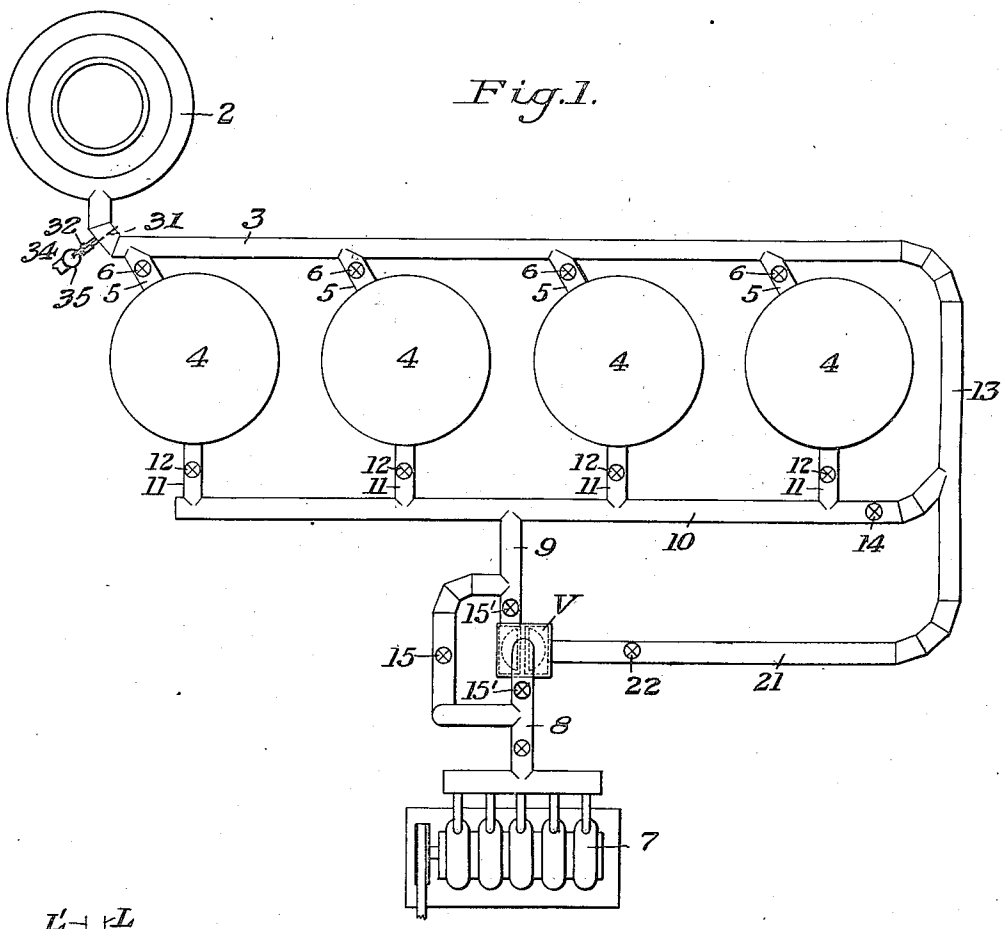
June 12, 1923. 1,458,288

H. W. GRAHAM

AIR BLAST CONTROL FOR BLAST FURNACES

Filed Oct. 22, 1920 2 Sheets-Sheet 1

Fig. 1.



