Aug. 19, 1924. 1,505,564

G. C. JETT

AIR CLEANING DEVICE

Filed Sept. 24, 1919 3 Sheets-Sheet 1

Fig. 2

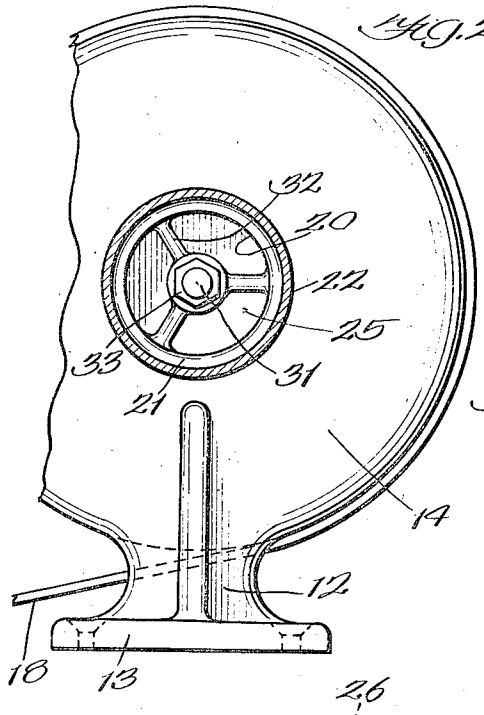
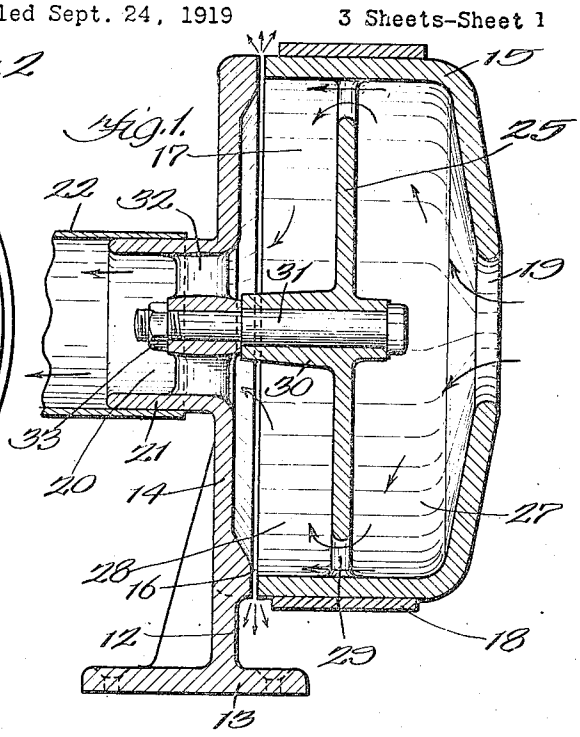


Fig. 1.



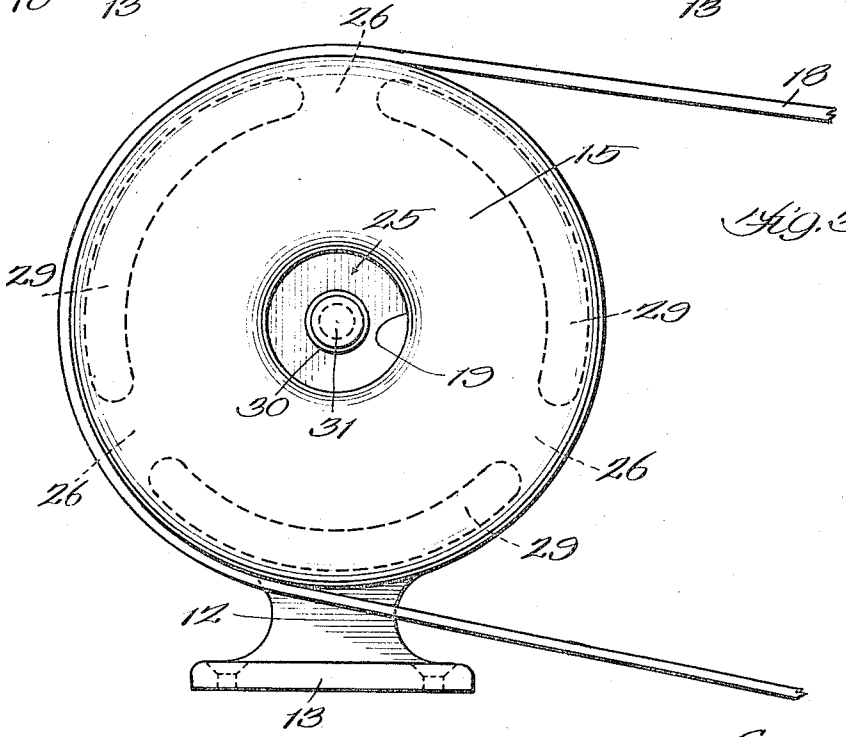


Fig. 3.

