Aug. 20, 1935. A. L. R. BERNARD 2,011,888

AIR CLEANER

Filed Feb. 1, 1932 2 Sheets-Sheet 1

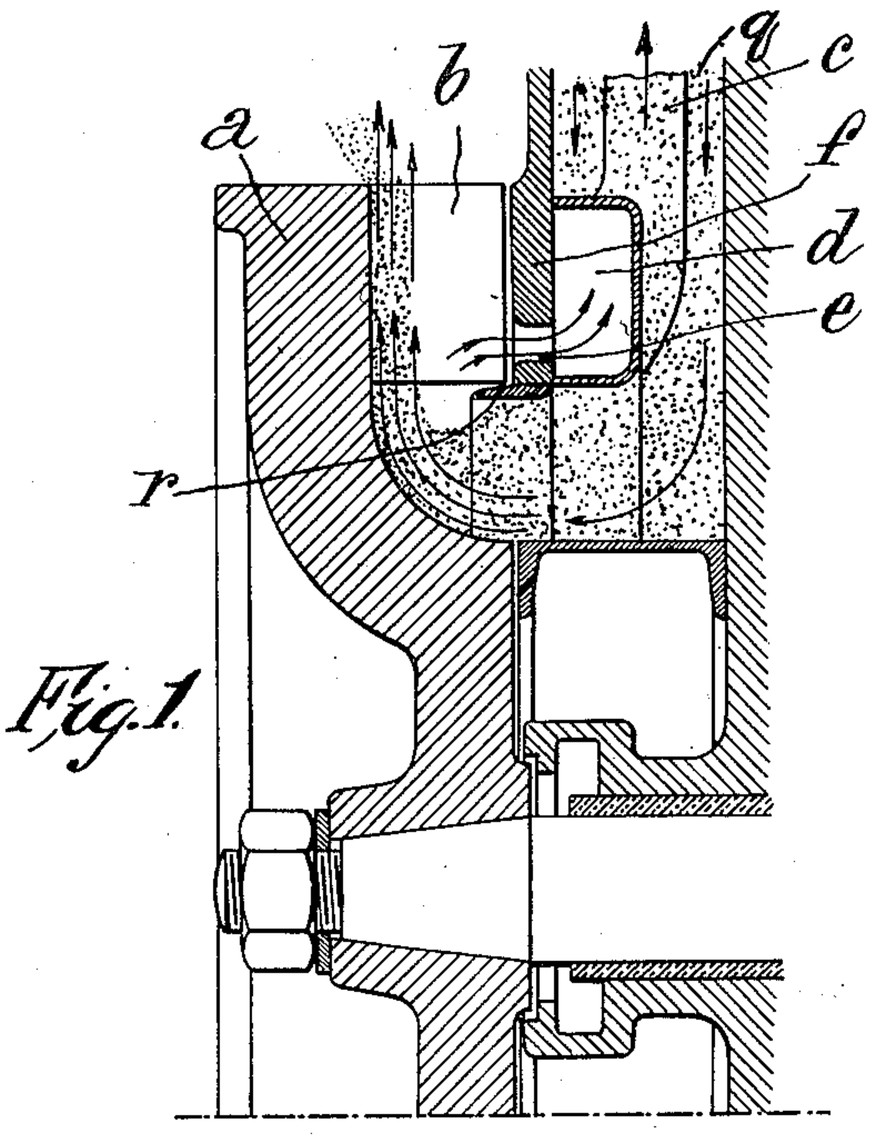


Fig. 1.

