Feb. 9, 1937. W. W. LOWTHER 2,069,889

AIR CLEANER

Filed Dec. 17, 1934

Fig. 1

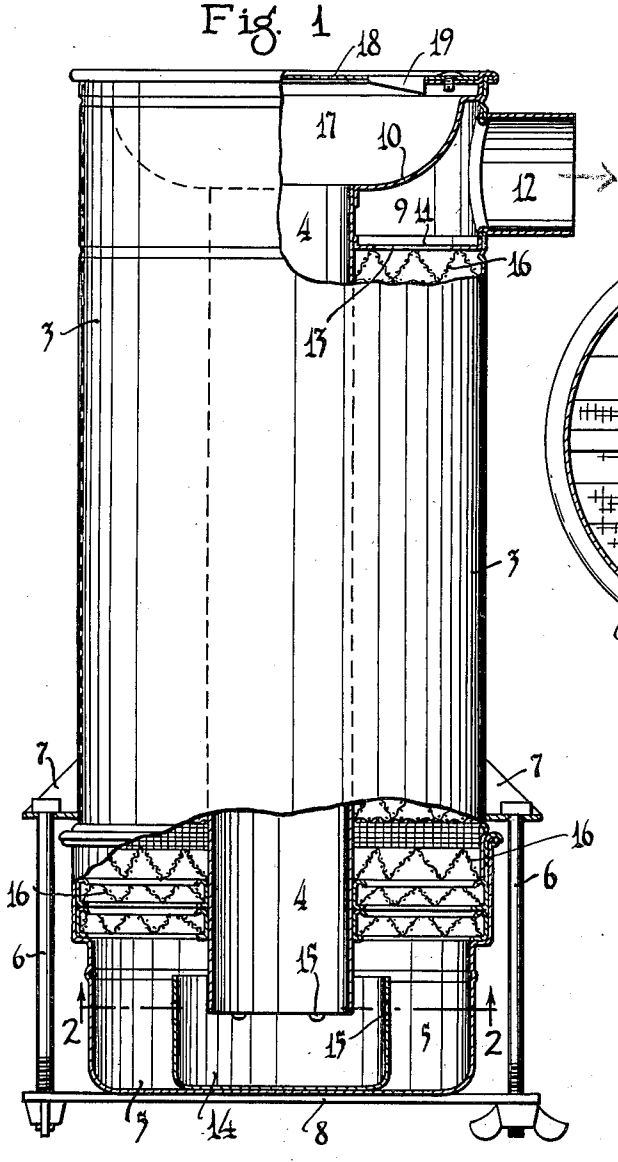
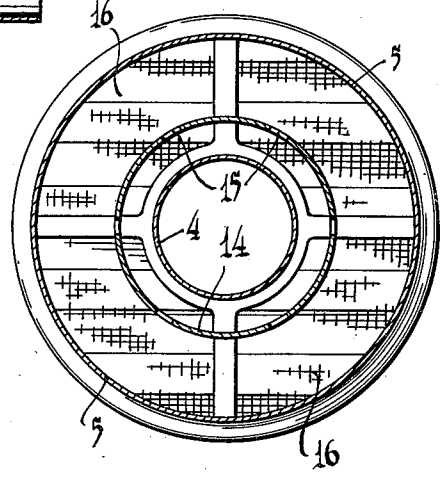


Fig. 2



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UNITED STATES PATENT OFFICE

2,069,889

AIR CLEANER

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9 Claims. (Cl. 183—15)

My present invention relates to air cleaners and is in the nature of an improvement on or modification of the air cleaner claimed in my pending applications, S. N. 702,482 and 702,483, filed of date December 15, 1933, which applications have matured into Patents 2,000,706, issued May 7, 1935, and 1,991,758, issued February 19, 1935, respectively. This invention relates particularly to an improvement in the oil well, oil cup and the disposition thereof in respect to the casing, air intake and screens of the air cleaner.

Generally stated, the invention consists of the novel devices, combination of devices and arrangement of parts hereinafter described and defined in the claims.

In the accompanying drawing, which illustrates the invention, like characters indicate like parts throughout the several views.

