

1,320,852.

A. A. GOUBERT.
GAS WASHER.
APPLICATION FILED MAY 1, 1918.

Patented Nov. 4, 1919.
3 SHEETS—SHEET 1.

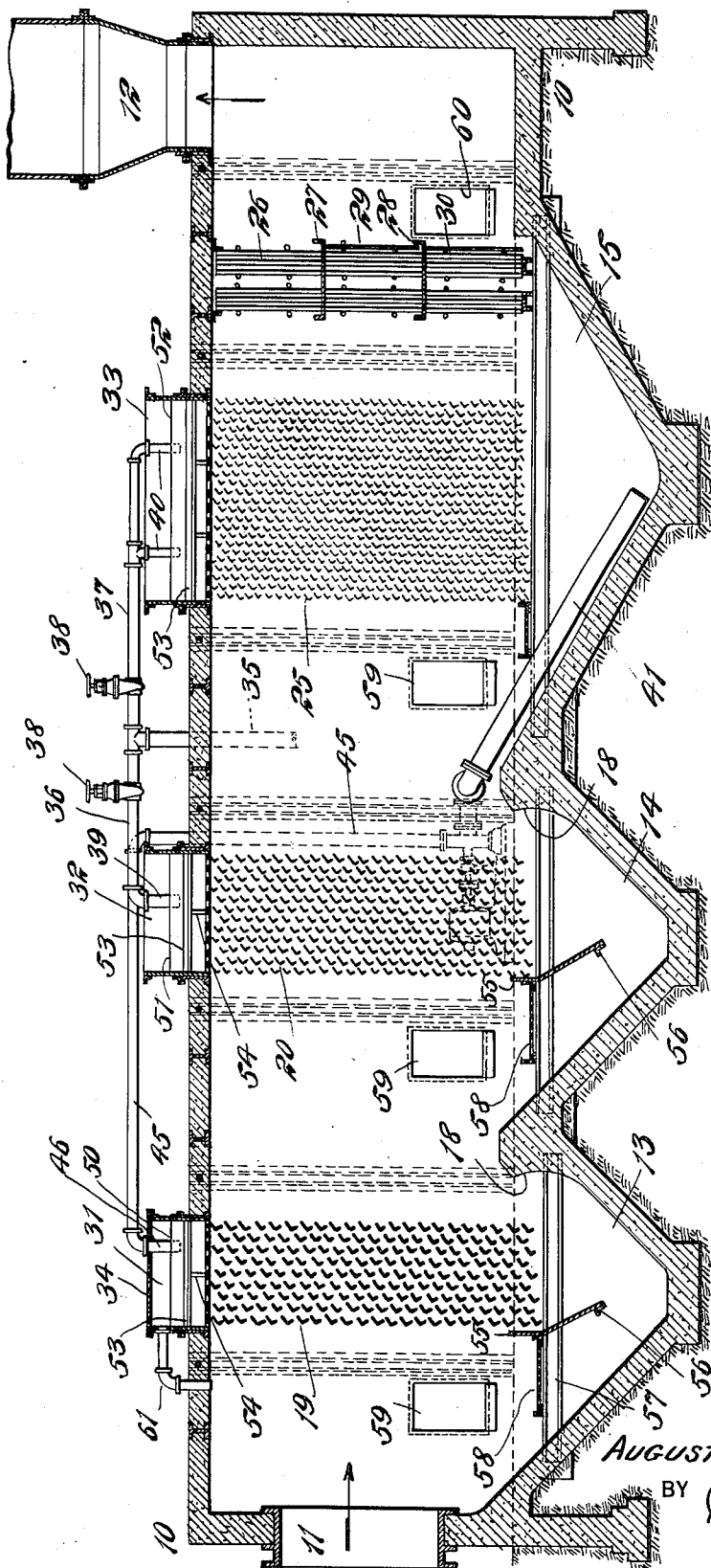


Fig. 1.