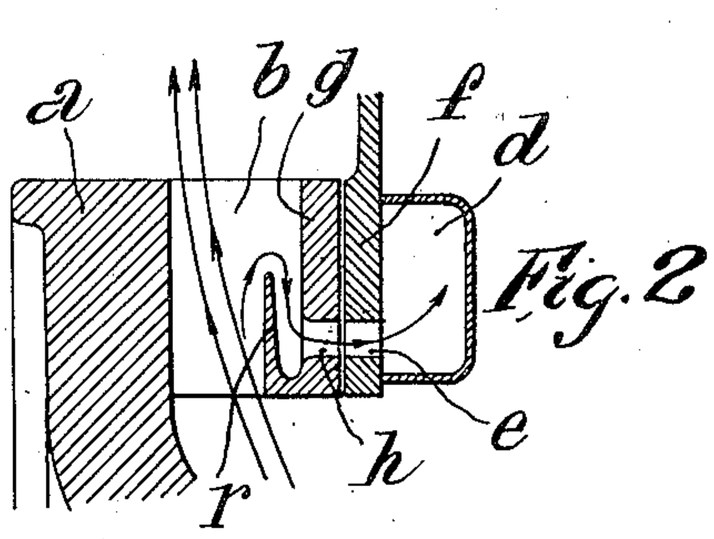


Fig. 2

Fig. 3

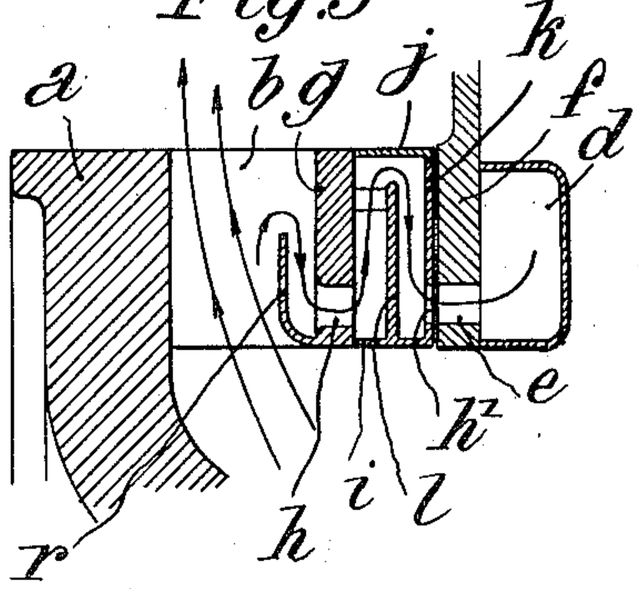


Fig. 6

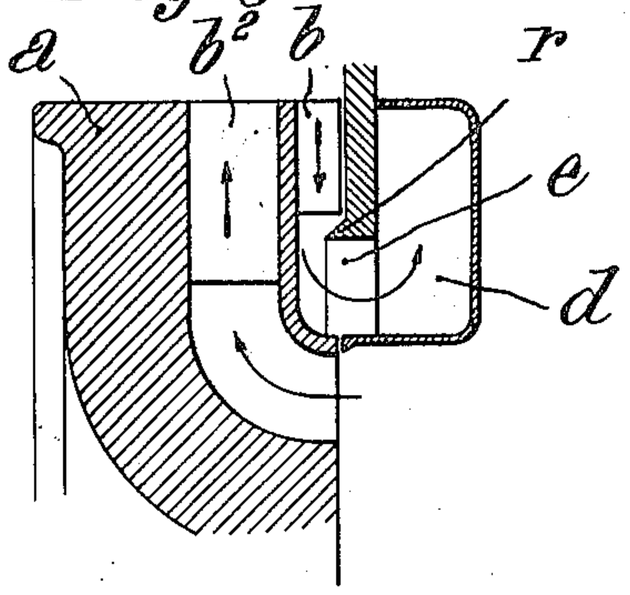


Fig. 4

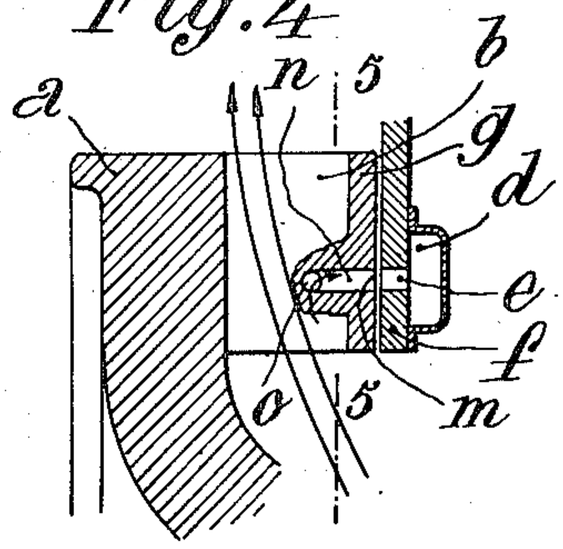
