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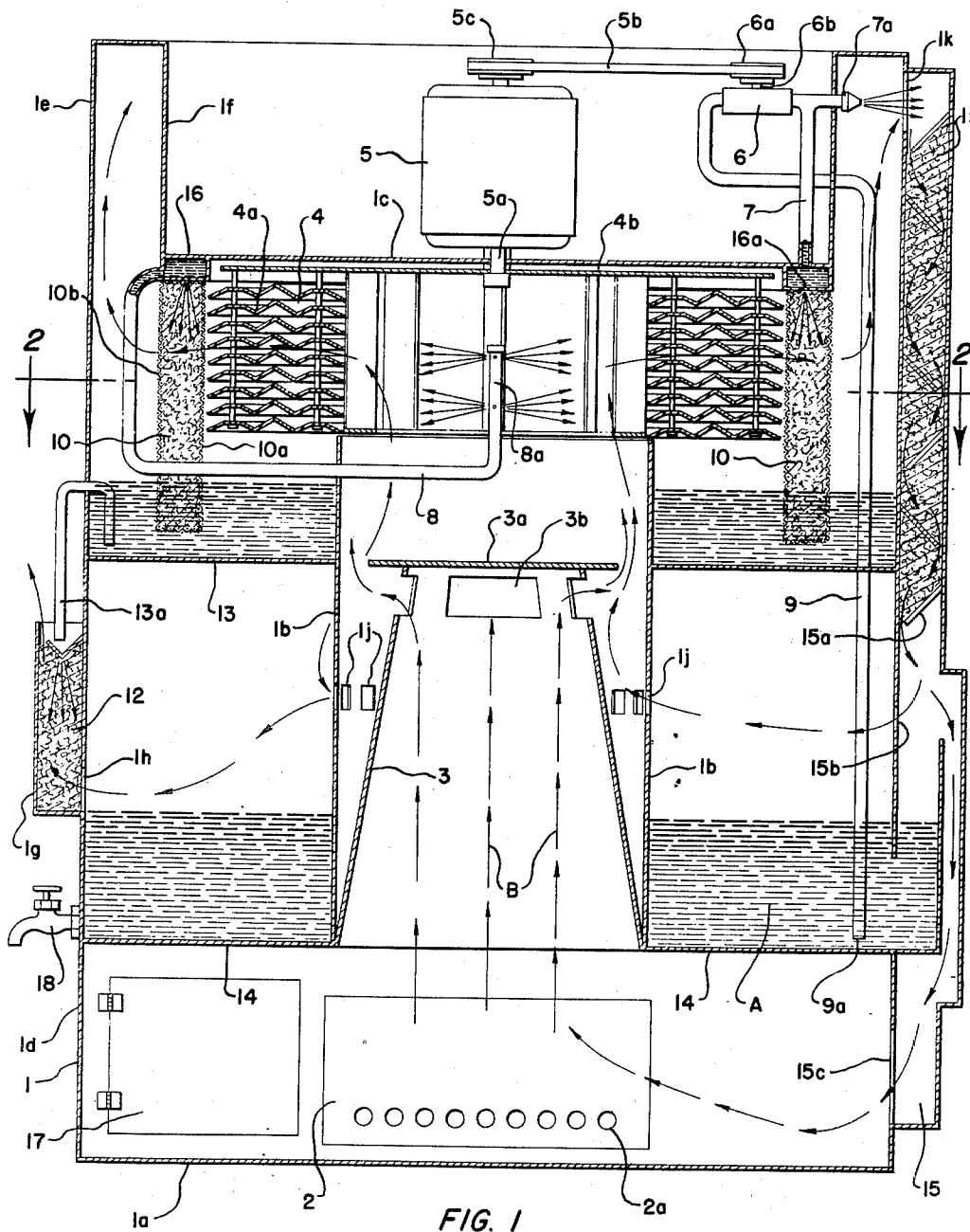
G. W. HARDY ET AL

