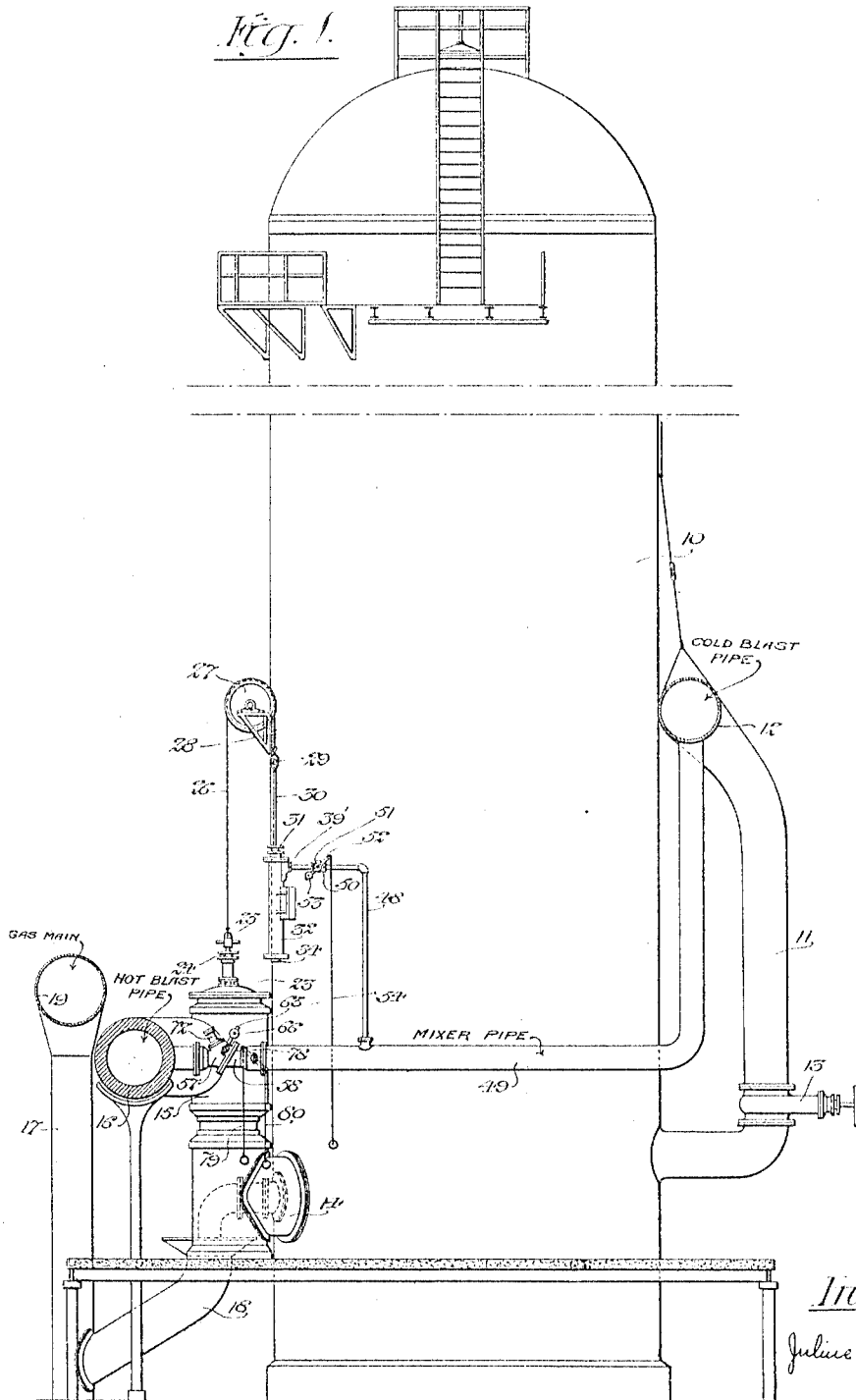


J. A. DYBLIE.
SAFETY APPLIANCE FOR HOT BLAST STOVES.
APPLICATION FILED APR. 14, 1911.

1,064,061.

Patented June 10, 1913.

3 SHEETS—SHEET 1.



Inventor:

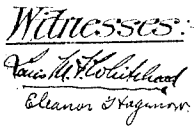
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1,064,061.