INVENTOR

George C. Jett.

BY W. Herbert & Fowkes.

ATTORNEY

Aug. 19, 1924. 1,505,564

G. C. JETT

AIR CLEANING DEVICE

Filed Sept. 24, 1919. 3 Sheets-Sheet 2

Fig. 4.

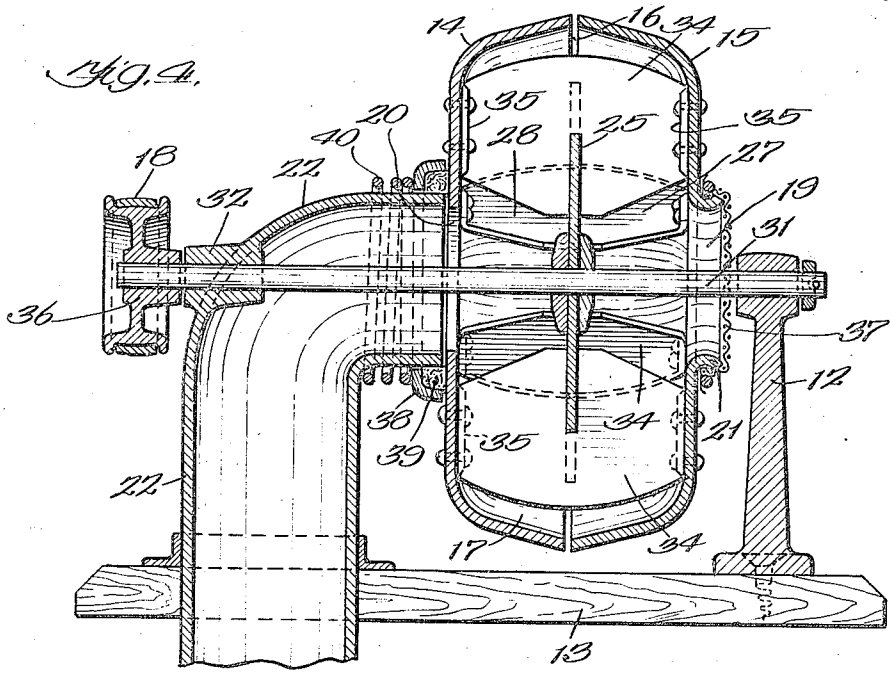
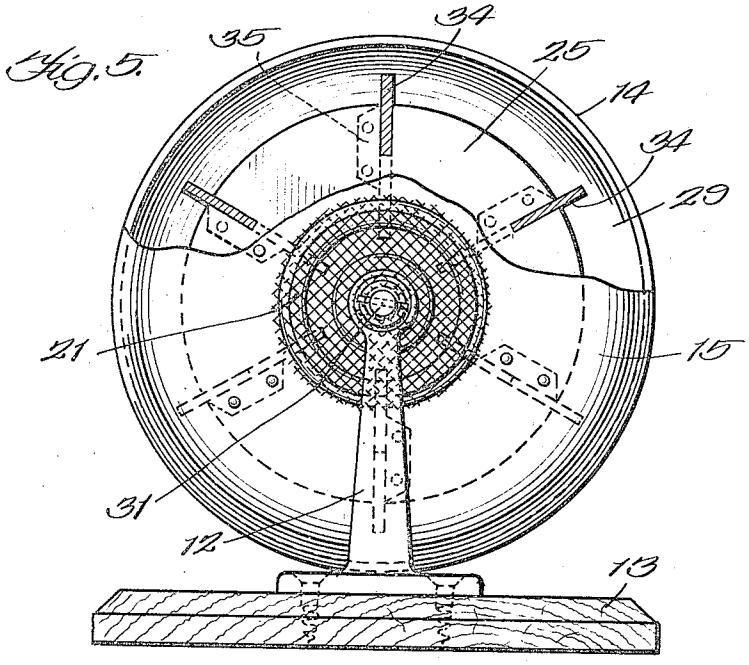


Fig. 5.



