Oct. 23, 1923. 1,471,565

J. L. MILTON

AIR CLEANER

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FIG. 1.

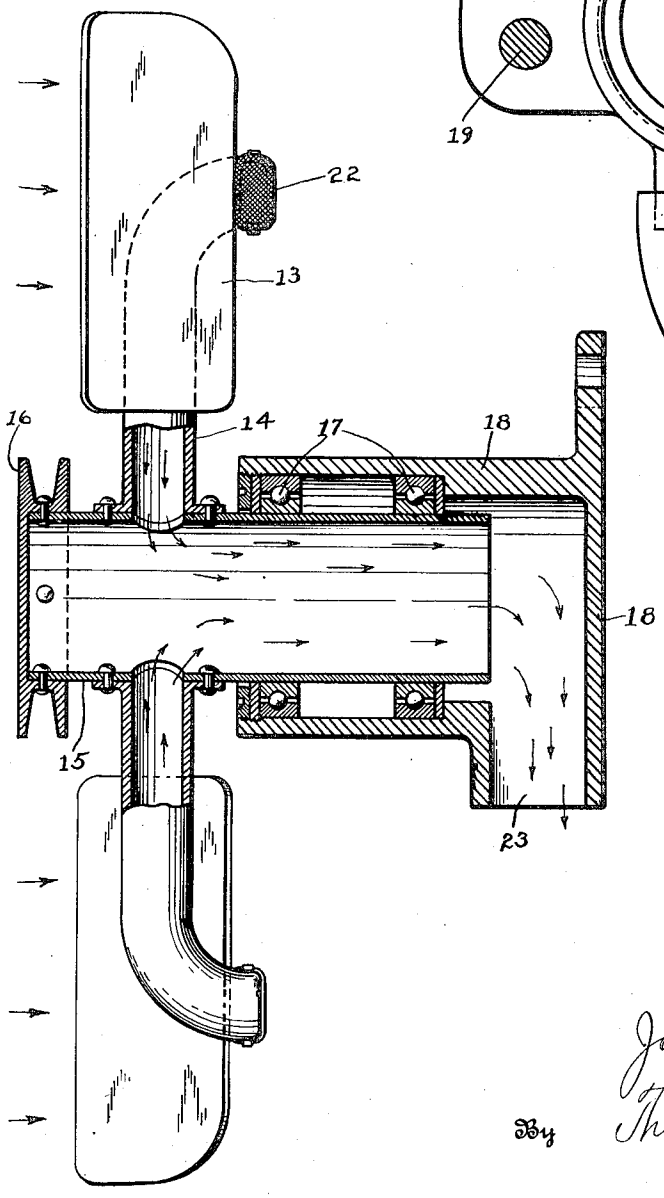
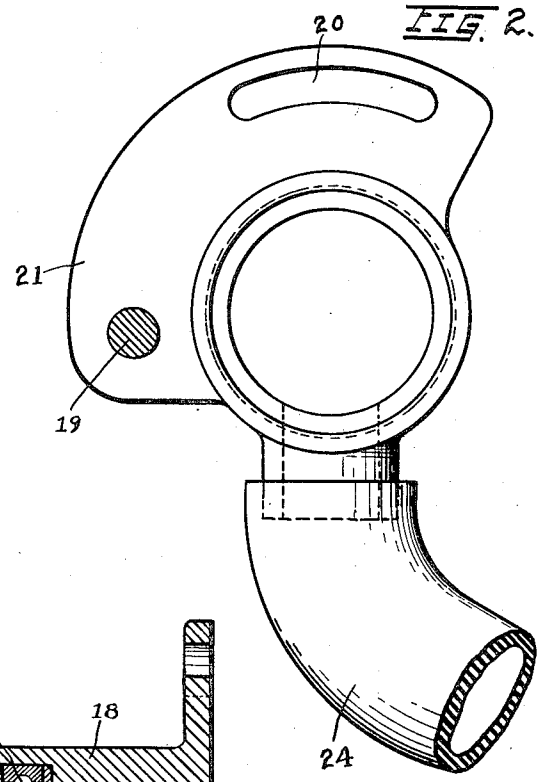


FIG. 2.