3 SHEETS--SHEET 2.



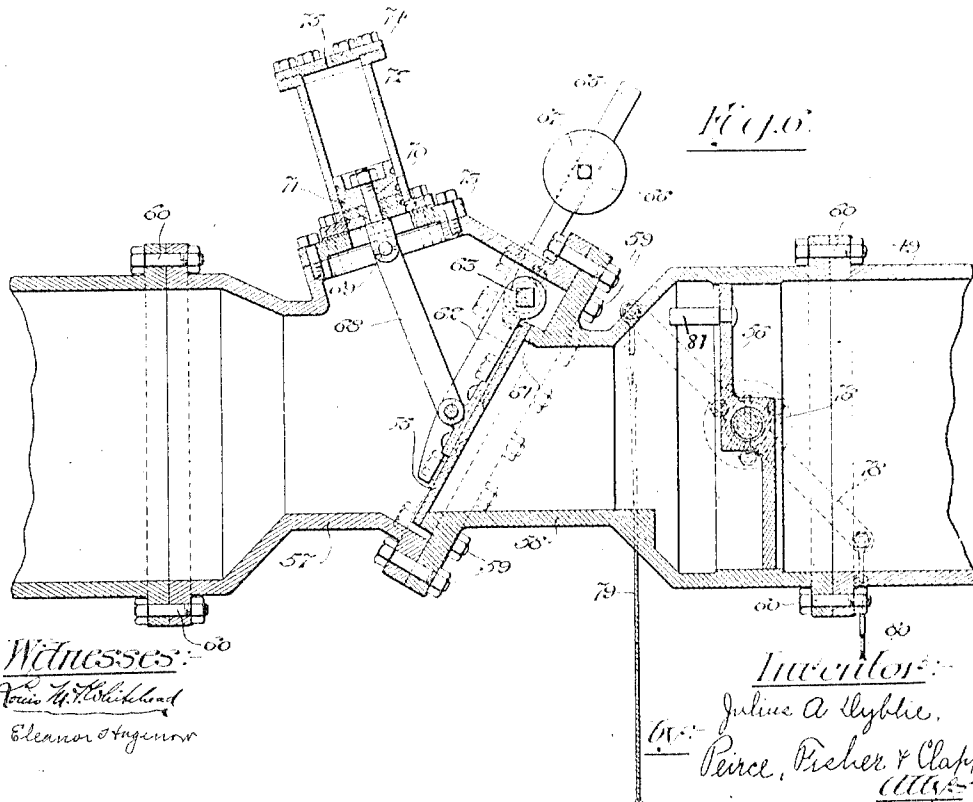
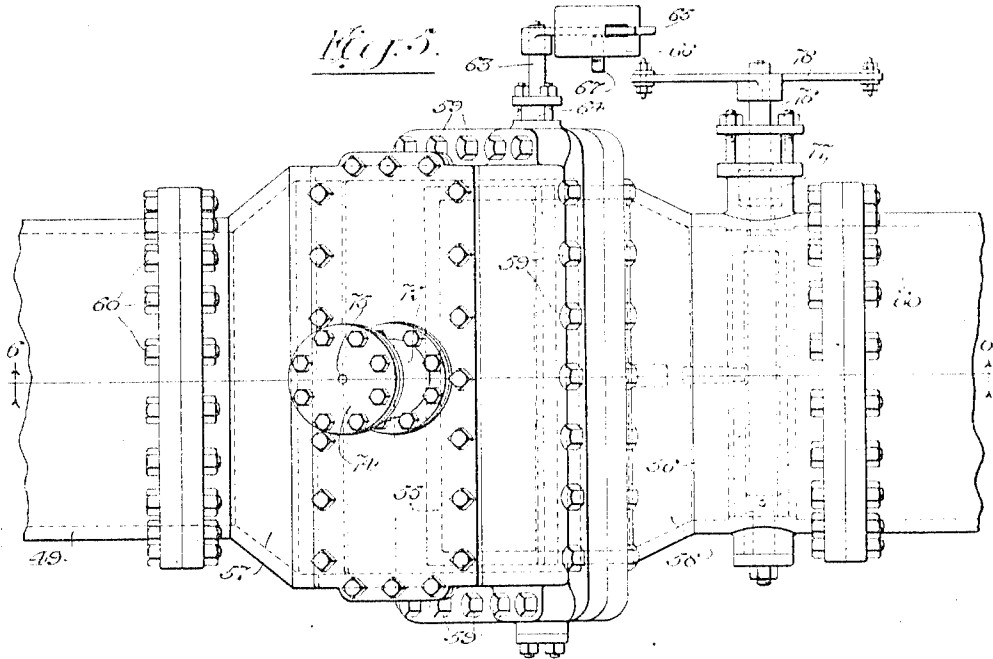
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UNITED STATES PATENT OFFICE.