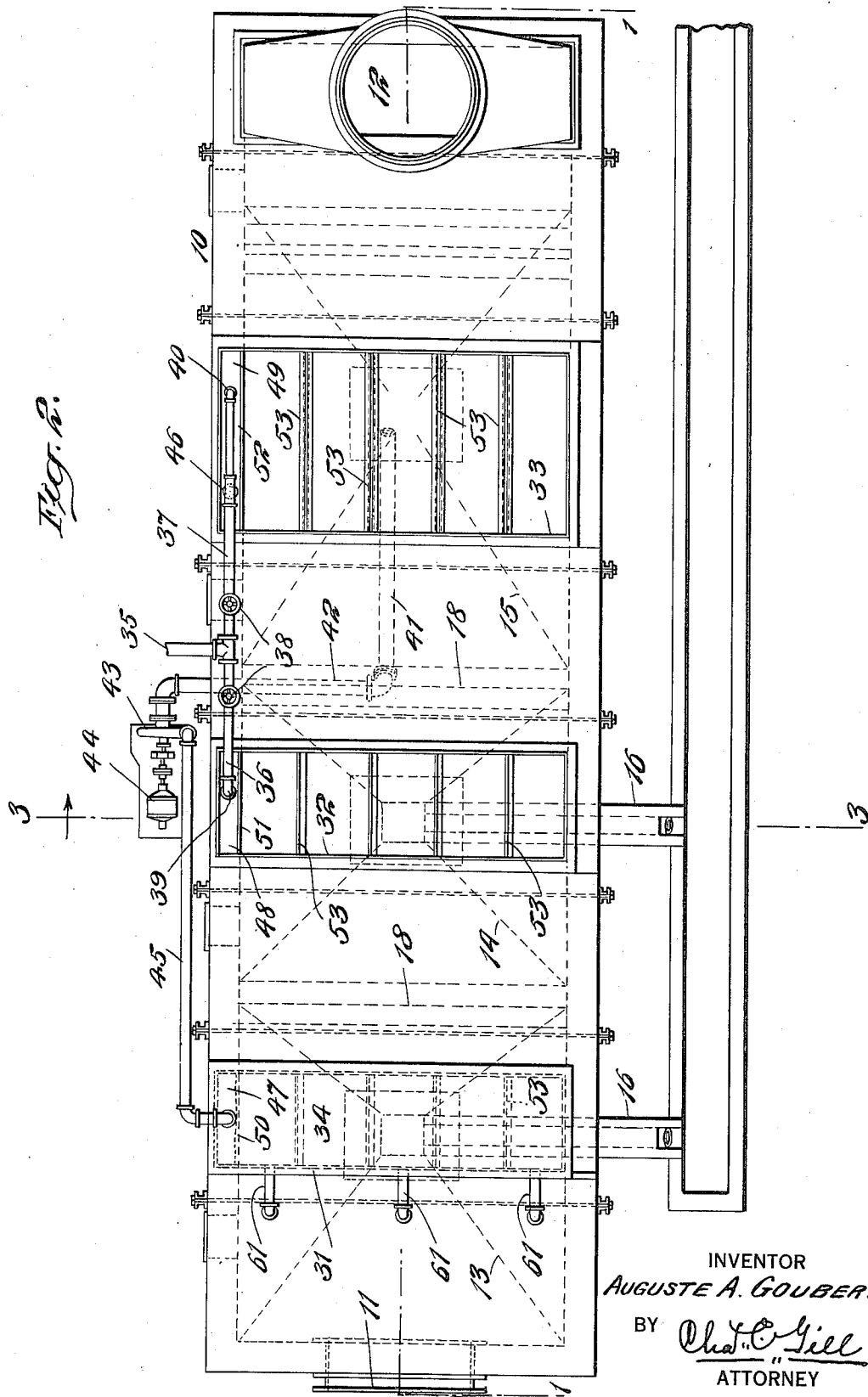
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3 SHEETS—SHEET 2.



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3 SHEETS—SHEET 3.

Fig. 3.

