Aug. 9, 1932. W. A. MILLER 1,871,384

AIR CLEANER

Filed April 15, 1929

Fig. 1

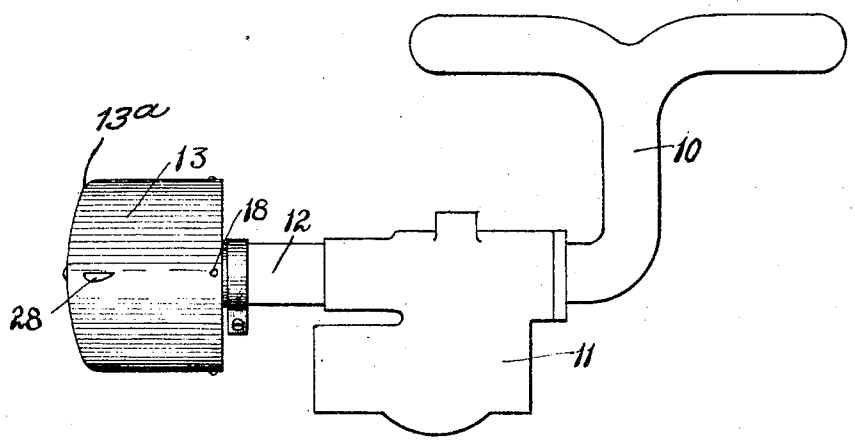


Fig. 2

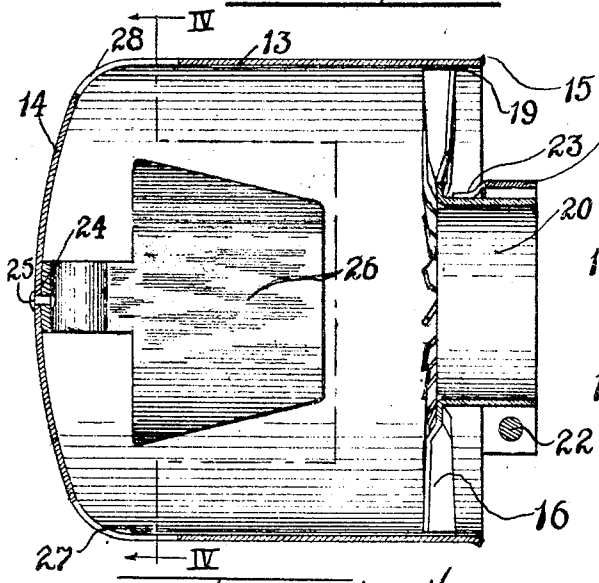


Fig. 3

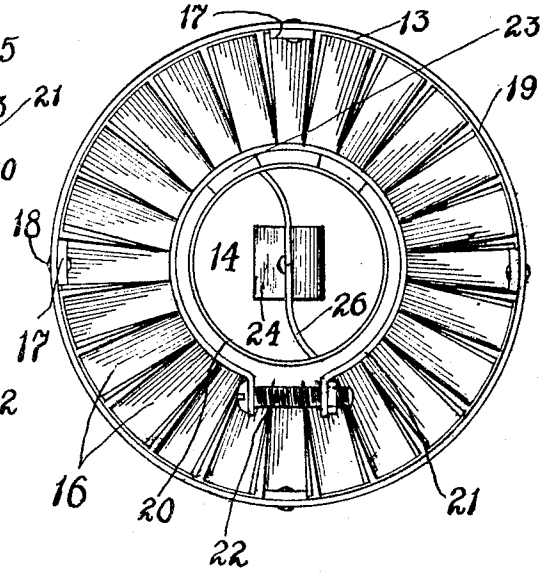
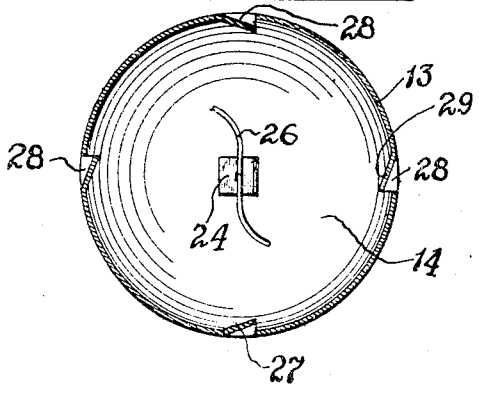