2,601,519

AIR CLEANER

Filed April 10, 1948

2 SHEETS—SHEET 1



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2 SHEETS--SHEET 2

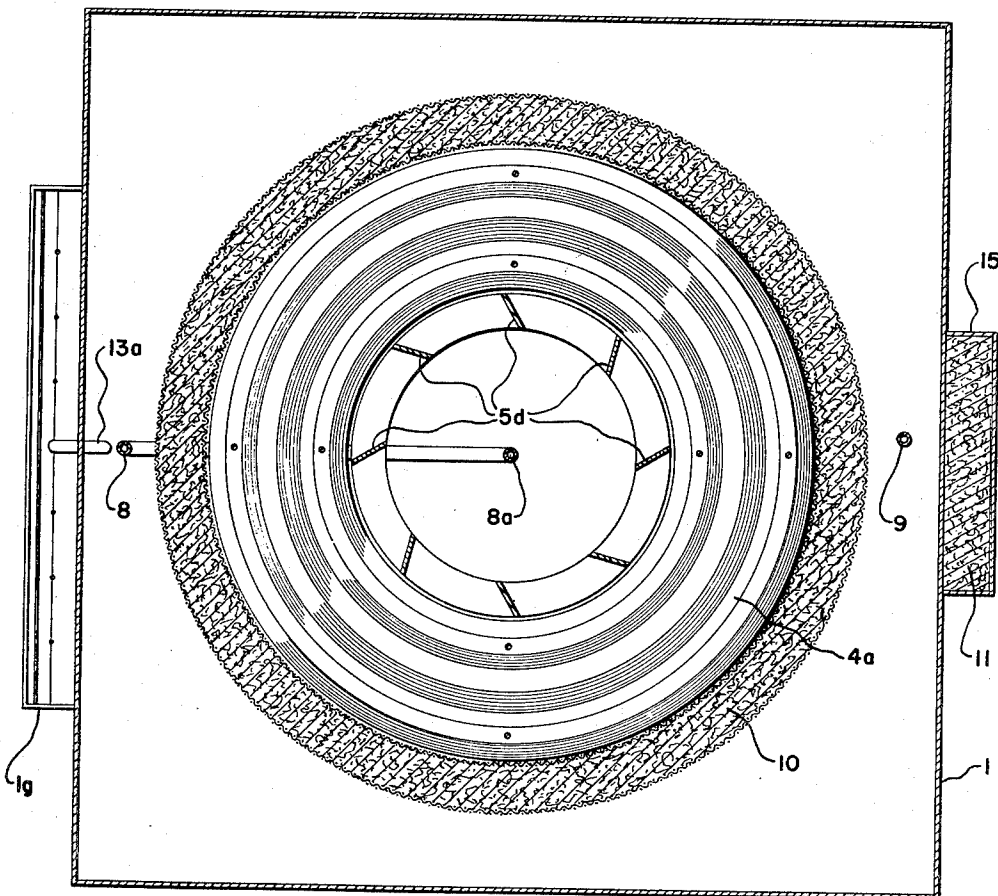


FIG. 2

INVENTORS
GORDON W. HARDY,
GEORGE C. RAY &
PAUL CARLE

BY

Wm. H. Dean
AGENT

UNITED STATES PATENT OFFICE

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AIR CLEANER

Gordon W. Hardy, Chula Vista, George C. Ray,
San Diego, and Paul Carle, Coronado, Calif.,
assignors to Air Purification, Inc., San Diego,
Calif., a corporation of California

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Our invention relates to a means and method for removing foreign matter from compressible fluids and the objects of our invention are:

First, to provide a means and method of this class which very efficiently removes carbon and noxious elements from flue gases smoke.

Second, to provide a means and method of this class in which various foreign materials may be removed from various compressible fluids and emulsified in wetting agent which effectively transfers the foreign materials from the compressible fluid stream into a hydraulic fluid sump from which it may be disposed.

Third, to provide a means of this class in which a centrifugal blower is driven by a source of power independent of the air stream passing through the blower whereby a greater centrifugal velocity is imparted to the air than its velocity axially of the blower.

Fourth, to provide a means of this class in which hydraulic fluid is dispensed centrally of a centrifugal blower through which the compressible fluid is driven causing emulsification of the foreign matter in the compressible fluid with the hydraulic fluid dispensed from said centrally disposed nozzle.

Fifth, to provide a means of this class in which valuable by-products of combustion may be recovered for commercial use.

Sixth, to provide a means of this class which effectively removes foreign matter from a compressible fluid and imparts increased static pressure to the compressible fluid at the outlet of said means in proportion to the inlet pressure therein, of said compressible fluids.

Seventh, to provide a means and method of this class which may be economically used to substantially eliminate the filth created by what is commonly known as "smog" issuing from smoke stacks of large factories or the like.

Eighth, to provide a means of this class in which foreign matter in a compressible fluid is subject to violent impact on surfaces which at all times are covered by a hydraulic fluid medium whereby very efficient emulsification of the foreign matter may be accomplished.