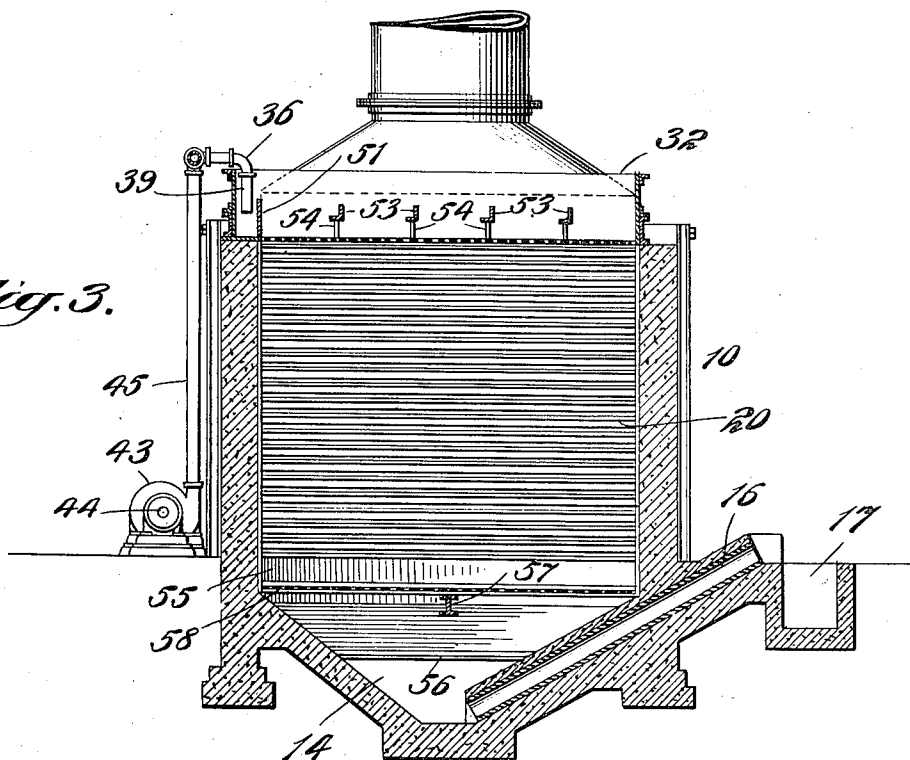


Fig. 4.

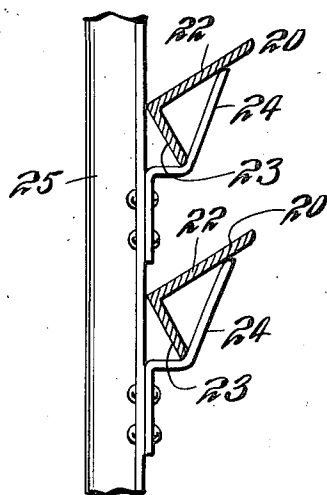
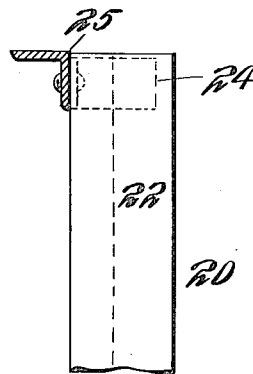


Fig. 5.



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UNITED STATES PATENT OFFICE.

AUGUSTE A. GOUBERT, OF ENGLEWOOD, NEW JERSEY, ASSIGNOR TO HARRY BENTZ, OF MONTCLAIR, NEW JERSEY.

GAS-WASHER.

1,320,852.

Specification of Letters Patent.

Patented Nov. 4, 1919.

Application filed May 1, 1918. Serial No. 231,809.

To all whom it may concern:

Be it known that I, AUGUSTE A. GOUBERT, a citizen of the United States, and a resident of Englewood, in the county of Bergen and State of New Jersey, have invented certain new and useful Improvements in Gas-Washers, of which the following is a specification.

The invention relates to gas washers or blast-furnace gas-cleaning plants, and it resides in a unit structure through which the gas passes and is cleaned in transit, the gas leaving the washer in condition for immediate use, if desired, for gas engines or other apparatus.

The present invention embodies certain improvements on the type of gas washer made the subject of Letters Patent of the United States No. 1,117,309 granted to Harry Bentz on November 17, 1914.

Among other objects, the present invention seeks to simplify and render more efficient apparatus of the character shown in the aforesaid Letters Patent No. 1,117,309.

One purpose of the invention is to provide means whereby in the event of "slips" or when a large volume of gas is suddenly released and the pressure in the mains abnormally increased, water seals at the sumps will be maintained even though the pressure should cause a substantial part of the water to be discharged.

I also provide sumps of special construction so that any sudden increase of pressure which might otherwise tend to throw the water of one sump into the next in succession, will be prevented from effecting that result, the rear walls of the sumps being so curved as to throw back into the respective sumps any waves of water which otherwise might pass over the walls from one sump into another.

The plant of my invention comprises banks or sheds of contact plates above the several sumps, these banks of plates extending from the roof of the general casing to below the water level in the sumps and being below troughs supplied with water and which troughs discharge the water so that the latter travels downwardly over the said plates and forms a thin film thereon and finally descends into the sumps. The gas is compelled to travel against and between the plates of the several banks, and the gas becomes washed or relieved of its impurities

while in transit and due to its contact with the films of water on the plates.

