Jan. 16, 1940. F. S. OREM 2,187,546

AIR CLEANING DEVICE

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Fig. 1.

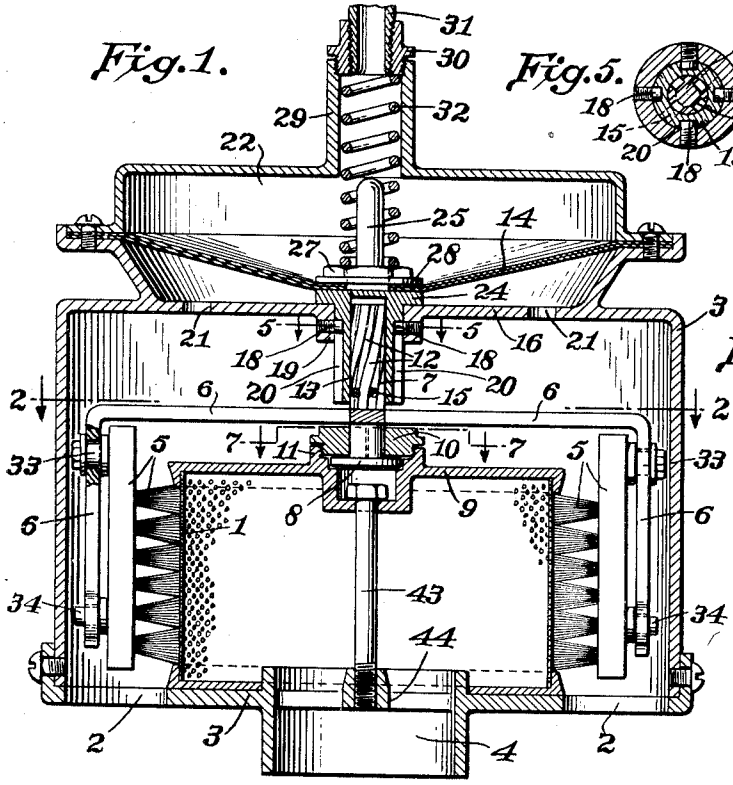


Fig. 5.

Fig. 4.

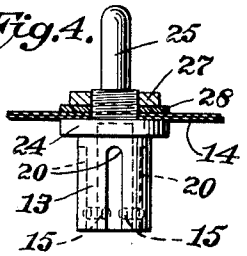


Fig. 3.

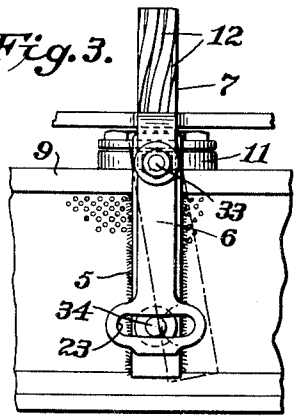


Fig. 2.

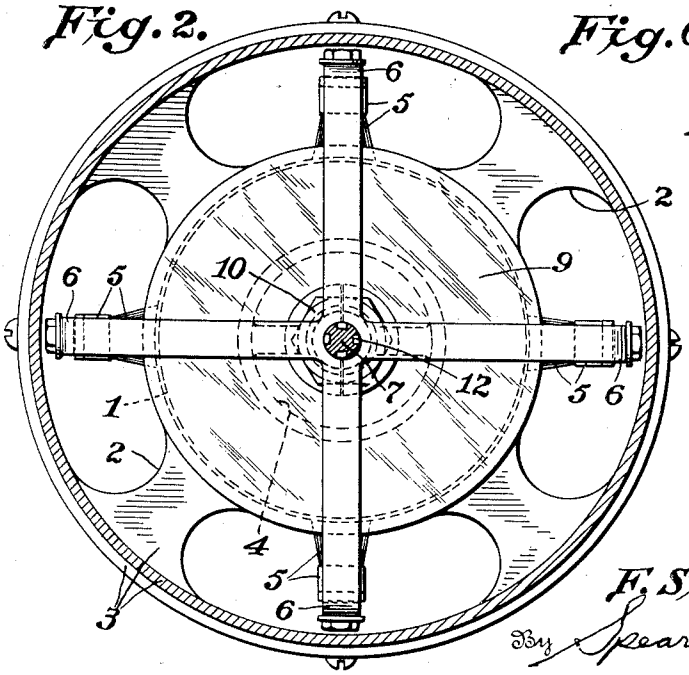


Fig. 6.