Ninth, to provide a means and method of this class in which products of combustion may be relieved of a great percentage of carbon and noxious materials by recirculation through the said means whereby said recirculation furnishes a portion of the oxygen.

Tenth, to provide a novel method for removing foreign matter from compressible fluids.

Eleventh, to provide a means of this class which is very simple and economical of construction, efficient in operation and which will not readily deteriorate or get out of order.

With these and other objects in view which will appear hereinafter, our invention consists

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of certain novel features of construction, combination and arrangement of parts and portions as will be hereinafter described in detail and particularly set forth in the appended claims; reference being had in the accompanying drawings and to the characters of reference thereon forming a part of this application in which:

Figure 1 is a vertical sectional view of the means used in connection with our method for removing foreign matter from compressible fluid. Figure 2 is a plan sectional view taken from the line 2-2 of Figure 1.

Similar characters of reference refer to similar parts and portions throughout the views of the drawing.

The casing, 1, fire box 2, diverter 3, centrifugal blower 4, motor 5, pump 6, hydraulic fluid conductors 7, 8 and 9, strainer elements 10, 11 and 12, hydraulic sumps 13 and 14, and the recirculation conductor 15, and hydraulic reservoir, constitute the principal parts, and portions of our means for removing foreign matter from compressible fluids.

The casing 1, forms the main frame and container for our means as shown in Figures 1 and 2 of the drawings, and the fire box 2, is placed in the inlet plenum 1a of the casing 1 as shown in Figure 1 of the drawings. It will be noted that the inlet plenum in 1a may be used to receive various compressible fluids other than smoke supplied by the fire box 2 as desired. Directly above the fire box 2 is a frusto-conical diverter 3 having a top plate 3a of larger diameter than the upper end of said diverter, adjacent to which are cordal openings 3b, provided for the escape of air or smoke passing upwardly through the diverter 3 into the cylindrical conductor 1b of the casing 1. This cylindrical conductor 1b communicates directly with the interior of the centrifugal blower 4. This centrifugal blower 4 is provided with revolving elements 4a which are annular and arranged in super imposed corrugated relationship to each other, the corrugations being transverse of the annular elements as indicated in Figs. 1 and 2 of the drawings. Angularly disposed vanes 5d are mounted on the frame 4b within the elements 4a in an annular manner. This blower structure may be varied as desired in order to provide maximum impingement efficiency of foreign matter in compressible fluids passing through the revolving element 4a of the centrifugal blower 4. The motor 5 is provided with a shaft 5a on which the frame plate 4b of the centrifugal blower is fixed. This shaft 4a passes through an enclosing cover plate 1c of the casing 1 which covers the normally upper end of the centrifugal blower 4, causing centrifugal dispersion of the fluids on a substantially horizontal plane as shown in Figure 1 of the drawings. Driven by means of the belt 5b on the pulley 5c

of the motor 5, is a pulley 6a on the operating shaft 6b on the pump 6 which is a hydraulic pump. This hydraulic pump 6 is provided with a fluid inlet conductor 9, the lower end 9a of which communicates with a hydraulic fluid A in the sump 14 just above the fire box 2 in the casing 1. The outlet fluid conductor 7 is provided with a nozzle 7a communicating therewith directing hydraulic spring into the recirculation conductor 15 above the strainer 11 therein. The bulk of liquid passing through the fluid conductor 7 passes into the hydraulic reservoir 16 which is an annular reservoir disposed above the strainer element 10 which is also annular as shown best in Figure 2 of the drawings. The hydraulic fluid conductor 8 communicates with the interior of the reservoir 16 and extends downwardly and inwardly toward the center of the casing 1 and then upwardly into the middle of the centrifugal blower 4. The upwardly extending end 8a of this hydraulic fluid conductor 8 is provided with a plurality of nozzle openings which dispense radially directed hydraulic spray directed toward the revolving elements 4a of the centrifugal blower 4. The inner and outer walls 10a and 10b respectively of the strainer 10 are preferably made of relatively stiff foraminous materials such as heavy screen wire or the like and the central element of the strainer 10 may be varied to suit the particular requirements for which the strainer 10 is designed. For general application such elements as steel wool or the like may be used. The lower end of this annular strainer 10 extends downwardly into the hydraulic sump 13 formed intermediate the hollow cylindrical portion 1b of the casing 1 and the outer wall 1d thereof. The casing 1 is provided with an annular air passage 1e therein surrounding the outer wall 10b of the strainer 10 directly above the sump 13. The inner wall of this passage 1e, designated 1f extends in vertical relationship to the plane of the cover plate 1c which is co-extensive with the top of the hydraulic reservoir 16 and the centrifugal blower 4, all as shown best in Figure 1 of the drawings. Communicating with the sump 13 is a siphon tube 13a extending downwardly to the upper side of the strainer 12, as shown in Figure 1 of the drawings which is disposed in an outlet casing portion 1g of the casing 1. This outlet casing portion 1g is provided with a drain opening and air outlet opening 1h in the bottom thereof which opening 1h is just above the sump 14 which accumulates emulsified matter relieved from the compressible fluid passing through the centrifugal blower 4 and into the strainer 10. Communicating directly with the passage 1e in the casing 1 is the recirculation conductor 15. This recirculation conductor 15 communicates with the interior of said passage 1e at the upper portion thereof through the opening 1k in the side wall thereof. The strainer 11 may be made of similar material to the strainer 10 hereinbefore described and is interrupted by apodposed angular baffles 15a in the recirculation conductor 15 which are downwardly declining as shown in Figure 1 of the drawings. The inner wall of the recirculation conductor 15 is provided with an opening 15b above the liquid level in the sump 14 so that compressible fluid may be recirculated through the hollow cylindrical casing 1b at the opening 1j which conduct a portion of the recirculated compressible fluid to the centrifugal blower while a certain percentage of the compressible fluid passes outwardly through the strainer 12 and the outlet casing 1g to atmos-