INVENTOR

George C. Jett.

BY

W. Herbert Fowkes.

ATTORNEY

Aug. 19, 1924. 1,505,564

G. C. JETT

AIR CLEANING DEVICE

Filed Sept. 24, 1919 3 Sheets-Sheet 3

Fig. 6.

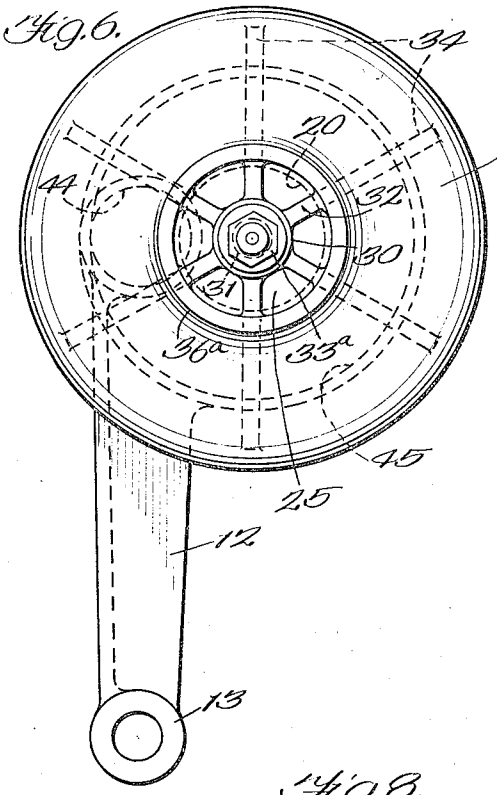


Fig. 7.

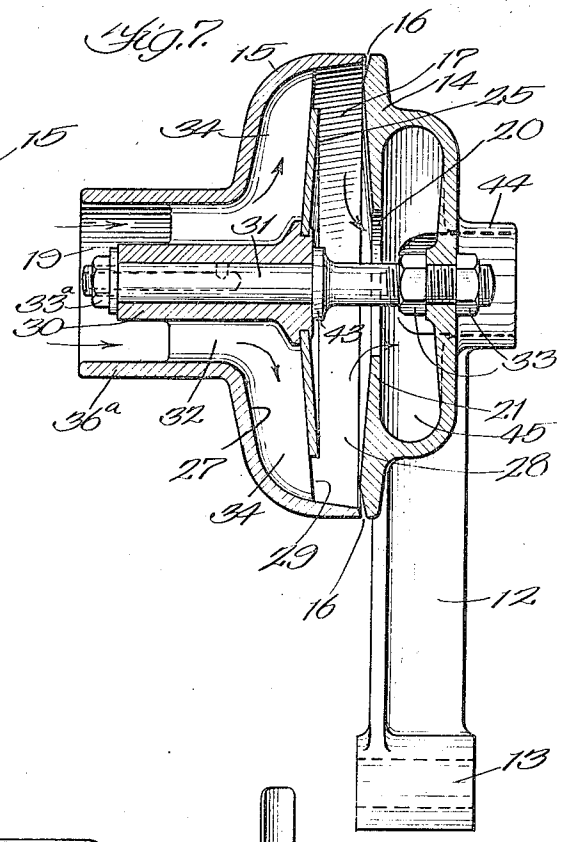
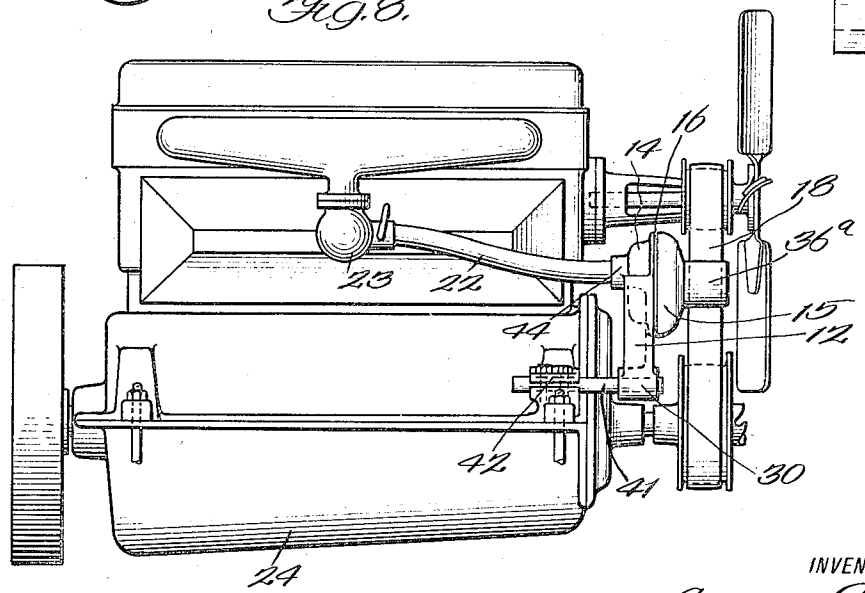


