Oct. 17, 1961 C. C. HOFFMAN 3,004,276

APPARATUS FOR QUICKLY CLEANING FOLDED FILTER ELEMENTS OF DRY TYPE AIR FILTERS

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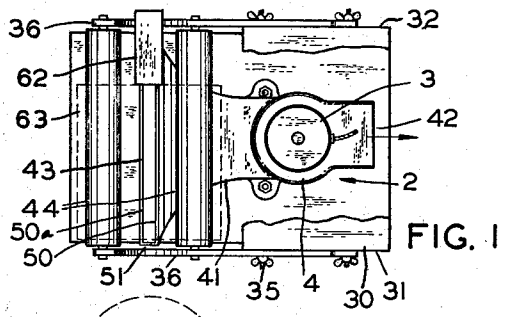


FIG. 1

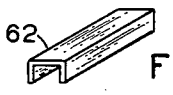


FIG. 6

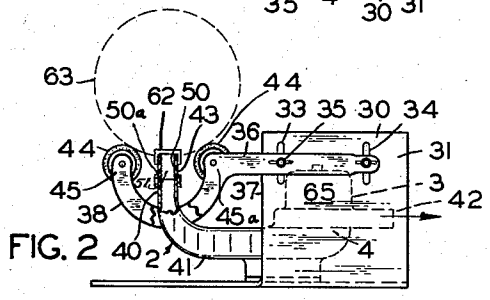


FIG. 2

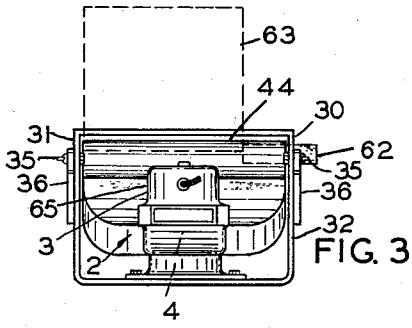


FIG. 3

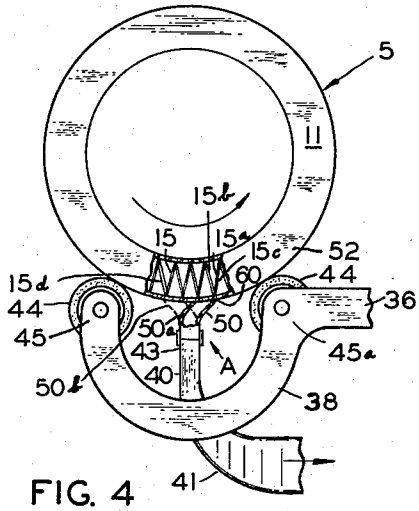


FIG. 4

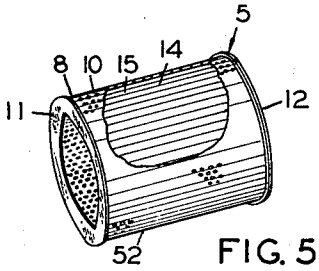


FIG. 5

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APPARATUS FOR QUICKLY CLEANING FOLDED FILTER ELEMENTS OF DRY TYPE AIR FILTERS

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3 Claims. (Cl. 15—306)

This invention pertains to cleaners for air cleaners of internal combustion engines.

According to the trend of current operation of internal combustion engines air cleaners of the paper fiber type are supplanting the oil bath cleaners previously used.

It has been found that the filters composed of an element of fibrous paper perforated with microscopic sized holes are much more efficient than the older type filter. In ordinary use the elements in these filters need to be cleaned about once a month, but in heavy duty work, such as where engines of large horse power are used to operate large tractors in places where the air is charged with dust, smoke and the like, it has been found that these filters should be changed every 24 hours.

Heretofore no particular attention was paid to the manner of cleaning the filters with the result that the operation has been very time consuming and inefficient.

It is one of the objects of this invention to provide a cleaner for these filters which will be efficient in use and thorough in its results.

In view of the foregoing one of the objects of this invention is to provide a device that will efficiently clean the folded paper fiber type air cleaner in an improved and efficient manner.

Another object is to provide a device which has a means for receiving and holding a drum type air filter having an element of the folded fiber type filter and will efficiently permit the rotation of the drum type casing of this filter and at the same time subject each of the folds of the fiber to suction sufficient to draw out material caught on the outer surfaces of the filter.

Another object is to provide a means for contacting the surfaces of the filter with a suction opening through which the entrapped dirt may be drawn.

