Dec. 17, 1946. J. B. SEBOK 2,412,753

AIR CLEANER

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Fig. 2.

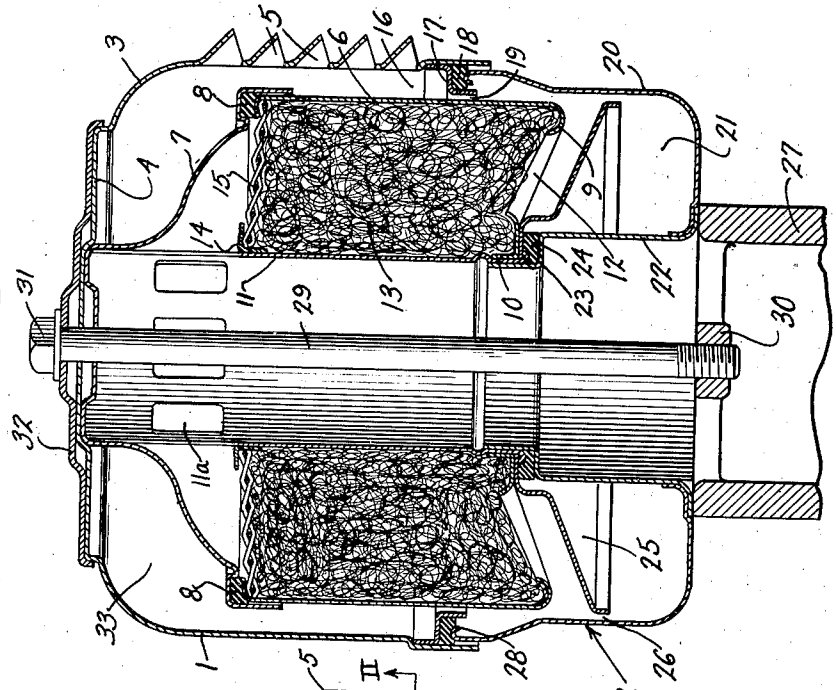
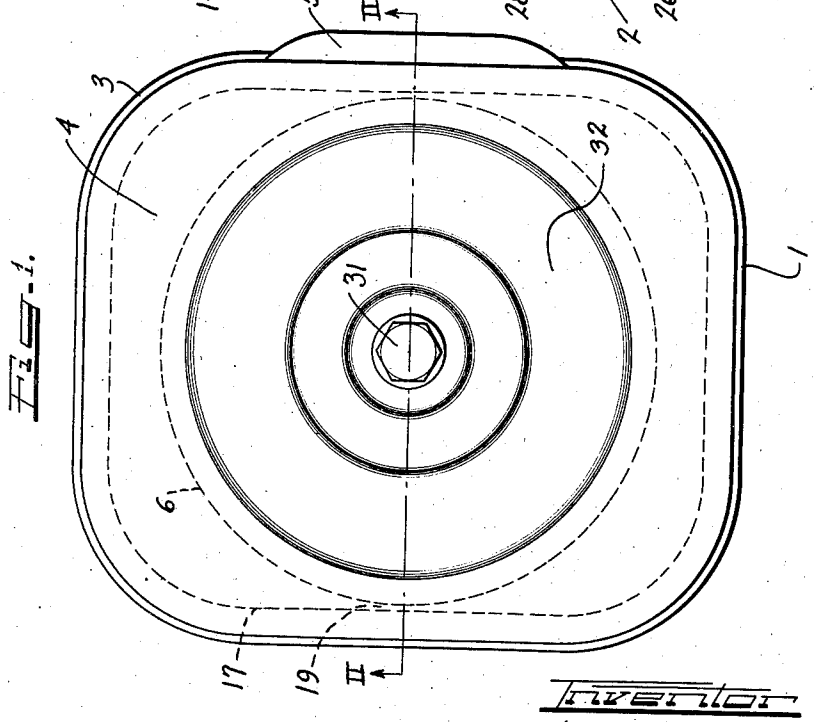


Fig. 1.