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AIR CLEANER

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FIG. 3.

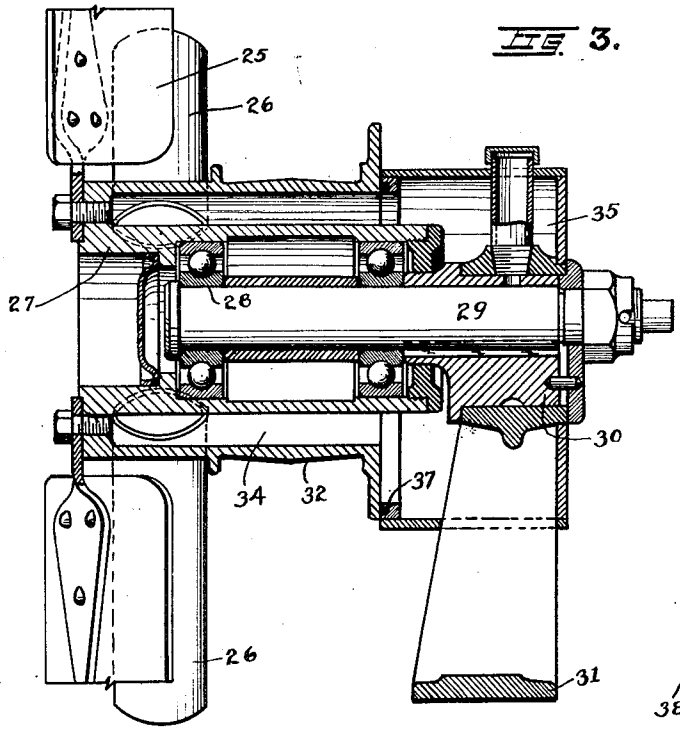


FIG. 6.

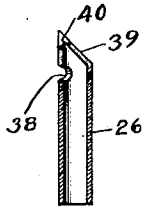


FIG. 4.

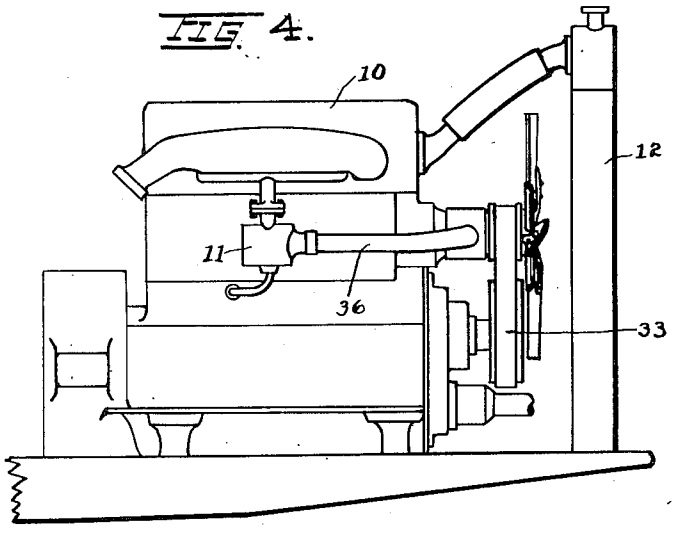
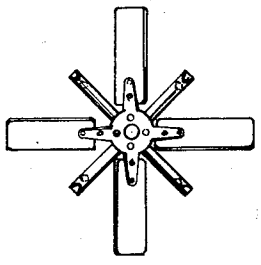


FIG. 5.



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AIR CLEANER

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FIG. 7.