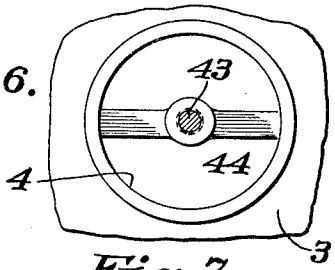
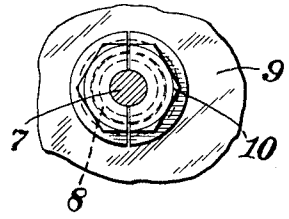


Fig. 7.



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Fig. 8.

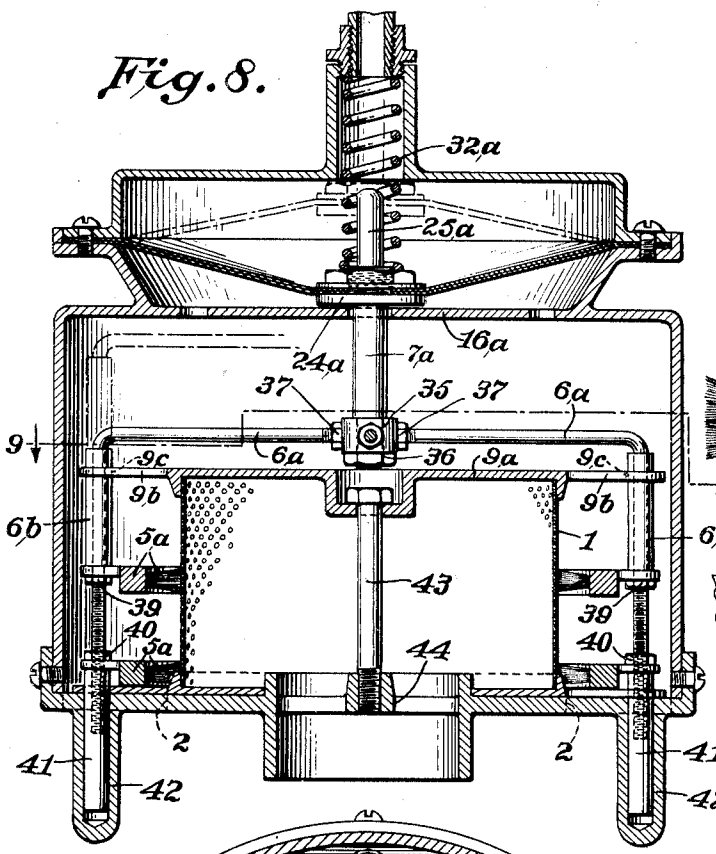


Fig. 10.

