

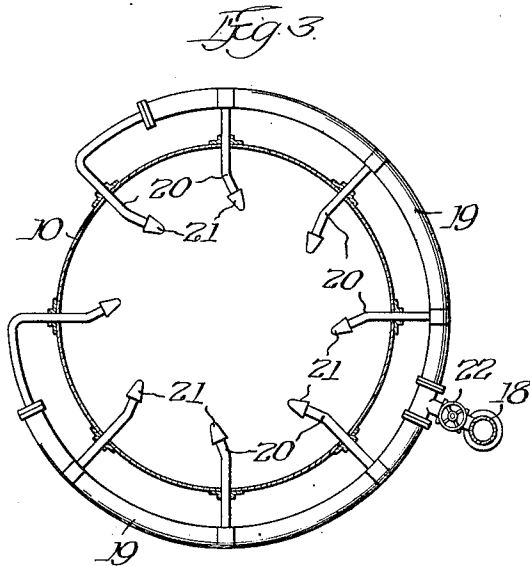
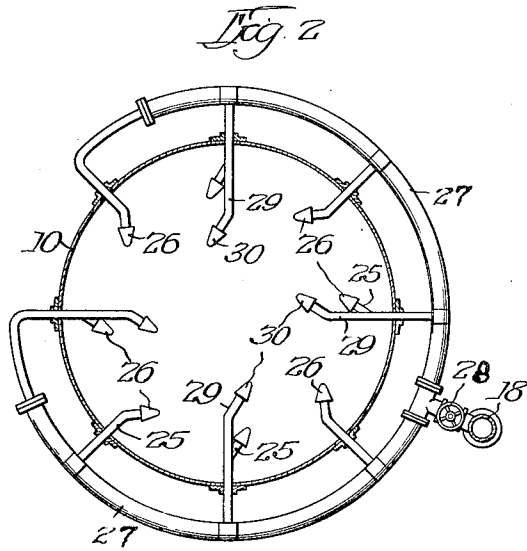
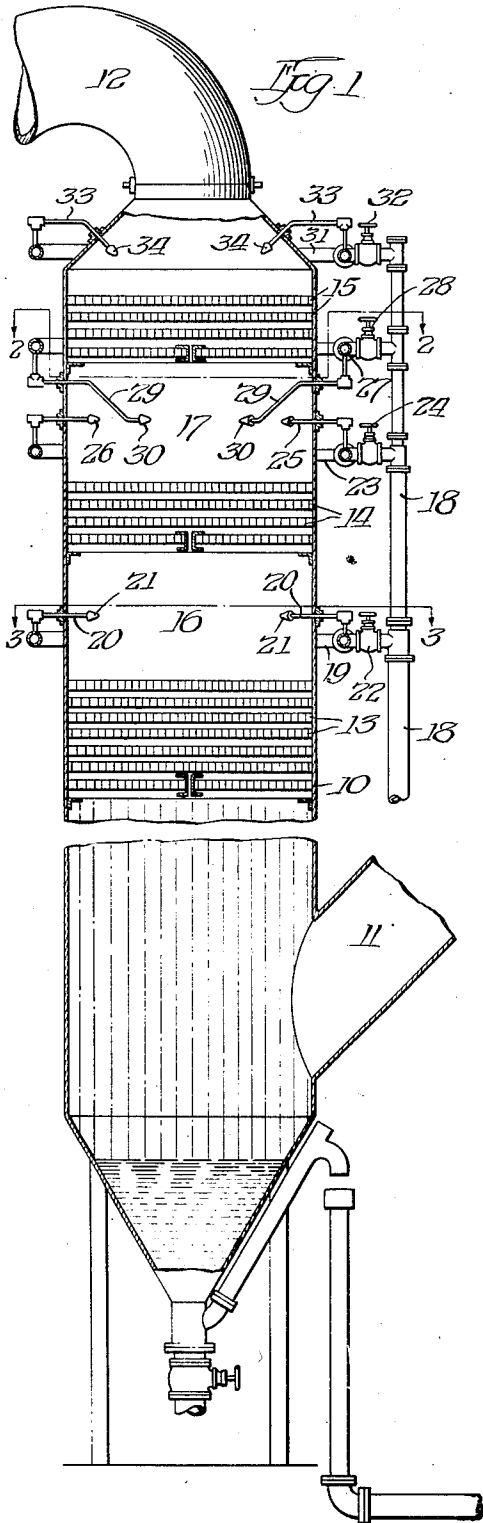
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W. MATHESIUS

METHOD FOR CLEANING GAS

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Inventor
Walter Mathesius
By Anthony Reina
Attorney

UNITED STATES PATENT OFFICE.

