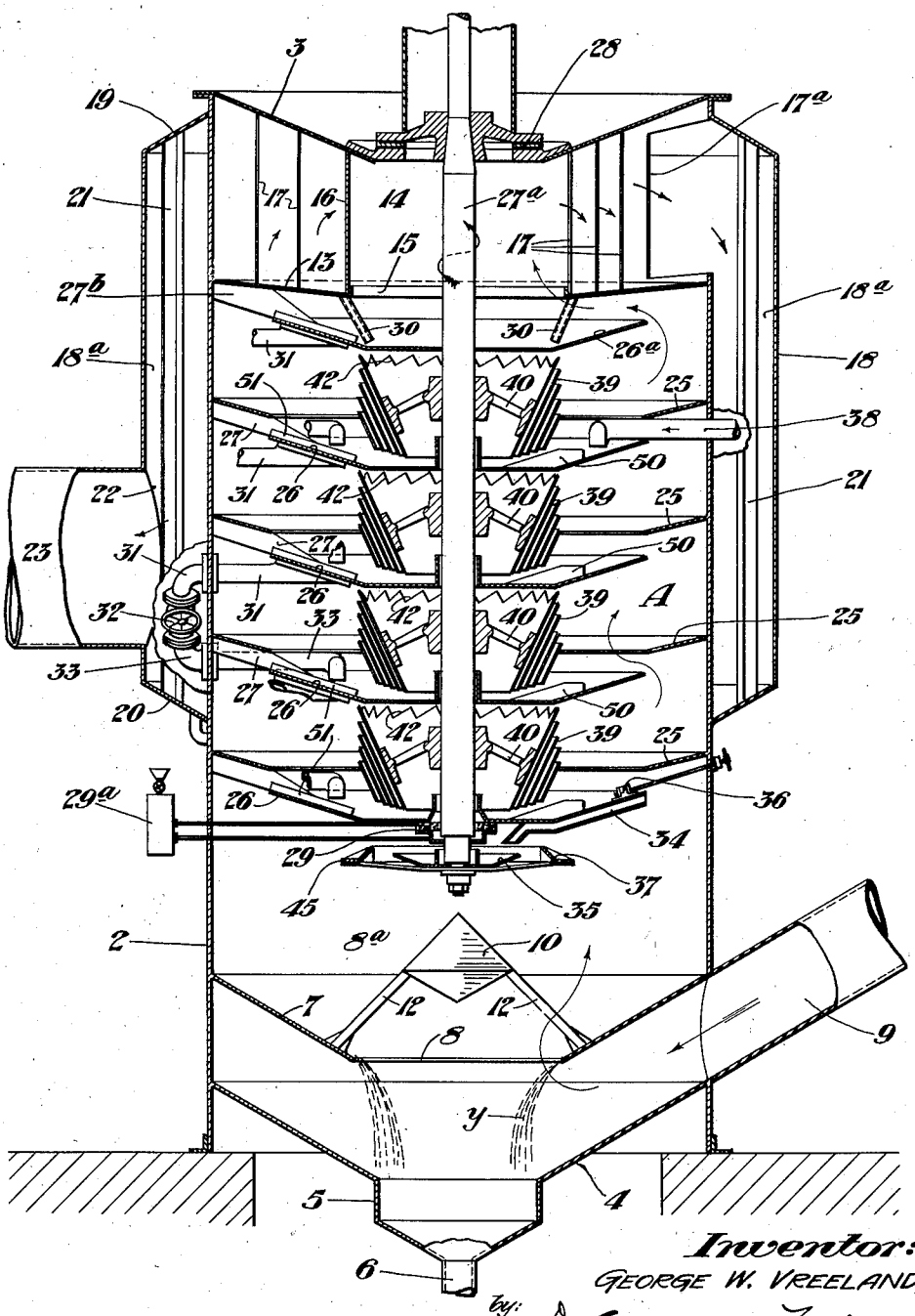
Sept. 23, 1930. G. W. VREELAND 1,776,644

GAS WASHER

Filed Feb. 24, 1928 3 Sheets-Sheet 1

Fig. 1.