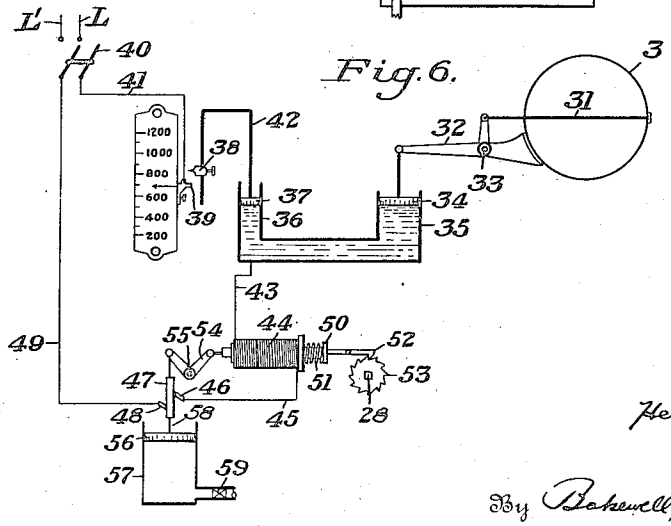


Fig. 6.

Inventor
Herbert W. Graham,
By Bakewell, Byrnes & Carmelee
his Attorneys.

June 12, 1923. 1,458,288

H. W. GRAHAM

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Fig. 2.

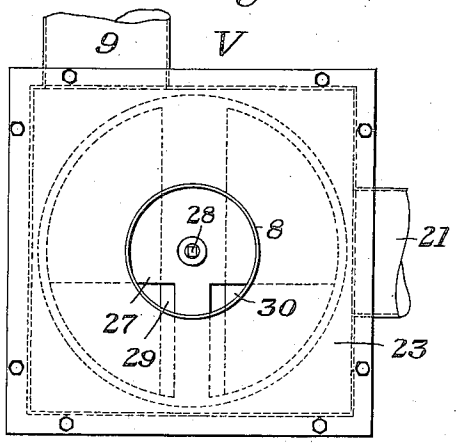


Fig. 3.

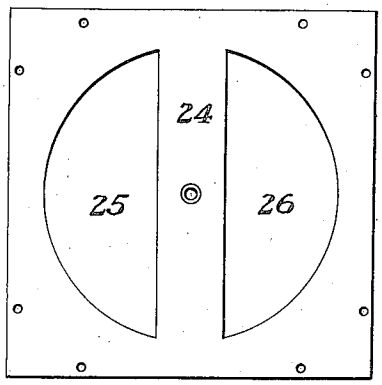


Fig. 4.

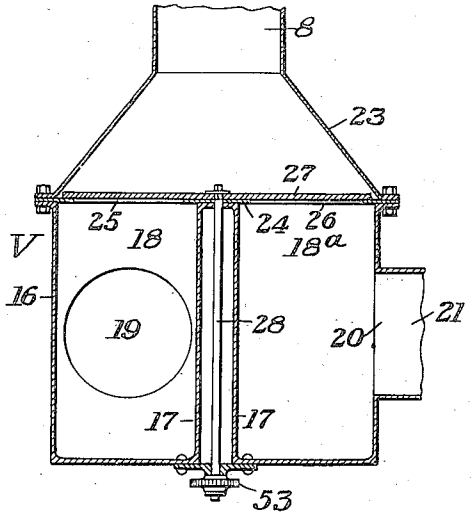
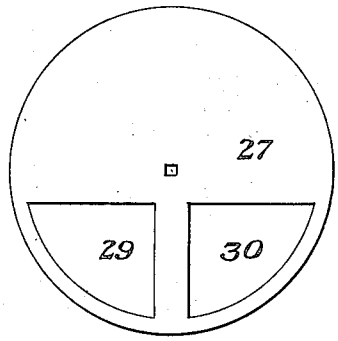


Fig. 5.



Inventor
Herbert W. Graham,

By Bakewell, Byrnes, Parmelee

his Attorneys.

Patented June 12, 1923. 1,458,288

UNITED STATES PATENT OFFICE.

HERBERT W. GRAHAM, OF PITTSBURGH, PENNSYLVANIA.

AIR-BLAST CONTROL FOR BLAST FURNACES.

Application filed October 22, 1920. Serial No. 418,778.

To all whom it may concern:

Be it known that I, HERBERT W. GRAHAM, a citizen of the United States, residing at Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Air-Blast Controls for Blast Furnaces, of which the following is a full, clear, and exact description.

