J. P. QUAM.

AIR CLEANING DEVICE.

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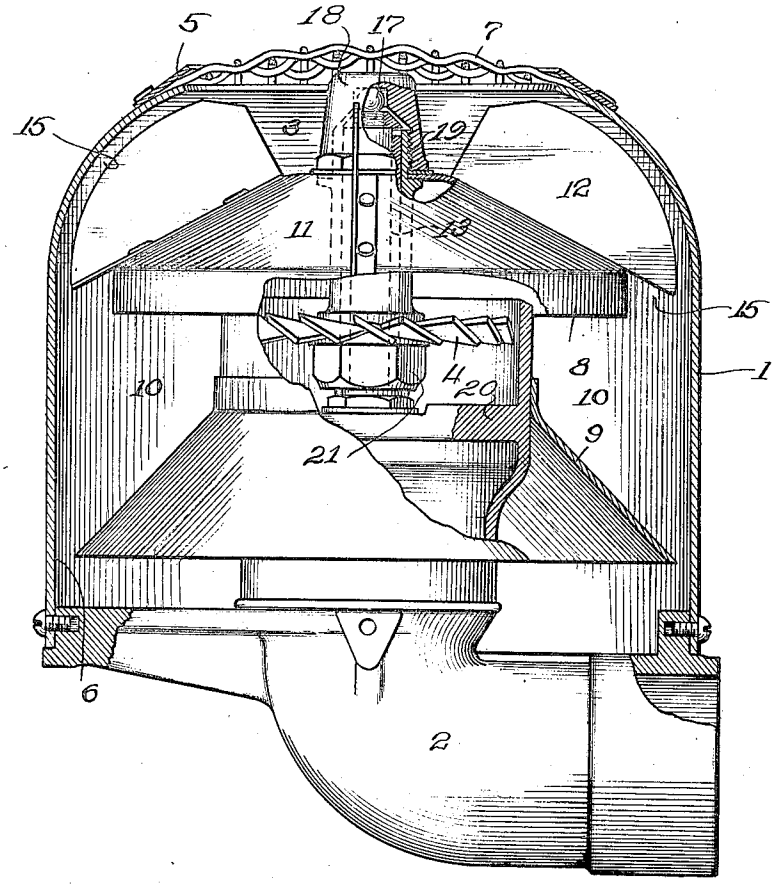
1,438,553. Patented Dec. 12, 1922.



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UNITED STATES PATENT OFFICE.

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AIR-CLEANING DEVICE.

Application filed September 2, 1921. Serial No. 497,873.

To all whom it may concern:

Be it known that I, JAMES P. QUAM, a citizen of the United States of America, and a resident of Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Air-Cleaning Devices, of which the following is a specification.

This invention relates to centrifugal separators having many different industrial applications but the device as here illustrated is intended particularly for the work of insuring a clean air supply to an internal combustion engine. It is well known that the dirt entering the carburetor and cylinders of the engine of a tractor has a ruinous effect. The dirt is drawn into the engine due to the neglect of providing sufficient water for the ordinary air washer with which tractors are commonly equipped or in some cases, as with most road vehicles, due to the entire absence of any means for separating the dust from the air.

The aim of the present invention is to overcome defects of operation of centrifugal separators, and the costly construction of air washing devices now commonly in use. Centrifugal separators as heretofore constructed are not sufficiently efficient for the work of removing almost impalpable dust from air as can be done by the present device, and air washing devices, as a rule, are comparatively expensive, are subject to freezing, interfere with the desired operation of the engine, and must be frequently filled with water or if this is neglected, as is frequently the case, the engine is very much damaged if not practically ruined because of the entrance of dirt in the cylinders, not only resulting in so-called objectionable "carbon deposit" on the cylinder walls but causing excessive wear.