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GAS WASHER

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Fig. 2.

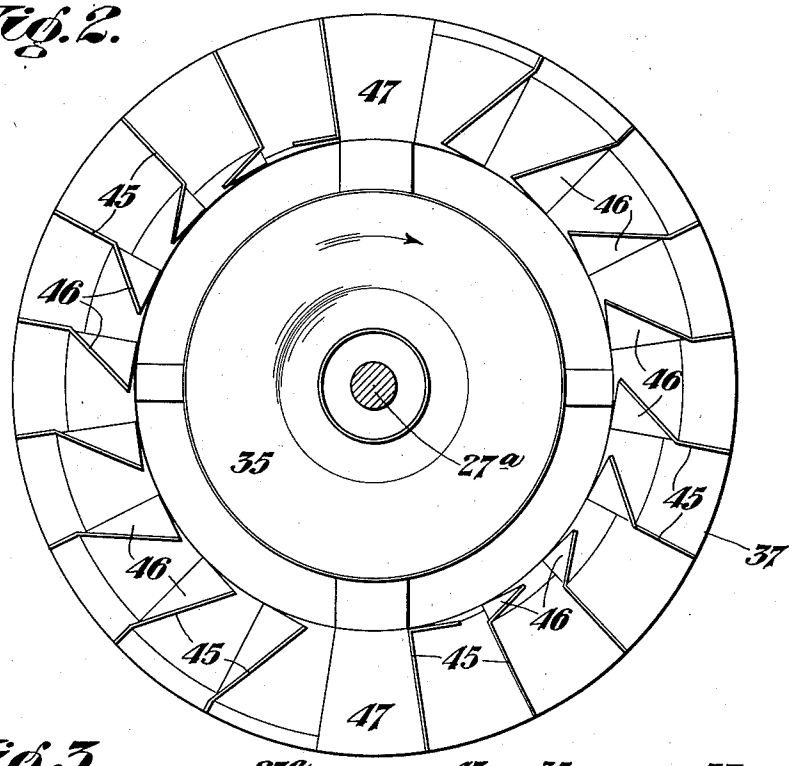


Fig. 3.

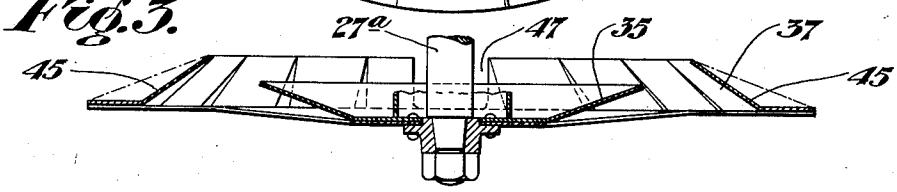
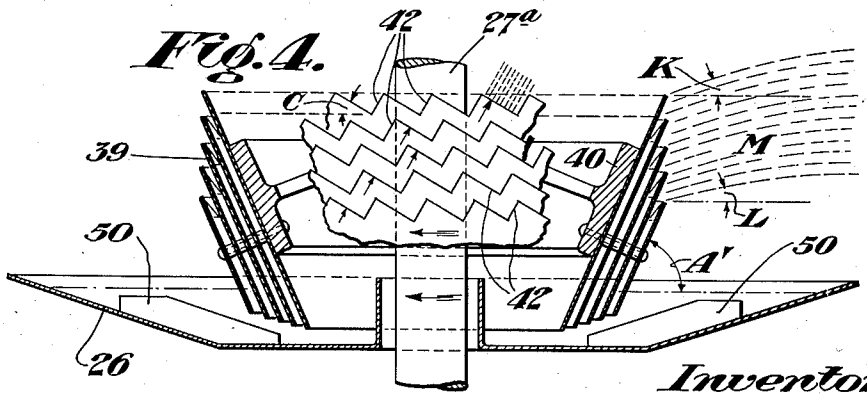


Fig. 4.