The present invention relates broadly to blast furnaces, and more particularly to means for controlling the blast air fed to the furnace.

The principal object of the present invention is to provide means for supplying blast air to the furnace at a uniform temperature.

A further object of the invention is to provide means automatically controlled by the temperature of the blast air for maintaining a uniform temperature thereof.

A still further object of the invention is to provide a control of the character described which may be readily and inexpensively applied to blast furnace installations at present in use.

Another object of the present invention is to provide a single control for replacing the independent controls heretofore utilized for regulating the temperature of the air blast to the furnace.

Still another object of the invention is to provide a single means for simultaneously controlling the supply of cold air from the blower to the heating stoves and the supply of cold air which is by-passed around said stoves.

The foregoing and other objects, together with their attendant advantages, will be apparent as the invention becomes better understood, by reference to the accompanying specification and drawings forming a part thereof, it being premised that changes may be made in the various details and the manner of operation, within the scope of the appended claims, without departing from the spirit of the invention.

Figure 1 is a diagrammatic illustration of the manner of utilizing my invention;

Figures 2, 3, 4 and 5 are detail views of one form of valve which may be utilized; and

Figure 6 is a diagrammatic illustration of an automatic temperature control for the valve.

At the present time, it is customary to supply cold air from a blower of any desired construction and pass at least a portion of the cold air through a stove which discharges into a hot air main or hot blast main leading to the blast furnace, for raising the temperature of the air before it is delivered to the furnace. It is also customary to provide an independent connection whereby cold air may be mixed with the heated air from the stove so that when the stove is at its greatest heat the air supplied thereby may be tempered to the desired point by mixing therewith any desired amount of cold air.

Heretofore, this tempering of the heated air, has been effected by a cold air valve, and the passage of the air from the blower to the heating stove has been controlled by an independent valve, thereby requiring the operation of two valves to produce the desired temperature. The present invention provides a single means taking the place of the independent controls heretofore utilized.

Referring more particularly to the drawings, there is illustrated a blast furnace 2 which may be of any desired construction, equipped with the usual hot blast main 3 for supplying heated air thereto. This hot blast main is in turn adapted to receive heated air from any one of a battery of heating stoves 4, which stoves are connected to the hot blast main through branch connections 5, each having therein a manually controlled valve 6.

For supplying cold air to the heating stoves there may be provided a blower 7 of any usual construction, having its outlet 8 connected through a valve V, hereinafter more fully described, to the branch 9 leading to the cold air main 10 which is connected to each of the heating stoves through independent branch connections 11. Each of these branch connections may also be provided with a manual control valve 12 for regulating the amount of cold air to the stoves and determining which of the stoves is to be utilized for heating the air. In standard installations it is customary to provide a by-pass 13 extending from the cold air main 10 to the hot blast main 3, the by-pass being controlled by a manually operated valve 14 which determines the amount of cold air directly fed to the hot blast main for effecting the tempering action heretofore described. The present invention adapts it-

self admirably to use with such an installation and eliminates the necessity of operating the independent controls described.

According to the present invention the valve V comprises a main casing 16 having an intermediate partition 17 dividing the casing into independent chambers 18 and 18a. The chamber 18 is provided with an outlet opening 19 connected to the pipe 9, while the chamber 18a is provided with an outlet opening 20 connected to a supplemental by-pass 21 communicating with the by-pass 13. This supplemental by-pass 21 may, if desired, be provided with a manually operable valve 22. The outlet 8 of the blower communicates with a casing 23, which is secured to one side of the casing 16 in such manner as to enclose a valve seat 24, having openings 25 and 26 therein communicating with the chambers 18 and 18a respectively. These openings are preferably segmental in shape to co-operate with a rotary valve 27 secured in any desired manner to an operating shaft 28 and provided with independent passages 29 and 30. With the valve 27 in the position illustrated in Figure 2, it will be apparent that cold air will be supplied in equal proportions to the chambers 18 and 18a. Rotation of the valve in a clockwise direction, as viewed in Figure 2, will result in uncovering a larger amount of the segmental opening 25 and covering a like amount of the segmental opening 26, whereby a greater amount of air will be fed to the chamber 18 than to the chamber 18a. Due to this construction it will be obvious that the single valve 27 simultaneously controls both the amount of air supplied to the heating stoves and the amount of air by-passed therearound, thereby enabling an arcuate control of the temperature conditions.

