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METHOD OF EQUALIZING PRESSURES.

APPLICATION FILED MAR. 3, 1910.

**1,034,217.**

Patented July 30, 1912.

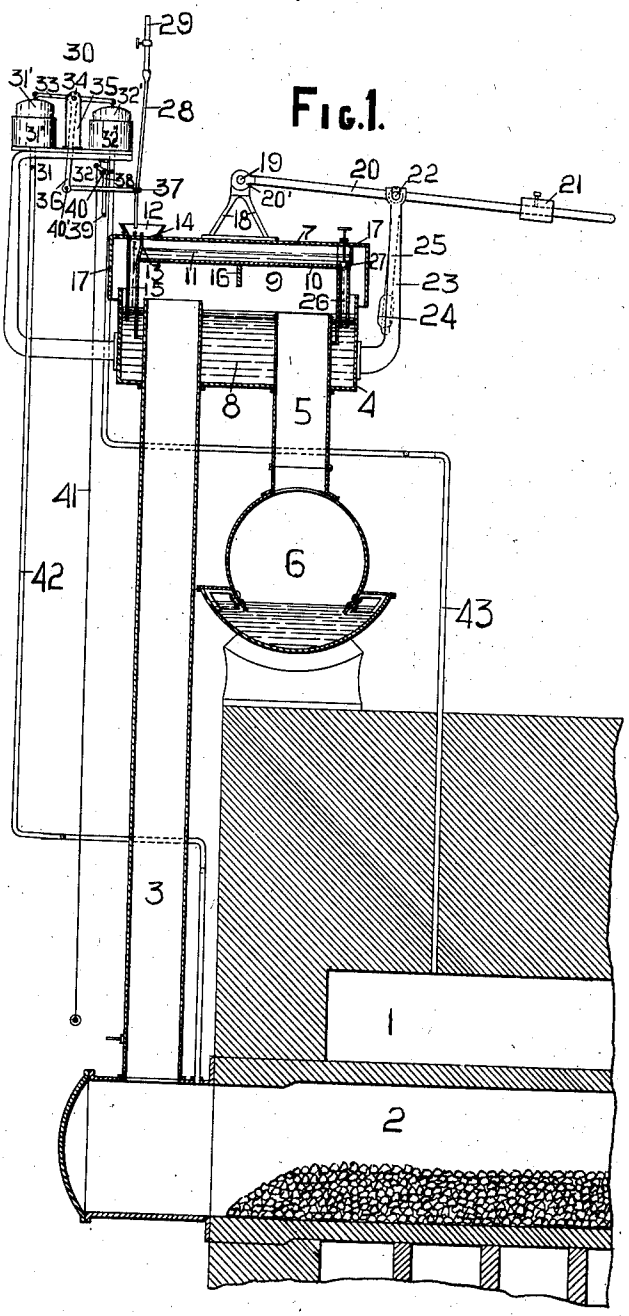


Fig. 1.

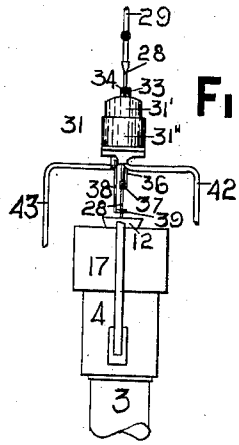


Fig. 2.

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# UNITED STATES PATENT OFFICE.

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## METHOD OF EQUALIZING PRESSURES.

1,034,217. Specification of Letters Patent. Patented July 30, 1912.

Application filed March 3, 1910. Serial No. 547,143.

*To all whom it may concern:*

Be it known that I, HENRY L. DOHERTY, a citizen of the United States, and a resident of New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Methods of Equalizing Pressures, of which the following is a specification.

This invention relates to a method of equalizing pressures, and particularly to a method of equalizing the pressures in a retort or oven for carbonizing coal and the combustion chamber of the furnace heating such retort or oven.

The object of my invention is the prevention both of leakage of gas from the retort or oven into the combustion chamber due to an excess of pressure in the said retort or oven as compared with the pressure prevailing in the combustion chamber, and of the infiltration of combustion gases from the combustion chamber into the retort or oven due to a relatively lower pressure in the same. The former condition is the one usually prevailing in practice although the latter condition might obtain due to abnormal conditions of working.

The specific apparatus which I have shown in the drawings I do not claim herein but claim in my co-pending application Ser. No. 611,900, filed Mar. 2nd, 1911.