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GAS WASHER

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Fig. 5.

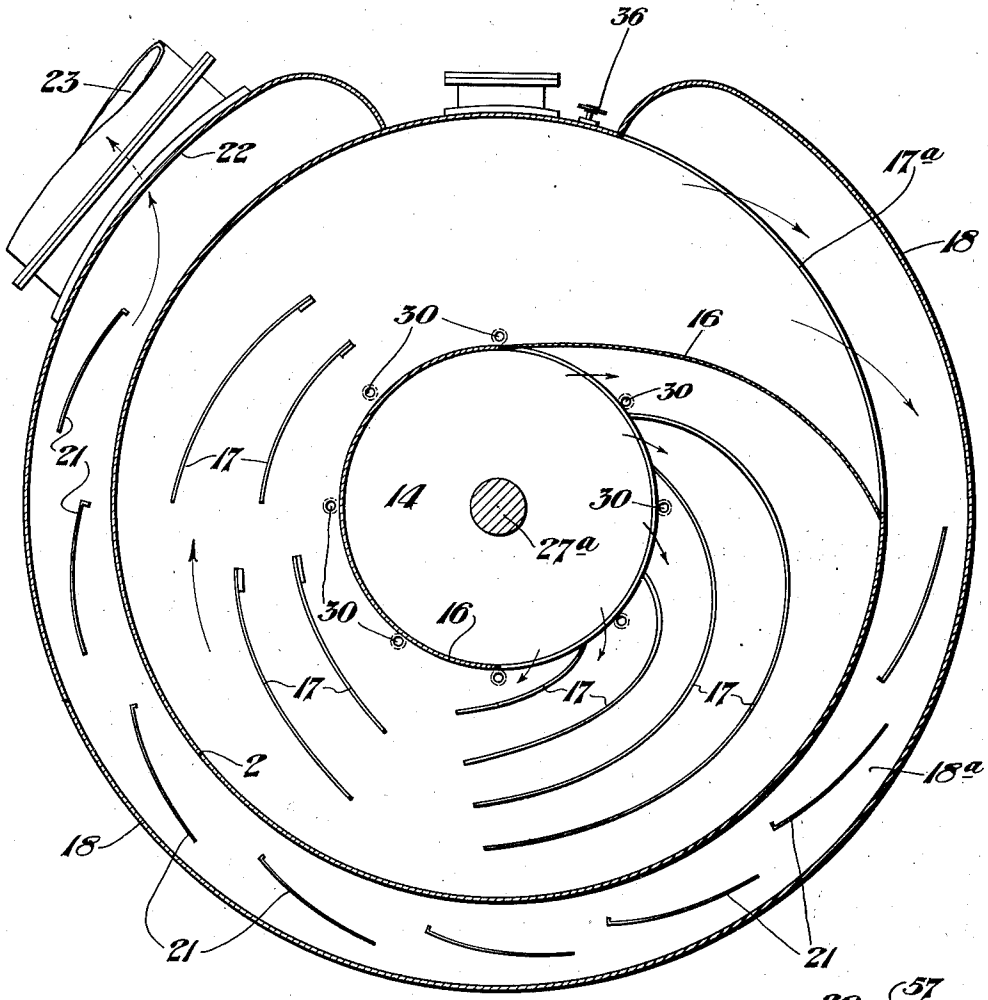


Fig. 7.

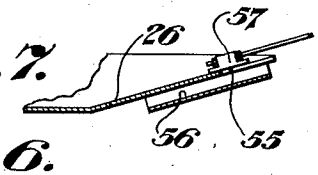
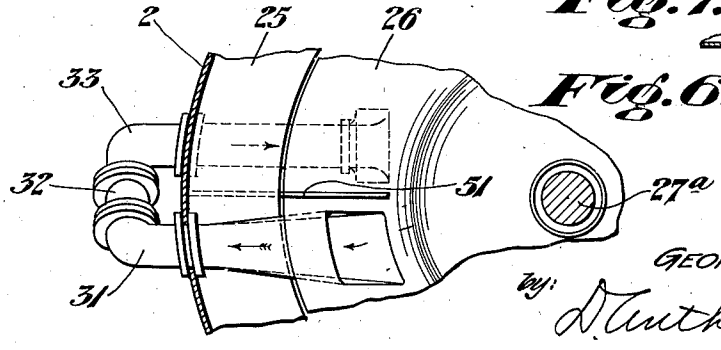


Fig. 6.