phere. A portion of the compressible fluid is recirculated downwardly into the intake plenum 1a of the casing 1 through the opening 15c in the side wall of the recirculation conductor 15, all as shown best in Figure 1 of the drawings.

It will be here noted that the pump 6 communicating with the sump 14 relieves fluid therefrom and supplies said fluid to the strainer 10 by means of the reservoir 16 provided with small openings 16a in the bottom thereof directly above said strainer 10. It will be here noted that conventional means not shown in the drawings may be used to control the admission of primary air to the fire box 2 in the end left plenum 1a of the casing 1 through the opening 2a in the fire box 2. Thus, outside air or primary oxygen may be admitted to the burner 2 in measured quantities sufficient to augment the recirculated air passing through the opening 15c and the recirculation conductor 15 for efficient combustion. As shown in Figure 1 of the drawings, we have provided a service door 17 which may be used as desired for maintenance work and admission of compressible fluids other than those emitted by the combustion taking place in the fire box 2.

The operation of our means and method for removing foreign matter from compressible fluids is substantially as follows:

When smoke is emitted from the fire box 2 or compressible fluid enters the plenum 1a of the casing 1 and passing as indicated by the arrows B through the diverter 3; the motor 5 is rotating the centrifugal blower 4 in which the vanes 5d under angularly disposed relationship to the axis of the blower 5 cause centrifugal dispersion of the compressible fluid radially through the revolving element 4 of said centrifugal blower. During operation of the motor 5, the pump 6 supplies fluid to the reservoir 16 which in turn supplies fluid to the tube 8 to the nozzle 8a which directs spray radially to the revolving element 4a of the centrifugal blower 4, mist passing downwardly in the hollow cylindrical casing portion 1b is shielded from the fire box 2 by the diverter 3 having the upper plate 3a thereon so that mist from the spray nozzle 8a does not in any way hamper operation of the combustion in the fire box 2. The motor 5 operating the centrifugal blower 4 causes considerable decrease in pressure at the inlet thereof creating a partial vacuum on the inlet plenum 1a of the casing 1 which increases the velocity over the normal inlet or thermal velocity passing upward through the diverter 3. The liquid or wetting agent passing out the nozzle portions 8a of the conductor 8 mixes with the air stream and passes horizontally through the revolving element 4 which is designed to cause several different changes in directional movement of the compressible fluid during its passage to the periphery of the revolving element 4a. Thus, the wetting agent or liquid passing radially into the revolving element 4a coats the same and the forceful centrifugal action of the foreign matter in the compressible fluid causes the same to impinge on the surfaces of the revolving element 4a and be emulsified during passage into the strainer 10 and preliminary thereto so that vertical drainage of the liquid carrying the foreign matter in emulsification gravitates downwardly in the strainer 10 into the sump 13 from which the siphon 13a carries the same through the strainer 12 from which it gravitates into the sump 13. The air passing outwardly through the outer wall 10b of the strainer 10 passes into the passage 1e and thence therefrom through the opening 1k