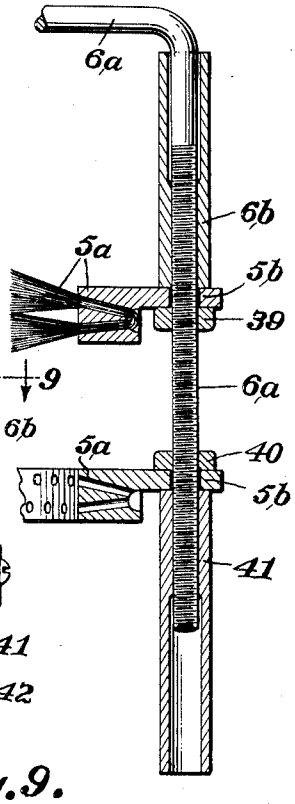
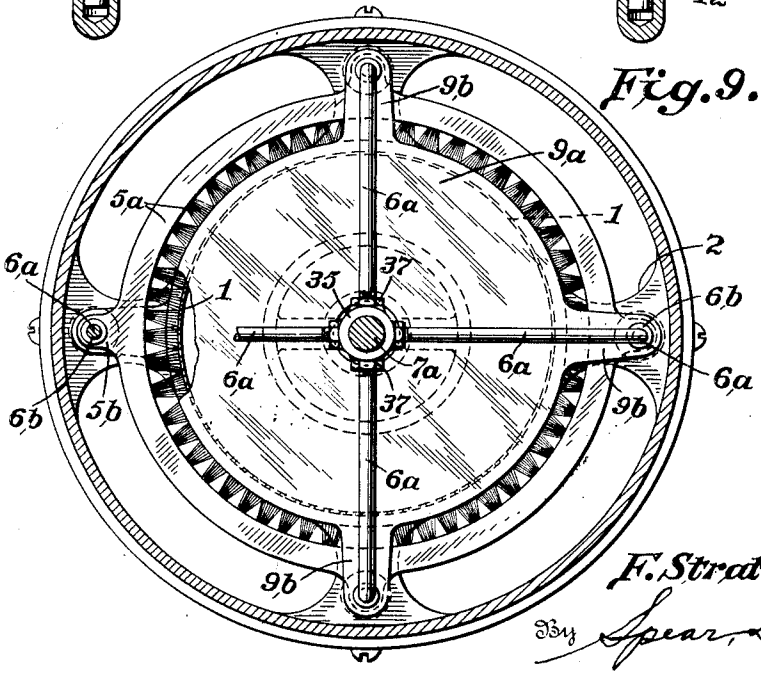


Fig. 9.



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UNITED STATES PATENT OFFICE

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AIR CLEANING DEVICE

Frederick Strattner Orem, Baltimore, Md.

Application April 14, 1938, Serial No. 202,076

11 Claims. (Cl. 183—60)

The invention relates to air cleaning devices such as employed in connection with internal combustion engines or the like, and more particularly to means associated with the air filter member of such device for automatically cleaning the same during its operation and use, to provide a self-cleaning device which does not require manual operation or servicing attention.

An object of the invention is the provision of wiping means for effectively cleaning the air filter member of accumulated dirt and dust, such wiping means being actuated and controlled by pressure responsive means subject to differences and variations in pressure during the operation and use of the air cleaning device.

Another object of the invention is to provide wiping means and actuating means therefor of novel form and construction to effect the dislodgment and removal of dirt and dust from the surface of the filter member.

Another object is to utilize suction to induce the passage of air through the cleaner and to effect a wiping of the surface of the filter member of the cleaner to clean the filter member.

Other objects will appear hereinafter, the invention consisting in the features, combination and arrangement of parts as shown and described, and as particularly pointed out in the claims.

Referring to the drawings:

Figure 1 is a partially sectional elevation of an air cleaning device according to the invention.

Fig. 2 is a section on line 2—2 of Fig. 1.

Fig. 3 is an end elevation of the brush member and associated structure.

Fig. 4 is a detail of a portion of the device.

Fig. 5 is a section on line 5—5 of Fig. 1.

Fig. 6 is a bottom plan view of the air cleaner outlet.

Fig. 7 is a section on line 7—7 of Fig. 1.

Fig. 8 shows a modification.

Fig. 9 is a section on line 9—9 of Fig. 8.

Fig. 10 is an enlarged view of the brush structure shown in Fig. 8.

In the drawings, 1 represents the filter member of the air cleaner which is preferably of perforated sheet metal in the form of a cylinder, the air entering through openings 2 in the casing 3 and passing through the perforations in the cylindrical filter member and thence through the outlet 4 of the air cleaner, which may desirably be connected to the intake of the carburetor of an internal combustion engine.

Air cleaners now in use tend to collect dirt and hold it and soon become clogged thereby interfering with the free flow of air and causing a great waste of fuel and loss of power.