Fig. 8.



INVENTOR

George C. Jett

BY

W. Herbert Fowkes

ATTORNEY

Patented Aug. 19, 1924. 1,505,564

UNITED STATES PATENT OFFICE.

GEORGE C. JETT, OF MILWAUKEE, WISCONSIN, ASSIGNOR OF TWO-FIFTHS TO WALTER H. STIEMKE, OF MILWAUKEE, WISCONSIN.

AIR-CLEANING DEVICE.

Application filed September 24, 1919. Serial No. 326,090.

To all whom it may concern:

Be it known that I, GEORGE C. JETT, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Air-Cleaning Devices, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates in general to the class of air cleaners, and has reference more particularly to air cleaning devices adapted for use in connection with internal combustion engines, one object being to improve the construction and increase the efficiency and utility of devices of this type.

Heretofore, it has been proposed to treat the dust laden air carried into those stationary air cleaning shells now being marketed by imparting a swirling motion to the air in said shell and to provide a dust receiving chamber at the bottom of the shell to which the dust and dirt is intended to be attracted by the force of gravity, the dust receiving chamber being comprised within and forming a part of the air cleaner shell itself. This proposition however in practice has been found objectionable since the swirling motion of the air is resolved into eddy currents in the vicinity of the dust receiver which tend to keep the finer dust in suspension. This dust is attracted to the core of the vortex and is discharged with the outgoing air so that the latter is therefore only partially cleansed. In other words, in a device of this sort the extracted dust is kept in the cleaner itself while the latter is in operation, consequently the force of gravity in respect to the finer dust is overcome by the force of the eddy currents set up in the cleaner itself. Obviously this condition resolves itself into a loss of effectiveness at the discharge end of the casing.

My invention contemplates the elimination of these disadvantages, and contemplates as further objects, to provide an air cleaning device which offers little or no frictional resistance to the passage of the air during the cleaning operation; to provide a mechanically driven air cleaning device which is adapted to clean the air by centrifugal force, and which is provided with an outlet for the extracted dirt, said outlet being positioned to eject the dust extracted from the dust laden incoming air during rotation of the device; to provide an air cleaning device of this character comprising a rotary drum wherein incoming air is forced into a high pressure zone from which the dust or dirt is ejected with comparatively little loss of air, and the balance of the air is thereupon drawn into a low pressure zone for its discharge without materially changing the air pressure at the intake opening and at the clean air discharge opening, and wherein said openings are located at or near the neutral axis of rotation of the drum and are therefore not effected to any noticeable extent by the rapid rotation of the latter. A still further object of the invention is to provide a device of the character stated capable of being readily installed on standard engines or other machines where it is desirable to obtain clean air, and which may be cheaply and easily manufactured.

In general, the invention contemplates the provision of an air cleaning device embodying a drum capable of rotation at comparatively high speeds, wherein the dust laden air drawn into the drum has imparted to it a rotating motion so that the particles of dust are centrifugally given a force equivalent to several hundred times their normal gravity weight, and are thrown and deflected circumferentially of the drum into what constitutes the high pressure zone. At this point a dust discharge passage or outlet is provided through which the dust is forcibly discharged with a blast of high pressure air in a continuous jet during rotation of the drum. Only a small fractional portion of the total incoming air escapes through the peripheral discharge opening, while the greater portion of the air, which is now cleansed, is drawn down by suction into the low pressure zone and thence through the clean air discharge. In the application of this device to an internal combustion engine, the discharge side of the drum is coupled by means of a pipe to the intake of the engine carbureter. Hence, all the air enters and leaves the drum at or near the axis of rotation, thereby insuring nearly equal pressures at each of these openings. Therefore it will be apparent that the air is drawn where the air pressure is low and not through the dirt discharge opening where the air pressure is high.