The objects of the present invention were to a great extent obtained by a centrifugal separator disclosed in applicant's co-pending application for patent, Serial No. 414,700, filed October 4th, 1920, but the present invention differs from the prior one mainly in that the prior device was designed to separate all of the dust from the incoming air and deliver it to a dust-receiving receptacle, while delivering all of the air which passes through the device to the carburetor of the engine, whereas in the present case the dust is not collected but merely thrown outside of the engine so as to avoid the bother of requiring any inspection or emptying of the dust receptacle. The present device also avoids the necessity of attaining an ultimate complete separation of the dirt from the air but by centrifugal action divides all of the incoming air into inner and outer strata, the outer stratum containing the dust and being delivered outside of the engine while the inner stratum is pure and is permitted to enter the carburetor.

An illustrative embodiment of this invention is shown in the accompanying drawing in which the figure is a sectional elevation of a device constructed in accordance with this invention, a part thereof being broken away so as to more clearly illustrate the interior construction.

An air cleaning device constructed in accordance with this invention involves a casing, through which the air is drawn by some suction means, which air acts upon a propeller for the purpose of rotating a rotor element which subjects the air passing through the casing to centrifugal action, a portion of the air containing the solid particles being caused to pass out through a suitable outlet to the atmosphere and the cleansed air being extracted from the casing through another outlet which is connected with the aforesaid suction device. The invention is particularly suitable for attachment to the carburetor of an internal combustion engine and especially where such engines are in service where a considerable amount of dust would otherwise be drawn through the carburetor and injected into the engine cylinders.

In the specific embodiment herein illustrated, the device comprises a casing 1 arranged upon the end of a conduit 2 and a rotor 3 adapted to be driven by a propeller 4 for the purpose of subjecting the air passing through the casing to centrifugal action.

The casing 1 is of cylindrical shape, open at both ends so as to provide an inlet 5 and an outlet 6, one end of the casing being arched inwardly toward the inlet 5. A coarse mesh wire guard 7 extends across the

inlet 5 for safety and to prevent anything from entering the opening which might cause damage to the device.

The conduit 2 extends inwardly from the outlet end of the casing 1 and has the open end 8 thereof located intermediate the inlet 5 and outlet 6. A frusto-conical partition 9 extends radially outward and axially downward from adjacent the open end 8 of the conduit 2 so as to restrict the outlet 6 to a narrow annular ring-like opening and at the same time provide a separating chamber 10 between the partition and the rotor 3 surrounding the open end 8 of said conduit. The opposite end of the conduit 2 is suitably arranged for connection to the inlet of the suction device such as a carburetor.

The rotor 3 comprises a frusto-conical member 11 having vanes 12 arranged upon the exterior thereof and journaled upon the shaft 13, and provided with a propeller 4 by which said rotor is driven.

The frusto-conical member 11 is arranged so that it coacts with the arched end of the casing 1 to provide an inwardly tapering passage 15 leading from the inlet 5 to the chamber 10 so that said passage has the effect of a nozzle upon the air as it is caused to move centrifugally inwardly toward the chamber 10. The vanes 12 conform, more or less, to the shape of the passage 15 and are rigidly secured in a suitable manner upon the member 11.

The rotatable unit comprising the rotor 4, frusto-conical member 11 with vanes 12 is supported by a ball 17 between the upper end of the fixed vertical spindle or shaft 13 and a cap 18 in threaded engagement with a sleeve 19 surrounding the spindle and rigid with the rotatable unit.

The supporting spindle 13 projects upwardly from a spider 20 formed in the upper end 8 of the conduit 2 and therefore serves not only to support the rotatable unit, but as a guide bearing to prevent vibration of said unit.

The propeller 4 comprises a plurality of blades rigidly secured to the lower end of a fitting 21 secured to the member 11. These blades are shaped so that the air drawn through the device causes a rotation of the member 11.

The operation of the device herein shown and described is substantially as follows:

The passage of air through the casing 1 caused by suction means attached to the conduit 2, reacts on the propeller 4 so as to rotate the rotor 3. This results in a greater passage of air through the inlet 5 than through conduit 2. The air is moved centrifugally and axially inwardly through the passage 15, the velocity thereof increasing as it approaches the more restricted inner part of the passage. By virtue of the centrifugal action, the particles of dust, dirt, etc., are of course thrown outwardly against the inner periphery of the casing 1. As the air leaves the passage 15 and enters the enlarged chamber 10, it attains its maximum velocity and pressure as crowded by the vanes 12 and its projected downwardly toward the restricted outlet 6 but the inner pure stratum of air is drawn or curled inwardly and upwardly to the open end 8 of the conduit 2 and out through the conduit by the suction of the engine. The outer stratum of air within the chamber 10 which contains the dust, dirt and other particles is forced downwardly and out through the restricted outlet 6 by the continuously incoming air. Any particles of dust or dirt that fall upon the frusto-conical partition 9, are of course caused to move down and out through the opening 6.