The trough above the first bank or shed of plates at the entrance end of the general casing is provided with a closed top and the upper part of the chamber of the said trough is connected by a pipe or pipes with the chamber of the general casing at the front of said first bank or shed of plates, and this special provision is made so that in the event of a "slip" the pressure created thereby may not operate to prevent the water from descending from the first trough and flowing downwardly over the first shed or bank of plates. The connection of the upper part of the chamber of the first trough by means of the pipe or pipes with the forward portion of the chamber within the main casing results in equalizing the gas pressure at the upper and lower sides of the body of water within the said first trough, and this results in the flow of the water down the first bank or shed of plates not being interrupted and in the operation of the plant even under excessive pressure in the forward portion of the general casing being efficient.

The plant of my invention comprises, further, novel features of detail, arrangement, construction and operation, and the invention as a whole will be fully understood from the detailed description hereinafter presented, reference being had to the accompanying drawings, in which:

Figure 1 is a central vertical longitudinal section taken along dotted line 1—1 of Fig. 2 through a gas-washer constructed in accordance with and embodying the invention;

Fig. 2 is a top view of the gas washer;

Fig. 3 is a vertical transverse section through the same, taken on the dotted line 3—3 of Fig. 2;

Fig. 4 is a fragmentary view, partly in section, showing, on a larger scale, two of the cleaning or contact plates over which the water descends and against which the gas passing through the apparatus is compelled to move, and

Fig. 5 is a top view, partly broken away, of the same, Figs. 4 and 5 being presented to illustrate the angular form of the plates and the means by which the plates are supported.

In the drawings, 10 designates an elon-

gated casing having an inlet 11 and an outlet 12 and through which the current of gas produced by suction fans, blowers or other means, is caused to pass and within which, by the means provided therein, the gas is very efficiently washed.

The casing 10 may be constructed of reinforced concrete or other suitable material, and at the base thereof a plurality of sumps or water compartments 13, 14, 15 are formed, these sumps extending transversely below the main casing and preferably being of approximately V-shape in both cross-section and longitudinal section. The sumps 13, 14 are respectively connected by conduits 16 with an open trough 17 extending lengthwise along one side of the main casing. The conduits 16 extend from a point above the upper level of the sumps 13, 14 to approximately the bottom of said sumps, and the trough 17 leads to a sewer or other point of discharge. The rear walls of the sumps 13, 14 extend upwardly above the normal water level in said sumps and curve forwardly at their upper transverse edges, as at 18, this formation being provided for the special purpose of preventing the gas under abnormal conditions of pressure from driving the water over the rear walls of said sumps, the water caused to rise against the upper portions of the rear walls of the sumps 13, 14 being by the formation of said walls thrown forwardly so as to fall into the sumps.

Within the main casing 10 I provide a plurality of vertical banks or sheds of transverse plates 19, 20 and 21, these banks of plates being arranged above the sumps 13, 14, 15 and extending from below the water level in said sumps to the top of the casing 10 and also extending from one side of said casing to the other side thereof. I preferably employ three banks of the plates 19, 20, 21, and by preference I employ a greater number of the plates in the bank 20 than in the bank 19 and a greater number of the plates in the bank 21 than in the bank 20. The individual plates in the banks of plates 19, 20, 21 correspond in outline and are angular in cross-section, and preferably the plates in the bank 20 are somewhat smaller in cross-section than the plates in the bank 19 and the plates in the bank 21 are smaller in cross-section than the plates in the bank 20, and all of these plates, except as to their number and proportions in each bank, are substantially the same as the plates illustrated for a somewhat corresponding purpose in Letters Patent No. 1,117,309, issued to Harry Bentz on November 17, 1914. The cross-sectional outline of the plates in the banks 19, 20, 21 is illustrated in Fig. 4, and said plates are so arranged that their angles project forwardly toward the entrance 11 for gas, whereby said plates pre-

sent their upwardly and downwardly rearwardly inclined members 22, 23, respectively, to the current of gas passing through the general casing 10. The individual plates of the banks of plates 19, 20, 21 are supported on brackets 24, as shown in Fig. 4, which are secured to the laterally extending members of angle bars 25 which are fastened to the inner opposite sides of the casing 10. In the drawings I have illustrated the bank 19 as containing nine vertical rows of horizontal plates, the bank 20 as containing twelve vertical rows of horizontal plates and the bank 21 as comprising 23 vertical rows of the horizontal plates, all these plates corresponding with one another except as to dimensions, in cross-section, and the plates in each vertical row in each bank are arranged in staggered relation to the adjacent row or rows of plates in the bank and all of said plates are so arranged that the plate in each row overlaps the plates in each adjacent row, the result being that the gas passing through the casing 10 is compelled to move against the forward surfaces of each vertical row or series of the plates and in an irregular manner pass through the narrow spaces between said plates, said spaces becoming narrower in respect to the banks 20, 21 as the flow of gas proceeds.