JULIUS A. DYBLIE, OF JOLIET, ILLINOIS, ASSIGNOR OF ONE-HALF TO JAMES T. LARIMER, OF JOLIET, ILLINOIS.

SAFETY APPLIANCE FOR HOT-BLAST STOVES.

1.064,061.

-Specification of Letters Patent.

Patented June 10, 1913.

Application filed April 14, 1911. Serial No. 621,062.

To all whom it may concern:

Be it known that I, JULIUS A. DYBLIE, a citizen of the United States, residing at Joliet, in the county of Will, State of Illinois, have invented certain new and useful Improvements in Safety Appliances for Hot-Blast Stoves, of which the following is a full, clear, and exact description.

The present invention relates to hot blast stoves that are employed to heat the compressed air before it is delivered to the twyers of a blast furnace and seeks to provide safety means to prevent back flow of gases from the furnace into the stoves and thereby avoid the danger of explosion of such gases in the stoves.

The invention consists in the features of improvement hereinafter described, illustrated in the preferred form in the accompanying drawings and more particularly pointed out in the claims at the end of this specification.

Figure 1 is a view in elevation of a hot blast stove having the present improvements applied thereto, certain adjacent parts being shown in section. Fig. 2 is an enlarged view, showing a portion of the hot blast stove and appliances connected therewith, parts being shown in vertical section. Fig. 3 is an enlarged detail view in vertical section through the inlet valve of the power cylinder which controls the valve between the stove and the hot blast delivery pipe. Fig. 4 is a view in vertical section on line 4—4 of Fig. 3. Fig. 5 is a plan view of the casing containing the check valve for the mixer pipe with associated parts. Fig. 6 is a view in vertical section on line 6—6 of Fig. 5.

The hot blast stove 10 may be of any usual or suitable construction. It will usually form one of a series and is provided with the usual inlet pipe 11 whereby compressed air is delivered to the stove from the main cold blast supply pipe 12. The branch inlet pipe 11 is provided with a cut-off valve 13 and the supply pipe 12 leads from a suitable air compressor (not shown). From the opposite side of the lower portion of the hot blast stove 10 leads a pipe 14 through which the heated compressed air passes from the stove and through a valve chamber 15 to the main hot blast pipe 16, whence it will be delivered to the bustle

pipe and twyers of the blast furnace. The hot blast stove 10 is connected as usual as by suitable pipes 17 and 18 with the gas main 19 that leads from the blast furnace, but the arrangement and connection of such gas pipes forms no part of the present invention.

The pipes 14 and 16 and the valve chamber 15 are lined with fire brick and the latter is provided at its base with a seat 20 for a valve 21. The stem 22 of this valve extends upward through the cover 23 of the valve chamber and through a suitable stuffing box 24. To a cap piece 25 on the upper end of the valve stem 22 is fastened one end of a cable 26 that passes around a pulley 27 (see Fig. 1) mounted upon a bracket 28 that is conveniently attached to the side wall of the stove 10. The other end of the cable 26 is secured, preferably by a turn-buckle 29 to the upper end of a piston rod 30 that extends through a stuffing box 31 on the upper end of a controlling cylinder 32 and is secured to a piston 33 in the cylinder. The latter is secured to the side wall of the stove 10 and is provided at its lower end with a head 34.

Adjacent its lower end, the cylinder is provided with relatively large and small vent ports 35 and 36, the larger port 35 being farther from the lower end of the cylinder than the smaller port 36. At its upper end, the cylinder is provided with a chamber 37 that communicates by a port 38 at its lower end with the interior of the cylinder at a slight distance below its upper end. A valve casing 39 extends through the upper portion of the chamber 37 and its reduced, inner end is threaded into an opening 40 in the wall of the cylinder 32 adjacent its upper end. The outer portion of the casing 39 fits in air-tight fashion in an opening in the outer wall of the chamber 37 and a hexagonal flange 39' on its outer end abuts against this wall. The inner end of the casing is provided with a beveled seat for a check valve 41, the stem 42 of which extends through the hub or central portion of a suitable guide or spider 43 formed integral with the valve casing 39. A spring 44, coiled around the stem, extends between a nut 45 threaded thereon and the spider 43 and tends to hold the check valve 41 on its seat. The valve 41 is provided with a

relatively small, restricted port 46 opening into the cylinder and the valve casing is provided with large ports 47 opening into the chamber 37. The valve stem 42 is preferably provided with guide wings 42' that fit within the reduced inner end of the casing 39.

