J. J. SHANNON.

AIR COOLED BLAST FURNACE STACK.

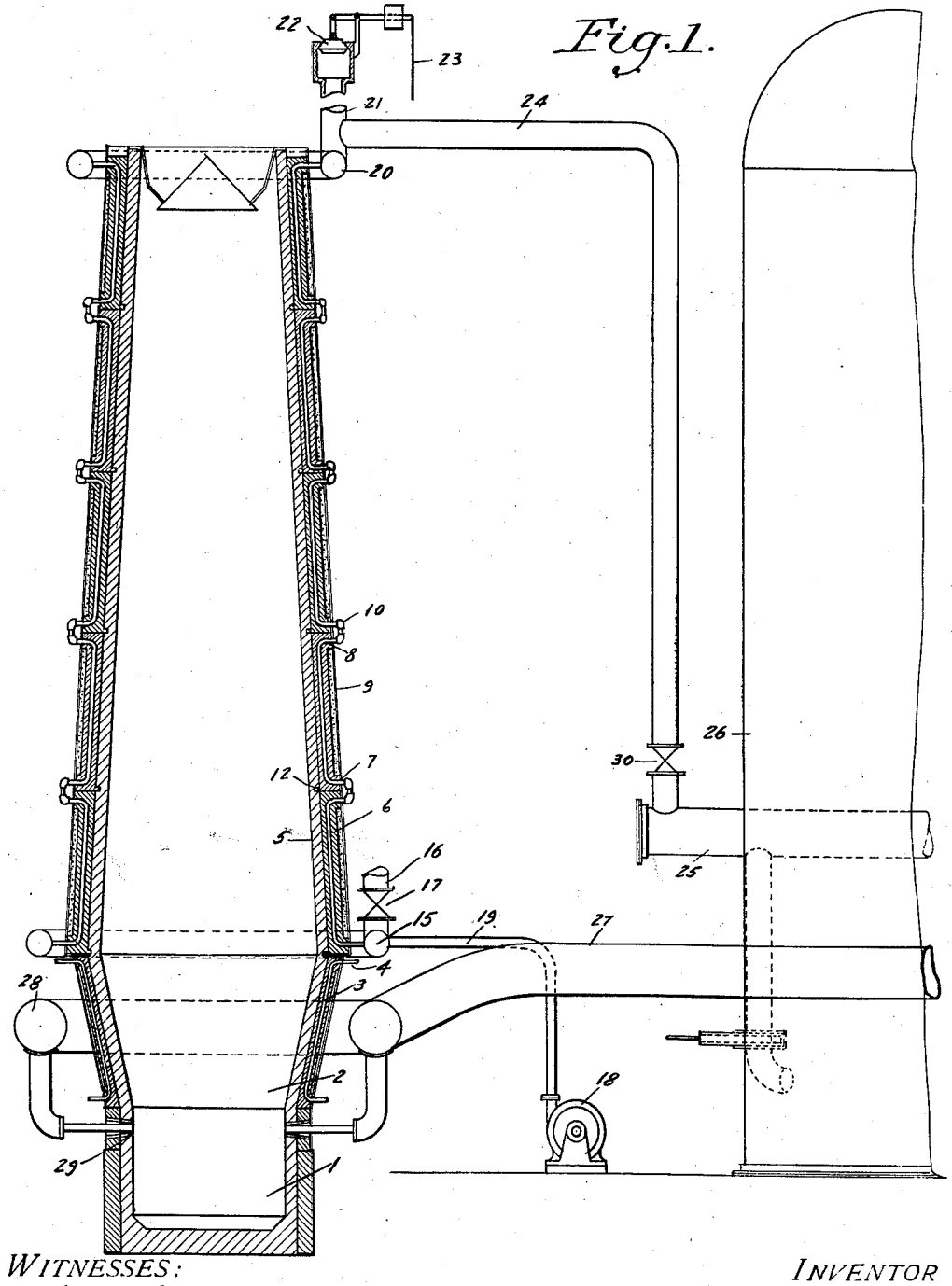
APPLICATION FILED MAR. 28, 1912. RENEWED AUG. 23, 1913.

1,090,574.

Patented Mar. 17, 1914.

2 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

C. J. Bradley

J. P. Dowd

INVENTOR

J. J. Shannon

BY

Pratt & Johnston

Attorney

J. J. SHANNON.

AIR COOLED BLAST FURNACE STACK.