Air enters cleaner from atmosphere through openings in bottom head. To do this the direction of flow of air coming from fan is changed to a right angle, the heavy particles of dirt continue on past the bottom head. After the dust laden air reaches the chamber surrounding the filtering member the direction of air flow again changes in passing through the filter member which causes the heavy particles of dirt to fall to atmosphere through the openings in bottom head. The openings in bottom head are large and the velocity of air at its maximum is very low. Each time the direction of the air is changed heavy particles of dirt leave the air entering the cleaner. The openings in the filter member are so small that only the very finest dust may pass through, if any. The larger particles of dirt will fall away or may rest on the outside of filter member, for automatic removal according to the invention.

Sufficient area of holes is provided to take care of friction of the air passing through.

Wiping means 5, desirably in the form of brushes, are disposed in engagement with the filter member and are mounted so as to be movable while in engagement with the filter member to clean the same.

In the form of the invention shown in Fig. 1, the brushes 5 are mounted on arms or bracket members 6 extending from and rotatable with a rotary shaft member 7, the flange 8 at the lower end of which desirably has a bearing in the end or cap member 9 for the filter member 1. A split retainer nut 10 may be provided overlying the flange 8 and threaded into a boss 11 of the cap member 9. The rotary shaft 7 is helically grooved throughout a portion of its length as shown at 12, and is desirably received within a sleeve 13 secured to the pressure responsive device which is preferably in the form of a diaphragm 14, the sleeve being provided with pin means 15 engaging the helical grooves 12, for imparting rotary movement to the shaft 7 as the sleeve reciprocates longitudinally relative to the shaft.

The sleeve member 13 is movable through an opening in the wall 16 of the casing 3 of the air cleaner device and may be guided against rotary movement by means of pins 18 screwed into a depending flange 19 of casing and extending into longitudinal slots or guideways 20 in the sleeve member 13.

Openings 21 in the wall 16 of the casing communicate atmospheric pressure in the main chamber of the device with the diaphragm chamber provided at 22, which desirably may be formed by a cover or cap member screwed to the casing and clamping the diaphragm 14 therebetween.

The sleeve 13 desirably may have a flange at 24 and a stem portion 25 extending through the diaphragm 14 with a nut 27 secured to a threaded portion of the stem 25 and bearing on washer 28 with the diaphragm between the washer and the flange 24.

The cover or cap member 22 is provided with a tubular projection 29, the outer end of which is fitted as indicated at 30 for connection, by any suitable conduit means 31, to a source of suction or reduced pressure, such as the intake manifold of the internal combustion engine.

A spring 32 is disposed in the tubular nozzle or projection 29 and bears at its outer end against fitting 30 and at its inner end receives the end of stem 25 and bears on the nut 27, thus urging the diaphragm inwardly.

The brushes or wiping means 5, as shown in Fig. 1 and Fig. 3, are pivotally mounted at their upper ends to the arms 6 as shown at 33 and their lower ends are free to move in either direction to the extent of a slot 23 in the bracket arm 6, in which a pin 34 on the brush is movable. This enables the brush to lag at its lower end as indicated in dotted lines in Fig. 3 in one direction or in the other direction, as the brushes are moved in one direction and then the other under action of the rotary movement imparted by the diaphragm and spring construction. This enables the dust and dirt dislodged from the filter member by the brush to freely drop downwardly clear of the brush upon dislodgment and tends to avoid accumulation of dirt in the brush or wiping means.

In the operation of the device shown in Fig. 1, the wiping means and associated parts are in the position they occupy when not actuated by the suction, such as that of an internal combustion engine, which source of suction is then at rest.

Upon the application of suction, as upon the starting of an internal combustion engine to which the device may be connected, air is drawn through the filter member and also the diaphragm is moved outwardly against the spring 32 and under the action of the difference in pressure on the opposite sides of the diaphragm, it being subject to the suction on its outer side and subject to atmospheric pressure on its inner side through holes 21. This rotates the shaft and brush arms through the helical groove or worm and pin connection and causes the brushes to move around and to wipe the surface of the filter member. The construction may be such as to the extent of movement of the diaphragm and sleeve and worm, as to cause the brushes to rotate around the cylindrical surface of the filter member to any desired angle, which desirably may be from about 45 to about 90 degrees, depending upon the number of brushes employed.