A by-pass pipe 48 is threaded into the outer end of the valve casing 39 and is suitably connected with the cold blast pipe 12 and preferably through the medium of a mixer pipe 49, to which the lower end of the pipe 48 is attached. (See Figs. 1 and 2.) In the by-pass pipe 48 is placed the casing 50 of a three-way valve, this casing having a vent nozzle 51. The three-way valve within the casing 50 may be of ordinary construction and to its stem is attached a lever 52, one end of which carries a weight 53, while the opposite end has connected thereto a cable or cord 54, whereby the shifting of the valve may be readily effected. The weight 53 normally holds the three-way valve in such position that communication is established between the mixer pipe 49 and the upper end of the cylinder 32, so that compressed air will flow through the by-pass pipe 48 into the upper end of the cylinder. By pulling the cord or cable 54, the three-way valve is shifted to cut off the flow of compressed air through the pipe 48 and establish communication between the upper end of the cylinder 32 and the atmosphere.

The mixer pipe 49 leads from the cold blast pipe 12 to the hot blast pipe 16 and in the mixer pipe is placed a casing wherein is contained a check valve 55 and preferably, also, the controlling valve 56. The casing is formed, as shown more particularly in Figs. 5 and 6 of the drawings, of two sections 57 and 58 having inclined abutting flanges secured together by bolts 59, the outer ends of the casing sections and the portions of the mixer pipe having abutting flanges connected by bolts 60. The inner end of the casing section 58 is provided with an inclined seat 61 for the valve 55. This valve comprises a plate pivotally connected to arms 62 upon its back, these arms being fastened at their upper ends to a shaft 63 that extends through the walls of the casing section 57. One end of the shaft 63 preferably extends through a stuffing box 64 and, outside the casing, has fixed thereto an arm 65 which extends in opposite direction from the arms 62 and whereon a counterbalancing weight 66 is adjustably secured by a set screw 67. To the back of the valve 55 is pivotally connected the lower end of a link 68, the opposite end of which link is pivotally secured by a pin 69 to the yoke-shaped end of a bolt 70 that is secured to a piston 71. The piston 71 is arranged in a cylinder 72, the flanged lower end of

which is bolted to a ring or plate 73 that is fastened to the upper face of the valve casing section 57 over an opening therein. The head 74 at the outer end of the cylinder 72 is provided with a vent port 75.

The valve 56 is preferably of the butterfly type and is mounted on a shaft 76 that is journaled in the side walls of the casing section 58 (see Fig. 5). One end of the shaft 76 extends through a stuffing box 77 at one side of the casing and an operating lever 78 is centrally fixed thereto. Cords or cables 79 and 80 are fixed to the ends of the lever for shifting the valve 56 to admit a greater or less quantity of cold compressed air from the supply pipe 12 to the hot blast pipe 16 and thereby regulate the temperature of the compressed air that is delivered to the blast furnace. The valve 56 is provided with a stop lug 81 which is arranged to engage the wall of the casing section 55 when the valve 56 is in wide open position.