Beyond the bank of plates 21 and between said bank and the outlet 12, I provide a series of vertical zig-zag plates 26 which are substantially indicated in Fig. 6 of the aforesaid Patent No. 1,117,309, although in this instance I make use of two vertical sets or banks of said plates and provide pans 27, 28 horizontally engaging said plates for the purpose of catching such moisture as may gather upon and flow down the plates, the pan 27 taking the moisture which may pass down the upper portions of said plates and the pan 28 receiving the moisture which may pass down the middle portions of said plates and also, by means of a pipe 29, receiving the collected moisture from the pan 27. The pan 28 has a drip pipe 30 for the discharge of water to the sump 15. The plates 26 are provided for a final elimination of moisture from the gas and said plates become highly efficient in the present instance since the moisture gathered on the upper portions of said plates does not have to travel entirely to the lower ends of said plates but is caught by the pan 27 which leaves the middle portions of the plates 26 in proper condition to take moisture from the middle portions of the current of gas, while the presence of the pan 28 renders the lower portions of the plates 26 properly conditioned to take moisture from the lower strata of the current of gas passing through the casing 10, the collected moisture gathered by the pans 27, 28 being by-passed to the sump 15. The water received by the

sump 15 is comparatively clean and therefore may be used again in carrying out the process hereinafter described of washing the gas.

5 Above the banks 19, 20, 21 of angular plates are provided water troughs 31, 32, 33, respectively, which extend transversely of the roof of the general casing 10 and have perforated bottoms through which water
10 passes and descends upon the plates 19, 20, 21 and traveling down the same forms thereon continuously descending films of water which carry away the impurities taken from the gas and finally enter the sumps 13, 14,
15 15. The water-troughs 32, 33 may each have an open top, while the trough 31 has a closed top 34. The troughs 32, 33 are supplied with water from any suitable source through the feed pipe 35 and branch pipes
20 36, 37, respectively, which are suitably valved, as at 38, and have discharge nozzles 39, 40, respectively, entering said troughs 32, 33, there being two discharge nozzles 40 because of the fact that the trough 33 is
25 larger than the trough 32 and must supply the continuous feed of water to the bank 21 possessing the greater number of angular plates. The water supplied through the feed pipe 35 is fresh clean water from a
30 main or other suitable source, and the water supplied to the trough 31 is that which is comparatively clean and taken from the sump 15. The sump 15 is connected by piping 41, 42, respectively, with a pump 43,
35 which is driven by a motor 44 and connected by piping 45 with the trough 31, said piping having a discharge branch or member 46 entering said trough 31. The water from the sump 15 is given a second use, because
40 the greater proportion of the impurities in the gas are removed by the banks of plates 19, 20 and because the water from sump 15 is therefore comparatively clean or sufficiently so to be used upon the first bank 19 of
45 angular plates. The nozzles or branch members 46, 39 and 40, respectively, enter auxiliary trough chambers 47, 48, 49 formed at corresponding ends of the troughs 31, 32, 33, respectively, and the water delivered to
50 said chambers 47, 48, 49 is compelled to pass over the dams or partitions 50, 51, 52, respectively, in order to enter the main body of said troughs 31, 32, 33, as will be understood on reference to Fig. 3. The trough
55 chambers 47, 48, 49 are above the side wall of the general casing 10, while the perforated bottoms of the troughs extend transversely between the sides of said casing and directly over the several banks of plates.
60 Within the troughs 31, 32, 33 I provide a series of angle bars 53 which extend transversely of the troughs and longitudinally of the general casing 10 and serve to brace the sides of the troughs. Stays 54 reach from
65 the bars 53 to the perforated bottoms of

said troughs and serve to support said bottoms or bottom plates against the weight of the water and thereby prevent the sagging of said plates.