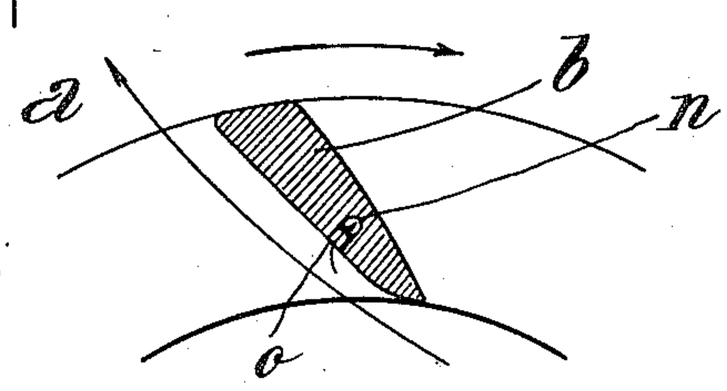


Fig. 5.



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ATTORNEY

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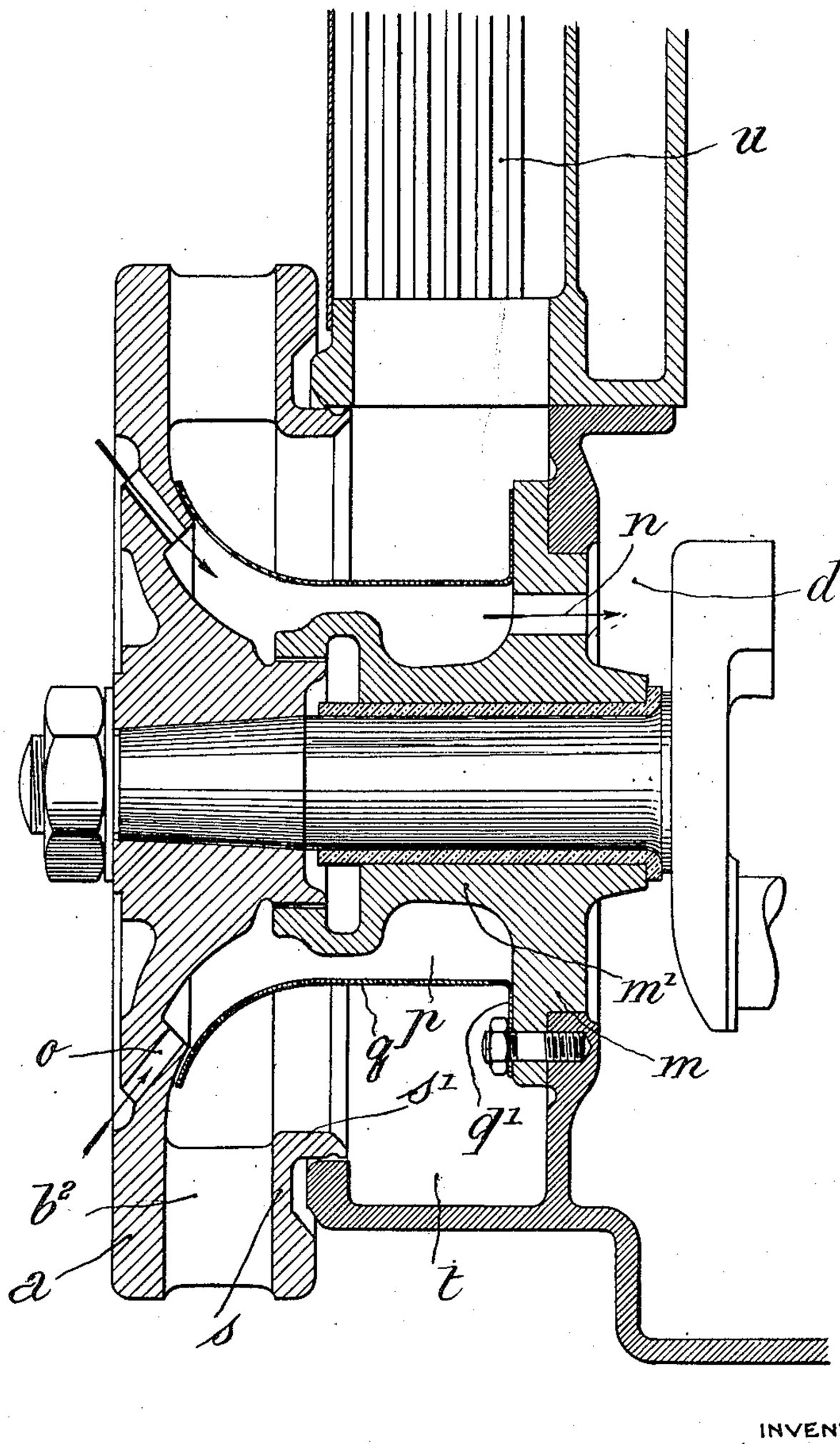
Fig. 7.



