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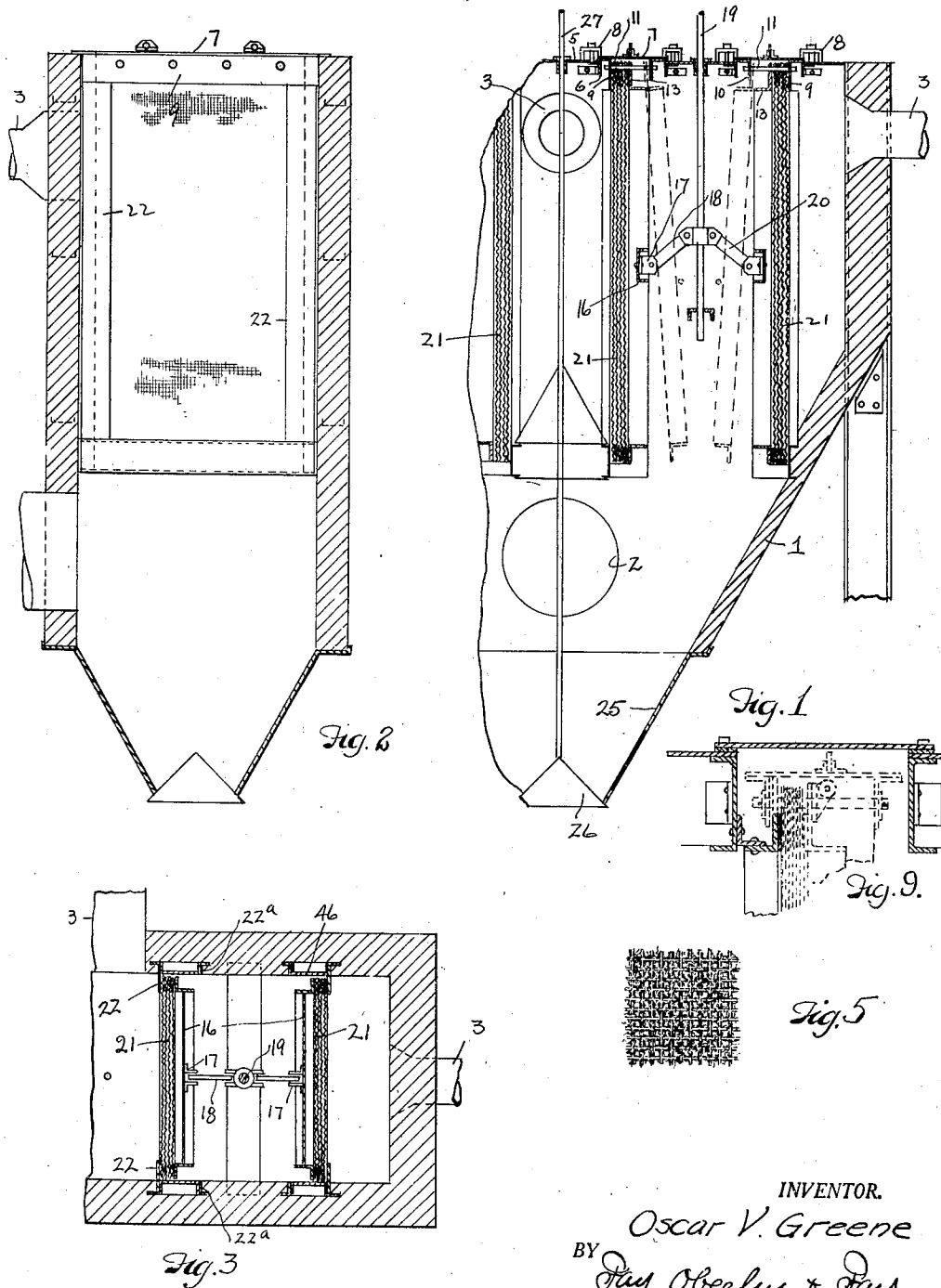
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GAS CLEANING APPARATUS