WALTHER MATHESIUS, OF CHICAGO, ILLINOIS.

METHOD FOR CLEANING GAS.

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To all whom it may concern:

Be it known that I, WALTHER MATHESIUS, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in a Method for Cleaning Gas, of which the following is a specification.

My invention relates to a method for cleaning gas and has particular reference to the washing of gas obtained from the operation of blast furnaces and removing the solids and vaporous matter carried by the said gas by means of a washing fluid introduced into said gas in a direction at right angles to the travel of the gas through a washer tower with sufficient velocity to overcome the rate of travel of the gas and scrubbing and cleaning the gas by the use of such cleaning fluid without the use of mechanical devices for bringing the gas and cleaning fluid into intimate contact with relation with each other.

I am aware that various methods of washing and cleaning blast furnace gas have been in common usage by means of a cleansing fluid usually introduced into the top of a stationary washing tower and falling by gravity to the bottom of the tower at the same time, as the gas passes upward through the said tower, with various forms of retarding means placed in said tower for distributing the gas throughout the tower and bringing the gas into contact with wetted surface of baffles, hurdles or the like while the water passes downward over the said hurdles washing off the deposits of solids and removing them from the gas.

I am also aware that various forms of mechanically operated apparatus have been used whereby the gas is agitated and scrubbed by means of revolving paddles, reels, or the like in a closed container and brought into more intimate contact with the cleansing fluids than is ordinarily obtained in stationary washing apparatus such as described in the preceding paragraph. However, in a device of this character, the expense of operation is high and where large quantities of gas have to be cleaned the initial expense for installations and the like makes this process prohibitive.

The primary object of my invention is the

cleaning of gas as it passes through a closed container by scrubbing the gas by means of sprays of water introduced into the container through which the gas passes and in which sprays form a vortex of cleansing fluid which causes the gas to rapidly revolve in said container and thoroughly scrubs the gas by bringing it into more intimate contact and relation with the cleansing fluid than has been obtained in existing forms of stationary washing apparatus and without the addition of or the use of any mechanical means for bringing the gas and water into closer contact and relation with each other.

A further object of my invention is the method of cleaning gas whereby the gas is kept evenly distributed throughout the container and the cleansing fluid is also evenly distributed over any given cross sectional area of the container so that channelling of the gas is prevented and also the fluid cleansing medium is brought into contact with each unit of gas as it passes through the washer.

Another and further object of my invention is the method of cleaning gas by bringing the gas into intimate contact with a plurality of whirling vortexes of cleansing fluid evenly distributed throughout any given cross sectional area of the container and forcing the cleansing fluid into the container at a higher velocity than the movement of the gas through the container so the gas is made to partake in the whirling movement and in finally divided form is brought into contact with the sprays and broken up and the impurities, both solid and vaporous are removed from the gas.

Another and further object of my invention is the method of cleaning gas whereby the cleaning fluid, as for instance water falling by gravity from the spray nozzles after its velocity is spent is picked up by the sprays in the lower part of the container and forms a part of another whirling vortex of water and is thus redistributed throughout the entire cross sectional area of the gas washer container so that the gas is prevented from channelling in the gas washer and keeping out of contact with the washing fluid.

These and other objects of my invention will be more fully and better understood by reference to the accompanying sheet of drawings illustrating a preferred form of

apparatus for carrying out my improved method of gas washing and in which—

Figure 1 is a vertical sectional view of a gas washer tower embodying an apparatus for carrying into effect my improved method;

Figure 2 is a horizontal sectional view on lines 2—2 of Figure 1 illustrating a concentric arrangement of spray nozzles in the same plane; and

Figure 3 is a horizontal sectional view on lines 3—3 of Figure 1.

Referring now specifically to the drawings, a gas washer tower 10 is shown having a gas inlet pipe 11 at the lower end thereof and a gas outlet pipe 12 located at the upper end of the said washer 10 and through which the gas passes from the tower. In the lower portion of the tower 10 is positioned a set of spaced hurdles 13 having passages there-through through which the gas passes on its upward travel through the gas washer tower 10. A set of intermediate spaced hurdles 14 is placed in said tower and extends across the entire cross sectional area of the tower with a set of upper hurdles 15 similarly arranged as the sets of hurdles 13 and 14, provided in the upper portion of the said tower through which the gas passes as it leaves the said tower. The positioning of the sets of hurdles in spaced relation with each other provides a lower chamber 16 between the sets of hurdles 13 and 14 and an upper chamber 17 between the set of upper hurdles 15 and the intermediate set of hurdles 14. A vertically extending water pipe 18 is provided to which a circular pipe 19 is secured extending circumferentially around the gas washer 10 with pipes 20, 20 extending through the gas washer shell and into the interior of the gas washer 10, the said pipes 20 being turned at an angle from the radial direction with respect to the vertical plane of the said washer tower and having nozzles 21, 21 on the ends of said pipes. By this set of spray nozzles a horizontally revolving spray of water is thus created in said gas washer in a clockwise or counter-clockwise direction as determined by the position of the spray nozzles 21, as each of the spray nozzles 21 directs its spray above, below, and behind each preceding nozzle thus intercepting the spray of the nozzle in front and carrying it along so that the whole arrangement results in a swift revolving vortex of sprays throughout the entire cross sectional area of the gas washer tower and a thorough scrubbing of the gas as it passes upward through the gas washer tower. A valve 22 is provided for controlling the supply of water passing to the spray nozzles 21, 21.