INVENTOR

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BY

ATTORNEY

Patented Aug. 20, 1935 2,011,888

UNITED STATES PATENT OFFICE

2,011,888

AIR CLEANER

Auguste Louis René Bernard, Rueil-Malmaison, France, assignor to "Fusion-Moteurs", Rueil-Malmaison, France, a society of France

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In Belgium February 17, 1931

11 Claims. (Cl. 183—77)

The present invention relates to methods and apparatus for supplying dust-free air to motors or to other machines.

One of the objects of the invention is to provide a method based upon the action of centrifugal force for creating a zone of separation between dust and pure air.

Another object is to provide a motor assembly in which the rotation of a fly wheel or other rotating element is utilized for separating air in, or adjacent to, the crank case into a dust-rich and dust-free zone, air being supplied to the motor from the latter zone.

A further object is to provide a motor assembly in which a fly wheel or other rotatable element acts to force the dust laden air centrifugally outward while the suction of the motor is utilized to aspirate air from a central zone freed of its dust by the centrifugal effect exerted on the dust laden air.

An additional object is to provide a motor assembly in which the air coming from the radiator or similar cooling element is hurled centrifugally outward, pure air being drawn inward at the same time from a dust-free zone by the suction exerted by a pump or by the motor itself.

Still further objects will appear in the course of the detailed description now to be given with reference to the accompanying drawings, in which:

Figure 1 is a diagrammatic axial section through the fly wheel and a journal of a motor showing how dust may be separated from air by the simple expedient of rapidly changing the direction of movement of the latter;

Figure 2 shows a second possible form of the invention;

Figure 3 is a section, similar to Figure 1 taken through a variant of the structure represented in Figure 2;

Figure 4 illustrates, in axial section, a fourth possible embodiment of the invention;

Figure 5 is a section taken on line 5—5 of Figure 4.

Figure 6 represents, in axial section, a form of assembly in which the dust laden air is hurled centrifugally outward while dust-free air is drawn inward from a zone comparatively free of dust;

Figure 7 shows, in section, a motor assembly operating similarly to the one illustrated in Figure 6.

Referring to Figure 1 of the drawings there is shown a motor assembly composed of the following elements: a fly wheel mounted on the main, or on an auxiliary, shaft of the motor and having a plurality of ventilating or cooling ribs or blades *b* mounted at, or adjacent, the periphery thereof, the fly wheel coacting with a fixed wall *f* to limit a conduit through which air will be drawn by the rotation of blades *b*; an air inlet conduit *q* connected to a radiator (see Figure 7), said inlet conduit delivering its air in a direction parallel to the axis of rotation of the fly-wheel; an annular conduit *d* positioned partially inside conduit *q* and communicating with the space between fly wheel *a* and wall *f* via a plurality of passages *e*, conduit *d* communicating by means of a conduit system *c* with the intake manifold or an equivalent suction system associated with the motor; and a deflector *r* extending into the space limited by wall *f* and fly-wheel *a*, said deflector acting to prevent the passage of dust-containing air into orifices *e*.

