Feb. 19, 1935. W. W. LOWTHER 1,991,759

AIR CLEANER

Filed Dec. 15, 1933

Fig. 1

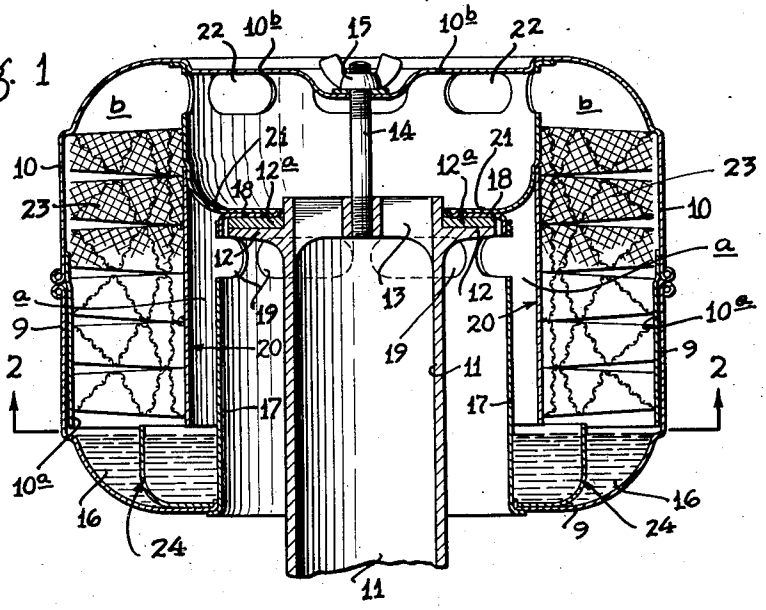
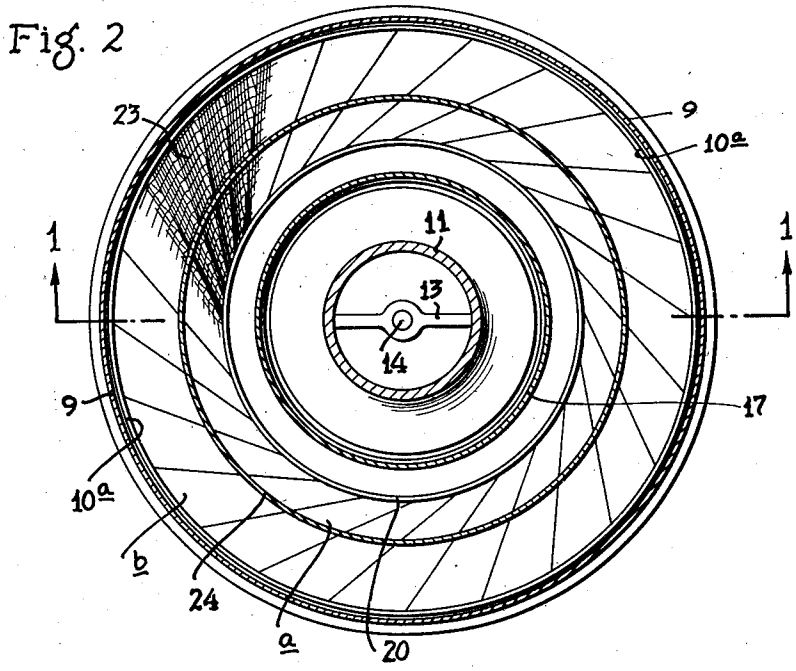


Fig. 2



INVENTOR
Wilfred W. Lowther
BY HIS ATTORNEYS
Merchant Kilgore

Patented Feb. 19, 1935

1,991,759

UNITED STATES PATENT OFFICE

1,991,759

AIR CLEANER

Wilfred W. Lowther, Minneapolis, Minn., assignor to Donaldson Company, Inc., St. Paul, Minn., a corporation of Minnesota

Application December 15, 1933, Serial No. 702,484

6 Claims. (Cl. 183—15)

My present invention provides an improved and simplified air cleaner, which is efficient even when made in small sizes such as adapted for use in connection with automobiles. The air cleaner involves a novel relative arrangement of oil well, screen and air passages to and from the same. The air passages or conduits are so arranged that the air will be drawn upwardly into the casing, will be delivered downwardly onto the oil in the well, will be carried upward through the screen, and thence delivered downward to the carburetor of the engine to which it is applied. The present invention is in the nature of a modification of or improvement on the air cleaner disclosed and claimed in Letters Patent of the United States No. 1,926,841, issued to Frank A. Donaldson of date September 12, 1933.