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Patented Sept. 23, 1930 1,776,644

UNITED STATES PATENT OFFICE

GEORGE W. VREELAND, OF STEUBENVILLE, OHIO

GAS WASHER

Application filed February 24, 1928. Serial No. 256,755.

This invention relates to gas washers and more particularly to two-stage gas washers, in which pumping cones are utilized in at least one of the stages to form a water spray.

One object of this invention is to provide a washer of this class having a novel form of pumping cone adapted to form an improved spray.

Another object is to provide an improved means for removing the moisture from the washed gases.

A further object is to provide a washer having the novel arrangement, construction, and design of parts hereinafter described and illustrated in the accompanying drawings.

In the drawings—

Figure 1 is a vertical sectional elevation through a gas washer constructed in accordance with my invention.

Figure 2 is a plan of the sling disk and distributing disk or rain-maker.

Figure 3 is a sectional elevation through the apparatus of Figure 2.

Figure 4 is an enlarged detail partly in section and partly in elevation, showing one of the sets of pumping cones.

Figure 5 is a sectional plan through the upper or outlet end of the washer.

Figure 6 is a fragmentary detail plan showing the overflow connection between the water pans.

Figure 7 is a fragmentary detail illustrating a modified form of pan in which the overflow is regulated by a slide valve.

Referring more particularly to the drawings, the numeral 2 designates the tower casing of the gas washer as a whole, which is of cylindrical form and has its upper end closed by a wall 3 and its lower end closed by a frusto-conical bottom wall 4, which is stepped down, as at 5, to receive the flow of wash liquid from the washer. The portion 5 of the bottom wall 4 is provided with a drain outlet 6 through which the wash liquid and foreign matter washed from the gas is drained.

A frusto-conical partition wall 7 extends transversely of the washer at a point slightly above the bottom wall 4 and has its central portion cut away to form a gas inlet 8 into the lower washing chamber 8^a above. The space between the bottom wall 4 and the partition wall 7 is a gas receiving chamber and a gas inlet main 9 enters through the side wall or shell of the washer to admit unwashed gas to such chamber.

A gas deflector 10 is mounted above the gas inlet 8 and is held in position by bracket supports or legs 12.

A second frusto-conical partition wall 13 extends transversely of the washer at a point below the top wall 3, and the space between the walls 3 and 13 forms a washed gas receiving chamber 14. The wall 13 has its central portion cut away to form a gas outlet 15, and a vertical wall 16 extends between the walls 13 and 3 and around one-half of the outlet 15 and is then curved clockwise and extended outwardly to the shell 2.

A plurality of clockwise-curved vanes 17 are also mounted in the space or chamber 14 so that the washed gas entering the chamber 14 is compelled to travel or whirl around the chamber 14 and thus have sufficient centrifugal force imparted thereto to throw out the major part of the entrained water picked up during the washing operation. The shell 2 is apertured or cut away at a point to the rear of the wall 16 to form a gas outlet port 17^a from the washer.

A second shell 18 is spaced from the shell 2 and extends around the major portion of the circumference of the washer to form a drying chamber 18^a, which has its upper and lower ends closed by walls 19 and 20, respectively. A plurality of trap vanes or deflector plates 21 are arranged vertically and at an angle to the circumference of the shell 18 in the chamber 18^a and have their vertical edges, farthest from the outlet port 17 in the washer, bent at right angles to baffle and trap out any entrained moisture remaining in the gas.