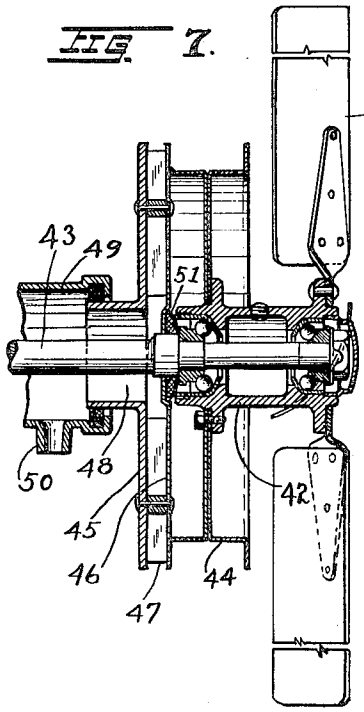


FIG. 8.

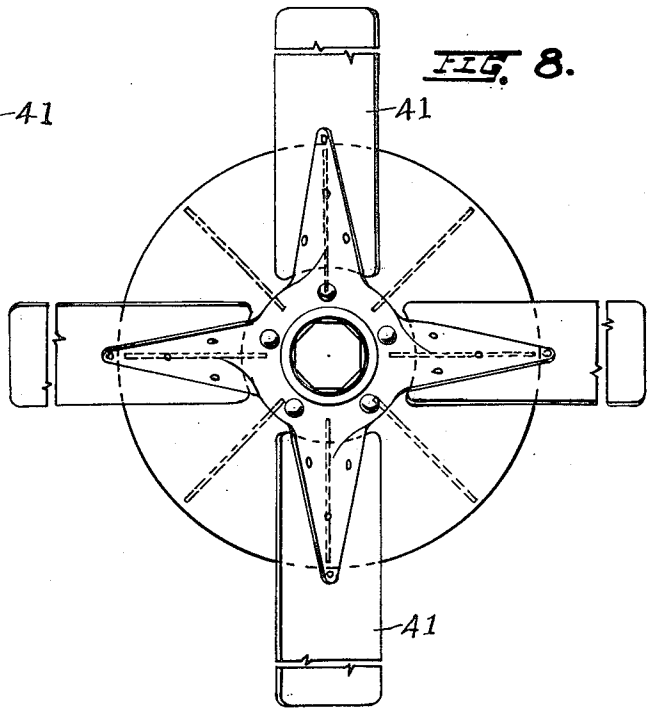


FIG. 9.

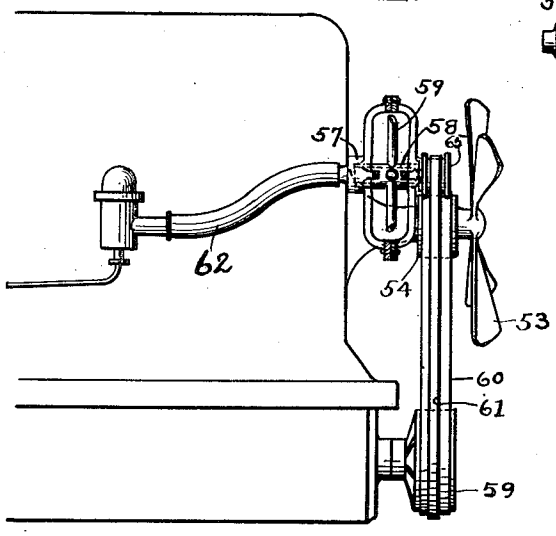


FIG. 10.

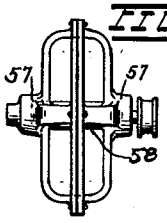
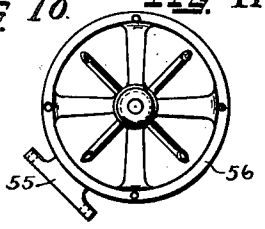


FIG. 11.



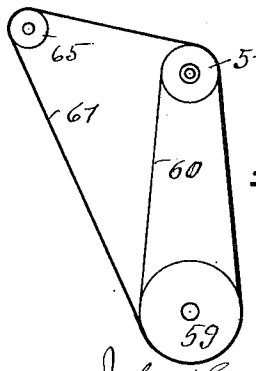


FIG. 12.

Inventor

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By Thurston Kirk Hudson

Attorney

Patented Oct. 23, 1923. 1,471,565

UNITED STATES PATENT OFFICE.