Fig. 4



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Atty

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1,871,384

UNITED STATES PATENT OFFICE

WALTER A. MILLER, OF CHICAGO, ILLINOIS, ASSIGNOR TO UNITED AIR CLEANER CO., OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS

AIR CLEANER

Application filed April 15, 1929. Serial No. 355,007.

This invention relates to improvements in air cleaners for removing dust, dirt particles, foreign substances and the like from air, the invention being highly desirable for use in conjunction with the air intake of a carburetor for an internal combustion engine, although the invention has many and varied uses as will be apparent to one skilled in the art.

In the past, many and various types of air cleaners have been developed, but in most instances, especially with regard to the centrifugal type, have proven objectionable in that they were not desirably efficient nor sufficiently simple in construction. In many cases, these objections also found embodiment in sharp corners within the cleaner which aided in production of eddy currents, insufficient outlets for the discharge of dirt particles from the air, insufficient means for properly directing the air where a reversal thereof is desired, and in other structural peculiarities of an undesirable nature.

The present invention has been designed to overcome the above noted as well as other and various defects and objections in the provision of an air cleaner which presents a smooth interior devoid of sharp corners and obstructions, whereby the production of eddy currents in the air stream is substantially eliminated.

The invention also seeks the provision of an air cleaner in which the central portion of a whirling mass of air is rendered substantially dead, this dead air being discharged from the cleaner as pure air, the impurities having been removed therefrom by the previous whirling action.

Another object of the present invention is to provide an air cleaner in which a whirling column of air is reversed in direction without any undue production of eddy currents, the central portion of the air being deadened, and pure air discharged from this central portion through the inlet end of the device.

Still another object of the present invention is the provision of an air cleaner which, when placed in proper position, permits the discharge of dirt particles, foreign substances, and the like from the inlet end of the cleaner.

Still a further object of the present invention is the provision of an air cleaner having a plurality of dirt discharge openings so related as not to impede the action of whirling air passing through the device, but in fact aid this air in the proper discharge of foreign substances.

It is a still further object of this invention to provide a new and novel method of cleaning air or other gases.

While some of the more salient features, characteristics, and advantages of a device and method embodying this invention have been above pointed out, others will become apparent from the following disclosures.

The invention includes these and other features of construction and combinations of parts hereinafter described, and shown in a preferred form in the drawing, as more particularly indicated by the claims.

On the drawing:

Figure 1 is a diagrammatic elevational view showing the intake manifold and carburetor for an internal combustion engine, the carburetor being equipped with a device embodying principles of the present invention.

Figure 2 is an enlarged longitudinal sectional view of the device itself.

Figure 3 is a front elevational view of the device taken from the right of Figure 2.

Figure 4 is a reduced transverse sectional view of the device taken substantially as indicated by the staggered line IV—IV of Figure 2.

As shown on the drawing:

In the structure selected to illustrate an embodiment of the present invention, there is shown an intake manifold 10 for an in-

ternal combustion engine, to which manifold any desired form of carburetor 11 may be connected. To the air intake 12 of the carburetor 11 an air cleaner embodying features and principles of the present invention is connected.

In this instance, the air cleaner includes a casing 13 having a smooth interior, the rear end of the casing being closed by a wall 14, the front end of the casing being open and slightly flared outwardly as indicated at 15. As indicated at 13*a* in Figure 1 the casing 13 is rounded inwardly towards the wall 14 so as to provide a smooth surface, devoid of sharp corners and the like, for aiding in the proper directing of air passing through the casing. The casing 13 including the rear wall 14 is preferably made in one piece, but if so desired the wall may be attached to a cylinder-like casing in any suitable manner. A smoother interior is insured for the front end of the casing 13 by the outward flare 15.