APPLICATION FILED MAR. 28, 1912. RENEWED AUG. 23, 1913.

1,090,574.

Patented Mar. 17, 1914.

2 SHEETS—SHEET 2.

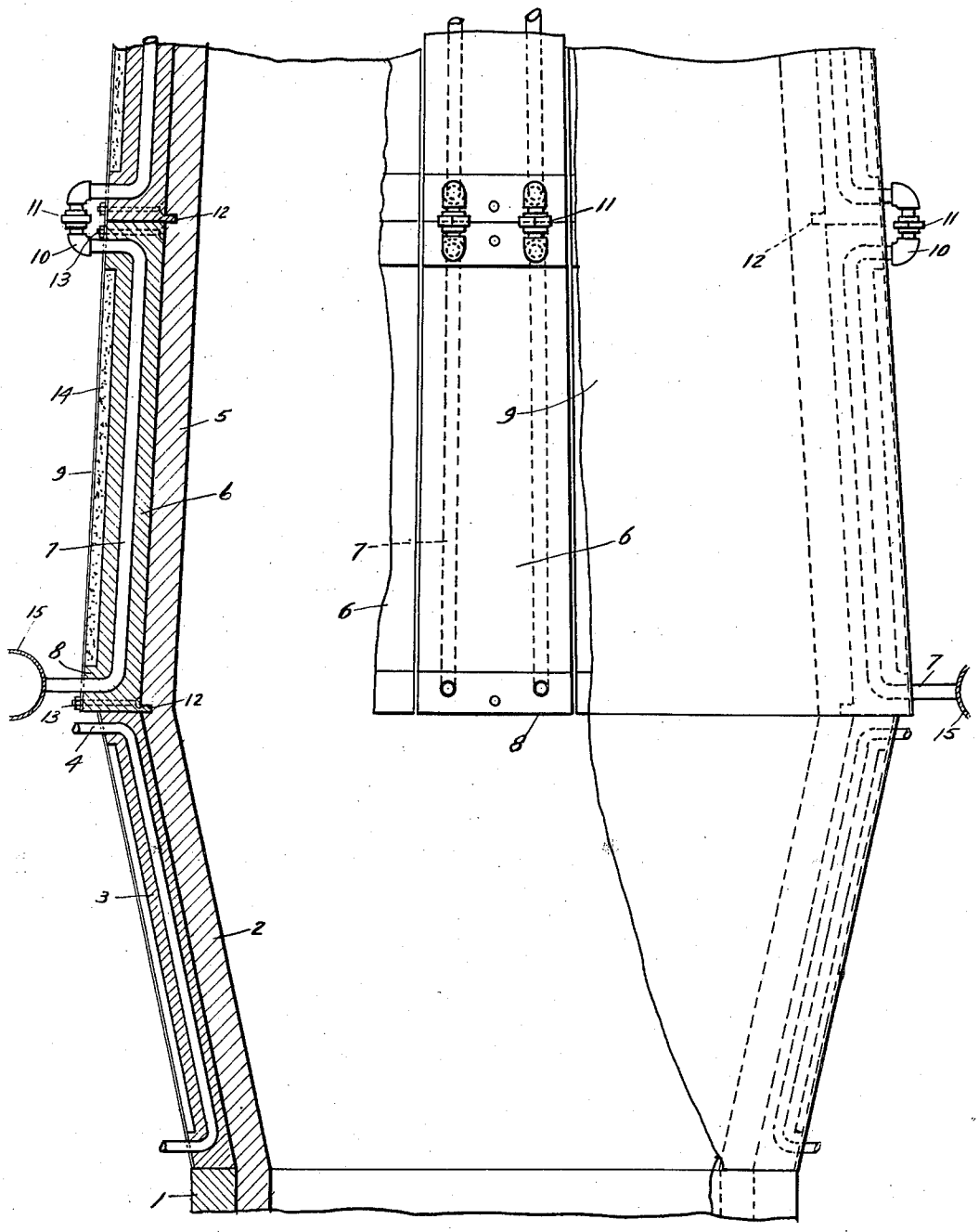


Fig. 2.

Witnesses

C. H. Bradbee

J. P. Wood

Inventor

J. J. Shannon

By Britt D. Schmeltz & Co

Attorney

UNITED STATES PATENT OFFICE.