JOHN LEWIS MILTON, OF CLEVELAND, OHIO.

AIR CLEANER.

Application filed October 18, 1919. Serial No. 331,537.

To all whom it may concern:

Be it known that I, JOHN LEWIS MILTON, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Air Cleaners, of which the following is a full, clear, and exact description.

This invention relates to air cleaners, or to a combined engine cooling and air cleaning device for motor vehicles propelled by internal combustion engines, such as tractors, trucks and passenger vehicles, and this application is in part a division of my prior application Serial No. 276,875, filed February 13, 1919.

In my prior application I have disclosed several forms of centrifugal air cleaners adapted to clean the air supplied to the carbureter, and combined with an engine cooling fan in such a manner that there is utilized for both the cleaner and the fan, a single bearing or set of bearings, and a single driving means, thus obtaining the features of compactness as well as simplicity in the supporting and driving elements. Additionally there is secured by the combination of the cleaner and fan into one unitary construction, a distinct advantage in the way of increased air cleaning efficiency, due to the fact that there is a cleaning or separating action in the cleaner by centrifugal action and also to the fact that the air taken into the cleaner is being impelled at a rapid rate by the fan. which results in the separation of a certain percentage of the foreign particles upon entering the cleaner proper.

Among the modifications shown in the prior application now under discussion, is one wherein the air is drawn in toward the axis of the rotating element through substantially radial arms, so disposed that as these arms and the fan blades proper are rotated, the air is cleaned to a very high degree, even of the finest particles, due to the fact that there is set up in the tubes or arms a strong centrifugal action to which the air passing through these arms to the carbureter is of necessity subjected, and also to the fact that the air entering the intake ports at the outer ends of the arms is under the influence of the fan blades.

The present invention has to do particularly with a centrifugal air cleaner wherein the air to be cleaned is required to pass inwardly through more or less radially disposed rapidly rotated ducts to or adjacent the axis of rotation so as to be subjected to the action of centrifugal force, and in another aspect the invention relates to a cleaner having the above characteristics and associated or incorporated with an engine cooling fan. In illustrating this idea or feature, I have shown one species of the more generic invention of my prior application, as well as several additional forms similar to it, wherein the air conveying and cleaning means is incorporated with the fan so as to have the same mounting, and to be driven by the same element or elements, and also I have illustrated a modification which while embodying the same basic idea as far as cooling and cleaning effects are obtained, illustrates the cleaner and fan with separate mountings.

The invention may be briefly summarized as consisting in certain novel details of construction, and combinations and arrangements of parts which will be described in the specification and set forth in the appended claims.

In the accompanying sheets of drawings illustrating my invention in different aspects, Fig. 1 is a sectional view of a combined cleaner and fan, together with a suitable mounting, as illustrated in my prior application; Fig. 2 is a face view of the mounting showing the manner in which the air is conducted from the mounting to the carbureter; Fig. 3 is a view similar to Fig. 1, illustrating a modification wherein tubes independent of the fan blades, but rotating therewith, are employed to conduct the air inwardly toward the axis of rotation; Fig. 4 is a view illustrating the manner in which the device shown in Fig. 3 may be mounted on an engine and connected to the carbureter; Fig. 5 is a face view looking toward the outer or radiator side of the combined fan and cleaning element; Fig. 6 is a sectional view through one of the radial air conducting tubes; Fig. 7 is a sectional view; and Fig. 8 is a face view of a further modification wherein the radially disposed ducts are formed structurally with the pulley which drives the cooling and cleaning device; Fig. 9 is a view similar to Fig. 4, showing a modification wherein the air cleaner of the general type illustrated in the preceding figures has a mounting independent of the fan mounting; Figs. 10 and

11 are respectively a side and face view of this cleaner detached from the engine; and Fig. 12 is a more or less diagrammatic view illustrating the manner in which the fan and cleaner of Fig. 9 may be driven by two belts.