During the operation of a blast furnace, it is customary to heat certain of the stoves, while others of the stoves are supplying heat for the hot blast. As the temperature of the stoves supplying this heat gradually lowers, it is necessary to supply more air thereto and less air to the by-pass. As before explained, this may be accomplished with the structure herein disclosed by rotating the valve 27 in a clockwise direction, as viewed in Figure 2. For accomplishing this rotation, automatically due to temperature changes, the hot blast main 3 may be provided with a thermally responsive element 31, suitably connected to one arm of a bell crank lever 32, having a pivotal mounting 33. As the temperature of the air in the hot blast main lowers, the element 31 will contract, thereby rotating the bell crank about its pivot 33 and lifting a piston 34 suitably connected thereto. This piston works in the larger end 35 of a U-shaped tube or container, the smaller end 36 of which contains a second piston 37. This second piston carries an adjustable contact 38, adapted when the piston 37 is lowered, due to the raising of the piston 34, to come into engagement with a second contact 39 which may be adjustably mounted adjacent thereto. This engagement will complete an electric circuit, when the switch 40 is in closed position, from the line wire L through one pole of the switch to the wire 41 and then through the contacts 39 and 38 to the conductor 42. By utilizing mercury, or similar conducting fluid within the tube, current will flow to the wire 43 and solenoid 44 to the wire 45. This wire may be connected to a brush 46 in contact with a conducting strip 47, another portion of which co-operates with a brush 48 connected to the wire 49 and thence through the other pole of the switch to the line wire L'. Energizing the solenoid 44 will cause the same to move its armature 50 against the action of the spring 51 in such direction that the pivoted pawl 52 will rotate the ratchet 53 in a counter-clockwise direction. As the ratchet 53 is secured to the shaft 28, this will in turn effect a movement of the valve 27 in a clockwise direction, as viewed in Figure 2, and cause the valve to supply more air to the stove and less air to the bypass, this condition tending to raise the temperature in the hot blast main as required.

Movement of the armature 50, as described, will rock the bell crank 54 about its pivot 55 in such manner that the piston 56 will be lowered within the dash-pot 57. As the piston rod 58 carries the conducting strip 47, it will be apparent that a predetermined movement of the piston will move this strip out of contact with the brush 46, thereby breaking the solenoid circuit. Return movement of the piston 56 will be impeded by a check valve 59 restricting the passage of air into the dash-pot 57 but permitting the free escape of air therefrom. Due to this dash-pot arrangement, prior to the time that the conducting strip 47 is again raised by the spring 50 into engagement with the brush 46, the temperature in the hot blast main will have expanded the element 31, thereby effecting disengagement of the contacts 38 and 39. As the temperature in the hot blast main responds quickly to variations in the respective amounts of air supplied to the stoves and to the bypass, such a construction is highly desirable in blast furnace installations.

If it is desired to operate the blast furnace system without utilizing the valve V, it is only necessary to open the normally closed valve 15 in the bypass around the valve V, and close the normally open valves 15' on opposite sides of the valve V. Due to this construction, the valve V may be cut out for repairs or inspection without shut-

ting down the blast furnace, or causing any delay in the operation thereof.

The advantages of the present invention arise from the means provided for simultaneously regulating the air supplies as required and for automatically controlling the regulation by the temperature conditions.

