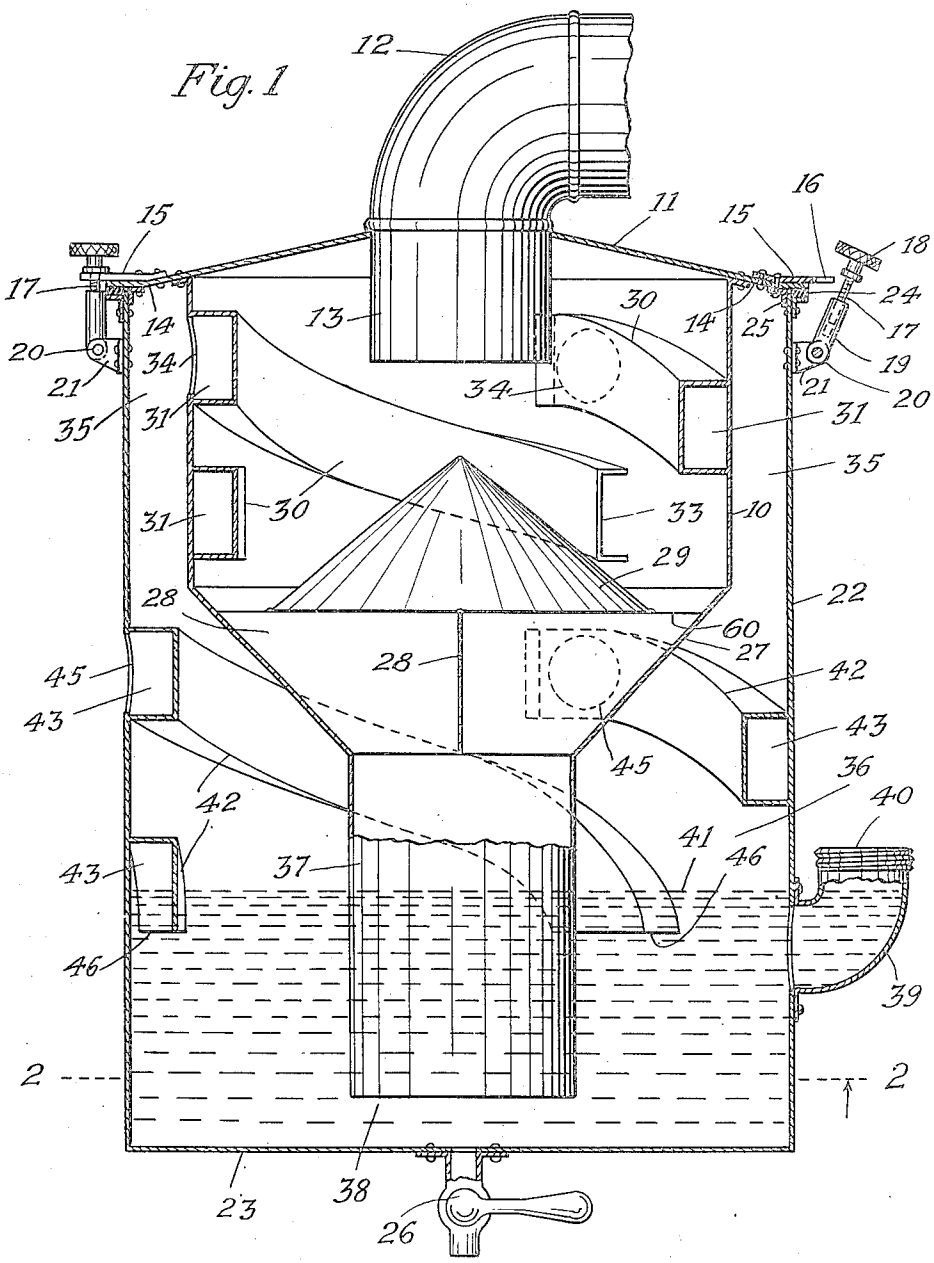
July 10, 1923. 1,461,174

A. C. BENNETT

AIR CLEANER

Filed Sept. 8, 1917 2 Sheets-Sheet 1

Fig. 1




Inventor:
Ashley C. Bennett.
By P. A. Whittlesey
his Attorney.