Specifically but briefly stated, my invention consists in a method of equalizing the pressure prevailing in a retort or carbonizing chamber with that prevailing in the furnace of said retort or chamber which consists in connecting the said carbonizing chamber with a gas conduit in which the pressure of the gas passing therethrough is maintained at a lower point than that of the combustion gases in the furnace, and then throttling the flow of gas from said carbonizing chamber until the pressure therein is substantially equal to that existing in the furnace and then varying said throttling action to balance any tendency of the pressure in said carbonizing chamber to vary from the pressure prevailing in the furnace of said chamber, the said throttling action being varied and controlled automatically by the pressure difference between the chamber and furnace. This method is, of course, of general application and is not limited to use in equalizing pressures between a retort chamber and its furnace.

In the accompanying drawings, I have shown the apparatus of my invention as applied to the equalizing of the pressures in a carbonizing chamber and the combustion chamber of the furnace heating the same. It is to be understood that this application, which I herein claim specifically, is only one of many applications of my method and apparatus. It may be applied generally to the equalizing of pressures in two gas conduits or between a gas conduit (in which a stream of gas is flowing) and a chamber containing a body of gas at rest. The apparatus of my invention may be applied without alteration to either case.

Figure 1 shows a vertical longitudinal section of my invention, as applied to a retort of a gas bench. Fig. 2 is a front elevation of the pressure equalizing device.

1 is the combustion chamber of the retort oven, 2 is a retort in said oven, 3 is the ascension pipe of the retort which conducts the gas to the hydraulic-seal device. This sealing device comprises a seal box, 4, in which terminate the upper extremities of the ascension pipe 3 and the connection 5 to the hydraulic main 6, and a lift, 7, the sides of which are immersed in the liquor seal 8 contained in the seal box 4, thus forming a sealed chamber, 9, through which the two pipes 3 and 5 communicate in the raised position of 7. The lift 7 is provided with a false top, 10, which forms a water receptacle, 11. In the top of 7 is an aperture, 12. The end wall 13 of 11 forms two passages, 14 and 15, which communicate, respectively, with the water receptacle 11 and the interior of the seal box 4.

Attached to the false top 10 and located between the ends of the pipes 3 and 5 is a vertical transverse partition 16. This is of such a depth that when the lift 7 is in its lowest position it will be immersed in the liquor seal 8 to a sufficient extent to shut off the flow of gas from 3 to 5. The side walls of 7 have a sufficient depth to remain immersed in the seal 8 when the lift 7 is in its highest position. An apron, 17, of light sheet metal is attached to the top of 7 and forms a loose cap which prevents the entrance of dust into the interior of 4. A bracket, 18, attached at the center of the top of 7 carries a bearing pin, 19, which is supported in the bearings 20′ carried by the forked extremity of the beam 20. The other extremity of 20 is provided with an adjustable weight, 21, which is so set that it

slightly overbalances 7 when the water pan 11 is empty. 20 is fulcrumed in the bearings 22, supported by the standard 23 attached to the fixed box 4. An adjustable equilibrium weight, 24, is attached to 20 at its center of support by the rigid arm 25. The point of support of the beam 20 should be at such a height above the level of the liquor seal 8 that the beam 20 will occupy a horizontal position when the lift 7 is in its average normal position. It will be seen that the turning moment of the weight 24 is *nil* in the average position of 7 but increases with the variation of the latter from its mid position. The relation in weight and length of lever arm of 24 and 21 is such that the turning moment of 24 relative to the point of support 22 of 20 will exceed that of 21, as soon as the lift 20 rises above its highest permissible position. The range of travel of 7 is thus limited to a height which will not cause the unsealing of the ascension pipe and hydraulic main connection, even if the water pan 11 should, for any reason, be empty. A discharge passage, 26, is provided for 11, the flow of water from 11 to 26 being regulated by the valve 27. It will be seen that the position of 7 is regulated by the balance between the gas pressure in 9 and the quantity of water in the pan 11. The opening of valve 27 after once set is maintained constant. The quantity of water in 11 at any given time thus depends upon the supply of water to 11 relative to the discharge.