Above the circular spray pipe 19, I provide a second circular pipe 23 which is connected to the vertical water pipe 18 and has

a valve 24 for controlling the water passing to the pipe 23 with a plurality of pipes 25, 25 projecting inwardly through the gas washer shell with nozzles 26, 26 positioned thereon, the said pipes 25 being turned at an angle from the radial direction with respect to the vertical plane of the tower so that again a revolving spray of water is created as described in the preceding paragraph. Above the pipe 23 is a third circular pipe 27 connected to the pipe 18 and having a valve 28 for controlling the water therethrough with pipes 29 extending through the gas washer tower shell and into said tower with nozzles 30, 30 positioned thereon, the said pipes 29 extending downwardly until the nozzles 30, 30 are in the same horizontal plane as the nozzles 26 and forming a row of spray nozzles near the center of the said gas washer tower and in concentric relation with respect to the nozzles 26, 26 so that the sprays of water passing from the nozzles 26 and 30, covering the entire area of the gas washer tower, jointly form a vortex of whirling sprays of higher velocity than that heretofore described and which, if desired, still more effectively cleans and scrubs and more violently agitates the gas as it passes through said gas washer tower. A fourth circular pipe 31 is provided encircling the upper portion of said tower having a valve 32 positioned between the supply pipe 18 and the pipe 31 with pipes 33 extending through the gas washer tower having nozzles 34, 34 positioned thereon which are adapted to direct sprays of water in an angular direction against the upper hurdles 15 and covering the entire surface of these hurdles, the purpose of these sprays being to remove the particles of dust and dirt adhering to the surface of the hurdles 15 and clean out the interstices between the hurdle blocks of the hurdles 15 by washing for short periods of time and at such intervals as may be desired during the operation of the gas washer.

In operation of the device it will be understood that the warm dust laden gas enters the inlet pipe 11 and coming in contact with the rain of water falling from the set of hurdles 13 is cooled and relieved of its coarser impurities. Upon entering the hurdles 13, it is induced by a multitude of wetted surfaces which prevent a straight travel in the upward direction to follow a tortuous path therethrough so that the gas, divided into a number of small unit streams is equally distributed over the horizontal area of the gas washer tower. The gas thereupon enters the chamber 16 where it is subjected to the whirling action of the spray passing from the nozzles 21, 21 and has its direction of travel changed. It is compelled to participate in the whirling motion of the vortex of water formed by the spray noz-

zles 21 and is given a thorough scrubbing by the spray which as its force is spent, drops out of the vortex formed in the chamber 16 and passes downward over the set of hurdles 13 toward the bottom of the gas washer tower. The gas after passing through the vortex of water in the chamber 16 passes through the set of hurdles 14 where again it follows a tortuous path prescribed by a multitude of wetted surfaces.

Upon leaving hurdles 14 and entering the chamber 17, the gas is again forced into a whirling motion which, if desired and as described above, may be made still more rapid than the first encountered. This may be accomplished by increasing, for example, the number of nozzles to a single set as illustrated in Figure 3 or, as shown in Figure 2, by an arrangement embodying two sets of nozzles, 26, 26 and 30, 30 placed concentrically. In this manner the gas is given a thorough scrubbing and whirling, wherein the particles of impurities and cleaning fluid are brought into intimate relation and contact with each other resulting in an absorption of the former by the latter.