In the accompanying drawing, which illustrates a commercial form of said air cleaner, like characters indicate like parts throughout the several views.

Referring to the drawing:

Fig. 1 is a vertical section taken on the line 1—1 of Fig. 2; and

Fig. 2 is a horizontal section taken on the line 2—2 of Fig. 1, looking upward.

The outer shell of the improved casing of the air cleaner is made up of two sheet metal sections 9 and 10, which are reversely cup-shaped and preferably telescoped together. The air outlet from the air cleaner is formed by an axially located air discharge tube 11 that is adapted to be connected to the air intake tube of a carburetor, not shown. Near its upper end, the air outlet tube 11 is provided with an integrally formed outstanding annular rest flange 12 shown as provided with a gasket 12^a directly mounted thereon.

Rigidly secured to the upper end of tube 11 is a spider-like bracket 13, which, for the purpose which will presently appear, is provided with an axially located upwardly projecting threaded bolt 14 equipped with a thumb nut 15.

The bottom of the case section 9 is formed to afford an annular oil well 16, from the inner edge of which a sheet metal cylindrical skirt 17 extends upward into the casing. This skirt 17 is concentrically spaced from the tube 11 and its upper end is turned inwardly to form an annular flange 18 that is seated upon the gasket 12^a. Near its flanged end, the skirt 17 is provided with a plurality of air ports 19.

The upper case section 10, at its lower edge, is shown as provided with a depending cylindrical flange 10^a that is detachably telescoped into the lower section 9. The top of the case section 10 is in the form of a head 10^b that closes the top of the casing. Secured to and depending from the head 10^b is a cylindrical sheet metal skirt 20 that is provided with an inwardly projecting annular flange 21, seated upon the flange 18 and gasket 12^a. That portion of the skirt 20 that is below the flange 21, is concentrically spaced from and outward of the skirt 17.

The skirt 20 extends downward close to the oil level which is substantially indicated by the section line 2—2, and divides the casing into two concentric chambers *a* and *b*. The skirt 17 forms between the clean air outlet tube 11 and the skirt 20 an annular air intake conduit that extends vertically upward to the ports 19 and from thence vertically downward to or approximately to the surface of the oil. In the extreme upper portion of the skirt 20, above the flange 21, are large air ports 22.

When the case sections 9 and 10 are telescoped together, the bolt 14 will be passed through an axial bolt passage in the head 10^b and when the nut is applied as shown in the drawing, the two sections will be firmly held together and firmly clamped to the flange 12 of the air outlet tube 11.

The screen or dust-intercepting element 23 will be placed in the annular compartment *b* and as already indicated, may take various forms so far as the present invention is concerned. This screen 23 may be such as that disclosed in said prior Donaldson patent or such as that disclosed in the application of William H. Schulz, S. N. 616,860, filed June 13, 1932 and entitled "Air cleaner".

As an important feature of this invention, the oil well 9 is provided with an annular closed bottom oil cup 24 that has less diameter and less height than said oil well. This oil well, however, is of greater diameter than the outer skirt 20 and its upper edge is located approximately at the oil level and at very nearly the same level as the lower edge of the said outer skirt.

It is further important to note that the annular air passage between the skirts 17 and 20 opens downwardly and is arranged to deliver air against the inner portion of the oil contained in the cup 24, and that the screen 23 overlies the outer portion of said cup and the entire surface of the oil contained in the annular portion of the wall 9 that is outward of said cup.