It will be noted that in the course of passage of the air through conduit *q* and outward along the fly-wheel, it traverses an "elbow" (which may be in the form of a circular segment of revolution) on it way towards blades *b*. When, therefore, fly wheel *a* rotates, air is drawn downward through conduit *q* by the aspirating action of blades *b* and, in traversing the elbow, suddenly changes direction and tends to collect in a zone adjacent the fly wheel surface as represented in Figure 1. The dust free air moving outward adjacent to wall *f* finds its way via passages *e* into annular conduit *d* by the suction applied to conduit *c* from the motor.

In the variant represented in Figure 2, which shows only a fragment of the assembly illustrated in Figure 1, a more perfect separation of dust from air is obtained by connecting an annular element *g* (or forming the latter integrally with) blades *b*, element *g* being traversed by a plurality of orifices *h* positioned to sweep past passages *e*, a deflector *r* being positioned in substantially parallel relation to element *g* and serving to more effectively prevent the entrance of dust into passages *h*. This form of apparatus, it will be obvious, operates substantially in the same manner as the one shown in Figure 1, the "elbow" or curved portion of the fly wheel acting to effect separation of the outwardly moving air into a dust-rich and a dust-free zone.

The form of assembly shown in Figure 3 is a further development of the inventive principle embodied in the structures illustrated in Figures 1 and 2. Here, in order to further insure complete separation of dust and air, an annular chamber *k*, *i* having a central annular baffle *l* positioned therein, is mounted on, or formed integrally with, blades *b* and annular wall *g*, orifices

h' being formed in one wall of chamber *k* to communicate with passages *e*. The chamber is intended to be closed peripherally by a detachable ring or wall *j* designed to be locked in position by any convenient device that may occur to those skilled in the art. Inspection of Figure 3 will show that if any dust laden air succeeds in passing baffle *r* and penetrates into chamber *k*, *i* via passage *h* it will be hurled centrifugally outward into contact with peripheral wall *j* under the deflecting action of baffle *l*. Any dust contained therein will then accumulate on the walls of element *j* which may be detached and cleaned whenever desired, purified air being drawn inward via passages *h'* and *e* into conduit *d* by suction as described already.

In the form of assembly shown in Figures 4 and 5 a somewhat different principle, or rather an auxiliary principle is utilized for insuring a perfect separation of dust and air. Fly wheel *a*, at its "elbow" portion continues to effect a primary separation of the dust from the air, a secondary separation being obtained by placing the air intake orifice on the posterior surface of blades *b* relatively to direction of rotation of the latter (see the arrow in Figure 5 and the position of air intake orifices *o*). Blades *b* are provided, as in the case of Figure 2, with an annular wall *g* positioned adjacent wall *f* and are each traversed by passages or conduits *n* terminating at one extremity in air inlet orifice *o* (positioned as already described) and, at their extremities in air discharge orifices *m* sweeping past passages *e*, the latter coacting with conduits *c* and *d* of the type shown in Figure 1.

The manner in which this form of the invention operates is obvious from the drawings and from the description of the mode of operation of the structures shown in Figures 1 to 3.

In the variant represented in Figure 6, the air traversing the "elbow" adjacent fly wheel *a* traverses a system limited by continuous lateral walls, the ventilating blades being formed in two portions *b* and b^2 lying on opposite sides of one of the lateral walls as shown in the drawing. The air traversing the "elbow" is again separated into dust rich and dust free portions as shown in Figure 1 and air for the motor is aspirated inward toward passages *e*, lying adjacent the "elbow" from the dust free zone adjacent blades *b*. Inward movement of the air is obtained by utilizing the suction exerted by the motor or by an auxiliary structure or pump connected thereto or coacting therewith. The dust-laden air discharged centrifugally from blades b^2 tends to move away from the zone of suction passing through passages *e* and blades *b*.