The sumps 13, 14 are equipped with
70 baffle plates 55 which extend from above the lower horizontal rows of plates in the banks 19, 20 downwardly a suitable distance into said sumps and are secured at their lower
75 edges to angle plates 56, which serve to support and strengthen the baffle plates. The upper portions of the plates 55 are substantially vertical and thence said plates when the sumps are of the formation shown, in-
80 cline downwardly and rearwardly. The plates 55 may be secured in any suitable manner, but preferably I will secure them on a longitudinal beam 57 and also on the walls of the sumps 13, 14. In the opera-
85 tion of a blast furnace, "slips" as they are commonly called, frequently occur, as when a large volume of gas is suddenly released and the pressure in the main increased abnormally, this gas having a tendency to
90 force out of the sumps 13, 14 a large amount of water and thereby breaking the water seal. The plates or shields 55, as well as the curved walls 18, are provided to pre-
95 vent any such disturbance of the water in the sumps 13, 14 by a slip or slips as would break the water seal at said sumps or cause the overflowing of the sumps, and in the
100 construction presented by me substantially seventy-five per cent. of the water in the sumps 13, 14 might be driven out by a "slip" without the water seal becoming
105 broken. The shields or baffles 55 also aid in preventing the incoming gas from having a ready exit around under the lower ends of the banks of plates 19, 20, and this is im-
110 portant although said plates are normally below the level of the water in the sumps 13, 14.

Over the sumps 13, 14, 15 and at the front of the banks 19, 20, 21 of angular plates
110 are metal bar platforms 58 upon which a workman may stand and move about when giving any necessary attention to the banks 19, 20, 21 of angular plates. One side of the general casing 10 is provided with door-
115 ways 59 through which workmen may enter and reach the platforms 58 when occasion requires. In the side of the casing near the rear end thereof is provided a door-
120 way 60 through which a workman may enter the chamber within the casing at the far or rear side of the zig-zag plates 26.

The trough 31 has a closed cover or top
125 34 so that said trough may in its upper portion afford a chamber above the water level within the trough and into which chamber, so as to create a pressure on the upper surface of the water, gas may pass through a pipe or pipes 61, which, as shown in Figs. 1 and 2, lead from the general front
130

chamber of the casing 10 into the upper portion of the trough 31. The pipes 61 are provided, as are the shields or plates 55 and end walls 18, to guard against the effect of "slips," the abnormal pressure of the "slip" not only tending to drive the water from the sumps 13, 14, but by acting through the lower perforated surface of the trough 31 to prevent the water in said trough from descending downwardly over the bank or shed of plates 19. With the trough 31 closed at the top and connected by the pipes 61 with the front portion of the general chamber of the main casing, the gas pressure will be equalized, by the presence of the pipes 61, upon the upper and lower surfaces of the body of water within the trough 31, and therefore the uniform flow of water from said trough downwardly over the bank of plates 19 will not be interrupted, and this is a feature of the highest importance, since the "slips" frequently occur and the present construction at the forward or entering end of the apparatus prevents the same from interfering with the regular efficient action of the contact plates 19.

Prior to the admission of gas through the inlet 11 to be cleansed of dust and other impurities, water will be supplied to the troughs 31, 32, 33, from which the water will flow through the perforated bottoms thereof upon the banks of plates 19, 20, 21 and enter the sumps 13, 14, 15, which should be filled above the lower ends of the banks of plates. This preliminary stage of the operation conditions the apparatus for use, and all of the plates in the banks 19, 20, 21 become thereby coated with a flowing thin film of water, more particularly on their forward angular sides. The gas may then be admitted at the inlet 11 and the gas thus admitted will expand into the area of the forward or inlet end of the apparatus and pass thence under pressure against and between the several banks of plates 19, 20, 21 and finally between the eliminator plates 26, whence the gas will pass through the outlet 12. The movement of the continuous flow of gas against the plates 19, 20, 21 results in the dust and other impurities in the gas adhering to the plates by reason of the water film thereon and being carried downwardly by the constant flow of the water to the sumps 13, 14, 15. A large portion of the impurities in the gas is removed by the plates 19, but for a thoroughly efficient cleansing of the gas I make use of the additional banks of plates 20, 21 so as to repeat the washing operation and render it absolutely certain that the impurities have been removed from the gas. The plates 20 are more numerous and of less cross-sectional area than the plates 19, and hence act with greater effect on the gas and serve to take from the gas such impurities therein as may