A constant flow of water is maintained through the flexible hose 28 connected to the water supply pipe 29. The water flows from the hose 28 either through the passage 14 to the pan 11, or through the passage 15 to the liquor in the seal 8, depending upon the position of the end of hose 28. This is determined and varied automatically according to the difference in pressure between the combustion chamber and the retort by means of the pressure balance 30. This, in the construction shown, comprises two small gas holders, 31 and 32, whose lifts 31′ and 32′, respectively, are attached to the extremities of the balance beam 33 which is fulcrumed in the bearings 34 supported by the standard 35. The tanks, 31″ and 32″, respectively, of the gas holders contain a sealing liquid—preferably oil in order to avoid evaporation. A pipe, 42, connects the interior of the lift 31′ with the mouthpiece of the retort 2, and a pipe, 43, connects the interior of lift 32′ with the combustion chamber 1 in the vicinity of retort 2. Attached rigidly to the middle of beam 33 of the pressure balance 30 is the arm 36. At the lower extremity of 36 is attached one extremity of the rod 37 whose other extremity is attached to the flexible hose 28. It is seen that any oscillation of 36 will cause an oscillation of the end of the hose 28 in the same plane. The length of the rod 37 is such that the discharge orifice of the hose will be held directly over the partition 13 when the arm 36 is vertical, which will be the case when the pressures in 1 and 2 are the same.

In order to permit the cutting off of the communication between the retort and hydraulic main at the time of drawing and charging the retort, a bell crank, 38, whose lower arm bears a projecting horizontal pin, 39, is mounted in bearings, 40, supported by a suitable standard, in such position that on hauling down the cord 41 attached to the upper arm of 38 the pin 39 will bear against the hose 28, shifting it over the passage 14 independently of the action of the pressure balance 30.

The method of operating my invention is as follows:—On first starting, the apparatus is so adjusted that under normal operating conditions during the average make of gas the lift 7 occupies such a position that the pressures in 1 and 2 are equal. The gas evolved from the coal undergoing carbonization in the retort now passes up through the ascension pipe 3, through the chamber 9 under the vertical partition 16, down through the connection 5 into the hydraulic main 6, from which it is drawn off by an exhauster (not shown). After a retort has been freshly charged, the make of gas is very rapid, and in consequence of this, the pressure in the retort tends to build up to a point above the average pressure therein. This pressure is transmitted through the pipe 42 to the gas holder 31, causing the lift of 31′ to rise, thus swinging the arm 36 to the left and communicating a left hand movement to the rod 37, thus pushing the lower extremity of hose 28 to the left so that the discharge therefrom passes through the passage 15 into the liquor-seal 8 in the seal-box 4. The connection 5 from 9 to 6 also serves as a liquor overflow from 4, the excess of water and condensed liquor and tar from the gas passing down through 5 to the hydraulic main. Since the water discharge valve 27 is always open, as the supply of water to 11 has been cut off, the pan 11 is quickly emptied to an extent that permits the counterpoise 21 to overbalance the lift 7 which consequently rises, thus increasing the opening between the partition 16 and the level of the seal 8 in 4. The area of the gas passage between the two compartments of 9 is thus increased to correspond with the increased make of gas which again passes unthrottled from 3 to 5, thus restoring the pressure in the retort to normal. The lifts 31′ and 32′ of the gas holders 31 and 32 return to their normal position.

It will be seen from the construction that the lift 7 and the regulating apparatus will never come to a position of complete rest.

When, in response to an increased pressure in the retort, the lift 7 has moved upward and the flow of water has been completely diverted from 14, the lift 7 tends to move upward until the pressure in 2 has fallen below normal under the influence of the exhauster, since the water is continuously discharging from 11. As the pressure falls in the retort the shifting of the holders moves the rod 37 to the right until the water is again discharging into 14 and the pan 11. As the water accumulates in 11, the lift 7 tends to fall again, again building up the pressure in 2. This causes a corresponding movement of the holders 31 and 32 again diverting the discharge of water into 15. As the pan 11 agains empties itself the end of hose 28 is again brought over 14, and so on. There is thus a continual slight movement of the lift 7. This vibration up and down from the equilibrium position of the lift 7 is however very slight. The lateral movement of the end of hose 28 need only be, practically, that of the diameter of the stream of water discharging from it to wholly divert the flow from one to the other of passages 14 and 15, since the thickness of the partition 13 is practically negligible. The relative lengths of the arms 35 and 36 are such that the vertical movement of the gas holders to cause a given lateral movement of the rod 37 and consequently of the hose 28 is considerably less than the lateral movement of the latter. The change in pressure between 1 and 2 required to entirely shift the water discharge is thus practically inappreciable since the friction opposing the movement of the lifts 31′ and 32′ is very slight, as they work in free suspension in the tanks 31″, 32″, and the power required to oscillate the hose 28 is negligible. The only resistance which the holders must overcome therefore is, practically speaking, the friction in the bearings 34 and 40. The pressure control which may be secured by my invention is therefore very delicate. The greater the flow of water that it is arranged to maintain through 11 the more quickly responsive will the equalizing device be to the relative changes of pressure in 1 and 2.