During maintenance of suction, as during the operation of the engine, the brushes remain in the position to which they have been moved, with the diaphragm in its outward position. Upon cessation of suction or lessened pressure, as upon stopping of the engine, the atmospheric pressure on the inner side of the diaphragm is overcome by the pressure of the spring 32 and the parts return to the position indicated in Fig. 1, the brushes being again moved over the surface of the filter member in the return movement, and inclining as indicated in Fig. 3, in accordance with the direction of movement, to brush the filter surface clean.

Referring to the form of the invention illustrated in Figs. 8, 9 and 10, the wiping means 5*a* are in the form of brushes curved to conform to the shape of the cylindrical surface of the filter member 1, and fixed to the arms 6*a* and movable therewith longitudinally of the cylindrical filter surface to clean the same. The arms 6*a* are secured to a pin or bolt member 7*a*, by being threaded into a collar member 35 received on the reduced end of the bolt 25*a* and retained thereon by a nut 36. Lock nuts 37 are provided on the arms 6*a* and engaging the collar. The bolt 7*a* extends outwardly through the casing wall 16*a* and is provided with a flange 24*a* engaging the diaphragm, and the bolt extends through the diaphragm providing projection 25*a* received within the spring 32*a* as before described in connection with the form of the invention shown in Fig. 1.

The end cap or cover member 9*a* in Fig. 8 is provided with lateral extensions 9*b* having openings therein to provide guides for the reciprocable bracket arms 6*a*, which may be provided with sleeves 6*b* carried by the arms and guided in the openings 9*c*.

The arms 6*a* are preferably screw threaded throughout most of their end portions, and the brush members 5*a*, which desirably may be in the form of rings, have apertured portions 5*b* receiving the arms 6*a*. Upper and lower complete circular brushes are preferably provided. The upper brush member may be held in adjusted position on the arms 6*a* by means of nuts 39 on its under side and the sleeves 6*b* on its upper side, the nuts and sleeves being in threaded engagement with the arms 6*a*. The lower brush member may be held in adjusted position by means of nuts 40 on its upper side and sleeves 41 in threaded engagement therewith on its under side. The sleeves 41 are guided in guide cylinders 42 depending from the casing.

The structure of the form of the invention of Fig. 8 is otherwise substantially the same as that of Fig. 1, a bolt 43 desirably being provided securing the upper end cap of the filter member to the cross bar 44 of the casing, in both forms.

In the at rest position of the device shown in Fig. 8 the lower brush member rests on the lower wall of the casing. When suction is applied, as by the starting of the engine to which the device may be attached, the diaphragm will be moved against the action of the spring to move the bracket arms and brushes with it, lengthwise of the surface of the cylindrical filter member, to the position indicated in dotted lines, the filter being thereby brushed clean. Upon cessation of suction, as by the stopping of the engine, the spring forces the diaphragm to move against the atmospheric pressure, and moves the brushes in a return cleaning action to the initial position of rest indicated in Fig. 8.

The brushes are preferably so positioned and adjusted on the threaded bracket arms that in the one stroke movement in either direction, the entire surface of the filter is brushed.

In both forms of the invention, the application of suction in the operation of the device activates the diaphragm to move the wiping means or brushes so as to brush the entire surface of the filter member, and upon cessation of suction the

brushes are given a return stroke, under action of the spring, which preferably is provided, or by gravity, to again brush the entire surface of the filter member.

I claim:

1. In apparatus of the class described, air cleaning means including an air filter, and means for cleaning said air filter comprising wiping means in engagement with said air filter and a support carrying said wiping means, said support being movably mounted to move the wiping means over the surface of the filter, and a diaphragm, means subjecting one side of the diaphragm to atmospheric pressure, and means subjecting the other side of the diaphragm to suction or lessened pressure to move the same, means providing a connection between said diaphragm and said support for imparting movement thereto, said diaphragm having a rigid projecting member fixedly mounted thereon and forming a part of the said connection, said projecting member being in direct engagement with a part of said wiping means support to move the wiper over the filter positively in both directions upon reciprocation of the diaphragm projection with the diaphragm.