Means are provided for imparting a whirling motion to air entering the casing 13, the means in this instance comprising an annular collar of sloping or inclined vanes 16, the vanes being preferably somewhat helical in formation. Certain of the vanes 16 are provided at the outer end thereof with an angularly disposed lug 17 secured to the casing 13 by rivets 18 or in any equivalent manner. The remainder of the vanes terminate short of the casing 13 so as to leave an annular space 19 between the vanes and casing for a purpose that will later appear. At the inner ends thereof the vanes merge into an outlet conduit 20, which is preferably though not necessarily formed integrally with the vanes. This outlet conduit preferably surrounds the axis of the casing 13 so as to communicate directly with the central part of the interior of the casing. For properly mounting the air cleaner upon the intake 12 of the carburetor 11, a resilient band or collar 21 is provided having spaced ends through which a bolt 22 extends by means of which the band may be tightened around the intake 12. The band 21 is secured, if so desired, to the outlet conduit 20 by means of lugs 23 which are spot welded to the conduit or secured thereto in any equivalent manner.

Preferably secured to the rear wall 14 of the casing adjacent the center thereof by means of an angularly bent portion 24 and rivets 25, is a curved blade 26 which is preferably in the shape of a trapezoid tapering towards the front end of the casing, so as not to be in the path of incoming air. As is seen clearly in Figure 2, the blade 26 terminates short of the inner end of the outlet conduit 20 so as to leave an air space therebetween free from any elements which might effect or cause motion of the air in this space.

Obviously whirling air will throw dust particles and foreign substances therein outwardly by centrifugal force, so that when incoming air passes rearwardly beyond the middle of the casing 13 most of the foreign substances will be circulating adjacent the wall of the casing, and these substances will be discharged from the casing through a tangential discharge port 27. This discharge port is preferably formed by slitting the casing and indenting a portion thereof adjacent to and on one side of the slit. Other ports 28 are provided in spaced relationship to each other and to the port 27, and, as indicated at 29 in Figure 4, these ports are formed in the same manner as the port 27. All the ports are preferably located adjacent the junction between the rear wall 14 and the casing 13, and it will be noted that the ports 28 are in opposition to the port 27. In other words, the indented portions 29 adjacent the ports 28 slope with the direction of whirl imparted to incoming air by the vanes 16, while the slope of the indented portion adjacent the port 27 is opposite to the direction of whirl. It is apparent, therefore, that air will be sucked into the ports 28 to encourage the production of a strong whirl adjacent the rear part of the casing to cause a better discharge of foreign substances and eliminate the development of reverse or eddy currents, the indentation adjacent the port 27 acting as a scoop for separating foreign substances from the whirling air, especially those substances which may tend to continue whirling with the air. In view of the fact that the heavier dirt particles or foreign substances will tend to descend to the lower portion of the casing, the discharge port 27 is preferably situated in the lower side of the casing when the cleaner is mounted in horizontal position.

In operation, the present invention is extremely simple though none the less positive and effective in its action. Due to the workings of an internal combustion engine suction will be created in the intake 12 of the carburetor 11, and as a result of this suction air will be drawn into the casing through the annular intake around the outlet conduit 20. This incoming air will be given a decided whirling action by the sloping vanes 16 so that the air will pass through the casing still whirling and throwing the foreign substances therein outwardly against the inner casing wall, the substances being discharged through the port 27. Of course, a certain small quantity of the air may also pass out through this port, but an ample sufficiency will remain for the operation of the carburetor 11. Due to the curvature at the rear end of the casing indicated at 13*a* in Figure 1, the whirling air will be downwardly deflected and consequently turned inwardly or reversed in direction. The inner portion of the air, which due to the whirling action will be clean and pure air, will then

be quieted by the blade 26 which is curved in opposition to the whirling motion of the air. The clean air will therefore be rendered substantially dead in the center of the casing from whence it may be readily sucked through the conduit 20 into the carbureter 11, the forward tapering of the blade 26 guiding the clean air directly towards the conduit 20.