After leaving the chamber 17, the gas enters hurdles 15 which, during the regular operation of the washer may not be sprayed with cleaning fluid and which serve for the purpose of eliminating from the gas the entrained moisture carried off from the spray chambers. This entrained moisture is well known to frequently hold suspended a certain amount of very finely divided solids; it is the purpose of the hurdles 15 to offer a multitude of surfaces for depositing such solids together with the entrained moisture, thus enabling the gas to pass from the tower 10 through outlet pipe 12, having been freed of impurities as well as of entrained washing fluid. The spray nozzles 34 connected to branch pipes 33 and supplied by means of circle pipe 31 from the main 18, serve the purpose of removing from hurdles 15, by washing at convenient intervals for short periods of time such accumulations of solids as may have been deposited thereon from the gas. In this manner a clogging of interstices through which the gas must pass is prevented. It will thus be understood that the spray nozzles may be positioned in the relationship with each other and may be turned at the angles as shown with respect to the vertical plane of the tower. The essential feature of my gas washing method is the formation inside of a stationary washing apparatus and throughout any given sectional area thereof of a whirling vortex of cleaning fluid through which the gas must pass, causing both gas and fluid to come into most intimate contact through the resultant whirling motion and acceleration of the gas current with an even distribution of water throughout the entire cross sec-

tional area of the said gas washer tower; the water eliminated therefrom by gravity, being picked up by a lower vortex of water, participating in its whirling movement and being redistributed so as to finally fall as a uniform rain to the bottom of the washer tower. Thus in a stationary gas washer revolving sprays of cleaning fluid are formed, the gas and fluid are brought into intimate contact with each other, and when applied in combination with suitable arrangements for preliminary and after treatment of the gas a high degree of cleansing is effected not hitherto possible with a minimum amount of cleansing fluid, all because of the superior intimacy of contact of the gas and washing fluid and also the uniform distribution of the washing fluid throughout the entire washer tower.

While the form of apparatus described in detail above, properly fulfills the functions required for the practice of my invention, I do not wish to be understood as limiting myself thereto, as I contemplate changes in form and the proportion of parts and the substitution of equivalents as circumstances may suggest or render expedient without departing from the spirit or scope of my invention.

I claim:

1. In the method of cleaning gas which consists in conducting the gas through a container and causing the entire body of gas to pass through a whirling vortex of cleansing fluid, the said vortex extending over the entire cross sectional area of said container in a predetermined plane, the cross-sectional area being substantially unobstructed in such plane.

2. The method of cleaning gas which consists in conducting the gas through a container, and in the container subjecting the gas to a whirling spray of cleansing fluid, passing the gas through means adapted to break up the whirling motion imparted by the spray, and passing the gas through a second whirling spray.

3. The method of cleaning gas which consists in conducting the gas through a container, and in the container subjecting the gas to a whirling spray of cleansing fluid, passing the gas through means adapted to break up the whirling motion imparted by the spray, and passing the gas through a second whirling spray, the second spray whirling in the opposite direction to the first spray.

4. The method of cleaning gas which consists in conducting the gas through a container, and in the container subjecting the gas to a whirling spray of cleansing fluid, passing the gas through means adapted to break up the whirling motion imparted by the spray, and passing the gas through a second whirling spray, the second spray

whirling in the opposite direction to the first spray and each spray covering the entire cross-sectional area of the container whereby the entire body of the gas is passed through the sprays.

5 5. In a method of cleaning gas which consists in conducting the gas through a container bringing the gas into contact with a falling rain of water covering the entire
10 cross-sectional area of the container; and then subjecting the gas to the cleansing action of whirling sprays of cleansing fluid spaced apart from each other and covering the entire cross sectional area of said con-
15 tainer in predetermined planes, one of said sprays whirling in the opposite direction to the other.

6. In a method of cleaning gas which consists in conducting the gas through a con-
20 tainer bringing the gas into contact with falling streams of water, distributing the gas while in said container by means of hurdles having passages therethrough and subjecting the gas to whirling sprays of
25 water directed into said container at right angles to the travel of the gas therethrough and at an angle with respect to the plane of the longitudinal axis of the said container in predetermined planes.

30 7. The method of cleaning a gas which

consists in conducting the gas through a container, and in the container subjecting the gas to contact with falling streams of water, passing the gas through means adapted to remove entrained globules of water
35 and foreign matter, subjecting the gas to a whirling spray whereby a whirling motion is imparted to the gas, and passing the gas through means adapted to stop the swirling action and remove entrained globules of
40 water and foreign matter.

8. The method of cleaning a gas which consists in conducting the gas through a container, and in the container subjecting the gas to contact with falling streams of water,
45 passing the gas through means adapted to remove entrained globules of water and foreign matter, subjecting the gas to a whirling spray whereby a whirling motion is imparted to the gas, passing the gas
50 through means adapted to stop the swirling action and remove entrained globules of water and foreign matter, and passing the gas through a second whirling spray whirling in the opposite direction from the first
55 said spray.

Signed at Chicago, Illinois, this second day of June, 1922.

WALTHER MATHESIUS