As already explained, before opening the retort for charging, the operator draws down the cord 41 operating the bell-crank 38 and shifting the hose 28 so that the entire discharge flows into 11 through the passage 14. The lift 7 is thus depressed to its lowest position immersing the partition 16 in the seal 8, thus cutting off communication between the retort and the hydraulic main. The arms of the bell-crank 38 are so weighted that when the cord 41 is free the lower arm of 40 will assume the vertical position.

When it is desired to clean either of the two gas pipes 3 or 5 or the seal box 4, the lift 7 is raised from the bearings 22 (the retort being open) and lifted entirely out of the seal box 4. A cap may then be placed over one of the pipes 3 or 5 and the other cleaned by inserting a suitable tool into the pipe.

Instead of the pressure balance shown, any equivalent device may be used instead. For instance, a diaphragm may be used the opposite sides of which are in communication with the retort and combustion chamber respectively, the movement of the diaphragm in this case being transmitted directly to the hose by having the rod 37 directly connected to the diaphragm.

Having described my invention, what I claim is:—

1. The method of equalizing the pressures in two independent and non-communicating gas passages which comprises compensating for any variation in pressure between the two passages by throttling the discharge of gas from one of the passages according to the difference in pressure developed between the two gas passages.

2. The method of equalizing the pressures in two gas passages which comprises exhausting the gas from the passage having the higher normal pressure and throttling the discharge of gas from said passage until the pressure prevailing therein is equal to that prevailing in the other of said gas passages.

3. The method of equalizing the pressures in two gas passages which comprises connecting the one of said gas passages in which the pressure is normally the higher with a chamber in which the gas is maintained at a lower pressure than the gas in the other of said gas passages, and then throttling the discharge of gas from the first of said gas passages until the pressure in the same is substantially equal to that in the second of said gas passages.

4. The method of equalizing the pressures in two gas passages which comprises connecting the one of said gas passages in which the pressure is normally the higher with a chamber in which the gas is maintained at a lower pressure than the gas in the other of said gas passages, then throttling the discharge of gas from the first of said gas passages until the pressure in the same is substantially equal to that in the second, increasing the throttling action on the discharge of gas from the first of said gas passages when the pressure in said passage falls below the pressure in the second of said passages and decreasing the throttling action on the discharge of gas from the first of said gas passages when the pressure in said passage rises above the pressure in the second of said passages.

5. The method of equalizing the pressure in a carbonizing chamber with that pre-

vailing in the furnace of said carbonizing chamber which comprises throttling the discharge of gas from the said carbonizing chamber and varying the throttling action according to the difference in pressure existing between the said carbonizing chamber and its furnace.

6. The method of equalizing the pressure in a carbonizing chamber with that prevailing in the furnace of said carbonizing chamber which comprises exhausting the gas from the said carbonizing chamber and varying the exhausting action on the gas in said carbonizing chamber inversely with the pressure difference prevailing between the said carbonizing chamber and its furnace.

7. The method of equalizing the pressure in a carbonizing chamber with that prevailing in the furnace of said carbonizing chamber which comprises connecting the said carbonizing chamber with a conduit in which the gas passing therethrough is maintained at a lower pressure than the gas in the furnace of said carbonizing chamber and then throttling the discharge of gas from said carbonizing chamber to said conduit until the pressure in the said carbonizing chamber is substantially equal to that in the furnace of said chamber.

8. The method of equalizing the pressure in a carbonizing chamber with that prevailing in the furnace of said chamber which comprises establishing communication between the said carbonizing chamber and a conduit in which the gas passing therethrough is maintained at a lower pressure than the combustion gases in the furnace of said carbonizing chamber and varying the degree of communication between the said carbonizing chamber and said conduit to balance any tendency of the pressure in said carbonizing chamber to vary from the pressure in the furnace of said chamber.

9. The method of equalizing the pressure in a carbonizing chamber with that prevailing in the furnace of said chamber which comprises connecting the said carbonizing chamber with a gas conduit in which the pressure of the gas passing therethrough is maintained below that prevailing in the furnace of said carbonizing chamber, then throttling the discharge of gas from the said carbonizing chamber until the pressure therein is substantially equal to that existing in the furnace of said carbonizing chamber, increasing the said throttling action when the pressure in said carbonizing chamber falls below the pressure in the furnace of said chamber and decreasing the said throttling action on the gas discharging from said carbonizing chamber when the pressure in the said chamber rises above the pressure in the furnace of said chamber.

Signed at New York city, in the county of New York and State of New York this 2nd day of March A. D. 1910.

HENRY L. DOHERTY.

Witnesses:
THOS. I. CARTER,
W. J. QUENTIN.