The dust laden air moves through the opening 6 with sufficient velocity to preclude the possibility of any of this air being drawn inwardly by the action of the suction device or engine connected to the conduit 2. The discharge of the dust, dirt and unclean air through the restricted outlet 6 to the atmosphere obviates the necessity of having a receptacle which requires more or less attention in seeing that it is frequently emptied and also obviates the possibility of the device not functioning to properly clean the air as is often the case when devices using receptacles do not have such receptacles frequently emptied or become broken and inasmuch as separation of dust from air is not wholly relied upon in the present device but merely the exclusion of dust containing air is insured, the action is rapid and nearly 100% efficient for the intended purpose.

The device to which this application for patent relates, may be clearly distinguished from other centrifugal separators not only by the decided increase in annular velocity at which it compels the air to travel, over its initial entering speed, but by delivering the dust laden air in a jet with sufficient momentum to permit the use of an outlet to the atmosphere and preclude the entrance of air at this outlet.

Although but one specific embodiment of this invention has been herein shown and described, it will be understood that numerous details of the construction shown may be altered or omitted without departing from the spirit of this invention as defined by the following claims.

I claim:

1. An air cleaning device, comprising a casing having an inlet at one end and a pair of concentrically arranged outlets at the other end, the outer of said outlets communicating directly with the atmosphere, a fan rotor journaled in said casing adjacent to said inlet and adapted to be rotated to draw air in through said inlet and project

it centrifugally and axially with respect to said casing, and a conduit adapted to connect the other said outlet to a suction means for drawing air from the interior of said casing.

2. An air cleaning device, comprising a casing having an inlet at one end and a pair of concentrically arranged outlets at the other end, the outer of said outlets communicating directly with the atmosphere, a rotor journaled in said casing adjacent to said inlet, a propeller carried by said rotor and adapted to be actuated by air drawn through said casing for rotating said rotor, means on said rotor adapted to facilitate suction of air through said inlet and project it centrifugally and axially with respect to said casing, and a conduit adapted to connect the other said outlet to a suction means for drawing air through said casing.

3. An air cleaning device, comprising a casing having an inlet at one end and a pair of concentrically arranged outlets at the other end, the outer of said outlets communicating directly with the atmosphere, and the other of which is located axially inwardly of the outer outlet, a rotor journaled in said casing adjacent to said inlet and coacting with said casing to provide a chamber surrounding said other outlet between said outer outlet and said rotor, a propeller carried by said rotor and adapted to be actuated by air drawn through said casing for rotating said rotor, means on said rotor adapted to facilitate suction of air through said inlet and project it centrifugally and axially with respect to said casing into said chamber, and a conduit adapted to connect the other said outlet to a suction means for drawing air through said casing.

4. An air cleaning device, comprising a casing open at both ends to provide an inlet and an outlet, a conduit extending into said casing and having its open end located intermediate said inlet and outlet, a rotor journaled in said casing adjacent to said inlet and adapted to be rotated by air drawn through said casing, means on said rotor for facilitating the suction of air through said inlet and projecting the air centrifugally and axially toward said outlet, and other means adjacent to said outlet restricting the area thereof and providing a chamber between said outlet and said rotor and surrounding said conduit end.

5. An air cleaning device, comprising a casing open at both ends to provide an inlet and an outlet, a conduit extending into said casing and having its open end located intermediate said inlet and outlet, a rotor journaled in said casing adjacent to said inlet, a propeller carried by said rotor and adapted to be actuated by air drawn through said casing for rotating said rotor, vanes on said rotor adapted to draw air in through said inlet and project it centrifugally and axially with respect to said casing, and a partition extending from said conduit radially outward toward said casing so as to restrict the area of said outlet and provide a chamber inwardly thereof surrounding said conduit end.