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AIR CLEANER

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5 Claims. (Cl. 183—15)

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This invention relates to improvements in air cleaners, and more particularly to air cleaners of the liquid bath type highly desirable for use in connection with internal combustion engines, especially engines associated with various types of vehicles, although the cleaner may have other uses and purposes as will be apparent to one skilled in the art.

More specifically, the air cleaner embodied in the instant invention is highly desirable for use in connection with motorcycles, although it will be apparent that it is equally adaptable for use on internal combustion engines associated with various other types of vehicles. For purposes of clarity, however, the invention will be described herein mainly in its relationship with a motorcycle.

Vehicles of the character of motorcycles frequently overturn during operation, especially when being driven over rough terrain as would occur, for example, during military maneuvers and operations. Liquid bath air cleaners have proven more efficient than other types, but when most of the liquid bath air cleaners of the type heretofore known have been used in conjunction with motorcycles and similar vehicles the overturning of the vehicle resulted in a loss of liquid from the air cleaner with the ensuing result that when the vehicle was again righted the air cleaner would not operate efficiently. Frequently, too, the motorcycle engine is in operation when the vehicle overturns and some of the misplaced cleansing liquid from the air cleaner would then be carried into the internal combustion engine, and in many instances the intake opening to the air cleaner became jammed with dirt by close proximity to or actual contact with the ground. Also, it is desirable to have a cleaner that may be serviced as economically and rapidly as possible without the aid of any special equipment carried for that particular purpose.

With the foregoing in mind, it is an important object of the instant invention to provide a liquid bath air cleaner, highly desirable for use in connection with motorcycles and similar vehicles, and so constructed that the air cleaner may be inverted or turned completely over without spilling cleansing liquid from the cleaner and with only a negligible amount of such cleansing liquid remaining within the filter medium within the cleaner.

Also an object of this invention is the provision of a liquid bath air cleaner, highly desirable for use in connection with motorcycles and similar vehicles, and which may be rolled

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with the motorcycle completely over sidewise without the loss of cleansing liquid.

A further object of the invention resides in the provision of a liquid bath air cleaner which may be tipped rearwardly to a greater extent or greater angle than it is possible for the vehicle with which the cleaner is associated to climb with a forward motion, all without the loss of any of the cleansing liquid.

Another object of the invention resides in the provision of a liquid bath air cleaner for an internal combustion engine, in which a single holding element not only attaches the cleaner to the engine or a part thereof, but also maintains the separable parts of the cleaner together in operative position.

Still another object of the invention is the provision of a liquid bath air cleaner highly desirable for use on motorcycles, and which is provided with a single inlet located in a sheltered position so that the inlet will always remain free and open regardless of the falling of the motorcycle.

A further feature of this invention resides in the provision of a liquid bath air cleaner having a partial baffle below a single inlet disposed at one side of the air cleaner to insure even distribution of incoming air to prevent turbulence caused by rush of air from one side only of the cleaner.

Still another object of the invention resides in providing a liquid bath air cleaner having an inlet passage of varying width within the cleaner, with the inlet opening being disposed above a narrower part of the intake passage to insure distribution of the air and prevent turbulence by a rush of air toward the liquid sump from one side only of the cleaner.

It is also a feature of the invention to provide a liquid bath air cleaner which is extremely economical and durable, and highly efficient in operation, and which cleaner may at the same time be dismantled and reassembled with very great facility.

While some of the more salient features, characteristics and advantages of the instant invention have been above pointed out, others will become apparent from the following disclosures, taken in conjunction with the accompanying drawing, in which:

Figure 1 is a top plan view of a liquid bath air cleaner embodying principles of the instant invention;

Figure 2 is a fragmentary vertical sectional view of the cleaner taken substantially as indi-

cated by the line II—II of Figure 1, looking in the direction of the arrows.