Filed Oct. 7, 1921

2 Sheets-Sheet 1



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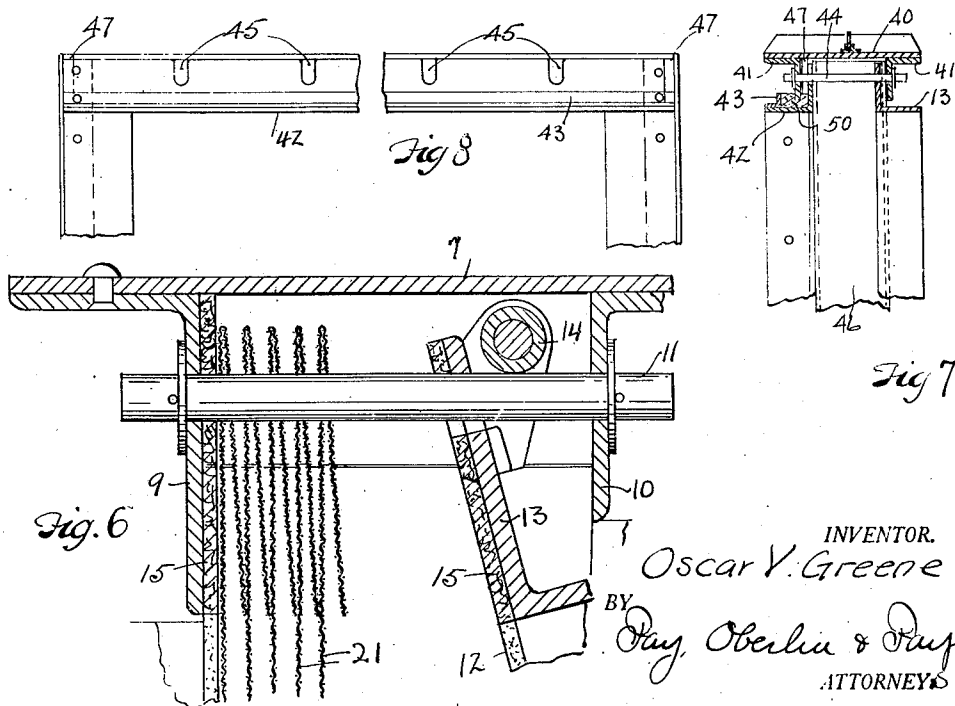
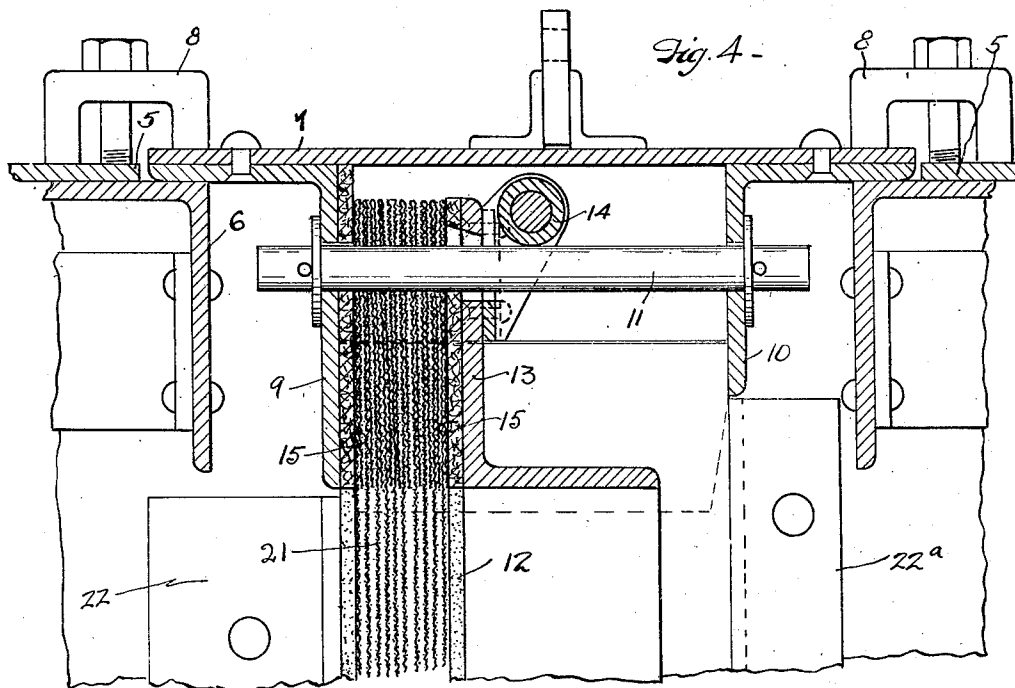
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UNITED STATES PATENT OFFICE.