The air cleaner described hereinabove may be disposed in a vertical as well as a horizontal position and still operate effectively. Of course, when the cleaner is disposed in a vertical position the conduit 20 will project downwardly and the rear wall 14 will form the top of the casing. In this position the device functions in the same manner as previously described, with the exception that the heavier particles of dirt or foreign substances which will be drawn downwardly by the action of gravity, especially where there is a lessening of the suction, pass out through the space 19 between the termini of the vanes 16 and the casing 13.

The method of cleaning air exemplified in the device hereinabove described and apparent from the foregoing disclosures, may be summed up as including the passing of air through a casing, imparting a whirling action to the air to throw foreign substances contained therein outwardly, discharging these substances by the action of the whirling air at the rear of the casing, reversing the direction and quieting the inner portion of the whirling air, and discharging or withdrawing pure air from this central portion through the front of the casing. In the event the cleaner is disposed in a vertical position, the method also includes not only the intake of impure air and the outlet of pure air at the front end of the casing, but also the discharge of the heavier foreign substances at this end of the casing, the lighter substances being discharged at the rear of the casing through the port 27.

Although an embodiment of the present invention has been disclosed and described for the purpose of cleaning air prior to its entry into an internal combustion engine through a carbureter connected thereto, it is apparent that the invention might also be used for the purpose of cleaning air or other gases in practically any desired location and for practically any purpose. It might also be noted that in some circumstances the device might not only be used for cleaning gaseous fluid, but also for the purpose of purifying liquids. It is therefore to be understood that where the term "air" is used herein and in the appended claims, the same is to be construed as meaning a fluid, and where the terms "foreign substances" are used, the same are to be construed as meaning any impurities dislodgeable by centrifugal action contained in a fluid.

From the foregoing, it will be apparent that I have provided a device for cleaning air by a new and novel method, the device being extremely simple in construction and operation together with being highly effective as a purifier. Moreover, it is to be noted that the device may be easily and readily attached to an object in connection with which the device is to be used, and due to its peculiar structure the device is open and ready for inspection at any and all times. It is further to be noted that the device is extremely compact and will occupy only a small space, is very durable, and may be economically manufactured.

I am aware that many changes may be made, and numerous details of construction may be varied through a wide range without departing from the principles of this invention, and I therefore do not purpose limiting the patent granted hereon, otherwise than necessitated by the prior art.

I claim as my invention:

1. In a device of the character described, a casing having a walled and an open end, said casing being interiorly smooth adjacent the open end thereof and having a discharge opening adjacent the walled end thereof, means in said casing for imparting a whirling action to incoming air, said means being spaced from the wall of said casing to permit foreign substances separated from the air to leave said casing adjacent the wall thereof, and said casing having an outlet for clean air.

2. In a device of the character described, a casing having a walled rear end, means for imparting a whirling action to air entering the front end of said casing, said casing having a plurality of openings adjacent the rear thereof, certain of said openings being for the discharge of foreign substances carried by the incoming air, and the remainder of said openings admitting air to said casing to cause a strong whirl near the rear thereof, and said casing having an outlet for cleaned air.

3. In a device of the character described, a casing including a walled rear end, means for imparting a whirling action to air entering said casing, said casing having tangential ports adjacent said walled end, certain of said ports thru which foreign substances carried by incoming air are discharged sloping inwardly opposite to the direction of whirl of the air, and the remainder of said ports sloping with the direction of whirl to augment the action of the air near the rear of the casing, and said casing having an outlet for clean air.

4. In a device of the character described, a casing having an air inlet adjacent each end thereof, means for imparting a whirling action to the air entering through one of said inlets, whereby said whirling action will suck

air into said casing through the other of said inlets to increase the whirl at that end of the casing, said casing having an outlet for foreign substances carried by incoming air at the end opposite said means, and an outlet conduit for cleaned air communicating with the interior of said casing.

In testimony whereof I have hereunto subscribed my name at Chicago, Cook County, Illinois.

WALTER A. MILLER.