JOHN J. SHANNON, OF BIRMINGHAM, ALABAMA, ASSIGNOR OF ONE-THIRD TO JAMES P. DOVEL, OF BIRMINGHAM, ALABAMA.

AIR-COOLED BLAST-FURNACE STACK.

1,090,574. Specification of Letters Patent. Patented Mar. 17, 1914.

Application filed March 28, 1912, Serial No. 686,899. Renewed August 23, 1913. Serial No. 786,348.

To all whom it may concern:

Be it known that I, JOHN J. SHANNON, a citizen of the United States of America, residing at Birmingham, in the county of Jefferson and State of Alabama, have invented certain new and useful Improvements in Air-Cooled Blast-Furnace Stacks, of which the following is a specification.

My invention relates to an improvement in the manner of constructing and cooling thin lined stacks of blast furnaces, cast metal wearing plates being used and cooled so that they will effectively resist the furnace heat even after the inner lining of refractory material has worn away and left the plates exposed.

As I propose to utilize air as the cooling medium for the plates, my invention is more particularly applicable to that portion of the furnace above the bosh and crucible, or, more generally, above the point where the intensity of heat in the furnace would tend to oxidize the air ducts or pipes of the cooling system.

Heretofore, the stacks of thin lined furnaces have been cooled by water which was circulated through coiled pipes cast in the metal plates that were bolted to the jacket. There are fundamental objections to such a system of cooling, such as the expense involved, not only in the consumption of water, but in the power required to force the water to the top of the stack; the loss of the heat units absorbed by the water in the cooling system, and finally in that water cooling systems are not readily controllable to modify their cooling effect on the stack as furnace conditions frequently require for best results. I have found that the utilization of air as a cooling medium offers a means of obviating the objections above referred to because the cooling medium itself, representing no item of expense, may be passed through the stack cooling system by a natural draft or by a forced draft which, due to the uses to which the air may be put, will represent no expense of operation, and because the volume of air flowing through the cooling system may be easily regulated to give the stack any desired temperature which will be made more uniform throughout the stack, due to the tendency of the air to radiate heat to the cooler part of the stack.

The object of my invention therefore primarily is to provide an air cooled furnace stack in which air is induced to pass through ducts preferably formed by pipes cast in the metal stack plates, either by a natural draft or by a forced draft.

A further object of my invention is to conserve the heat which the air absorbs in cooling the stack by returning the heated air from the cooling system into the cold blast or the furnace stoves.

My invention further comprises improvements in the manner of assembling the cast metal stack plates within the furnace jacket and introducing a non-conducting filler between the plates containing the cooling pipes and the jacket to reduce the loss of heat by radiation from the stack.

My invention further comprises the details of construction and arrangement of parts hereinafter more particularly described and claimed, reference being had to the accompanying drawings, in which:—

Figure 1 is a vertical sectional view through a blast furnace equipped with my cooling system. Fig. 2 is an enlarged view of a part of the furnace stack showing the cooling plates in vertical section and in elevation with the jacket broken away.

Similar reference numerals refer to similar parts throughout the drawings.

The blast furnace illustrated comprises the crucible 1, the bosh 2 surrounded by segmental cast metal plates 3 which are cooled by pipes 4 through which water, or any desired cooling medium may be circulated in any preferred manner. The furnace stack has a thin brick lining 5 surrounded by a series of cast metal segmental wear plates 6 in which vertically disposed pipes 7 are cast, preferably two pipes to the section and so arranged that the pipes are substantially equi-distantly distributed around the furnace. The plates 6 are thickened at each end to provide an off-set shoulder 8 through which the ends of the pipes project at right angles far enough to pass out through the outer jacket 9 of the furnace stack where elbows 10 and a union 11 are used to connect the upper end of one pipe with the lower end of the alining pipe in the section above it. The sections 6 are provided at their lower ends with inwardly disposed shoulders 12 which are engaged in the brick lining 5 to tie the plates and lining together more securely. Countersunk bolts 13 connect the shoulders 8 of the plates to the

jacket and leave annular spaces between the plates and jacket which are adapted to be filled with grouting, mineral wool or non-conducting material 14 to prevent radiation from the jacket of heat units which it is my purpose to conserve. The several cooling pipes are preferably arranged as described and connected up to provide the sectional cast metal stack wall with a series of vertical air ducts which extend therethrough continuously from the bottom to top and are spaced and have an air carrying capacity sufficient to maintain the cooling plates at a low enough temperature to prevent the heat in the stack from injuring or destroying them. As the air flows upwardly through the ducts it exerts its maximum cooling where most needed, namely, at the bottom of the stack, and becoming more and more heated as it flows upwardly, the air tends to radiate heat into the cooler top of the stack and thus maintain more uniform temperature conditions throughout the stack walls.