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GAS-CLEANING APPARATUS.

Application filed October 7, 1921. Serial No. 506,099.

The present invention relates to an improved gas cleaning apparatus for removing fine particles of dust and other solid matter from various gases such as blast furnace gas and the like. To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims.

The annexed drawings and the following description set forth in detail certain mechanism embodying the invention, such disclosed means constituting, however, but one of various mechanical forms in which the principle of the invention may be used.

In said annexed drawings:—

Fig. 1 is a transverse vertical section through my improved apparatus; Fig. 2 is a vertical section taken at right angles to the section of Fig. 1; Fig. 3 is a plan view of the apparatus shown in Figs. 1 and 2; Fig. 4 is a partial section taken on the same plane as the section of Fig. 1, but showing on an enlarged scale the screen-holding mechanism; Fig. 5 is a plan view of one of the screens used in my apparatus; Fig. 6 is a partial view similar to Fig. 4, but showing the screens expanded; Fig. 7 is a sectional view showing a modification of the screen frames and method of sealing them into the casing; and Fig. 8 is a side elevation of the upper portion of one of the frames shown in Fig. 7; Fig. 9 is a vertical section showing a further modification of the screen holding frames and cover construction.

In Fig. 1 there is shown a casing 1 provided with a gas inlet passage 2 and gas outlet passages 3 formed on opposite sides of the upper portion of the casing. Mounted between the gas outlet passages 3 are two series of dust-removing screens which are hung in vertical positions, one in front of each of the passages 3, the gas being allowed to pass upwardly through the casing between these two series of screens and then through the screens and out of the casing by means of passages 3.

The construction and mounting of the gas cleaning screens is shown in detail in Fig. 4. The top 5 of the casing is open and is provided with angle plates 6 upon which there rests a removable cover plate 7 which

is held in place by suitable clamps 8. Extending downwardly from this cover plate are two flanges 9 and 10 spaced a suitable distance apart and carrying transverse horizontal rods or bars 11 in a position closely adjacent to the cover 7. Movable mounted on these rods 11 is a rectangular framework 12 which is so supported by means of an upwardly extending angle plate 13 apertured to fit loosely over the rods 11 and provided with bearing rollers 14 which rest upon the bars 11 and facilitate movement of the frame therealong. Mounted on the adjacent surfaces of the angles 9 and 13 are compressible pads 15 of some suitable material, such, for instance, as woven asbestos.

The frame 12 is provided with a transverse bar 16 intermediate its ends, to which is attached a bracket 17 and a pivoted link 18. This link 18 is in turn pivotally connected to a vertically mounted plunger bar 19 which extends externally of the cover and through an opening formed in top of the casing 5 in order that the bar and framework may be operated from outside of the gas-cleaning apparatus. A similar construction is mounted in a reverse position to that just described and is also connected to the plunger 19 by means of a link 20 so that these two frames may be pulled toward each other and then pressed or swung away from each other at the same time by a single movement of the plunger 19.

For removing the dust and other particles of solid material from the gas I employ a series of woven wire screens 21, each of which is movably mounted on the bars 11 between the pads 15 on the angles 9 and 13. When the plunger 19 is moved downward and the frames 12 are moved against the screens, the latter are pressed tightly against each other and against the open framework 22. The edges of all the screens in this position are sealed between the compressible pads 15 so that there may be no escape of gas between the edges of the screens, all of the gas being forced to pass through the screens and then out of the passage ports 3. At proper intervals when the screens have collected a considerable amount of dust and other solid matter, the plunger 19 is raised pulling the frames 12 into the position shown in dotted

lines in Fig. 1 and allowing the screens to be spaced apart slightly, (Fig. 6) this spacing being aided by the hem around the periphery of each screen and by the natural resilience of the screens which were in compression when the frames were in their vertical positions. The plunger is then moved downward to cause the frames 12 to strike against the screens and jar them against each other, in this way knocking loose the deposit of material on the various screens. After the collected material has been removed from the screens in this manner the screens are again locked in their compressed vertical positions by moving the frames to the full line positions shown in Fig. 4 and the apparatus is again ready for use.