The shell 18 is apertured or cut away at the side farthest from the port 17 and adjacent the lower end of the chamber 18^a to form an outlet 22 for the washed and dried gas. A main 23 is connected to the outlet 22 and serves to conduct the gas away from the washer and drier.

The washed gas, which has had considerable whirl or centrifugal force imparted thereto in its travel around the chamber 14, passes uninterruptedly into the drying chamber 18^a and is compelled to continue its centrifugal motion around the drying chamber 18^a where it will strike the plates 21 and be sufficiently baffled to remove any remaining entrained moisture.

The space between the transverse walls 7 and 13 forms the washing chamber A. A plurality of downwardly inclined deflector rings 25 are secured around the interior of the shell 2 at vertically spaced intervals, the lowermost of said rings being positioned materially above the wall 7. A water pan 26 is mounted below each of the rings 25 and secured thereto by web plates 27.

A shaft 27^a is journaled centrally in the washer, the upper end of the shaft is journaled in a heavy duty roller bearing 28 while its lower end is journaled in a steady bearing 29 to prevent whipping. The bearing 29 is carried by the lowermost pan 26 and is adapted to be lubricated by an automatic lubricating mechanism 29^a.

A pan 26^a is mounted below the partition wall 13 and is secured thereto by web plates 27^b. The pan 26^a is adapted to receive the water or other fluid thrown out of the gases by centrifugal force in the chamber 14, which water or fluid is drained from the chamber 14 through drain pipes 30.

Each of the pans 26 and 26^a, except the lowermost pan 26, are provided with an overflow drain pipe 31 which extends outwardly through the shell 2 and is connected by a valve 32 to a supply pipe 33 leading to the next lower pan. The lowermost pan 26 is provided with an overflow conduit 34 leading to a sling disk 35 mounted on the lower end of the shaft 27^a. A valve 36 controls the flow through the conduit 34. A water distributing disk or rain-maker 37, of materially greater diameter than the disk 35, is also mounted on the lower end of the shaft 27^a and is adapted to distribute the water discharged by the sling disk 35.

Water is adapted to be supplied to the uppermost pan 26 by a water main 38 and the head of water in each of the respective pans 26 is adapted to be regulated by the valves 32.

A plurality of sets of pumping cones 39 are secured on the shaft 27^a, one set being provided for each of the pans 26. The cones 39 are secured to spiders 40 which are keyed or otherwise secured to the shaft 27^a, and the lower ends of the cones 39 are adapted to be immersed in the water in the pans so that as the shaft 27^a and cones 39 are rotated, the water will be drawn up along the inner surfaces of the cones and discharged from the upper edges thereof.

The cones 39 have their upper edges serrated in saw-tooth fashion, as at 42, that is, are provided with alternate pointed projections and depressions. As the cones are revolved the water or wash liquid will be compelled to rise on the inside surface of the cones 39 in a thin sheet, the angle on which the liquid rises depends on the speed of the cones 39 and the angle at which the pumping cones 39 are set with respect to the fluid level in the pans 26, which angle is indicated at A', and the saw-teeth or serrations 42 in the top edge of the cones 39 are formed on an angle C which is complementary to the angle A'. The pumped liquid is adapted to be discharged at right angles to the inclined edges of the serrations and the liquid thus discharged will rise at a greater angle as it leaves the upper part of the serrations and a lesser angle at the bottom of the serrations as indicated by the angles K and L, respectively. It will, of course, be understood that the angle of rise of the liquid discharged intermediate the top and bottom of the serrations will be somewhere between the angles K and L.

When a set or nest of cones 39 are used as shown it is preferable to set the cones so that the top of the serrations 42 on the outer cone is on a level with the bottom or root of the serrations of the cone next inside of the outer cone so that the liquid thrown by one cone will not interfere with the liquid thrown by the other cones.

By constructing the cones 39 as above described the liquid is discharged in a spray covering an area, as indicated at M, of uniform density and high velocity, with maximum quantity of liquid pumped and with the expenditure of minimum power.