6. An air cleaning device, comprising a casing open at both ends to provide an inlet and an outlet, a conduit extending into said casing and having its open end located intermediate said inlet and outlet, a rotor journaled in said casing adjacent to said inlet, said casing and rotor being shaped and arranged relatively to each other so that the passage between them gradually tapers inwardly, a propeller carried by said rotor and adapted to be actuated by air drawn through said casing for rotating said rotor, vanes on said rotor adapted to draw air in through said inlet and project it centrifugally and axially with respect to said casing, and a partition extending from said conduit radially outward toward said casing so as to restrict the area of said outlet and provide a chamber inwardly thereof surrounding said conduit end.

7. An air cleaning device, comprising a cylindrical casing open at both ends so as to provide an inlet and an outlet, said casing being arched inwardly at the inlet end, a conduit extending into said casing and having its open end located intermediate said inlet and outlet, a frusto-conical member journaled within said casing adjacent to said inlet, whereby the opposed faces of said arched casing and member provide an inwardly tapering passage leading from said inlet, a propeller carried by said member and adapted to be actuated by air drawn through said casing for rotating said member, vanes mounted on the exterior of said member and adapted to draw air in through said inlet and project it centrifugally and axially with respect to said casing, and a partition arranged in the outlet end of said casing and extending from said conduit end radially outward so as to restrict the area of said outlet and provide a chamber inwardly thereof surrounding said conduit end.

8. An air cleaning device, comprising a cylindrical casing open at both ends so as to provide an inlet and an outlet, said casing being arched inwardly at the inlet end, a conduit extending into said casing from the outlet end thereof and having its open end located intermediate said inlet and outlet, a frusto-conical member journaled within said casing adjacent to said inlet, whereby the opposed faces of said arched casing and member provide an inwardly tapering passage leading from said inlet, a propeller carried by said member and adapted to be

actuated by air drawn through said casing for rotating said member, vanes mounted on the exterior of said member and adapted to draw air in through said inlet and project it centrifugally and axially with respect to said casing, and a frusto-conical partition arranged in the outlet end of said casing and extending from said conduit end radially outward and axially downward so as to restrict the area of said outlet and provide a chamber inwardly thereof surrounding said conduit end.

9. A centrifugal separator of the class described comprising a casing having an inlet, and an inner and an outer outlet, the outer outlet communicating directly with the atmosphere, a rotor journaled in said casing arranged to be driven by air or other fluid passing through said casing and cause said air to divide so that that portion of the air which contains heavier than air particles will be projected outwardly and pass through said outer outlet, due to its velocity while the pure air near the center is passed through the inner outlet.

10. A centrifugal separator of the class described comprising a casing provided with an inlet and an inner and an outer outlet, a rotor journaled within said casing and adapted to be driven by air or other fluid passed through the casing, vanes on said rotor for producing a whirling action of the air passing through the casing and throw the heavier air or dust laden air outwardly with sufficient velocity to pass through said outer outlet irrespective of the travel of pure air through the inner outlet.

11. A separator of the class described, comprising a casing having an inlet and two outlets, said outlets being spaced apart radially with respect to the axis of the casing, a rotor within said casing arranged to impart a whirling motion to air passing from the inlet to the outlets, said rotor and casing being formed to provide a nozzle shaped passageway directing the air toward said outer outlet, and an inclined partition between the rotor and outer outlet for providing a settling chamber and restricting said other outlet.

12. A separator of the class described, comprising a casing having an inlet and two outlets, said outlets being spaced apart radially with respect to the axis of the casing, a rotor within said casing arranged to be rotated by and impart a whirling motion to air passing from the inlet to the outlets, said rotor and casing being formed to provide a nozzle shaped passageway directing the air toward said outer outlet, and an inclined partition between the rotor and outer outlet for providing a settling chamber and restricting said outer outlet.

Signed at Chicago this 30th day of August, 1921.

JAMES P. QUAM.