In Fig. 7 I have shown a modified form of cover in which the cover 40 is provided with two downwardly extending angle irons 41, corresponding to 9 and 10 of Fig. 5, which are faced away from each other. The stationary screen-holding frame, 22 in Fig. 3, in this form, is provided with a cross connecting angle iron 42, having slots in its upturned leg for accommodating rods 44 in cover. A small angle iron 43 is attached to the lower horizontal flange of the angle in such a way as to form a long shallow pocket, running the entire length of angle 42. Angle 42 is firmly attached to channel 46, which in turn is fastened to casing by angles 22 and 22'. The cover is positioned laterally by one side of channels 46 and lugs 47, which latter act also as seals at ends of angles 41. When cover is put in place, the long shallow pocket is filled with mud or grout, into which the vertical leg of one of angle irons 41 dip, thereby forming a perfect seal against gas leakage around edges of screen retaining frame.

The material which is removed from the screens falls vertically downward between them striking against the inclined lower surface 25, and from which it may be discharged by raising a conical valve 26 which is operated by a rod 27 extending upwardly through the casing.

My apparatus is so constructed that the screens may be readily removed by merely uncoupling link 18 and loosening the clamps 8 and then lifting out of the casing the entire cover, movable screen frame and screens, as an entire unit, and the screens then repaired or replaced and the unit again set in position.

The screens which are used in the present apparatus have openings of considerably greater size than the size of the dust particles which are to be collected and ordinarily therefore these dust particles would pass through the screens, and but a very small percentage would be collected upon the wires of the screens.

The dusts which are encountered in metal-

lurgical and industrial plants vary greatly in one particular, i. e., the tendency for the separate particles to adhere to each other, which tendency, when marked, we will designate by the word "adhesive", a characteristic possessed by most "fumes", as against a non-adhesive tendency, which we will designate by the word "granular", characteristic of dry cement, sand, etc.

When woven wire screens of very small mesh are used as a filtering medium for fume producing gases, it has been the experience that while such a screen will stop the condensed particles of fume, it becomes almost impossible, sooner or later, to properly rid the screen of the fume for continuous operation. In other words, the fume tends to plug the screen, so that the gas cannot pass through. With non-adhesive or "granular" dust, this tendency to plug is practically nil, and in consequence a much smaller mesh may be used than is the case with "adhesive" dust. It will be observed that the matter of ridding the filtering medium of major portion of the dust is of as great importance as is the matter of collecting it. "Adhesive" dusts are in a large measure like mud, while "granular" dusts act in a manner similar to a sand blast.

In my method of using superposed screens of woven wire the dust collecting is accomplished by baffling the gases so that the particles of dust impinge upon the screen surface, whereby the momentum is taken out of the dust particle and it drops out of the gas stream, collecting on the layer of dust which is retained on the screens by the roughened surface on the wires. If the dust is "granular" and the gas velocity high, the sand blast effect is produced, and a large number of screens are required to effect the dust separation or collection. Whereas with "adhesive" dust, the particles adhere to each other readily, a small number of screens will produce the results required.

From the foregoing it will be observed that the property which facilitates collection, i. e. adhesiveness, is likewise the property which occasions plugging, or an inability of getting properly rid of the dust, in consequence of which the filtering surface, both in character and amount, must be adapted to the particular characteristics of the dusts contended with.

Mention has been made in previous applications of methods of roughening the wire strands of the screen to produce this dust coating on the wires, and of staggering and orienting the mesh on the screens to provide as tortuous a passage as possible.

As previously mentioned, as the dusts approach the "granular" character the number of screens must be increased and the gas velocity through the screens relatively re-

duced. It is for the purpose of overcoming the expense attendant upon the very large number of screens required for granular material that the following described method of treatment has been developed.