Operation

Under suction from the engine to which the cleaner is applied, partial vacuum or suction will be produced in the axial air outlet tube 11 and

this will cause a flow of air to the air cleaner, first upwardly through the annular space between the tube 11 and inner skirt 17, and through the ports 19, and from thence downward through the annular air intake passage formed between the two skirts 17 and 20. The air thus delivered against the surface of the oil in the cup 24 will violently agitate the oil of the well, will dash the same into a spray or foam and will carry the oil upward into the screen 23. The oil carried into the screen 23 will run down over the inclined surfaces thereof, forming oil films through which the dust-laden air must be passed and by which the dust or foreign materials will be collected and carried downward with the oil. The vertical extent of the screens is such that no oil or dirt will be carried completely through the screens and only clean air will pass from the screens through the ports 22 to the clean air outlet tube 11 and thence to the carburetor, not shown.

Of course, much of the oil in the well will be carried out of the cup 24 upward into the screen. The oil carried into the screen will, on reaching a certain altitude depending on the force of the air current, be divided into two streams, a major portion of which will be drifted toward the casing and delivered into the annular outer portion of the oil well or outside of the cup 24, while a minor portion of the oil will run against the exterior of the outer skirt 20 and return or attempt to return to the cup 24, where it will be again intercepted to a greater or less extent and returned to the screens. The oil will accumulate in the outer portion of the well and overflow into the cup 24 so that when the air cleaner is in action, there will be a continuous circulation of oil from the cup into the screen, back into the outer portion of the oil well, and thence by overflow, back into the cup. Of course, the dust or foreign materials collected from the air by the oil will be maintained in the oil and precipitated to the bottom of the oil cup. The rim of the cup 24, being located midway between the innermost and outermost portions of the screen, confines the initial upward flow of the dust-laden air and oil to the inner portion of the annular screen and causes a continuous drifting of the oil from the inner toward the outer portion of the screen, and from the outer portion of the oil well to the inwardly located annular cup.

This, in practice, has been found to be very efficient air cleaning action and one that is capable of being incorporated in a very simple air cleaner of small dimensions, especially adapted for use in connection with automobiles, where space for the proper location of an air cleaner is very limited.

What I claim is:

1. In an air cleaner, a casing, an annular oil well at the bottom of said casing, a closed bottomed annular oil cup located in said oil well and having less diameter and less height than said oil well, an annular screen in said casing overlying a portion of said oil cup and the major portion of said oil well, said casing having an annular air intake passage arranged to deliver dust-laden air downward against the innermost portion of the oil contained in said cup, said casing further having a clean air outlet leading from the upper portion of the said screen.

2. In an air cleaner, a casing, an annular oil well at the bottom of said casing, a closed bottomed annular oil cup located in said oil well and having less diameter and less height than said oil well, an annular screen in said casing overlying a portion of said oil cup and the major portion of said oil well, said casing having an axial downwardly extended clean air outlet tube and said casing further having an annular air intake passage surrounding said air outlet tube and extended within the casing first upward and thence downward and terminated in an annular delivery end arranged to deliver the dust-laden air downwardly against the innermost portion of the oil contained in said cup.

3. In an air cleaner, a clean air outlet tube, an inner skirt spaced from but surrounuing said outlet tube, an outer skirt spaced from but surrounding said inner skirt, a casing surrounding and enclosing said two skirts and the upper end portion of said air outlet tube, said inner skirt and casing being joined at their lower portions to form an annular oil well, said outer skirt and casing forming an annular screen chamber that is connected to the upper end of said outlet tube, and an annular screen interposed in said screen chamber, said two skirts affording an air inlet passage that extends upward and thence downward over said oil well, and a closed bottomed annular oil cup in said oil well immediately surrounding said inner skirt and extended radially outward beyond said outer skirt and under a portion of said annular screen.

4. An air cleaner comprising a casing provided with an oil well in its bottom, and having an air inlet and an air outlet, dust and oil-intercepting means located in said casing between said oil well and said air outlet, and a closed bottom oil cup in said oil well between said air inlet and intercepting means, located so that the dust-laden air, in passing to said intercepting means, will pass the upper edge of said cup.

5. The structure defined in claim 4 in which said air inlet, oil well, cup and intercepting means are in concentric arrangement.

6. An air cleaner comprising a casing provided with an oil well in its bottom, and having an air inlet and an air outlet, dust and oil-intercepting means located in said casing between said oil well and said air outlet, and a cup-forming flange in said oil well between said air inlet and intercepting means, located so that the dust-laden air, in passing to said intercepting means, will pass the upper edge of said cup-forming flange.

WILFRED W. LOWTHER.