Still another object is to provide a means for applying suctions to the outside of the filter and at the same time cause a movement of the filter element which will assist in loosening particles of dirt caught in the folds of the filter.

Still another object is to provide a combination of the suction attachment above mentioned with an efficient rotary suction pump which will provide an adequate suction and volume of air to draw off the entrapped dirt.

Other objects will appear hereinafter.

I attain the foregoing objects by means of the devices, parts and combinations of parts hereinafter described and illustrated in the accompanying drawing, wherein:

FIGURE 1 is a plan view of the device with portions broken away.

FIGURE 2 is a side elevational view of the device shown in FIGURE 1 with certain parts broken away to show interior construction.

FIGURE 3 is an end elevational view thereof.

FIGURE 4 is a side elevational view of the suction applying element and holder drawn on an enlarged scale.

FIGURE 5 is a perspective view of a typical filter element with a portion of the outer case removed to show interior construction.

Similar numerals refere to similar parts in the several views.

In the first three figures of the drawing 2 indicates the suction element broadly; 3 indicates an electric motor driving a centrifugal suction pump 4; 5 indicates a typical drum type air filter supported by rollers 44 on brackets 36.

Air filters of the type herein concerned consist of a drum shaped cylindrical case 8, as shown particularly in FIGURE 5, which has a cylindrical screen or perforated metal interior sleeve and a larger perforated metal cylindrical screen 10 on the outside. These cylindrical elements are concentric and are closed at the ends by ring shaped metal ends 11 and 12. This structure provides an annular space 14 between the interior and exterior cylinders above described. This annular space is filled with a filter element 15 composed of a strip of heavy fibrous paper, or the like, perforated by many holes of microscopic size. These holes are so small that they do not pass dust particles or other materials suspended in the air which are apt to damage metal engine parts. There are a sufficient number of these holes to pass an adequate flow of air to the engine intake manifold. The material of the filter strip is folded first one way and then the other in a zig zag manner to form pleats. These pleats are somewhat similar to the expansible walls of an accordian and the strip, folded as stated, is packed into the annular space 14.

Filters of this type have the pleat like folds loosely secured between the inner and outer walls of the filter body and are sufficiently loose so that they are free to move to and fro annularly relative to the length of the filter 15 as it reposes in the annular space 14.

The device here concerned is designed for the purpose of cleaning filters of this type by applying suction to the outer surface of the folded filter element 15. If suction alone is applied, however, cleaning of the filter is inefficient and this invention includes the discovery I have made which is that if the suction is applied through a narrow slot to the outside surface of the case 8, and the channel through which the suction draft flows is positioned at an angle relative to the radius at the position of contact, the suction draft will draw the adjacent folds of the filter unit in the direction of the flow of the draft so that the pleats of the filter unit move in this direction. The folds ahead of the draft are expanded due to movement of the pleat folds toward the suction slot. This movement opens up the folds ahead of the slot that open outward and in so doing releases dirt entrapped at the bottom of the crease of the fold and thereby facilitates the loosening of the dirt caught in the crease as well as dirt on the surface of the filter so that all of the dirt may be easily drawn out of the filter case 8 by the suction draft.

Referring to the embodiment of the device shown in the accompanying drawing, 30 indicates a box which is adapted to hold the blower 3 and provide a support for other parts of the apparatus. On the sides 31 and 32 of the box 30 there are vertical slots 33 and 34. Bolts 35 extend through these slots and through holes in the brackets 36 which are disposed on each side of the box and to provide vertically adjustable attachment for said brackets on the box.

Brackets 36 extend beyond the inside face 37 of box 30 and are provided with downwardly curved yokes 38 which span the suction element 40 of the intake 41 which constitutes a transition piece leading to the intake of centrifugal suction pump 4. The exhaust from this pump, indicated by numeral 42, leads outside box 30. Note that the rectangular intake slotted opening 43 of suction element 40 is positioned substantially midway between transversely extending supporting rollers 44. These rollers are journalled at their ends on the opposed raised parts 45 and 45*a* of the yokes 38 on brackets 36.

The rollers 44 provide rolling supports for filter unit 5 so that it may be supported above the vacuum slotted

opening 43 and may be rotated on the rollers over opening 43.