My invention in so far as the cleaner is concerned, may be used advantageously, independently of the cooling fan, but has especial utility when associated with or incorporated with the fan, in which event it may be utilized with any form of internal combustion engine 10, having a carbureter such as indicated at 11, and while it readily lends itself to a water cooled engine having the usual radiator 12, its field of use is not confined to water cooled engines, but is inclusive of air cooled engines.

In the construction shown in Figs. 1 and 2, illustrating one form of a combined cooling fan and centrifugal air cleaner, the blades 13 are secured directly to hollow arms or cleaner tubes 14, which are secured to a rotary hollow carrier in the form of a tube 15, to which is secured a driving pulley 16, adapted to be engaged by an engine driven belt, this carrier or tube being supported through the medium of ball bearings 17 in a mounting or bearing support 18, adapted to be secured on the front of the engine.

The support 18 is designed to be adjustably secured to the engine so that the belt tension may be varied, and in this instance this is accomplished through the medium of a bolt 19 on which the member 18 may be swung to any desired position and then secured therein by a bolt or equivalent securing device passing through an elongated slot 20, both securing members passing through a flange or extension 21 of the support. The outer ends of the arms are turned inwardly toward the engine, and they are provided at their extreme upper or outer ends with quick detachable screens 22, through which the air which is supplied to the carbureter must pass. The inner ends of the arms communicate with the tube 15, and from this tube the cleaned air passes to the supporting member 18 which is provided with an outlet 23 adapted to be connected by a pipe or tube 24 to the carbureter.

With this construction, one drive and one mounting is required for the combined cleaner and cooling fan, and since the tubes or arms 14 are rotated at high speed, the air passing inwardly through these tubes is subjected to the strong centrifugal action which tends to throw all foreign particles out through the upper ends of the arms, or to the screens covering the intake openings at the outer ends of the tubes. Additionally, since the air which is drawn through the screens into the outer ends of these tubes is being impelled at a high velocity past the screened intake openings of the tubes, the air in entering the tubes changes its direction so that due to momentum, much of the foreign particles even though passing adjacent the intake openings of the tubes, continues past the latter with the result that a double cleaning effect is obtained, not considering that obtained by the action of the screens themselves.

These results are attained to a very satisfactory degree by having the cross-sectional area of the air tubes such that the air passes inwardly at a comparatively low velocity, or in a sufficiently low velocity that thorough cleaning is obtained.

If the cleaners in any of the forms shown herein, should be operated as described, without being connected to the carbureter, air would be taken in at the center and discharged at the outer openings due to centrifugal force which accordingly would set up a slight vacuum so as to cause an outward flow. This is overcome by the engine's suction, and the air travel is reversed in the cleaner in its normal operation and is caused to flow in the opposite direction to that in which it would flow if not under the engine's influence.

In the modification shown in Figs. 3 to 6, the fan blades 25 and the cleaner tubes 26 are attached independently of each other to a combined fan and cleaner head 27, which is rotatably supported through the medium of ball bearings 28 on a stationary pin or shaft 29, held in an eccentric but adjustable member 30 to a bracket or equivalent device 31 adapted to be secured to the front of the engine. The head has a portion 32 adapted to be engaged by a driving belt or equivalent driving member 33 shown in Fig. 4.

The head 27 is composed of inner and outer annular members, between which there is an annular space 34, with which the inner ends of the tubes 26 communicate, the outer portions of the tubes having intake openings, shortly to be described. One end of this annular space 34 in the head 27 opens into and is adapted to deliver the cleaned air into a chamber 35, which has a delivery connection 36 to the carbureter. One side of this chamber 35 has a sliding engagement with the head 27, suitable packing 37 being arranged between the engaging surfaces to prevent leakage.

Each of the cleaner tubes 26 is provided near its outer end with an air intake opening 38, which faces toward the engine, or in the direction in which the air is impelled by the fan blades. Preferably this air intake opening is a short distance below the extreme outer end of the tube, which outer end is in this instance tapered, as shown at 39, and has a discharge opening

40 at the contracted or extreme outer end of the tube. The action of this combined cleaner and cooling fan is like that first described, the air being impelled past the intake openings of the cleaner tubes, and the cleaner tubes though rotating at high speed, conducting the cleaned air inwardly toward the axis of rotation, while the foreign particles are thrown by centrifugal force out to and then from the outer ends of the tubes.