When the stove is in operation cold compressed air is admitted through the pipe 11 to the bottom of the stove 10 and air under pressure flows from the supply pipe 12 through the mixer and by-pass pipes 49 and 48 to the upper end of the controlling cylinder 32. The pressure of the air unseats the check valve 41 so that compressed air passes into the upper end of the cylinder and forces the piston 33 down. The downward movement of the piston, through the medium of the cable 26, lifts the valve 21 from the position shown in full lines to that shown by dotted lines in Fig. 2 of the drawings. As the piston 33 is thus forced downward, air escapes freely from the lower portion of the controlling cylinder 32 through the vent ports 35 and 36 adjacent the lower end thereof. As the piston approaches the lower end of the cylinder, it closes the larger vent port 35 and the lower end of the cylinder then acts as a dash-pot to check the too rapid movement of the piston and of the valve 21 controlled thereby. The smaller vent port 36 then allows the slow escape of air from the lower end of the cylinder 32 until the valve 21 has been completely raised to its open position shown by dotted lines in Fig. 2. So long as air under pressure is thus maintained in the upper end of the controlling cylinder 32, the valve 21 is held in open position, so that the heated air passes from the stove 10 through the pipe 14 and valve casing 15 to the hot blast pipe 16, whence it is delivered to the furnace. If, however, from any cause the pressure of air in the cold blast pipe is cut off or reduced to such degree that there may be danger of a back-flow of gas from the furnace through the hot blast pipe 16, the pressure in the upper end of the cylinder 32 is reduced and the weight of the valve 21 and

its stem 22, (which is in excess of the weight of the piston 33 and its stem 30) causes the valve 21 to promptly descend to its seat 20 at the lower end of the casing 15. When the piston 33 moves from the position shown by dotted lines in Fig. 2, toward the position shown by full lines in said figure, air escapes from the upper portion of the cylinder 32 through the port 38, chamber 37, through the ports 47 of the valve casing 39 and as well, also, through the hole or port 46 of the valve 41 into the by-pass pipe 48 but as soon as the piston 33 closes the port 38 the upper end of the cylinder acts as a dash-pot to resist the too violent closing of the valve 21, although the restricted port 46 in the check-valve 41 will permit the gradual escape of air until the piston 21 reaches the upper end of its movement. Hence, it will be seen that by placing the cut-off valve 21 under the control of mechanism actuated by the air pressure of the system, (and obviously the air pressure for this purpose, while preferably taken from the cold blast supply, may be taken from any desired point of the system) any such reduction of the air pressure as would permit a back-flow of gas from the furnace through the hot blast pipe into the stove, will insure the prompt closing of the cut-off valve. It should also be noted that the valve 21 is arranged in the discharge side of its seat and is in the nature of a check valve. That is to say, the flow of compressed air from the stove tends to open the valve and any back flow of gas through the pipe 16 tends to close it. The flow of air and gas through the valve casing thus assists the controlling cylinder in properly shifting the valve to guard the stove against the back flow of gas and the danger of explosion in the stove.

When the operator desires to stop the passage of air through the stove, he closes the valve 13 in the branch supply pipe 11 and shifts the three-way valve within the casing 50 by pulling the cord or cable 54, so that the passage of air through the by-pass pipe 48 to the cylinder 32 is cut off and communication is established between the upper end of the cylinder 32 and the atmosphere through the vent nozzle 51 in the three-way valve casing 50, so that the air in the upper end of the cylinder escapes to the atmosphere. The controlling valve 21 then descends by gravity to its seat 20 at the lower end of the valve casing 15. The valve 21 then remains in closed position until the valve 13 is opened to again supply compressed air to the stove and until the three-way valve is released so that it is shifted by the weight 53 to again admit compressed air to the upper end of the cylinder.

By means of the cables or cords 79 and 80 the operator can shift the butterfly valve 56

so as to permit the required amount of air to pass through the mixer pipe 49 to the hot blast pipe 16, and when the butterfly valve 56 is opened more or less, the pressure of air from the mixer pipe opens the cut-off or check valve 55 which is on the delivery side of its seat. The piston 71 will also be shifted outwardly in the cylinder 72 and the air pressure on the underside of the piston will hold the valve 55 open. If the air pressure falls for any reason the pressure on the piston 71 is relieved and the valve 55 falls by gravity to closed position and the back-flow of gases from the furnace into the mixer pipe and other parts connected thereto is prevented. By providing the outer end of the cylinder 72 with the contracted vent port 75, the cylinder and piston also act as a dash-pot to prevent the violent opening and closing of the heavy check-valve 55.