Inasmuch as I propose to utilize either a natural draft to induce the required circulation of air through the air ducts or a forced draft, I prefer to so connect the lower ends of the air ducts that the apparatus will automatically change from a forced draft to a natural draft without requiring manipulation. To this end the lower ends of the ducts connect with a circular distributing pipe 15 surrounding the lower end of the stack and having a direct air inlet pipe 16 controlled by an automatic check valve 17. A high pressure blower 18, of any suitable type and driven in any suitable manner, is connected by a pipe 19 with the distributing pipe 15 and when the forced draft is on, the check valve 17 will automatically close. The upper ends of the air ducts connect with a circular collecting pipe 20 which surrounds the top of the stack and is supported by the superstructure of the furnace in any practicable manner. From the pipe 20 there leads a draft flue 21 in which I dispose a counterbalanced check valve 22 having its counterbalance arm provided with an operating cord or chain 23 which hangs down in reach of the furnace attendants to enable said valve to be set in adjusted positions for controlling the volume of air flowing through the cooling system under natural draft conditions. A pipe 24 leads from the pipe 23 to the cold blast main 25 which supplies air to the stoves 26. The hot blast main 27 delivers the hot air from the stoves to the bustle pipe 28 and twyers 29. An automatic check valve 30 is interposed in the pipe 24 which will open when the forced draft pressure exists in pipe 24, as this pressure will be higher than the pressure normally obtaining in the cold blast main.

Under natural draft operating conditions, valves 16 and 22 will be opened and valve 30 closed. The draft in stack 21 and the draft induced in the air ducts will draw a volume of air through pipes 16, 15 and through the ducts which are spaced and designed so that the cooling plates will be protected. In this use of my invention the heat units absorbed by the air will be discharged through stack 21 and lost. To conserve these I utilize a forced draft, causing the blower 18 to force air at the required pressure into the distributing pipe 15 and through the ducts to collecting pipe 20. This forced pressure will close valves 16 and 21 and open valve 30, whereupon the air containing the heat units it has absorbed in cooling the stack wall will be discharged back into the air blast to the furnace so that practically no heat is wasted. Further the operation of the blower 18 does not represent any substantial increase in cost of operation since it supplements the work of the main blowing engines. The power required to pump water through a stack cooling system represents a total loss and the heat units absorbed by the water also represent a loss.

Under certain operating conditions it is desirable to regulate the cooling system so that the temperature of the stack may be varied. Under the natural draft conditions this regulation may be obtained by adjusting the valve 22 to control the volume of air flowing through the cooling system. Under the forced draft operating conditions this regulation may be obtained by controlling the blower to vary the quantity and pressure of air which it delivers to the distributing pipe 15 and which control may be effected in any practicable way.

Obviously, where conditions will not justify the use of the forced draft system, the distributing pipe 15 may be dispensed with and the lower ends of the air ducts left open. I regard it as of advantage that the cooling pipes extend straight up through the furnace walls, as the direct passage thus afforded for the air insures a quicker flow and a greater volume of cooling air per unit of height of the stack. A much greater number of straight cooling pipes can be distributed around the stack than would be the case if coiled pipes were used, and inasmuch as the essence of the invention consists in economically passing the requisite volume of air through the cooling system, the advantage of the straight closely associated pipes is of material importance.

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

1. A blast furnace stack having a thin lining of refractory material, a sectional metallic wall surrounding said lining and provided with alining vertical air flues in the

sections thereof, means to connect said flues to provide continuous parallel straight air passages from bottom to top of the stack, a metallic jacket surrounding said sectional wall, and flanges on both sides of the sections, the inner flanges being tied into the refractory lining and the outer flanges being connected to said jacket, substantially as described.

2. A blast furnace stack having a thin inner lining of refractory material, a wall surrounding said lining and comprising metallic sections, vertical air passages formed in said sections which are arranged to bring the passages into vertical alinement, means to connect the alining passages between the superposed sections, and a common valve means for controlling the flow of air through said passages.