In the modification shown in Figs. 7 and 8, the fan blades 41 are connected to a hub 42, which is journaled through ball bearings on a stationary pin or shaft 43 which can be supported in the manner already described, or in any approved manner. Secured to this hub is a belt pulley 44, and formed at the side of this pulley are radially disposed ducts formed between two plates 45 and 46, the latter constituting part of the pulley 44, by radial vanes or partitions 47 forming inwardly divergent radial spaces open at their outer ends for the admission of the air to be cleaned, and open at their inner ends to an annular chamber 48 formed in this instance by a flange or sleeve on the plate 45 concentric with respect to the axis of the shaft 43, this flange being centered on a stationary chamber or so-called adaptor 49 with an outlet 50 through which air is conducted by a tube or pipe to the carbureter as in the other instances.

With this construction, as in those first described, air is impelled past the outlet openings of the air ducts of the cleaner, and that required to supply the air to the carbureter is sucked into the outer ends of these ducts, and as the latter are rotating at high speed when this takes place, foreign particles entering the ducts are thrown outwardly, and only the thoroughly cleaned air is drawn inwardly against the action of the centrifugal force to the adaptor 49, and hence to the carbureter.

Suitable packing 51 is provided between the pulley and the shaft, and between the flange forming the chamber 48 and the adaptor to prevent leakage at these points, and to cause all air which enters the cleaner and is supplied to the carbureter to enter the outer ends of the cleaner ducts.

In the modification shown in Figs. 9 to 12, the same results are obtained as far as cleaning is concerned as with the prior constructions, but in this instance the cooling fan and cleaner have different mountings. The fan, here designated 53, is supported from the engine through the medium of a stationary pin or shaft, or in any other desired manner, and is provided with a driving pulley 54. Likewise supported on the engine, but independently of the fan, as by means of a bracket or base 55, which can be bolted to the engine casting or a part fixed to it, is a stationary cleaner casing 56 having at the center, hubs 57, in which is journaled a hollow cleaner shaft 58, carrying one or more, preferably a plurality of radial, or substantially radial cleaner tubes 59 which are preferably formed like the cleaner tubes in the modification of Figs. 3 to 6, with tapered outer ends having discharge openings such as 40 of Fig. 6, for the discharge of foreign particles, and having a short distance from their outer ends, intake openings such as 38 of Fig. 6, for the air, which openings face toward the engine housing, or away from the fan. It might be mentioned at this point that this cleaner is between the fan and the engine housing, so that the air entering the cleaner tubes is under the influence of the fan, as in the preceding cases, though located inwardly with respect to the fan, and in this instance, off-center with respect to the axis of rotation of the fan.

The inner ends of the tubes deliver air to the hollow shaft and the latter to a space or chamber in the inner hub 57 to which an air delivery tube or pipe 62 is connected, this tube or pipe leading to the carbureter, as shown in Fig. 9.

There are various ways in which the last described fan and cleaner may be driven by utilizing a single driving element such as an engine driven pulley 59. In Figs. 9 and 12 a so-called tandem drive is provided, the fan having a driving belt 60 which extends from the engine driven pulley 59 to the fan pulley 54, and the cleaner having a separate driving belt 61, which surrounds the fan belt and passes about all three pulleys, i. e. the engine driven pulley, fan pulley, and a cleaner pulley 65 which is on the outer end of the cleaner shaft 58, just outside the housing or casing 56. In this instance, the cleaner belt engages the fan belt, and is driven at the same linear speed as the latter.

Instead of using the two belts, a single belt could be utilized, as will be obvious.

Other ways by which the fan and cleaner could be driven might occur to one skilled in the art, and I do not, therefore, wish to be limited to the specific methods or ways of driving illustrated.