Referring to the drawing:

Fig. 1 is a view partly in side elevation and partly in vertical section showing an air cleaner involving my invention; and

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

As shown, the air cleaner involves an outer casing or shell that is preferably in the form of an upright cylinder 3, the lower end of which is primarily open. An axial air intake tube 4 extends downward through the casing 3. A large or main oil well 5 of cup-shaped form is telescoped onto the lower end of the casing 3 and closes the lower end of the latter.

As a means for securely but detachably holding the oil well telescoped onto the casing, nut-equipped bolts 6 are passed through lugs 7 on the casing and through the ends of a bar 8 that is applied to the bottom of the oil well. At the upper end of the casing is an air outlet chamber 9 that is formed between baffle plates 10 and 11. The upper baffle 10 is secured to the upper end of the inlet tube 4 and to the upper end of the casing. The lower baffle 11 is secured to the air tube 4 and to the casing 3 at a point considerably below a lateral air outlet passage 12, which latter is adapted and intended to be connected to the carburetor of an internal combustion engine. The lower baffle plate 11 constitutes the bottom of the outlet chamber 9 and is provided with an annular air passage 13.

Located within and secured with respect to the bottom of the oil well 5 is an upwardly opening oil containing cup shaped receptacle 14 that is of much less diameter than the oil well, of considerably greater diameter than the lower end of the intake tube 4 which extends therein in opposed relation to the bottom of said receptacle 14, and the upper edge of which is considerably above the plane of the lower edge of the air intake tube and approximately even with the normal oil level in said well, providing between the spaced walls of the inlet tube 4 and cup-shaped receptacle 14 a primary outlet passageway for air to the interior of said casing 3, and primary inlet for oil to said receptacle from said well 5, during certain operating conditions due to differences in pressures in said inlet tube 4 and outlet 12. This cup shaped receptacle 14 has as an important feature thereof circumferentially spaced ports or passages 15 in its vertical wall that are located approximately in the plane of the lower end of said air intake tube 4. The oil well will normally be filled with oil approximately to the level of the upper edge of said cup 14. The important action that takes place with the structure just noted will be more fully considered in the description of the operation.

Within the casing surrounding the air intake tube is an annular screen preferably made up of woven wire screen elements. These screen elements 16 may take various forms, but as shown, are of the type and arrangement disclosed and claimed in the application of Frank A. Donaldson, entitled "Air cleaner", filed of even date herewith.

An expanded air intake chamber 17 is, in the structure illustrated, formed at the upper end of the air intake 4 by an annular baffle 18 secured to the upper edge of the casing and provided with circumferentially spaced air ports 19 preferably of the arrangement disclosed and claimed in the pending application of Frank A. Donaldson, S. N. 722,458, filed of date April 26, 1934, which application has matured into Patent No. 1,992,025, issued February 19, 1935.

Operation

When the engine is in operation, partial vacuum will be produced in the air chamber 9 which drop in pressure in said casing above the body of oil in the well 5 causes air to rush downwardly through the air intake tube 4 and against or through the oil in the cup 14. By the inrush of air, the oil will be displaced and carried upward through the annular space between the lower end of the air tube and the rim of the cup, and from thence will be carried upward into the screen elements. The extent to which the air will carry the oil upward through the screen elements will, of course, depend largely upon the speed of the engine and the velocity of the air. Before the

oil reaches the uppermost screen element, however, it will be released from the air current and will flow back over and through the screens. In running down onto and through the screens, the oil will form films over the openings of the screens and through which the air must pass, so that all the dust carried by the air will be taken from the air and returned with the oil downward and back to the oil well.

At low engine speeds, when the air flow through the cleaner is intermittent or pulsatory, the oil cup 14 will be maintained only partially filled with oil as a large part thereof will be constantly displaced and carried into the screen chamber and oil well, thereby, building up the head of oil in the well above the upper edge of the oil cup. Under this pulsating action, at low engine speeds, oil will to a desired extent overflow the upper edge of the cup and will also be intermittently injected into the air stream within the partially filled cup through holes 15, due to back surges filled cup between suction impulses upon the body of oil in the well. The upper edge of the cup and openings 15 in the side wall thereof thus serving to maintain a regulated body of oil in the cup 14 and to supply oil to the air stream in regulated amounts, thereby materially increasing the efficiency of the cleaner at low engine speeds.