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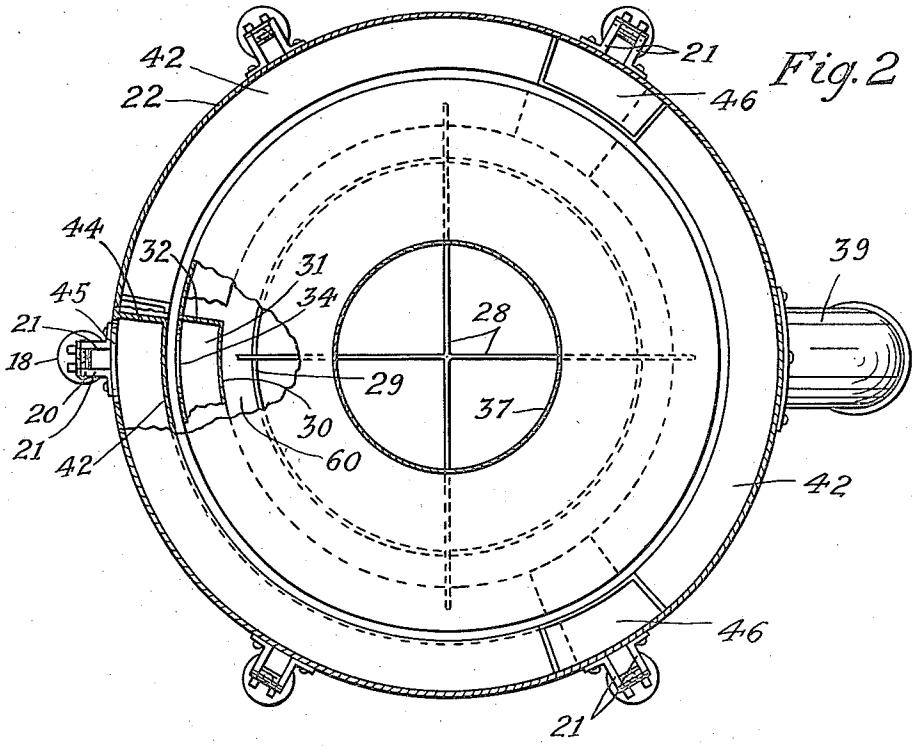


Fig. 2

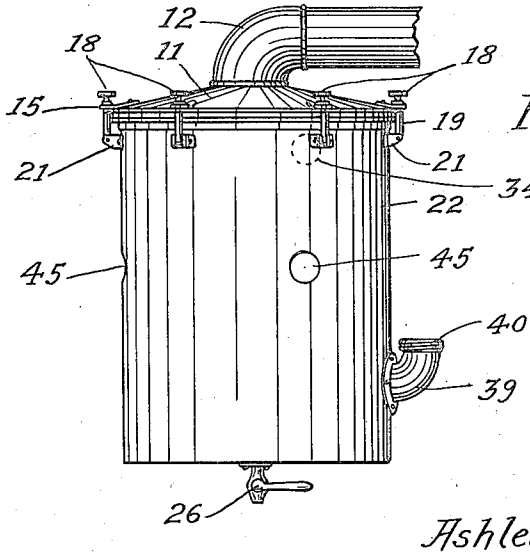


Fig. 3

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# UNITED STATES PATENT OFFICE.

ASHLEY C. BENNETT, OF MINNEAPOLIS, MINNESOTA, ASSIGNOR TO IRENE E. BENNETT, OF MINNEAPOLIS, MINNESOTA.

## AIR CLEANER.

Application filed September 8, 1917. Serial No. 180,393.

*To all whom it may concern:*

Be it known that I, ASHLEY C. BENNETT, a citizen of the United States, residing at Minneapolis, in the county of Hennepin and State of Minnesota, have invented certain new and useful Improvements in Air Cleaners, of which the following is a specification.

My invention relates to air cleaners and has for its object to provide an improved air cleaner wherein the air to be cleaned is projected in a spiral direction into a body of water at the bottom of the cleaner and rotates with the water, thereafter passing through a second casing wherein a second rotary motion is given to the air, thus removing from the air which has contacted with the air any moisture which may have been carried with the air from the water. In its broader scope my invention comprises a combined gravity and liquid air cleaner in combination with a water separator whereby the air is first freed from all or the major part of the solid impurities carried thereby and then is freed from excess amounts of moisture. It is the purpose of this invention particularly to clean air for use in carbureters or for other purposes where quantities of entirely pure air are required.

The full objects and advantages of my invention will appear in connection with the detailed description thereof and are particularly pointed out in the claims.

In the drawings, illustrating the application of my invention in one form,—

Fig. 1 is a sectional elevation of an air cleaner embodying my invention. Fig. 2 is a part sectional plan view of the apparatus viewed from below. Fig. 3 is an elevation view of the assembled device.