The fact that the spray rises after leaving the saw-teeth or serrations on the cones is due in part to the difference in speed at the top and root of the serrations.

The sling disk 35 is adapted to throw water outwardly onto the distributing disk 37. The disk 37 is provided with a plurality of deflecting plates or vanes 45 which have deflecting portions 46 arranged at different angles. The vanes 45 are so positioned that two diametrically open spaces 47 are provided through which the water will be discharged uninterruptedly so as to strike against the walls of the washer to wash down any foreign matter collected thereon.

The vanes 45 are adapted to be set at different angles from zero at the open sections to 90 degrees, where the fluid or water will be splashed vertically up and down, so that the fluid will be deflected over the entire area of the washer and produce a uniform rain for rough cleaning the gas.

By thus providing for the rough or preliminary washing or cleaning of the gas with a uniform rain over the entire area of the washer through which the hot uncleaned gas must pass, an excellent condition is provided for wetting down the heavier particles of dust

and the water vapor in the gas is increased, which vapor is later condensed by the finer sprays formed by the pumping cones 39. The water sprayed by the sling disk 35 is the same water which has been previously sprayed through the hot gas by the cones 39 and, therefore, is preheated and in better condition to form vapor to charge the gas than fresh cold water would be.

In order to prevent the water in the pans 26 taking on a swirling motion, due to the rotation of the cones 39, a plurality of vertically extending ribs 50 are provided at spaced intervals around the pans.

A partition rib or plate 51 is provided on the pans 26 between the water outlet to the pipe 31 and the point of inlet from the pipe 33 so as to compel the water discharged from the pipe 33 to travel around the entire pan, instead of short-circuiting directly across to the drain pipe 31.

In operation, the dust ladened gases enter the lower end of the washer through the inlet 9 and are compelled to pass through a wall of wash water y discharging around the inlet port 8 in the wall 7. While passing through the wall of water y some of the heavier particles of dust will be removed.

After passing through the wall of water y, the gas will flow upwardly through the port 8 into the path of the rain of wash water discharged from the water distributor 37. As the gas flows upwardly through the spray or rain of water from the water distributor 37, all the heavier particles and a major portion of all the dust and foreign matter will be washed from the gas and the gas will be charged with water vapor which will be condensed in the later or refined cleaning operation.

The partially cleaned gas will pass upwardly through the washing chamber after passing through the rough rain wash spray and will be subjected to the successive fine dense sprays formed by the saw-tooth edged pumping cones 39. The successive spray from the pumping cones will each be cooler than the next lower spray, due to the fact that the water is supplied to the uppermost pan 26. The cool water sprays will not only wash any foreign matter from the gas but will condense out all the water and other condensable vapors. As the vapors are condensed they will form drops around the fine dust particles and thus aid in removing very fine dust particles which would not ordinarily be removed.

The washed gas, after passing through the spray formed by the uppermost set of pumping cones 39, will pass through the port 15 into the clean gas receiving chamber 14 where the major portion of the entrained water will be thrown out by centrifugal force, and the partially dried gas will pass from the chamber 14 through the port 17 into the drying chamber 18^a where the remaining water will be removed by centrifugal force and trapping or baffling vanes 21. The dried gas from the chamber 18^a is adapted to pass through the port 22, through a main 23, to any point of use.

In Figure 7 I have shown a modified form of pan 26 which is provided with an overflow port 55 opening into a conduit or trough 56 adapted to discharge the overflow water into the next lower pan. A slide valve 57 is provided for regulating the flow of water through the port 55 and thereby regulate the head of water in the pan. If desired, it will be understood that this modified form of overflow port, conduit and valve may be used instead of the conduits 31 and 33, and valve 32.

While I have shown and described one specific embodiment of my invention, it will be understood that I do not wish to be limited thereto since various modifications may be made without departing from the scope of my invention as defined in the appended claims.