I have found, that for very fine granular dusts, by treating the screens before use in such a way as to build upon the wires thereof a fibrous or cellular coating, or a combination of the two of suitable heat-resisting material that it is possible to collect even the very fine particles of solid material which is found in gases on relatively coarse screens. In Fig. 5 I have shown an enlarged view of a part of one of the screens after such treatment. The screens are first coated with some adhesive which will dry or fuse into a hard condition, and will not be affected, or at least will not be softened when subjected to relatively high temperatures. There are various adhesives which may be used for this purpose, but I have employed sodium silicate which forms a hard cellular coating over the wires of the screen when subjected to heat before it is thoroughly dry. After the sodium silicate has been applied to the wire, but before it is dry, I distribute uniformly over either one or both surfaces of the screen finely divided or finely ground fibrous material, such, for example, as asbestos or mineral wool which readily adheres to the sodium silicate or other adhesive. With the adhesive, the fibrous material forms an irregular fibrous and cellular mass on each wire, which presents a very considerable area of dust-collecting surface. The matter of alignment when using a coating of this nature is not material. The dust particles are caught against or between the fibers on the wires of the screen and are there held until the screens are jarred, which action results in dropping the collected dust, but does not appreciably injure the coating either of adhesive or fibrous material which is on the wires of the screen. Of course, in time the screens will lose some of the fibrous material through repeated jarring for the purpose of cleaning, and must then be removed and either re-coated or new screens must be substituted.

Fig. 9 is a modification of Fig. 7 arrangement, in that the seal is effected without the need of any grout or mud, and a separate and additional cover plate with gas tight gasket is employed in place of cover plate on removable screen holding head. In this arrangement the stationary screen holding frame 50 is entirely sealed in the casing around its edges and no dependence is placed upon the fit of the movable head to effect the seal.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as re-

gards the mechanism herein disclosed, provided the means stated by any of the following claims or the equivalent of such stated means be employed.

I therefore particularly point out and distinctly claim as my invention:—

1. In a gas cleaning apparatus, the combination of a casing provided with gas inlet and outlet connections, a series of dust collecting screens mounted in a vertical position in said casing between said inlet and outlet connections, and mechanically operated means adapted to move said screens into compacted relation.

2. In a gas cleaning apparatus, the combination of a casing provided with gas and inlet and outlet connections, a series of laterally movable dust collecting screens mounted in vertical position in close relation in said casing between said inlet and outlet connections and means engaging against one of said screens adapted to jar said screens against each other to loosen dust collected thereon.

3. In a gas cleaning apparatus, the combination of a casing provided with gas inlet and outlet connections, a series of screens each pivotally and slidably mounted at one end and said screens being mounted adjacent to each other in vertical positions between said inlet and outlet connections in said casing, and means engaging against one of said screens, said means being adapted to jar said screens against each other to loosen dust collected thereon.

4. In a gas cleaning apparatus, the combination of a casing provided with gas inlet and outlet connections, a series of screens each pivotally and slidably mounted at one end and said screens being mounted adjacent to each other in vertical positions between said inlet and outlet connections in said casing, a framework also pivotally mounted about the same axis as said screens, and means extending exteriorly of said casing, said means being adapted to cause said frame to jar said screens to loosen the dust collected thereon.

5. In a gas cleaning apparatus, the combination of a casing provided with gas inlet and outlet connections and having also an opening in its top, a cover removably mounted to close such opening in the top of said casing, a series of flat screens pivotally supported from said cover in close proximity to each other, and means engaging against one of said screens, said means being adapted to jar said screens against each other to loosen dust collected thereon.

6. In a gas cleaning apparatus, the combination of a casing provided with gas inlet and outlet connections and having also an opening in its top, a cover removably mounted to close such opening in the top of said casing, a series of flat screens pivotally

mounted on said cover in close proximity to each other and in position to hang between said inlet and outlet connections in said casing when said cover is in position, and means engaging against one of said screens, said means being adapted to jar said screens against each other.

7. In a gas cleaning apparatus, the combination of a casing provided with lateral gas inlet and outlet connections, a series of flat dust collecting screens pivotally mounted in close relation to each other in a vertical position in said casing between said inlet and outlet connections, means engaging against one of said screens, said means being adapted to jar said screens against each other to loosen the dust collected thereon, and a valve in the bottom of said casing adapted to control the removal of dust falling to such bottom from said screens.

8. In a gas cleaning apparatus, the combination of a casing provided with gas inlet and outlet connections, a stationary framework mounted between said inlet and outlet connections, a movable framework mounted between said inlet and outlet connections, a series of dust collecting screens mounted between said stationary and said movable framework, and means adapted to move said movable framework against and away from said screens.

9. In a gas cleaning apparatus, the combination of a casing provided with gas inlet and outlet connections, a stationary framework mounted between said inlet and outlet connections, a movable framework mounted between said inlet and outlet connections, a series of dust collecting screens mounted between said stationary and said movable framework, and means adapted to compress the edges of said screens between said stationary and movable framework.