These, together with such other objects and advantages as may be hereinafter set forth, or are incident to my invention, I attain by means of a construction illustrated in preferred form in the accompanying drawings, wherein:—

Figure 1 represents a central vertical sectional view of one embodiment of my improved cleaning device in its simplest form;

Figures 2 and 3 are rear and front views in elevation of the same;

Figure 4 is a central vertical sectional view of another embodiment of my invention, in which case the baffle of the rotary air chamber or drum is provided with air propelling transverse blades or vanes;

Figure 5 represents a front elevation of the same, the front drum section being partly broken away to better disclose the baffle and its vanes;

Figures 6 and 7 are views in front elevation and in section of a further and preferred embodiment of the invention; and

Figure 8 is a view in side elevation of a standard make of internal combustion engine illustrating a desirable application of the preceding embodiment of the invention to the intake of the engine carburetor, the cleaner being shown as having a driven relation with the fan belt of the engine.

In the various figures composing the drawings similar parts of the construction are designated throughout by like reference characters.

Referring to the embodiment of the invention illustrated in Figures 1, 2 and 3, it will be seen that I provide a support 12 having an attaching base 13, the support having integrally formed with it a head 14 which forms a part of the rotary drum 15, both parts being slightly spaced away to provide a peripheral outlet or passage 16 for the discharge of dust from the chamber 17 during rotation of the drum by the belt 18 which may be driven from any convenient source of power.

The reference characters 19 and 20 respectively designate the intake opening for the incoming dust laden air and the clean air outlet opening of the drum, the outlet being defined by an annular flange 21 adapted to conveniently receive thereon the inner end of a suction or discharge pipe 22 which may, in turn, be connected at its outer end with a low pressure means, such as the intake of the carburetor 23 of the internal combustion engine 24 illustrated in Figure 8. Both openings 19 and 20 are located about the neutral axis of the drum, and on opposite sides of a diaphragm or baffle member 25 peripherally joined by web portions 26 to the drum in advance of the dust discharge passage 16. The baffle is positioned substantially midway of the openings 19 and 20 to provide compartments 27 and 28, communication therebetween being established by means of the circumferential ports 29. In the present instance the baffle is formed with a hub 30 journalled on a spindle 31 whose threaded end is carried in a spider 32 rigid with the flange 21 and is secured in place by means of any suitable securing element, such as the nut 33.

With the parts positioned as described, and assuming that the drum 15 is being rapidly rotated by the belt 18, it will be apparent that the dust laden air drawn into the compartment 27 under the influence of the suction present in the pipe 22 is radially and outwardly deflected by the baffle 25 toward the circumference of the drum where the compartments 27 and 28 merge at the ports 29, and at which point a high pressure dust extracting and ejecting zone is constituted by the centrifugal force set up in the drum due to its rapid rotation by the belt. The passage 16 provides an outlet for the dust, the discharge of which is accompanied by a blast of air and this discharge therefore has a continuous jet characteristic, though it should be observed that only a comparatively small amount of air escapes, the far greater portion of the air in a thoroughly cleaned state passing inwardly toward the outlet 20 from whence it is conveyed to the point of use by means of the pipe 22.

In other words the ingress and egress of the air with reference to the chamber 17 occurs at the neutral axis or low pressure zone of the drum, while the actual separation and ejectment of the dust and dirt takes place at or near a zone of high pressure due to centrifugal force which is evoked. And obviously so, since the action of centrifugal force imparts to the small particles of dust a force equivalent to many times their normal gravity weight. They therefore quickly seek the peripheral high pressure zone, and this action is assisted or rendered complete by the baffle which serves to cause all the dust laden air to take this course. The air inlet and outlet openings being located axially of the drum in a zone of low pressure are not affected to any appreciable extent by the rapid rotation of the drum, and consequently no air is drawn through the dust discharge passage where the pressure is high. Furthermore, little or no resistance is offered to the air in its travel through the cleaner, this travel being generally designated by those directional arrows in Figure 1 of the drawings imprinted within the chamber 17 of the cleaner.