Under certain conditions it has been found that oil will cease to flow through the holes 15 into the cup when the engine is operated some place between three-fourths full load and full load, for example, and that for a period there will be substantially no movement of either air or oil through the holes 15, but that under further increased load, the pressure in the cup becomes so great that air passes outwardly through the holes 15 and bubbles up through the annular head of oil. This action has been found to be highly important for the reason that a point is reached near maximum engine speed or load where the air flow past the upper edge of the cup is at such great velocity and is so steady and the air pressure above the cup is so relatively great that the oil remains banked up in the head above and outward of the cup and practically ceases to overflow the upper edge of the cup. Now it will be obvious that in the absence of the holes 15 this failure of oil to enter the air stream by overflowing the cup under conditions encountered near maximum load would result in rapid starving of the intercepting screens *y* and great loss in air cleaning efficiency if operation near maximum engine load were continued for an extended period. However, when the holes 15 are provided the outward movement of air through the holes 15 does, in bubbling through the annular head of oil, raise some of the oil in the path of rapidly expanding air above and outward of the cup and this oil is delivered to the screens *y* in sufficient quantities to retain the efficiency of the cleaner during prolonged periods of engine operation near maximum load. There is little danger in getting an over supply of oil from this source due to the relatively small volume and low velocity of the air passed through the holes 15 and the relatively low velocity of the main air stream at the points where it intercepts the oil raised by air from the holes 15.

At high engine speeds, however, the movement of the air through the cleaner will be nearly continuous or non-pulsatory and the increased velocity and constancy of pressure will displace completely or substantially all of the oil in the cup 14, and thereafter the air stream will be supplied with oil which will continually overflow the upper edge of the cup 14 and due to a balancing of pressure in the cup and well the holes 15 in the cup 14 will then be substantially ineffective.

The point is that at low engine speeds, where most cleaners of the fluid type become relatively inefficient, oil is supplied to the air stream not only from over the upper edge of the cup 14 but through the openings 15 therein, thereby increasing materially the amount of oil supplied to the air stream at low speeds, with a resultant rate of increase in efficiency at low speeds; but at high speeds when cleaners of this general character are apt to supply so much oil to the air stream that some of the oil will be carried completely through the cleaner and into the engine, the holes 15 become substantially ineffective, thereby materially reducing the amount of oil fed to the air stream and the cup 14 serves to limit the amount of oil picked up by the air stream to an extent necessary to insure against the carrying over of the oil through the cleaner. The apertured cup 14 serves as a metering device to increase the amount of oil supplied to the air at low engine speeds and reduce the same at high engine speeds.

From the foregoing it is evident that the oil cup which is located within the oil well should not only be spaced from the delivery end of the air intake tube, but should be extended considerably above the plane of the lower edge of the latter and that the cup be provided in the side walls with perforations or oil passages located well above its bottom and below its upper edge. It has been found that the best results have been obtained by placing the said perforations substantially as shown or approximately in the plane of the lower end of the air intake tube. Obviously, certain modifications as to details of construction and arrangement of parts may be made within the scope of the invention herein disclosed and claimed.

The screens described afford the best known form of air impervious oil and dust-intercepting means.

What I claim is:

1. An air cleaner comprising a casing provided with an oil well 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-shaped receptacle supported in said oil well in spaced opposed relation to the discharge end of this air inlet and having its upper end surrounding the inner end portion of said inlet, whereby dust laden air in passing to said intercepting means over the upper edge of said receptacle will impinge upon and displace the body of oil in said receptacle, and metering openings in the side wall of said receptacle to control the flow of oil therethrough from the oil well to the air stream under operating conditions.