The invention provides exceedingly effective means whereby all danger of the back-flow of gas into the blast stove, cold blast pipes or into the air compressor is prevented in case the air pressure from any cause is excessively diminished or cut off. The advantages of the invention will be readily understood, since, obviously, any such back-flow of gas from the furnace is liable to produce an explosion. The flow of compressed air from the stove and through the mixer pipe tends to open the safety check valves 21 and 55 while any back flow of gas tends to close the same. Both valves are automatically opened by the air pressure and are held open as long as the air pressure persists, but are automatically closed upon the failure of the air pressure. At the same time the valve 21 can be controlled by hand, through the medium of the three-way valve in the casing 50 to cut off or establish communication between the stove and the hot blast pipe. The valves 21 and 55 are necessarily large and heavy but the valve 21 is partially counterbalanced by the piston 33 and the valve 55, as stated, is preferably counterbalanced by the weight 66. Moreover, the cylinders 32 and 72 are arranged to act as dash-pots to cushion the opening and closing movements of these heavy valves.

It is obvious that numerous changes may be made in the details set forth without departure from the essentials of the invention as defined in the claims.

I claim as my invention:—

1. In combination, a hot blast main, a hot blast stove having a discharge pipe opening into said main, a safety check valve in said discharge pipe between said main and said stove, and a fluid pressure motor controlled by the pressure of the air blast for opening said valve.

2. In combination, a hot blast stove, a discharge pipe for the hot blast, a safety valve for said discharge pipe, a fluid pressure mo-

tor controlled by the pressure of the air blast for actuating said valve, and means for controlling said motor to effect the opening and closing of said valve at will.

- 5 3. In combination, a hot blast main, a hot blast stove having a discharge pipe opening into said main, a self closing, safety check valve in said discharge pipe between said stove and said main, a fluid pressure device controlled by the compressed air of the blast for opening and holding open said valve, and means for controlling said motor to effect the opening and closing of the valve at will.
- 10 4. In combination, a hot blast stove, a discharge pipe for the hot blast, a self-closing, safety check-valve in said discharge pipe, a fluid pressure device controlled by the compressed air of the blast for opening and holding open said safety valve, and a manually operable valve for controlling the admission and exhaust of compressed air to and from said fluid pressure device to control the opening and closing of the valve at will.
- 15 5. In combination, a hot blast stove, a discharge pipe for the hot blast, a safety cut-off valve for said discharge pipe arranged above and on the discharge side of its seat and vertically movable to and from its seat, a motor cylinder and piston for shifting said cut-off valve, a pipe for conducting the compressed air of the blast to one end of said cylinder and valve mechanism for cutting off the supply through said pipe and connecting said cylinder to the atmosphere.
- 20 6. In combination, a hot blast stove, a discharge pipe for the hot blast, a safety cut-off valve for said discharge pipe arranged above and on the discharge side of its seat and vertically movable to and from its seat, a motor cylinder and piston for shifting said cut-off valve, a pipe for conducting the compressed air of the blast to one end of the cylinder, and a manually operable valve for controlling the admission and exhaust of air to and from said cylinder.
- 25 7. In combination, a hot blast stove, a discharge pipe for the hot blast, a safety cut-off valve for said discharge pipe arranged above and on the discharge side of its seat and vertically movable to and from its seat, a motor cylinder and piston for shifting said cut-off valve, said cylinder having a plurality of ports at different distances from its opposite ends, and a pipe communicating with the ports at one end of said cylinder for supplying the compressed air of the blast thereto.
- 30 8. In combination, a hot blast stove, a discharge pipe for the hot blast, a safety cut-off valve for said discharge pipe arranged above and on the discharge side of its seat and vertically movable to and from its seat, a motor cylinder and piston for shifting
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said cut-off valve, said cylinder having two vent ports at different distances from one end, and two inlet and exhaust ports at different distances from its opposite end, an inwardly opening check valve controlling the outer inlet and exhaust port, said check valve having a restricted opening there-through, and a pipe communicating with said inlet and exhaust ports for supplying the compressed air of the blast thereto.

9. In combination, a hot blast stove, a delivery pipe for the hot blast, a vertically movable cut-off valve in said delivery pipe arranged on the discharge side of its seat, a controlling cylinder, a piston in said cylinder, a cable connecting the rod of said piston and the stem of said valve, a pulley over which said piston extends, a supply pipe connected to said inlet pipe for conducting the compressed air of the blast to the upper end of the cylinder, and a manually operable valve for cutting off the supply of compressed air and for connecting the upper end of said cylinder to the atmosphere.

10. In combination, a hot blast stove, a delivery pipe for the hot blast, a vertically movable cut-off valve in said delivery pipe arranged on the discharge side of its seat, a controlling cylinder, a piston in said cylinder, connected to said cut-off valve, a mixer pipe connecting said inlet and delivery pipes, a supply pipe connected to said mixer pipe and to one end of said cylinder and manually operable controlling valves in said mixer and said supply pipes.