In the embodiment of Figures 4 and 5 parts similar to those of the cleaner above described are denoted by like reference characters, and, it will be observed I provide the baffle 25, in the present instance, with a

plurality of flanges or vanes 34, which extend transversely thereof to have their marginal portions 35 secured to opposite wall portions of the drum sections 14, 15. These vanes stop short of the drum periphery to provide a communicating port 29, and are provided to propel the air during drum rotation. By this arrangement I obtain a small sized air cleaner of relatively large capacity. If desired the drum may receive rotation by means of the belt driven pulley 36 acting through the propeller shaft 31. A screen 37 may also be provided at the inlet opening 19 to exclude large pieces of foreign matter as hair and chaff, and the like. At the joint between the drum section 14 and the clean air discharge pipe is a follower cup 38 and a felt packing ring 39 which are pressed forwardly and firmly held in position by a spring 40 to maintain an air tight joint.

Referring now to the embodiment of my invention disclosed in Figures 6, 7 and 8, it will be seen that this exemplification, embodying all the elements of the preceding sructure as it does, is however adapted for application to fan belt 18, in the manner illustrated in Figure 8. In this instance the inlet drum section 15 is extended to form an annular projection or pulley 36a. The attaching portion 13 of the standard 12 is provided with a rod 41 which is adjustably engaged by a clamp 42 on the engine 24, the whole cleaner being movable axially of the rod to bring the pulley 36a into a driven contactual relation with the belt 18 and in regard to which it also acts as a tightener. As will be apparent, the spindle 31 is stationary, being secured by the nuts 33 to that part 14 of the drum which is integral with the support 12, so that the rotary drum part 15, which carries with it the pulley 36a, has a hub bearing on the spindle at 30. The spindle has an enlargement 43 at one end of the hub and a securing nut 33a at the other in order to maintain a correct journal relation between the spindle and the hub. The diaphragm or baffle 25, as will be seen from an inspection of Figure 7, is slightly dished and has its inner margin secured to the hub 30, and as in the preceding instances its peripheral portion stops short of the drum to provide the communicating port 29 in advance of the vanes 34. These latter in the instant case are formed integrally with the rotary drum section 15 and the hub 30, the entire device operating exactly as before described, for even though the outlet pipe 44 is shown eccentrically located the air chamber 17 is axially provided with the customary clean air outlet 20 leading through chamber 45 to said pipe 44 and from thence to the air supply pipe 22, the latter in turn being operatively associated with the intake of the curburetor 23.

From the foregoing it will be seen that I provide a rotary or mechanically driven air cleaner or separator capable of discharging continuously the dirt and dust from the interior thereof during rotary movement in a most efficient manner, to an extent approximating 98 per cent. The cleaner possesses durability to a marked extent, and is readily adaptable to the particular use in hand. It may be easily installed and cheaply manufactured, and eliminates the use of liquid reservoirs and the inclusion in the air chamber of dust receiving pockets or receptacles. Other advantages will be apparent to those skilled in the art.

Furthermore, it will be obvious that in adapting the invention to varying situations the cross-sectional area of the air inlet may be relatively less than that of the clean air outlet to create a through circulation within the cleaner during its rotation, and thereby obviate the necessity for utilizing a suction discharge pipe, though it will be understood the latter represents the preferred construction. Nor do I wish to be understood as limiting myself to the exact arrangement or to the precise construction of the various parts of the cleaner apparatus, as it is deemed obvious that other modifications than those disclosed herein may be made without in any way departing from the spirit and scope of my invention as pointed out in the following claims.

I claim:—

1. In an air cleaner, a shaft, a hub, and a drum of differential diameters supported from the hub by radial blades, the smaller portion constituting a central air inlet for the larger and being adapted to serve as a pulley whereby the drum may be caused to rotate upon the shaft.

2. The combination with an internal combustion engine provided with a cooling fan, an exposed fan belt and with a carburetor air inlet, of an air cleaner comprising a drum characterized by an exposed rotatable part and a peripheral opening, a duct affording communication between the interior of said drum and said inlet, and a bracket for supporting said drum, said bracket being arranged to present the exposed rotatable part of said drum in frictional relation to said fan belt to receive motion therefrom.