Figure 7 represents a preferred form of the invention utilizing the principle shown in Figure 6. Element *m* is a base bolted or otherwise fastened to the crank case and supporting a journal *m'* in which the crank shaft rotates, element *m* being traversed by a passage or passages *n* communicating with an air supply duct *d* through which suction is exerted by the motor.

The fly wheel *a* is provided with blades b^2 supported between the main body of the fly wheel *a* and an annular ring *s* provided with a flanged portion *s'* machined to fit, with as little play as possible, into an annular orifice in the crank case. Air enters a chamber *t* in the crank case assembly from a radiator *u* and, after traversing an "elbow" similar to the one shown in Figure 1, is hurled outward past blades b^2. To insure a supply of pure air, a flared sheet metal shell *q* is supported by a flange *q'* on the crank case so as to limit a tapering chamber *p* through which air may be drawn from a plurality of ducts *o* situated on the side of fly wheel *a* opposite blades b^2. Ducts *o* should be located further from the center of the crank shaft than passage *n* and slope downward towards the latter. If desired, they may be also positioned non-radially. The free end of shell *q* is formed to frictionally contact with the fly wheel, felt or similar material being mounted at the interface of contact so as to further isolate the air coming in through passage *p* from the air outside shell *q* undergoing the centrifugal effect of the fly wheel. From the foregoing it will be seen that the air supplied from the radiator undergoes an outward course from the exterior surface of shell *q*, while the air for the motor is drawn inward from a point situated in a zone central with relation to the dust laden air undergoing centrifugal action. Shell *q* should taper downward from points adjacent ducts *o* to points adjacent passages *n*.

Instead of being bolted to the crank case as at *q'*, it may be bolted at its other extremity to the fly wheel, the crank case extremity being then made mobile.

The invention is particularly adapted to motors in which the fly wheel is already provided with blades for assuring the passage of cooling air through a radiator system. Fly wheels of this type are shown in the structures represented in Figures 1 to 5. In the form of assemblies illustrated in Figures 6 and 7, blades b^2 must be provided for accomplishing a similar function.

The form of assembly shown in Figure 7 is particularly adapted to motors in which the fly wheel functions as an air turbine to create a depression at the base of a cooling system (radiator or condenser).

It is to be understood that in each of the forms of the invention described, the aspirated air may be deflected by proper baffles (not shown) or by a conduit system which will bring it in contact with the lubricating oil in the crank case, whereby whatever impurities remain therein may be transferred to the oil.

The invention not only permits an effective separation of dust from air but accomplishes this result with a minimum of braking action on the air being aspirated.

The invention is not to be taken as limited to any particular structure shown in the various figures of the drawings. Thus the flow of purified air into conduit *d* may be effected by centrifugal action, as in Figure 1, or by suction, as represented in various of the other figures of the drawings or by both of these actions.

What I claim is:

1. In a motor, a rotatable element, a fixed wall positioned in spaced relation to said rotatable element and coacting therewith to form an air conduit, said fixed wall having a pair of openings formed therein, positioned at different distances from the axis of rotation of said rotatable element, conduit means for supplying air to one of said openings, and independent conduit means positioned to receive air from the second of said openings.

2. In a motor, a rotatable element, a fixed wall positioned in spaced relation to said rotatable element and coacting therewith to form an air conduit, said fixed wall having a pair of openings formed therein positioned at different distances from the axis of rotation of said rotatable element, an air supply conduit connected to the

opening nearer the axis of rotation of said rotatable element, and an air discharge conduit connected to the opening further from the axis of rotation of said rotatable element.

3. In a motor, a rotatable element, a wall positioned in spaced relation to said rotatable element and coacting therewith to form an air conduit, said wall having a pair of openings formed therein positioned at different distances from the axis of rotation of said rotatable element, an air inlet conduit connected to the opening which is further from the axis of rotation of said rotatable element, and an air outlet conduit connected to the opening which is the nearer to said axis of rotation.