2. In apparatus according to claim 1, said support being rotatably mounted and having a central shaft member and said connection including a sleeve portion on one of said members receiving the other of said members with a thread or cam structure therebetween to rotate the support upon movement of the diaphragm.

3. Apparatus according to claim 1 in which said projecting member is disposed centrally of the diaphragm, said support being carried by said projecting member and movable therewith upon movement of the diaphragm.

4. In apparatus according to claim 1, said filter being of cylindrical formation and having a bearing at one end for rotatably mounting said support, said support having a central shaft member and an arm extending from said central shaft member and carrying said wiping means at its outer portion in contact with said cylindrical filter, and said connection including a sleeve portion on one of said members receiving the other of said members with a thread or cam structure therebetween to rotate the support upon movement of the diaphragm.

5. In apparatus of the class described, means providing a substantially vertically disposed filter surface to be cleaned, and wiping means for said surface comprising a substantially vertically disposed wiping member carried by a movably mounted support, said vertically disposed member being pivoted at its upper end to said support and having its lower end free to swing as the wiping member is moved over the said surface, and a pin and slot construction limiting said swinging movement.

6. In apparatus of the class described, air cleaning means including a cylindrical air filter member mounted in a casing having air inlet and outlet openings in its under side leading to and from said air filter member, a shaft member having a rotary bearing at one end in the head of the filter member, said shaft carrying a bracket supporting wiping means at the outer portion thereof in contact with said filter member, said casing providing a diaphragm chamber at its upper end, a diaphragm disposed in said chamber, openings in the casing communicating one side of said diaphragm chamber with the atmosphere, an opening in the casing from the other side of said chamber to a source of suction, a sleeve projection on the lower side of said diaphragm extending into operative engagement with said rotary shaft and receiving the same, and a thread or cam connection between the sleeve and rotary shaft to rotate the latter upon movement of the diaphragm.

7. In apparatus of the class described, air cleaning means including a cylindrical air filter member mounted in a casing having air inlet and outlet openings in its under side leading to and from said air filter member, said casing providing a diaphragm chamber at its upper end, a diaphragm disposed in said chamber, openings in the casing communicating one side of said diaphragm chamber with the atmosphere, an opening in the casing from the other side of said chamber to a source of suction, wiping means in contact with said filter member, and means directly connecting said diaphragm and wiping means comprising a rigid member fixed to and projecting from the lower side of said diaphragm and extending downwardly toward said filter member, said rigid projecting member carrying a bracket supporting said wiping means at the outer portion thereof in contact with said filter member to reciprocate the wiping means longitudinally over said filter member upon longitudinal reciprocation of said projecting member with movement of the diaphragm.

8. Apparatus according to claim 7 in which said bracket comprises a plurality of radial arms having downwardly extending portions at their outer ends, and said wiping means comprising a plurality of curved brush members secured to said downwardly extending portions and extending in horizontal planes at different levels, said casing providing guide openings for said downwardly extending portions, and the head of the filter member having extensions providing guide openings for said downwardly extending portions.

9. Apparatus according to claim 6 in which said bracket support comprises a plurality of arms carried by said shaft and having downwardly extending portions at their outer ends, carrying the wiping means in the form of brushes substantially vertically disposed and pivoted at their upper ends.

10. Apparatus according to claim 6 in which said thread or cam connection comprises a helical groove on said shaft and a pin on said sleeve extending into said groove, and a spring urging said diaphragm downwardly.

11. In apparatus of the class described, means providing a substantially vertically disposed filter surface to be cleaned, and wiping means for said surface comprising a substantially vertically disposed wiping member carried by a movably mounted support, said vertically disposed member being pivoted at its upper end to said support and having its lower end free to swing as the wiping member is moved over the said surface, and means limiting swinging movement in both directions.

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