Along the sides of the slotted opening 43 there are flexible contact strips 50 and 50*a* made of resilient material. These strips are closed by flexible end tabs 51 to provide a flexible vacuum or suction contact element A which may be brought into resilient, and substantially air tight contact with the periphery 52 of the element 5. The rollers 44 are arranged on brackets 36 so that unit 5, when mounted on them, will drop into position, as shown in FIGURE 4, with the strips 50 and 50*a* bent to one side. Strips 50 and 50*a* bend under the weight of the unit 5 and in the direction that it is rotated. Thus, as shown in FIGURE 4, the unit is being turned counterclockwise and the strips, as shown in solid lines, are bent toward the right. Suction through the suction element 41 will then draw on the filter element 15 so as to move the folds 15*a* of the element in a clockwise direction. The movement is through a short space only, but it is sufficient to draw the entire element 15 a short distance in a clockwise direction, at the same time opening the outward fold 15*b* in the position shown. Successive folds are likewise opened as the unit 5 is turned by hand while resting on rollers 44.

In the position shown in FIGURE 4, dirt is principally removed, aside from dirt caught in the fold 15*b*, from the right hand side 15*c* of each fold of the pleats of the element. If the filter unit 5 is now rotated in the opposite direction the flexible strips 50 and 50*a* will assume the position indicated by dotted lines 50*b*. In this position suction will be applied to the sides of the pleat folds indicated by numerals 15*d*.

In order to adequately clean a filter it is first rotated in a counter-clockwise direction while on rollers 44 and then in a clockwise direction. In this way dirt from both filter folds is removed and the motion of opening and compressing the pleat folds loosens deeply embedded dirt so that the entire unit is cleaned.

In order to adjust the pressure of contact of the periphery 52 of the unit 5 with the outer edges 60 of strips 50 and 50*a*, I provide the slots 33 and 34 on the sides of the case 30, as above described. Bolts 35 may be tightened while the bracket 36 is being adjusted to provide the desired contact with the edges 60 of the strips 50 and 50*a*. Thus, the device is easily accommodated to units of different diameter. The transverse slot formed by strips 50 and 50*a* may be partially closed by a cap strip 62 which when placed over one end of the slot will close it so that the vacuum is directed chiefly through the open part of the slot which is in contact with the periphery of the drum. In this way the device will accommodate drums of different lengths.

In use a drum such as is indicated by numeral 5 is placed on the roller supports 44 in a position indicated by dotted lines 63 in FIGURE 2. The motor 65 is operated and suction is created along the opening slot between the strips 50 and 50*a*. The unit 5 is then rotated in first one direction and then the other, as above mentioned, and the movement of the folds and pleats of the element 15 is sufficient to loosen all dirt clogging its exterior and to aid in the suction removal of all dirt caught on the sides of the pleat folds.

As is clear from the drawings, the lips 50 and 50*a* at all times are spaced apart in the direction of casing rotation by an amount at least as great as the maximum opening of successive folds of the filter.

I claim:

1. Apparatus of the character described for quickly cleaning an air filter in the form of a cylindrical housing including concentric inner and outer perforate shell casings and a perforate filter element contained between said casings and having open folds, the elongated creases of which extend substantially parallel to the housing axis, said apparatus comprising means to support the filter housing in position for rotation about the housing axis, suction means for drawing air reversely through the filter housing and said element in a direction opposite the direction of air and dust entrance into said housing during service use of the filter, said suction means including a nozzle having a pair of elongated lips forming an elongated air and removed dust inlet parallel to said axis and adjacent the path of housing rotation for direct proximate exposure to narrow and elongated surface portions of one of said casings brought successively opposite said inlet as the housing is rotated, one of said elongated lips comprising a flexible seal projecting into the path of rotation of said one casing at the side of said inlet away from which the casing rotates, said seal being adapted to be flexed by said one casing in the direction of rotation thereof and to remain in surface sealing engagement therewith and said lips at all times being spaced apart in the direction of casing rotation by an amount at least as great as the maximum opening of successive folds whereby air drawn into the nozzle is caused to move the filter element folds rapidly and relatively away from and toward one another to loosen dust packed between the folds and near the fold creases as said folds are rotated with the housing opposite said nozzle inlet, all without damage to said filter element.

2. The invention as defined in claim 1 in which said one lip seal comprises an elongated strip of resilient material and the other lip also comprises an elongated strip of resilient material.

3. The invention as defined in claim 2 in which said means to support the filter housing for rotation comprise rollers having axes of rotation substantially parallel to said axis and at opposite sides of said nozzle, and adjustable roller carrier means movable to carry at least one of said rollers toward and away from the path of filter housing rotation thereby to support different diameter filter housings in direct proximately exposed relation to said nozzle inlet.

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