As illustrated, a cylindrical inner casing 10 is secured to a top 11 which may be sligthly conical, the top in turn being centrally secured to a discharge pipe 12 which has a portion 13 which extends within the casing 10. The top 11 is formed with a projecting portion 14 to which are secured a multiplicity of lugs 15 each provided with slots 16 adapted to receive shanks 17 of thumb screws 18, which shanks are threaded into carriers 19 pivoted at 20 to lugs 21 extended outwardly from an outer cylindrical casing 22 formed with a closed bottom 23. By means of the thumb screws 18 in cooperation with the slotted lugs 15 the portion 22 is removably secured to the top 11, a gasket 24 at said top and engaging the projecting portion 14 making an air-tight joint between the same. The outer casing 22 is further held positioned by means of angle pieces 25 secured to the projecting portion 14. The bottom 23 may be provided with a cock 26 by which liquid may be withdrawn when desired.

The cylindrical casing 10 has secured to the lower portion thereof a conical extension 27 within which are transverse partitions 28 dividing the space within the conical extension into passageways, and upon the conical extension is an upwardly-extending cone 29 the lower edge of which is spaced as indicated at 60 from the wall of cone 27.

Within the casing 10 are a multiplicity of troughs 30 forming in combination with the casing 10 spiral passageways 31 which are provided with closed upper ends 32 and open lower ends 33, the upper ends surrounding apertures 34 extending through casing 10 into the passageways 31. It will be seen that these apertures 34 open within an annular space 35 formed between the cylindrical casing 10 and the outer cylindrical casing 22, which annular space opens at its bottom into the chamber 36 formed in the lower portion of the casing 22. Secured to the lower end of conical portion 27 and reaching to a point near the bottom of chamber 36 is a cylindrical extension 37, the lower edge of which is spaced as indicated at 38 a short distance from the bottom 23 of the container 22. Water and other liquid is supplied to the chamber 36 through a pipe 39 normally sealed tight by a screw cap 40, the water reaching a level indicated at 41 in chamber 36. A multiplicity of troughs 42 (here shown as three in number) extend spirally around the inside of casing 22 forming spiral passageways 43 having closed upper ends 44. The passages 43 at their upper ends surround openings 45 extending through the casing 22, these openings being the inlet openings for outside air into the entire cleaner. The lower ends of troughs 43 are open and extend in a plane parallel with bottom 23 to a point below the water surface 41 as indicated at 46 in Fig. 1.

The operation of the cleaner is as follows. The pipe 12 is connected with an air-current inducing means such as a pump or gas engine, or, where desired, the current may be

forced through the air cleaner by pressure means applied to apertures 45. Whatever means for inducing the air current are employed, such air will enter the casing through apertures 45 and pass downwardly through passageways 43 formed by troughs 42 and the casing 22, discharging at the various mouths 46 into the body of water at the bottom of chamber 22. These air currents entering the water so as to travel in a rotary direction and impinging upon the water will set the body of water into rotation, and centrifugal force, due to this rotation, will cause the water to pile up around the inner wall of chamber 36, thus rising to a higher level and at all times keeping the mouths 46 of passageways 43 well covered. All of the air which enters the casing must, therefore, pass through a screen of rotating water, and extremely fine particles of dust or lint which would not ordinarily be precipitated by gravity will adhere to the water and so be removed from the air. The air after passing out of the water will ascend in chamber 36 and the annular extension 35 thereof finally passing through openings 34 into the spirial passageways 31 within casing 10. This air will leave these passageways at the mouths 33 beside the central cone 29 and above the apertures 60 below said cone, traveling in a cyclone or whirl. All particles of moisture carried upward from the water will be precipitated by gravity upon the walls of cone 27 or cone 29 and will flow downward into the interior of conical extension 27, ultimately reaching the body of water at the bottom of the chamber 36. The dead-air space below cone 29 and above the water in extension 37 will, however, always be maintained because of the water seal at the bottom of chamber 37. The cyclone of air formed as it leaves the passageways 31 will ultimately ascend to the pipe 13 and leave the chamber through the passageway 12 wholly freed of dust of every sort and kind, no matter how fine, and also freed from any excess moisture by reason of the water in the chamber 36. The precipitation of water effected by the internal cleaner will almost, if not quite, equal any evaporation brought about by the movement of the currents of air through the cleaner, for which reason water in the cleaner will be exhausted very slowly and will seldom need to be changed excepting for the purpose of removal of the mud resulting from accumulations of dust and other solid impurities separated from the air. Furthermore, if it should happen that the water would ultimately become exhausted before the operator discovered it no injurious result will follow, since all but the very finest of the dust going to the cleaner will be removed by the action of gravity upon the cyclone within the casing 10. The cleaning of the device is effected readily by simply removing the outer casing 22, which then exists as an open top receptacle which can readily be emptied and washed clean.