4. In a motor, a rotatable element, a wall positioned in spaced relation to said rotatable element and mounted to rotate therewith, said wall having an opening therethrough and coacting with said rotatable element to form an air conduit, a fixed wall positioned in spaced relation to said first named wall and having an opening formed therein positioned to communicate with the opening in said first named wall, conduit means for introducing air into the space between said rotatable element and said first named wall, and conduit means coacting with the opening in said fixed wall and operating to draw off air.

5. In a motor, a rotatable element, a plurality of blades mounted on said rotatable element, said blades having passages formed therethrough terminating at one extremity at the lateral portion of the blade and at their other extremities on the posterior surface of the latter relatively to their normal direction of rotation, and conduit means positioned to communicate with the extremity of said passages situated on the lateral portion of said blade.

6. In a motor, a rotatable element having a passage formed therethrough, a fixed wall having a passage formed therethrough, a shell extending between said rotatable element and said fixed wall, said shell limiting a chamber extending between the passages in said rotatable element and in said fixed wall, a plurality of blades mounted on said rotatable element exteriorly with relation to said shell, conduit means for supplying air to the space adjacent the exterior of said shell, and means for drawing off air through the pasage in said fixed wall.

7. In a motor, a rotatable element having a passage formed therethrough, a fixed wall having a passage formed therethrough, said last named passage being positioned at a lesser distance from the axis of rotation of said rotatable element than the passage through the said rotatable element, a shell extending between said rotatable element and said fixed wall, said shell limiting a chamber extending between the passages in said rotatable element and in said fixed wall, a plurality of blades mounted on said rotatable element exteriorly with relation to said shell, conduit means for supplying air to the space adjacent the exterior of said shell, and means for drawing off air through the passage in said fixed wall.

8. In a motor, a rotatable element, a wall positioned in spaced relation to said rotatable element and mounted to rotate therewith and having an opening therein, said wall co-acting with said rotatable element to limit an air conduit, a fixed wall positioned in spaced relation to said first named wall and having an opening formed therein, means for supplying air into the space between said rotatable element and said first named wall, means for conducting off air entering the opening in said fixed wall, and a chamber mounted to rotate with said first named wall, said chamber having a baffle mounted therein and having openings formed in the wall thereof permitting the flow of air from the opening in said first named wall into the openings in said fixed wall.

9. In a motor, a rotatable element, a wall positioned in spaced relation to said rotatable element and mounted to rotate therewith and having an opening therein, said wall co-acting with said rotatable element to limit an air conduit, a fixed wall positioned in spaced relation to the first named wall and having an opening formed therein, means for supplying air into the space between said rotatable element and said first named wall, means for conducting off air entering the opening in said fixed wall, a chamber mounted to rotate with the said first named wall and interposed between the latter and said fixed wall, said chamber having a detachable peripheral wall, said chamber having openings formed therein permitting the flow of air from the opening in said first named wall into the opening in said fixed wall, and a baffle mounted in said chamber between said openings.

10. In a motor, a fly wheel adapted to be rotated by the motor and having a passage formed therethrough, a fixed wall having a passage formed therethrough, said last named passage being positioned at a lesser distance from the axis of rotation of said fly wheel than the passage through said fly wheel, a shell extending between said rotatable element and said fixed wall, said shell limiting a chamber extending between the passages in said rotatable element and in said fixed wall, and means for drawing off air through the passage in said fixed wall.

11. In combination with a motor having an intake manifold, a rotatable element comprising a circular wall, a fixed wall positioned in spaced relation to said circular wall and coacting therewith to form an air conduit, said fixed wall having an opening towards the center of said circular wall, said opening communicating with said intake manifold, blades fixed on said circular wall having their free edge in the vicinity of the portion of said fixed wall situated around said opening, said blades and fixed wall limiting free spaces communicating freely with the atmosphere at their outer end, said motor drawing air through said intake manifold, said opening and the free spaces between said blades.

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