11. In combination, a hot blast stove having a pipe for admitting cold compressed air thereto and a pipe for discharging the heated air therefrom, a mixer pipe extending between the cold blast pipe and the hot blast pipe, a valve casing in said mixer pipe, a safety check-valve in said casing and a fluid pressure device exposed on opposite sides to the atmosphere and to the pressure in said mixer pipe for controlling said valve.

12. In combination, a hot blast stove having a pipe for admitting cold compressed air thereto and a pipe for discharging the heated air therefrom, a mixer pipe extending between the cold blast pipe and the hot blast pipe, a valve casing in said mixer pipe, a safety check-valve in said casing opening in the direction of the normal flow through said mixer pipe and a motor cylinder and piston connected to said check valve, one end of said cylinder being in communication with the said mixer pipe on the delivery side of said check-valve.

13. In combination, a hot blast stove having a pipe for admitting cold compressed air thereto and a pipe for discharging the heated air therefrom, a mixer pipe extending between the cold blast pipe and the hot blast pipe, a valve casing in said mixer pipe, an inclined check valve in said casing piv-

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otany mounted adjacent its upper edge and opening in the direction of the normal flow through said mixer pipe, a cylinder secured to said casing and communicating therewith on the discharge side of said check-valve, a piston in said cylinder, and a link connecting said piston to said check valve.

14. In combination, a hot blast stove having a pipe for admitting cold compressed air thereto and a pipe for discharging the heated air therefrom, a mixer pipe connecting the cold blast pipe and the hot blast pipe, a self-closing, safety check valve in said mixer pipe opening in the direction of the normal flow therethrough, and a fluid pressure device exposed on one side to the pressure in said mixer pipe for holding said safety check valve open.

15. In combination, a hot blast stove having a pipe for admitting cold compressed air thereto and a pipe for discharging the heated air therefrom, a mixer pipe extending between the cold blast pipe and the hot blast pipe, a manually operable valve in said mixer pipe for regulating the flow therethrough, a self-closing, safety check valve in said mixer pipe opening in the direction of the normal flow therethrough, and means controlled by the flow of air through said mixer pipe for holding said safety check valve open.

16. In combination, a hot blast stove having inlet and discharge pipes for the compressed air, a mixer pipe connecting said inlet pipe directly with said discharge pipe, self closing, safety check valves in said discharge pipe and in said mixer pipe, and means controlled by the pressure of the air blast for holding said safety check valves open.

17. In combination, a hot blast stove having inlet and discharge pipes for the compressed air, a mixer pipe directly connecting said inlet and said discharge pipes, self closing, safety check valves in said discharge pipe and in said mixer pipe, and fluid pressure devices controlled by the pressure of the air blast for holding said safety check valves open, and manually operable means for cut-

ting off the flow of air to said discharge pipe and said mixer pipe.

18. In combination, a hot blast stove, a discharge pipe for the hot blast, a safety check valve in said discharge pipe, a fluid pressure device for opening and holding open said valve, a pipe for conducting compressed air of the blast to said cylinder, and valve mechanism normally held in position to open communication through said pipe, said valve being manually shiftable to cut off communication through said pipe and connect said cylinder to an exhaust port, whereby the closing of said valve may be controlled at will.

19. In safety appliances for blast furnaces, the combination with a hot blast stove and discharge pipe leading therefrom, a safety check valve in said discharge pipe for preventing the back flow of furnace gases therethrough and a fluid pressure device controlling said safety check valve.

20. In combination, a hot blast stove, a discharge pipe for the hot blast leading from said stove, a safety check valve for said discharge pipe between the stove and the furnace and arranged to close automatically and prevent back flow and escape of gases from the furnace, and means controlled by the pressure of the blast for opening and holding open said valve.

21. In combination, a hot blast stove, a discharge pipe for the hot blast, a self closing, safety check valve for said discharge pipe, and a fluid pressure device controlled by the pressure of the blast for holding said valve open.

22. In combination, a hot blast stove, a discharge pipe for the hot blast, a safety check valve for said discharge pipe, a fluid pressure device for opening said valve and means for controlling said fluid pressure device to effect the opening and closing of said valve at will.

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