not have been caught on the plates 19. The plates in the bank 21 are more numerous and of less cross-sectional area than the plates in the bank 20, and hence said plates 21 act with maximum effect in removing impurities from the gas. The staggered arrangement of the plates in the banks 19, 20, 21 compel the thorough contact of the gas therewith and against the films of water thereon. The banks 19, 20, 21 by reason of the staggered order of the plates and the closeness with which the plates are arranged with relation to each other, retard the flow of gas and compel the gas to efficiently move against the surfaces of said plates and the films of water passing downwardly over the same. The gas is permitted to expand after passing through each bank of the plates. The velocity of the current of gas may result in the gas carrying particles of water coated with dust or holding dust beyond the respective banks of plates and such particles or globules will fall into the sumps. After the gas leaves the final bank of plates 21 it is permitted to again expand on its passage to the zig-zag plates 26, which are eliminator plates and arrest any entrained water and remaining dust which may still be in the gas, so that the gas is finally delivered to the outlet 12 in condition for immediate use, if desired, in gas engines and other apparatus requiring it.

The water flowing downwardly over the several banks of plates 19, 20, 21 passes into the sumps below said banks, and the overflow from the sumps 14, 15 escapes through the conduits 16 into the trough 17, which may lead to a sewer or other point of discharge. The water which enters the sump 15 remains sufficiently clean to be used over again, and hence, as hereinbefore described, the surplus water from the sump 15, which is larger than the other sumps, is pumped into the trough 31 and employed on the plates 19 in the first stage of the cleansing operation.

The apparatus shown forms a complete unit plant adapted to receive the gas after the preliminary dry cleaning and delivering it properly cleansed, ready for gas engines, in one continuous operation requiring no special attention, using comparatively little water and involving only nominal power charges. With the use of my invention the gas becomes efficiently cleansed at very small expense. With the employment of the several banks of plates of the character described, the gas may be efficiently cleansed in transit without any necessity for subjecting the gas to treatment in the chamber at the front of the respective banks, and in this regard the apparatus as a whole has been simplified without detracting from its efficiency. The means provided at the sumps 13, 14 and at the trough

31, to-wit, the cover 34 and pipes 61, assure the safe automatic operation of the apparatus, the features just referred to taking care of excessive pressures and "slips," as they are called, automatically and assuredly.

The efficiency of the gas washer is enhanced by reason of the commodious expansion chambers formed between the several banks of plates, within which respective chambers the gas may expand after passing through one bank of plates and before entering the next or succeeding bank. These expansion chambers are clearly represented in Fig. 1, in which it will be seen that they are sufficiently commodious to act as mixing chambers to permit a re-distribution of the strata of gas after passing through one bank and before entering the next bank of plates or sheds in series. The re-distribution of the strata of gas within the aforesaid chambers is caused by the reduction of velocity of gas in the large area of said chambers and the fact that the lower strata of gas being warmer will have a tendency to rise, while the upper strata of gas being colder, will have a tendency to fall. In the aforesaid Letters Patent No. 1,117,309 chambers are formed between the several banks or sheds of plates, but said chambers are of comparatively small area and contain the spray nozzles, whereas the chambers between the banks or sheds of plates in my apparatus, as illustrated in Fig. 1, are of considerable area and therefore permit the result that I have just hereinbefore described, to-wit, the re-distribution of the strata of gas after passing through one bank or shed of plates and before entering the next bank or shed of plates.

It is understood that the proportions of the apparatus hereinbefore described as well as other details will vary in accordance with the character of gas to be washed, since the washer may be designed and proportioned for washing various gases or for washing air.

As illustrating my invention I have presented the same as embodied in a blast furnace gas cleaning plant, and preferably the apparatus will occupy a space 18 feet wide and 60 feet long and be capable of cleaning about 50,000 cubic feet of gas per minute.

The invention is not limited to details of form or construction other than the appended claims may require.

What I claim as my invention and desire to secure by Letters Patent, is:

1. A gas washer including in combination a casing having a gas inlet and a gas outlet through which a current of gas passes, a plurality of banks of closely arranged plates in the path of the gas and against and between which the gas passes, reservoirs above said banks for delivering water upon said

plates and thereby providing a film of water constantly flowing over said plates to arrest and carry away such solid particles as may be in the gas, means for supplying said reservoirs with water, and means below said banks for receiving the water flowing downwardly therefrom, the plates in the successive banks increasing in number and decreasing in cross-sectional area and also in respect to the horizontal and vertical spaces separating them.