2. In an air cleaner, the combination with a casing having an outlet, an oil well in the base of said casing and an air intake tube leading into said well, a screen extending between said inlet and outlet above said oil well, and a partition wall supported within said oil well and arranged to provide an oil containing cup-shaped receptacle in opposed relation to the delivery end of said air intake tube and having its upper edge disposed above the normal oil level in said oil well, and oil and air controlling openings in the side wall of said receptacle below the normal oil level in said oil well.

3. In an air cleaner, the combination with a casing having an oil well and an axially disposed

air intake tube extending into said well, of a screen within said casing and surrounding said air intake tube above the oil level in said well, and said well including a cup-shaped receptacle the side walls of which are spaced from the walls of said well and from the discharge end portion of said air intake tube, whereby to provide a primary air passage between the discharge end portion of said inlet tube and the upper side wall portions of said receptacle communicating with said casing above the normal oil level within said well and a port extending through the side wall of said receptacle and establishing communication between the interior of said receptacle and said well below the normal oil level adapted under varying changes in pressure within said receptacle and casing to control the flow of oil to said receptacle and air to said well.

4. The structure defined in claim 3 in which the side walls of said receptacle are provided with a series of circumferentially spaced oil and air controlling ports arranged adjacent the discharge end of the air intake tube.

5. An air cleaner comprising a casing having an oil well, an air inlet and air outlet, said inlet and outlet being arranged respectively below and above the normal oil level in said well, dust and oil intercepting means located between said inlet and outlet in normal spaced relation to the body of oil in said well, partition walls arranged in the oil well of said casing to provide a cup-shaped chamber into which the discharge end of said air inlet extends, a primary air passageway formed by said partition wall approximately at the normal level of the body of oil in said well, and other passageways in said chamber in communication with said well below the oil level adapted under certain operating conditions in said inlet and outlet to supply oil to said chamber, and under other operating conditions to conduct inlet air from said chamber to said well.

6. In an air cleaner, the combination with a casing having an oil well at its bottom and an air intake tube leading into said well, of dust and oil intercepting means within said casing surrounding said air intake tube above said oil well, and an oil containing cup-shaped receptacle supported within said oil well spaced from the walls of said well and in opposed relation to the delivery end of said air intake tube, the side walls of said receptacle extending above the delivery end of the intake tube and being provided with air and oil controlling ports below its upper edge and above the bottom thereof.

7. In an air cleaner, the combination with a casing having an oil well in its bottom and an air intake tube leading into said well, dust and oil intercepting means within said casing above said oil well, and said oil well including partition walls defining a cup-shaped receptacle positioned in opposed spaced relation to the delivery end of said intake tube, the said walls of said receptacle being laterally spaced from the side walls of the well and delivery end of said intake tube and providing a primary air outlet from the delivery end of said tube to a point above the normal oil level in the well, said receptacle walls having metering ports intermediate its upper and lower ends to control the flow of oil to said receptacle and the discharge of air from said receptacle to said well under varying operating conditions within said casing.

8. An air cleaner comprising a casing provided with an oil well, an air outlet leading from the casing at a point upwardly spaced from said oil well, an upwardly opening receptacle provided by a partition wall located in said oil well, a downwardly directed air inlet passageway arranged to discharge into said receptacle, metering openings in the partition wall of said upwardly opening receptacle intermediate the upper and lower edges thereof, and an upwardly directed primary air passageway between the walls of said inlet passageway and receptacle in communication with the interior of the casing above the oil in the well, whereby said metering openings are rendered effective to control the supply of oil from the well to the air stream in said primary air passageway through displacement of oil in said receptacle below said metering openings by impingement of the air stream thereon.

9. In an air cleaner, a casing having an oil well, an air outlet from the casing, an air inlet passage opening into the oil well, an upwardly opening receptacle supported in said oil well in opposed relation to the discharge end of the air inlet passage and having its side walls spaced from the walls of the well and from the discharge portion of said air intake passage, whereby the dust-laden air stream in passing from the air inlet passage and over the upper edge of said receptacle will impinge upon and displace the body of oil in said receptacle, and metering openings in the side wall of said receptacle to control the supply of oil from the oil well to said air stream, under operating conditions.

WILFRED W. LOWTHER.