower control system as described in claim 1 and wherein the blower control means comprises electromotive means adapted to actuate the blowers and a timer adapted to control energization of the electromotive means, the steam temperature controlling means comprises a cooling water system adapted to reduce the steam temperature, a valve in the system controlling rate of cooling water flow in response to the temperature of steam in said conduit, and means responsive to the rate of cooling water flow adapted to operate the timer.

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