With the modification illustrated in Figs. 9 to 12, the same efficient cleaning of the air is obtained as results from the constructions first described, this modification now under discussion being one example of possible modifications of my invention wherein the fan and cleaner are not formed or embodied in a single unit.

It might be mentioned in conclusion, that though I now prefer to form the cleaner and fan in one unitary construction or as a combined cooling and cleaning unit, and though I have illustrated only one embodiment of my invention where the two parts

are formed as separate units, and that embodiment showing the cleaner so located with respect to the fan that the air drawn into the cleaner is under the influence of the fan, nevertheless a centrifugal cleaner constructed as, or operating on the principle herein described, could be so formed and mounted as to be wholly independent of the action of the fan, and in fact, could be employed for purposes or with apparatus not requiring a cooling fan.

The cleaner formed in accordance with the present invention, while having a large field of use with internal combustion engines for cleaning the air supplied to the carbureter, might be employed advantageously for other purposes and with other apparatus than internal combustion engines, in which event it might be employed for cleaning air or gas.

Having described my invention, I claim:

1. A centrifugal cleaner, the combination with rotary means for creating a flow of a gaseous fluid in a straight line, of an air intake device in the current produced by said means and rotatable therewith, said device having an axial portion and means for admitting air thereto comprising a radial duct extending outwardly from the axial portion and having an intake opening adjacent its outer end.

2. In a centrifugal cleaner in combination with means for creating a flow of a gaseous fluid in a straight line, of a rotary device in the flow or current and comprising a chamber near the axis of rotation, and an inwardly extending hollow tubular member having a duct provided with an air intake opening relatively remote from the axis of rotation, and at its inner end communicating with said chamber.

3. In a centrifugal cleaner, fan blades for creating a flow or current of a gaseous fluid in a straight line, and a rotary tubular member in the current produced by the fan blades and extending toward the axis of rotation from a point relatively remote therefrom, said tubular member having a duct with intake and delivery openings, the former being further from the axis of rotation than the latter.

4. In a combined fan and centrifugal cleaner, a rotary device comprising fan blades adapted to create a flow of gaseous fluid in a straight line, a chamber at the axis of rotation and one or more ducts separate from the fan blades and extending inwardly to said chamber and each provided with an intake opening located outwardly beyond said chamber in the current produced by said blades.

5. In a combined fan and centrifugal cleaner, a plurality of rotating fan blades adapted to create a flow of gaseous fluid in a straight line, and a plurality of substantially radial separating members rotating with the blades and extending inwardly toward the axis of rotation, and provided with intake and delivery openings, the former being further from the axis of rotation than the latter and in the current produced by said blades.

6. In a combined fan and centrifugal cleaner, a rotating device having a plurality of fan blades and inwardly extending cleaner members separate from the fan blades and located between the same, each having an intake opening and a delivery opening, the former located a greater distance from the axis of rotation than the latter.

7. In combination with an internal combustion engine having a carbureter, of a combined engine cooling fan and a centrifugal cleaner for the air which is delivered to the carbureter comprising a fan and a tubular radially extending cleaner member in the current or flow produced by the fan, and provided with a delivery opening which is connected to the carbureter, and an intake opening further from the axis of rotation than the delivery opening.

8. In combination with an internal combustion engine having a carbureter, of a combined engine cooling fan and a centrifugal cleaner for the air which is delivered to the carbureter, comprising a unitary rotary device including fan blades, a chamber adjacent the axis of rotation connected to the carbureter, and hollow tubular members extending inwardly to and connected to the chamber, and provided with air intake openings located outwardly beyond said chamber.

9. In combination with an internal combustion engine having a carbureter, of a combined engine cooling fan and centrifugal air cleaner comprising a rotary device having fan blades, a chamber adjacent the axis of rotation connected to the carbureter, and a plurality of hollow air conducting members located between the fan blades and at the inner ends connected to said chamber, said members being provided with air intake openings located outwardly beyond said chamber.

In testimony whereof, I hereunto affix my signature.

JOHN LEWIS MILTON.