Further advantages arise from the construction permitting use with a standard installation in such manner that either the automatic control or the standard installation may be utilized.

I claim:

1. A system for blast furnace control, comprising a hot blast main for the furnace, means for creating an air blast, a heater connected to said main and said means for heating a portion of the air, a second connection between said main and said means for a portion of the air, and means for simultaneously controlling from minimum to maximum the amount of air passing through either of said connections, said means being effective for causing substantially all of said air to pass through either one of said connections at will, substantially as described.

2. A system for blast furnace control, comprising a hot blast main, a cold blast main, a heater intermediate said mains, a shunt connection between said mains, means for supplying air to said cold blast main, and means for simultaneously controlling from minimum to maximum the amount of air passing through either said heater or said shunt connection, said means being effective for causing substantially all of said air to pass through either the heater or the shunt connection, substantially as described.

3. A system for blast furnace control, comprising a hot blast main, for the furnace, means for creating an air blast, a heater connected to said main, and said means for heating a portion of the air, a second connection between said main and said means for a portion of the air, and a single valve for simultaneously controlling from minimum to maximum the amount of air passing through either of said connections, said means being effective for causing substantially all of said air to pass through either one of said connections at will, substantially as described.

4. A system for blast furnace control, comprising a hot blast main, a cold blast main, a heater connected to said mains, a shunt connection between said mains, means for supplying air to said cold blast main, and a single valve for simultaneously controlling from minimum to maximum the amount of air passing through either said heater or said shunt connection, said means being effective for causing substantially all of said air to pass through either the heater or the shunt connection, substantially as described.

5. A system for blast furnace control comprising a hot blast main, a cold blast main, a heater connected to said mains, a shunt for said heater connected to said main, means for supplying air to said cold blast main, means for simultaneously controlling from minimum to maximum the amount of air passing through either of said connections, said means being effective for causing substantially all of said air to pass through either of said connections at will and automatic means for operating said controlling means, substantially as described.

6. A system for blast furnace control, comprising a hot blast main, a cold blast main, a heater connected to said mains, a shunt for said heater connected to said mains, means for supplying air to said cold blast main, means for simultaneously controlling from minimum to maximum the amount of air passing through either said heater or said shunt, said means being effective for causing substantially all of said air to pass through either the heater or the shunt at will, and means responsive to temperature changes in said hot blast main for automatically operating said controlling means, substantially as described.

7. A system for blast furnace control, comprising a hot blast main for the furnace, means for creating an air blast, a heater connected to said main and to said means for heating a portion of the air, a second connection between said main and said means for a portion of the air, a device for simultaneously controlling from minimum to maximum the amount of air passing through said heater and said second connection, said means being effective for causing substantially all of the air to pass through either the heater or the second connection at will, and temperature responsive means for operating said device, substantially as described.

8. The combination with a blast furnace, of a heater to heat blast air and having connection with the furnace, means for creating an air blast, a valve device interposed between the said blast means and the heater, said valve device having a connection with the heater and a second connection that bypasses the heater, and means in said valve device for simultaneously controlling both connections, substantially as described.

9. The combination with a blast furnace, of a heater to heat blast air and having connection with the furnace, means for creating an air blast and means interposed between the said air blast means and the heater, said means having a connection with the heater and a second connection that bypasses the heater for simultaneously controlling both of said connections, substantially as described.

10. The combination with a blast furnace,

of a heater to heat blast air, means for creating an air blast, connections between the heater and furnace, connections between the air blast means and the heater, a valve device interposed in the latter connection and having one port to control the air passing to the heater, and also having a second port, bypass connections from the second port of the valve device around the heater, and a valve in said valve device to simultaneously control both ports thereof, substantially as described.

11. The combination with a blast furnace, of a heater to heat blast air, a main connecting the heater and furnace, an air blast supply, a valve device having a single inlet and two outlets, connections between the air blast supply and the single inlet of the valve device, a connection between one outlet of the valve device and the heater, a connection between the other outlet of the valve device and the main, said latter connection shunting the heater, and a valve in said valve device and controlling both outlets thereof, substantially as described.