3. In a blast furnace, a cooling means for the stack thereof comprising a plurality of segmental metallic plates, a jacket surrounding said plates, a thin inner lining for said plates, vertical passages formed in the plates which are arranged to bring their respective passages into position to form series of vertical alining passages extending substantially from bottom to top of the stack, means to connect the alining passage ways, a common chamber into which said passages are adapted to discharge heated air, and valve means to control the flow of air from said chamber, substantially as described.

4. In a blast furnace, a cooling means for the stack wall thereof comprising a plurality of segmental metallic plates which surround the wall, vertical passages provided in the plates which are arranged to bring their respective passages into position to form series of vertical alining passages extending substantially from bottom to top of the stack, means to connect the alining passage ways forming a series, an annular pipe surrounding the top of the furnace and connected to the upper ends of the series of passage ways, and valve means to control the discharge of heated air from said pipe.

5. In a blast furnace, a stack wall thereof comprising an outer jacket, an inner wall of metal cooling plates, and a refractory lining for said wall, vertical passages in the plates which are arranged to bring their respective passages into position to form series of vertical alining passages extending substantially from bottom to top of the stack, means to connect the alining passage ways forming a series, an annular pipe surrounding the top of the furnace and connected to the tops of the passage ways, and a valve controlled discharge pipe leading from said annular pipe and forming a draft stack.

6. In a means for cooling a blast furnace stack wall, the combination of a series of metallic plates which surround the furnace wall, means to circulate a cooling medium through said plates, flanges on each section, an outer jacket surrounding said metallic sections and adapted to engage the flanges thereof to form annular recesses surrounding the stack, and a fire-proof non-conducting filler interposed in said recesses, substantially as described.

7. In a means for cooling a blast furnace stack wall, the combination of an outer jacket, a series of metallic plates connected to the inner face of the jacket, means to circulate air through said plates which are designed to leave recesses between them and said jacket, a non-conducting filler interposed in said recesses, and means to return the heated air discharged from said circulating means into the forced draft of the furnace, substantially as described.

8. A thin lined furnace stack having a wall formed by metal cooling plates, air ducts leading upwardly and adapted to cool said plates, a jacket surrounding said wall, air-blowing means, and pipe means connected therewith to return the heated air discharged from the upper ends of said ducts back to the furnace.

9. A thin lined furnace stack having a wall formed by metal cooling plates, air passages leading substantially from bottom to top of the wall, means to force air through said passages, and pipe means to discharge the heated air into the furnace stoves, substantially as described.

10. The combination with a furnace, stoves therefor, and hot and cold blast mains, of a wall in the furnace stack formed of metal plates, air passages in said wall, a blower adapted to force air through said passages, and pipe means to carry the heated air from said passages and discharge it into said cold blast main.

11. The combination with a furnace, stoves therefor, and hot and cold blast mains, of a wall in the furnace stack formed of metal plates, air passages in said wall, a blower adapted to force air through said passages, a pipe adapted to convey the heated air from said passages and discharge it into said cold blast main, and a check valve in said pipe, substantially as described.

12. A thin lined furnace stack having a wall formed of metal plates, air pipes for cooling said plates, a draft stack with which said pipes communicate at their upper ends, valve means to shut off the pipes from said draft stack, an air blast main for the furnace, a pipe adapted to convey the hot air, when said draft stack is closed, to said air blast main, an air blower adapted to force air through said cooling pipes, and valve means to open the intake ends of said cooling pipes to the atmosphere, substantially as described.

13. In a furnace stack, air cooling pipes leading upwardly through the stack wall,

means to force air through said pipes, a forced draft main for the furnace, and pipe means to collect the heated air from the tops of said pipes and discharge it back into the suction end of said forced draft main.

14. In combination, a blast furnace comprising a thin lined stack having a wall of metal plates, air pipes to cool said plates, an air supply main connected to the lower ends of said pipes, an air collecting main connected to the top of said pipes, check valve controlled inlet and outlet pipes for said distributing and collecting mains respectively, a forced draft means connected to said distributing mains, an air blast main for the furnace, and a check valve controlled pipe leading from the collecting main to said air blast main.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN J. SHANNON.

Witnesses:
NOMIE WELSH,
MINNIE L. DANIEL.