I claim—

1. A gas washer comprising, in combination, a tower, a vertically disposed shaft journaled in said tower, a plurality of liquid containing pans spaced vertically in said tower, a plurality of sets of pumping cones mounted on said shaft, one of said sets of cones being positioned within each of said pans, means for supplying spray liquid to the uppermost of said pans, means for conducting the overflow of liquid from each of said pans to the next lower pan, a sling disk mounted on the lower end of said shaft, and means for conducting the overflow of liquid from the lowermost of said pans to said sling disk, and a revolving liquid distributor adapted to break up the flow of liquid from said sling disk and form a spray, a dirty gas inlet adjacent the lower end of said tower and materially below said liquid distributor, and a clean gas outlet adjacent the upper end of said tower and materially above the uppermost of said sets of pumping cones.

2. A gas washer comprising, in combination, a tower, a vertically disposed shaft journaled in said tower, a plurality of liquid containing pans spaced vertically in said tower, a plurality of sets of pumping cones mounted on said shaft, one of said sets of cones being positioned within each of said pans, said cones having their upper edges serrated to form alternate projections and depressions similar to saw-teeth, means for supplying spray liquid to the uppermost of said pans, means for conducting the overflow of liquid from each of said pans to the next lower pan, means for rotating said shaft to rotate said cones and cause them to discharge the liquid from said pans in the form of a spray of a depth substantially equal to the depth of said serrations, a sling disk mounted on the lower end of said shaft, and means for conducting

the overflow of said liquid from the lowermost of said pans to said sling disk, and a revolving liquid distributor adapted to break up the flow of liquid from said sling disk and form a spray, a dirty gas inlet adjacent the lower end of said tower and materially below said liquid distributor, and a clean gas outlet adjacent the upper end of said tower and materially above the uppermost of said sets of pumping cones.

3. A gas washer comprising, in combination, a tower, a vertically disposed shaft journaled in said tower, at least one liquid containing pan in said tower, a set of pumping cones in said pan, means for supplying spray liquid to said pan, a sling disk mounted on the lower end of said shaft, means for conducting the overflow of liquid from said pan to said sling disk, a revolving liquid distributor adapted to break up the flow of liquid from said sling disk and form a spray, a dirty gas inlet adjacent the lower end of said tower and materially below said liquid distributor, and a clean gas outlet adjacent the upper end of said tower and materially above the liquid containing pan.

4. A gas washer comprising, in combination, a tower, a vertically disposed shaft journaled in said tower, at least one liquid containing pan in said tower, a set of pumping cones in said pan, said cones having their upper edges serrated to form alternate projections and depressions similar to saw teeth, means for supplying spray liquid to said pan, means for rotating said shaft to rotate said cones and cause them to discharge the liquid from said pan in the form of a spray of a depth substantially equal to the depth of said serrations, a sling disk mounted on the lower end of said shaft, means for conducting the overflow of liquid from said pan to said sling disk, a revolving liquid distributor adapted to break up the flow of liquid from said sling disk and form a spray, a dirty gas inlet adjacent the lower end of said tower and materially below said liquid distributor, and a clean gas outlet adjacent the upper end of said tower and materially above the liquid containing pan.

5. A gas washer comprising, in combination, a tower, a vertically disposed shaft journaled in said tower, at least one liquid containing pan in said tower, a set of pumping cones in said pan, means for supplying spray liquid to said pan, means for rotating said shaft to rotate said cones and cause them to discharge the liquid from said pan in the form of a substantially horizontal spray, a dirty gas inlet adjacent the lower end of said tower and materially below said pan, a clean gas outlet adjacent the upper end of said tower and materially above said pan, a sling disk mounted on the lower end of said shaft, means for supplying spray liquid to said disk, means for breaking up the flow of liquid from said disk to form a liquid spray adjacent the lower end of said tower in substantially a counterdirection to the flow of gas to remove at least some of the heavier particles of foreign matter, and other means for forming a curtain of liquid across said dirty gas inlet to cool and flood out the heaviest particles.

In testimony whereof, I have hereunto set my hand.

GEORGE W. VREELAND.