12. A system for blast furnace control, comprising a hot blast main for the furnace, means for creating an air blast, a heater connected to said main and said means for heating a portion of the air, a second connection between said main and said means for a portion of the air, means for simultaneously controlling the amount of air passing through both of said connections, and means independent of said last mentioned means for individually controlling each of said connections, substantially as described.

13. A system for blast furnace control, comprising a hot blast main, a cold blast main, a heater connected to said mains, a shunt connection for said heater between said mains, means for supplying air to said cold blast main, means for simultaneously controlling the division of air between said heater and said shunt connection, and means independent of said last mentioned means for individually controlling the amount of air to said heater and to said shunt connection, respectively, substantially as described.

14. The combination with a blast furnace, of a heater to heat the blast air, a main connecting the heater and furnace, an air blast supply, a valve device having a single inlet and two outlets, a connection between the air blast supply and the single inlet of the valve device, a connection between one outlet of the valve device and the heater, a connection between the other outlet of the valve device and the main, said latter connection bypassing the heater, and a valve in said valve device and having two ports and a blank wall whereby the volume of air from the outlet of the valve device to the heater may be increased while the volume of air from the outlet to the main may be simultaneously decreased, substantially as described.

15. A system for blast furnace control, comprising a hot blast main, a cold blast main, a heater connected to said mains, a shunt connection for said heater between said mains, means for supplying air to said cold blast main, and means automatically controlled by the temperature in said hot blast main for simultaneously controlling from minimum to maximum the amount of air passing through said heater and said shunt connection, said means being effective for causing substantially all of said air to pass through either said heater or said shunt connection at will.

16. The combination with a blast furnace, of a heater to heat blast air and having connections with the furnace, means for creating an air blast, a valve device interposed between the said blast means and the heater, said valve device having a connection with the heater, and a second connection that by-passes the heater, means in said valve device for simultaneously controlling both connections, and automatic means for operating said last mentioned means, substantially as described.

17. The combination with a blast furnace, of a heater to heat blast air and having connection with the furnace, means for creating an air blast, means interposed between the said air blast means and the heater, said means having a connection with the heater and a second connection that by-passes the heater for simultaneously controlling both of said connections, and automatic means for controlling said last mentioned means, substantially as described.

18. The combination with a blast furnace, of a heater to heat blast air, means for creating an air blast, connections between the heater and furnace, connections between the air blast means and the heater, a valve device interposed in the latter connection and having one port to control the air passing to the heater and also having a second port, bypass connections from the second port of the valve device around the heater, a valve in said valve device to simultaneously control both ports thereof, and means for automatically controlling said valve, substantially as described.

19. The combination with a blast furnace, of a heater to heat blast air, a main connecting the heater and furnace, an air blast supply, a valve device having a single inlet and two outlets, connections between the air blast supply and the single inlet of the valve device, a connection between one outlet of the valve device and the heater, a connection between the other outlet of the valve device and the main, said latter connection shunting the heater, a valve in said valve device

controlling both outlets thereof, and means for automatically controlling the position of said valve, substantially as described.

20. The combination with a blast furnace, of a heater to heat the blast air, a main connecting the heater and furnace, an air blast supply, a valve device having a single inlet and two outlets, a connection between the air blast supply and the single inlet of the valve device, a connection between one outlet of the valve device and the heater, connection between the other outlet of the valve device and the main, said latter connection by-passing the heater, a valve in said valve device having two ports and a blank wall whereby the volume of air from the outlet of the valve device to the heater may be increased, while the volume of air from the outlet to the main may be simultaneously decreased, and means for automatically controlling the position of said valve, substantially as described.

In testimony whereof I have hereunto set my hand.

HERBERT W. GRAHAM.