10. In a gas cleaning apparatus, the combination of a casing provided with gas inlet and outlet connections, a series of foraminous sheets separably mounted in an upright position in said casing in juxtaposed relation between said inlet and outlet connections and being capable of movement out of normal juxtaposed relation for cleaning.

11. A dust cleaning element comprising an integral woven wire screen provided with a relatively rigid body portion and a compressible marginal portion integral therewith.

12. A dust collecting screen comprising a metallic woven wire screen having its edge portions rebent upon the body of the screen, thereby providing an integral resilient, compressive marginal portion.

13. In a dust collecting apparatus, the combination of a series of spaced woven wire screens mounted to move toward and away from each other, resilient spacing means

mounted around the edges of said screens, and means adapted to compress said screens together.

14. In a dust collecting apparatus, the combination of a series of spaced woven wire screens mounted to move toward and away from each other, said screens having inwardly extending marginal portions lying parallel thereto, and means adapted to compress said screens together.

15. In a dust collecting apparatus, the combination of a series of spaced woven wire screens mounted to move toward and away from each other, said screens having inwardly extending marginal portions lying parallel thereto, and a screen compressing framework adapted to engage said screens opposite such marginal portions.

16. In apparatus of the character described, the combination of a casing provided with inlet and outlet openings, a dust receiver connected thereto, a filtering element comprising a plurality of foraminous sheets mounted in juxtaposed relation between such inlet and outlet openings, and means restricting the passage of gas through such element to a direction at approximately right angles thereto.

17. In apparatus of the character described, the combination of a casing provided with inlet and outlet openings, a dust receiver connected thereto, a filtering element comprising a plurality of foraminous sheets mounted in juxtaposed relation between such inlet and outlet openings, means restricting the passage of gas through such element to a direction at approximately right angles thereto, and other means adapted to permit discharge of dust collected by said elements in a direction parallel to and between said sheets into said dust receiver.

18. In apparatus of the character described, the combination of a dust collecting medium comprising a plurality of foraminous sheets placed in close proximity to each other, a support for said medium, means adapted to close the margins of said medium against said support, and means adapted to open said margins from said support for the discharge of dust from said medium.

19. In apparatus of the character described, the combination of a casing provided with inlet and outlet openings, a dust receiver connected thereto, a dust collecting medium mounted in said casing, means adapted to seal the marginal portions of said medium against the walls of said casing to prevent the passage of gas thereby, and other means adapted to unseal the margins of said medium for the discharge of dust therethrough.

20. In apparatus of the character described, the combination of a casing provided with inlet and outlet openings, a dust receiver connected thereto, a plurality of su-

perposed reticulated elements placed in substantially parallel vertical relation to said casing between inlet and outlet openings, such elements being adapted to collect suspended material throughout their intramarginal portions, and means operable exteriorly of said casing for loosening said material from said elements, said means being also adapted to separate said elements to permit discharge of collected material therefrom into said receiver.

21. In apparatus of the character described, the combination of a casing having inlet and outlet openings, a series of parallel screens mounted in close proximity to each other said casing between such openings, and means removably sealing the lowermost margins of said screens against the wall of said casing to prevent the passage of gas thereby, said means being also adapted to free such lowermost margins from said casing to permit the discharge of material collected on said screens from between the same.

22. In apparatus of the character described, the combination of a casing having inlet and outlet openings, a series of parallel screens mounted in juxtaposed relation in said casing between such openings, means removably sealing the lowermost margins of said screens against the wall of said casing

to prevent the passage of gas thereby, said means being also adapted to free such lowermost margins from said casing to permit the discharge of material collected on said screens from between the same, and means for jarring said screens to free material collected thereon.

23. In apparatus of the character described, the combination of a dust collecting medium, including a plurality of foraminous sheets in close proximity to each other, a frame supporting said medium, means adapted to seal the marginal portions of said medium against said frame to restrict the flow of gas therepast, and means adapted to unseal said marginal portions from said frame for the discharge of dust from said medium.

24. In apparatus of the character described, the combination of a casing provided with inlet and outlet openings, a plurality of foraminous dust collecting sheets mounted in compacted relation between said openings, and means sealing said sheets against the walls of said casing and against each other and maintaining the same in such compacted relation.

Signed by me, this 30th day of September, 1921.

OSCAR V. GREENE.