The advantages of this invention will be apparent. It provides an air cleaner combining the advantages of a water filter with a gravity separator. The water certainly gathers to itself all of the solid impurities in the air. These impurities are precipitated either directly in the body of the water or later with particles of the water in the gravity separator, thus insuring delivery of perfectly pure air freed from all solid particles of impurities of every sort, and which is also freed from any excess of moisture, and this in connection with means which enables a comparatively small body of water to operate for an extended period as a filter, and in a construction which if the water should become depleted the cleaner will nevertheless continue to operate to withdraw the major part of the solids from the air. It is of particular importance, when operating the cleaner in very dry climates where the dry air rapidly evaporates and absorbs the water within the casing, that the cleaner will operate effectively without water, since under such conditions the water may be evaporated much more rapidly than the operator expects, and the casing be dry for considerable periods of time before the fact is discovered. Similarly, under such conditions it may happen that when the operator discovers that the cleaner is dry no water would be available until after a mile or so of travel of the traction engine at its work. Under any such contingency my air cleaner continues to remove all of the dust and dirt which could have any really injurious effect upon the motor or its parts.

I claim:

1. An air cleaner comprising a casing adapted to contain a body of liquid therein, means for connecting the casing with an air-current inducing means, means for admitting outside air into the casing and conveying it into said body of liquid, and a casing within the first-named casing through which the air is directed after it leaves said liquid to cause said air to turn in the form of a cyclone to separate excess moisture and solids from said air.

2. An air cleaner comprising a cylindrical casing, a second casing within the first-named casing having an open-ended portion extended to near the bottom thereof, means opening into the second casing for connecting the cleaner with an air-current inducing means, said first-named casing and the extension of the second casing adapted to contain a body of liquid which forms an air seal between the chambers of the first and second casing, means within the first casing

for admitting air thereto under the influence of said air-current inducing means and for directing said air into said body of liquid, and means within the second casing for admitting air thereto after it leaves the liquid and causing it to move in a cyclone within the second casing to separate excess moisture and solids from said air.

3. An air cleaner comprising a cylindrical casing, a second casing within the first-named casing having an open-ended portion extended to near the bottom thereof, means opening into the second casing for connecting the cleaner with an air-current inducing means, said first-named casing and the extension of the second casing adapted to contain a body of liquid which forms an air seal between the chambers of the first and second casing, a multiplicity of spiral passageways formed within the cylindrical casing and communicating at their upper ends with the outside air and having their lower ends extended beneath the surface of said body of liquid, and means within the second casing for admitting air thereto after it leaves the liquid and causing it to move in a cyclone within the second casing to separate excess moisture and solids from said air.

4. An air cleaner comprising a cylindrical casing, a second casing within the first-named casing having an open-ended portion extended to near the bottom thereof, means opening into the second casing for connecting the cleaner with an air-current inducing means, said first-named casing and the extension of the second casing adapted to contain a body of liquid which forms an air seal between the chambers of the first and second casing, a multiplicity of spiral passageways formed within the cylindrical casing and communicating at their upper ends with the outside air and having their lower ends extended beneath the surface of said body of liquid, and a multiplicity of spiral passageways within the second casing opening at their tops into the chamber of the first casing and discharging at their bottoms near the top of said extension for causing the air to move in a cyclone within the second casing to separate excess moisture and solids from the said air.

5. An air cleaner comprising a casing adapted to contain a circular body of water therein, means for connecting the casing with an air-current inducing means, and means for admitting outside air into said casing under the influence of said air-current inducing means and for directing said air into the upper part of said body of liquid at the circumference thereof at a downwardly oblique angle to cause the air and liquid within the casing to rotate.

6. An air cleaner comprising a casing adapted to contain a body of liquid therein, means for connecting the casing with an air-current inducing means, means for admitting outside air into said casing under the influence of said air-current inducing means and for directing said air into said body of liquid at an angle to cause the air and liquid within the casing to rotate, and means within the casing operative upon the air after it leaves the body of liquid to cause said air to move to the discharge point in a cyclone to separate excess moisture and solids from said air.

7. An air cleaner comprising a casing adapted to contain a body of liquid therein, a second casing within the first casing, means for placing the interior of the second casing in communication with the air-current inducing means, means for admitting outside air into the first casing under the influence of such air-current inducing means and for directing said air into said body of liquid at an angle to cause the air and liquid within the casing to rotate, and means for admitting said air after it leaves the liquid into the second casing and for directing said air within the casing to cause the same to rotate therein before passing out of the same to the air-current inducing means.

In testimony whereof I hereunto affix my signature.

ASHLEY C. BENNETT.