and into the recirculation conductor 16 in which the liquid or wetting agent passes from the nozzle 7a as indicated in Figure 1 of the drawings. The compressible fluid passing downward through the strainer 11 is directed by the overlapping opposed declining baffles 15a until it reaches the opening 15b. A portion of the compressible fluid passes through the opening 15b then to the opening 17 and backwardly through the centrifugal blower 4. A small percentage of the compressible fluid surrounds the casing 1b and passes outwardly through the opening 1h then up through the strainer 12 saturated by the fluid from the siphon tube 13a. After passing through the strainer 12 the small percentage of air returns to atmosphere. Some of the air passing downwardly in the recirculating conductor 15 passes beyond the opening 15b and thence into the inlet plenum 1a of the casing 1 through the opening 15c. This air or compressible fluid furnishes a certain proportion of the oxygen required for operating of the combustion in the fire box 2, it is being noted that all the oxygen passing through the compressible fluid is not initially consumed, in combustion.

A fluid contained in the sump 14 and other hydraulic equipment of our means for removing foreign matter from compressible fluids may be a detergent wetting agent or other liquid, particularly suited for removing certain elements from the compressible air stream, thus the elements to be removed from the compressible air stream dictate to an extent the chemical constituents of the liquid maintained in the sump 14.

The operation of our method in connection with the heretofore described means is substantially as follows:

A compressible fluid bearing foreign matter is first moved in one direction, then supplied with hydraulic material in spray form, then the compressible fluid is centrifugally forced abruptly in another direction together with the hydraulic fluid. The compressible medium is then strained; the portion of said compressible fluid is recirculated and again mixed with hydraulic fluid with which it is radially forced centrifugally through the hereinbefore mentioned strainer. The portion of the compressible fluid is exhausted to atmosphere. It will be here noted that the hydraulic fluid supplied to the compressible fluid before centrifugal actuation is particularly adapted to emulsify the foreign matter in the compressible fluid. This method incorporates the actuation of the compressible fluid at a greater speed centrifugally than the initial velocity of the compressible fluid before mixing with the hydraulic fluid and subsequent centrifugal action.

The term compressible fluids, used herein includes, air, gases, smoke, products of combustion, flue vapors, or the like. The term hydraulic, as used herein pertains to liquids having an affinity for various foreign materials in various compressible fluids. The term emulsion used herein includes the mixture of the foreign matter removed from compressible fluids and the hydraulic fluids having an affinity therefor.

It is to be here noted that the foregoing method is primarily for use in cleaning air or flue gases for removing foreign matter from the air, and removing certain products of combustion from the flue gases.

Though we have shown and described a particular construction, combination and arrangement of parts and portions, and a certain method, we do not wish to be limited to this

particular method, but desire to include in the scope of our invention the construction, combination and arrangement, and the method as substantially set forth in the appended claims.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is:

1. In a means of the class described, a motor, a centrifugal blower operated thereby, a spray nozzle centrally of said blower, at the inlet thereof, a vertical axis cylindrical strainer surrounding said blower, means for supplying liquid to said strainer, a sump below said strainer, a siphon tube communicating with said sump, a second strainer below said siphon tube and a second sump below said second strainer for receiving liquid from said siphon tube through said second strainer.

2. In a means of the class described, a motor, a centrifugal blower operated thereby, a spray nozzle centrally of said blower, at the inlet thereof, a vertical axis cylindrical strainer surrounding said blower, means for supplying liquid to said strainer, a sump below said strainer, a siphon tube communicating with said sump, a second strainer below said siphon tube and a second sump below said second strainer, for receiving liquid from said siphon tube through said second strainer, air passage means at the outlet of said first mentioned strainer communicating with said second mentioned strainer above said last mentioned sump, whereby air passes through said second mentioned strainer to atmosphere.

3. In a means of the class described, a motor, a centrifugal blower operated thereby, a spray nozzle centrally of said blower, at the inlet thereof, a vertical axis cylindrical strainer surrounding said blower, means for supplying liquid to said strainer, a sump below said strainer, a siphon tube communicating with said sump, a second strainer below said siphon tube and a second sump below said second strainer for receiving liquid from said siphon tube through said second strainer, air passage means at the outlet of said first mentioned strainer communicating with said second mentioned strainer above said last mentioned sump, whereby air passes through said second mentioned strainer to atmosphere, a third strainer in said air passage means for removing foreign matter from said air passage means, means for supplying liquid to said third mentioned strainer for washing said foreign matter into said last mentioned sump.

GORDON W. HARDY.
GEORGE C. RAY.
PAUL CARLE.

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