2. A gas washer through which gas or air is caused to pass under pressure and within which the pressure of gas or air is likely to fluctuate; said washer including, in combination, a casing through which the current of gas is caused to pass, a bank of contact plates occupying the cross-sectional area of the chamber within said casing against and between which plates the gas passes, a reservoir above said bank for delivering water by gravity upon said plates and thereby providing a film of water constantly flowing over said plates to arrest and carry away such solid particles as may be in the gas and which reservoir has a closed top, and means for supplying said reservoir with water, said reservoir above the water therein being in communication with the chamber of said casing so that the gas pressure may be exerted on the top of said water as well as against the bottom thereof and is always equalized, thereby assuring a uniform flow of the water.

3. A gas washer including, in combination, a casing having a gas inlet and a gas outlet through which a current of gas passes, a plurality of banks of closely arranged plates in the path of the gas and against and between which the gas passes, reservoirs above said banks for delivering water upon said plates and thereby providing a film of water constantly flowing over said plates to arrest and carry away such solid particles as may be in the gas, means for supplying said reservoirs with water, and means below said banks for receiving the water flowing downwardly therefrom, the plates in the successive banks increasing in number and decreasing in cross-sectional area and also in respect to the horizontal and vertical spaces separating them, and said banks being separated from one another in series by commodious chambers to permit a re-distribution of the strata of gas after passing through one bank and before entering the succeeding bank.

4. A gas washer including, in combination, a casing having a gas inlet and a gas outlet through which a current of gas passes, a bank of contact plates in several rows occupying the cross-sectional area of the chamber within said casing against and between which plates the gas passes, a trough above said bank for delivering water upon said

plates and thereby providing a film of water constantly flowing over said plates to arrest and carry away such solid particles as may be in the gas, means for supplying said trough with water, and a sump below said bank for receiving the water therefrom and maintaining a body of water whose level is above the lower end of said bank, the upper portion of the rear wall of said sump being inclined forwardly toward said bank of plates for preventing any sudden increase of the gas pressure, as when a furnace slip occurs, from driving the water rearwardly from the sump.

5. A gas washer including, in combination, a casing having a gas inlet and a gas outlet through which a current of gas passes, a bank of contact plates in several rows occupying the cross-sectional area of the chamber within said casing against and between which plates the gas passes, a trough above said bank for delivering water upon said plates and thereby providing a film of water constantly flowing over said plates to arrest and carry away such solid particles as may be in the gas, means for supplying said trough with water, a sump below said bank for receiving the water therefrom and maintaining a body of water whose level is above the lower end of said bank, and a baffle-plate extending from above the lower plates in said bank downwardly into the water within the sump.

6. A gas washer including, in combination, a casing having a gas inlet and a gas outlet through which a current of gas passes, a plurality of vertical series of horizontally extending plates in the path of the gas which are approximately of L-shape in cross-section and arranged in angular position, the plates of one series being staggered with relation to the plates in the next series, a trough above said series of plates for delivering water thereto and thereby

providing a film of water constantly flowing over said plates to arrest and carry away such solid particles as may be in the gas and which trough has a closed top and a perforated bottom, means for supplying said trough with water, and means below said plates for receiving the water therefrom and maintaining a water seal at the bottom of said series of plates, said trough, above the water therein, being in communication with the chamber of said casing so that the gas pressure may be exerted on the top of said water in opposition to the gas pressure exerted against the bottom thereof.

7. A gas washer including, in combination, a casing having a gas inlet and a gas outlet through which a current of gas passes, a bank of contact plates in several rows occupying the cross-sectional area of the chamber within said casing against and between which plates the gas passes, a trough above said bank for delivering water upon said plates and thereby providing a film of water constantly flowing over said plates to arrest and carry away such solid particles as may be in the gas and which trough has a closed top and a perforated bottom, means for supplying said trough with water, and a sump below said bank for receiving the water therefrom and maintaining a body of water whose level is above the lower end of said bank, said trough above the water therein being in communication with the chamber of said casing so that the gas pressure may be exerted on the top of said water as well as against the bottom thereof.

Signed at New York, in the county of New York, and State of New York, this 29th day of April, A. D. 1918.

AUGUSTE A. GOUBERT.

Witnesses:

ARTHUR MARION,
CHAS. C. GILL.