3. The combination with an internal combustion engine provided with a cooling fan, an exposed fan belt and with a carburetor inlet, of an air cleaner in communication with said inlet and including a peripherally divided drum having apertured fixed and rotatable portions separated by a restricted gap, a shaft supported from the fixed portion of the drum for mounting the rotatable portion thereof, and a bracket for said fixed portion associated with said engine in a way to bring the rotatable part of said drum into frictional contact with said fan belt.

4. The combination with the air inlet of an internal combustion engine, of a rotary drum provided with an air inlet of less diameter than the drum and disposed substantially at its axis, and with air impelling means rotatable within said drum unitarily therewith, said drum including a relatively stationary drum head spaced axially from the drum to provide a peripheral opening for the discharge of centrifugally impelled impurities and having a substantially axial outlet in communication with the inlet of the engine.

5. The combination with the air inlet of an internal combustion engine, of an air cleaner comprising a disk provided with a port in communication with the air inlet, a shaft axially disposed with reference to the disk, a drum adapted to be relatively rotated by the engine upon the shaft in close proximity to the disk, and radial blades within the drum adapted to impart motion to air therein whereby solid material in the air will be expelled freely thru the peripheral slot between the rotating drum and the stationary disk, air being drawn thru the cleaner at substantially constant pressure by the vacuum produced at the carbureter inlet by engine suction.

6. A centrifugal air cleaning device designed for use in connection with the intake of an internal combustion engine, comprising a rotary chamber driven by said engine, said chamber having centrally disposed air inlet and air outlet openings of small diameter as compared with that of the chamber and provided peripherally with a dust discharge passage located intermediate said openings, air conveying means within said chamber and adapted during rotation of said chamber to aid in the centrifugal extraction of the dust from the incoming air and its discharge through said aperture, and a tubular clean air conducting member connecting the outlet opening and the intake of said engine.

7. The combination with an internal combustion engine provided with an exposed fan belt and a carburetor inlet, of an air cleaner associated with said inlet and including a drum having fixed and rotatable portions separated by a restricted gap, a shaft supported from the fixed portion of said drum, a hub rotatably mounted on said shaft, radially disposed structural elements supporting the rotatable drum portion from said hub, said elements being adapted to cause air within said rotatable portion to assume the motion thereof, a bracket for said fixed portion associated with the engine in a way to bring the rotatable portion into frictional contact with said belt, and axial inlet and outlet ducts formed respectively in the rotatable and fixed portions of said drum, the gap between said portions being remote from the drum axis.

8. The combination with an internal combustion engine provided with an exposed moving part, of an air cleaning device including a bracket member, a shaft projecting therefrom, a plate centrally apertured and substantially co-axial with said shaft, a hub journalled upon said shaft, radial blades projecting from said hub, and a differential drum supported from said hub by said blades and adapted to rotate in close proximity to said plate, one portion of said drum being cylindrical and adapted to receive motion from said exposed moving part.

9. In combination, a hub, a drum of differential diameters provided with an axial inlet in its smaller portion, a series of radial blades disposed between said hub and the drum, a disk carried by said hub and disposed in the larger portion of the drum, said disk being materially greater in diameter than the smaller portion of the drum, an axis upon which said hub and drum are adapted to rotate, and a relatively fixed drum head provided with an aperture adjacent said axis, said aperture being substantially equal in diameter to the inlet portion of the drum.

10. In an air cleaner, the combination of a support, a drum comprising a stationary part rigid with said support and a rotary part, a spindle for the rotary part carried by the rigid part, the parts being spaced away to provide a peripheral dust discharge passage therebetween, a baffle within said drum terminating short of said passage, and air propelling means intermediate said baffle and the wall of the rotary drum part, said drum parts provided with air inlet and outlet openings located on opposite sides of the baffle and disposed substantially axially of the drum.

11. In an internal combustion engine, the combination with a fan, a fan belt and the intake of said engine, of a rotary air cleaner comprising a two-part drum, one part of which is provided with an air outlet and adjustably supported by said engine and the other part formed with an extension disposed in frictional driving contact with said belt to be rotated by it, a discharge pipe connecting said outlet with the intake of said engine, said parts being associated but spaced apart to provide a dust discharge passage located laterally of said outlet, said extension having an air inlet, and air conducting and propelling means leading from said air inlet to said dust discharge passage.

GEORGE C. JETT.