As shown on the drawing:

In the illustrated embodiment of this invention there is seen an air cleaner including a casing comprising a pair of separable sections, an upper section 1 and a lower section 2. The upper section and part of the lower section are of general rectangular shape, as can be seen best in Figure 1, with relatively widely rounded corners 3, such shaping adding to the ruggedness and durability of the casing construction. The upper casing section is preferably provided with an integral closed top 4 and the inlet to the cleaner is disposed centrally in one of the side walls of this upper casing section. As seen best in Figure 2, the inlet is in the form of a vertical series of louvered openings 5, the louver arrangement protecting the inlet openings against falling or flying debris and dirt.

Assuming, for purposes of illustration, that the cleaner is mounted upon a vehicle of the character of a motorcycle, the louvered inlet 5 is disposed toward the rear, the opposite wider wall of the casing being toward the front of the motorcycle. Thus, the inlet is in a sheltered position, and the forward wall, which is in line for dirt and debris thrown upwardly from the front wheel of the motorcycle, is entirely imperforate. This arrangement prevents undue plugging of the air cleaner due to clods of dirt and mud being hurled against it.

The upper casing section is provided interiorly with a cylindrical partition 6 which is free of the casing section and on which is seated an imperforate substantially dome-shaped cover 7 which is secured such as by spot welding or the equivalent to the top 4. The outer margin of this cover 7 is channeled to provide a seat for an annular gasket 8 which rests upon the inturned upper edge of the partition 6, the lower margin of the cover telescoping over the partition outside the gasket.

At the lower end thereof the inner partition 6 is turned inwardly as indicated at 9 with a smooth curve to lessen restriction and extends obliquely upward, terminating in a vertical flange 10 spot welded or equivalently secured to the lower end portion of a centrally disposed outlet conduit 11. In its under turned portion the partition 6 is provided with a series of enlarged apertures 12 each having an inwardly rolled margin to lessen restriction. This under portion of the partition functions as a support for a filter mass 13 which is disposed annularly around the center tube outlet 11 and which may be made of any suitable material such as a mass of wavy wire, cactus fibre, curled cattle-tail hair, or any other suitable filter medium. At an intermediate part of the center tube outlet 11 an annular bracket 14 is fixed in position, and beneath this bracket and under the inturned edge of the partition 6 is disposed an annular flat ring 15 of hardware cloth or the equivalent which holds the filter mass 13 in position at the top.

The outlet conduit 11 freely telescopes within the upper part of the dome cover 7 and extends to the top of the cleaner to give a solid support through the center of the cleaner. Within the cover 7 the conduit is provided with a plurality of openings 11a for the exit of cleaned air.

The outside wall of the partition 6 is, of course, imperforate and together with the inner wall of the upper casing section 1 defines a downwardly extending annular inlet passage 16 for incoming air. Near the lower end of the upper casing section 1 an annular Z-shaped bracket member 17 is secured to the inner wall to form a socket for a gasket 18 abutted by the upper edge of the lower casing section when the two sections are joined together in operative position, as seen more clearly in Figure 2. The bracket 17 is of uniform width entirely around the casing wall, and therefore it will more closely approach the partition 6 at the front and rear end walls of the casing than it will at the side walls of the casing, as is shown by the dotted lines in Figure 1. A relatively narrow passage 19 is thus provided between the bracket 17 and the partition 6, which passage is wider at the side walls than at the front and rear walls of the cleaner. Thus, incoming air descending through the passage 16, which of course will also be wider at the side walls than at the front and rear walls of the casing, will tend to spread more uniformly throughout the casing and not descend through the passage 19 at the rear end wall of the casing only. By this arrangement a more even distribution of air is obtained, and turbulenec resulting from the major portion of air attempting to pass through a narrow and restricted part of the air path is avoided, so that when incoming air ultimately reaches the sump containing the cleansing liquid it is relatively evenly distributed throughout the incoming air passage, and the operating efficiency of the cleaner as a whole is maintained at a very high level.

The lower casing section, which is of generally rectangular shape in the vicinity of its junction with the upper casing section, has a cylindrical bottom portion 20 which houses a liquid sump 21. A centrally disposed outlet conduit 22 is secured to the lower casing section and forms the inner wall of the liquid sump which, of course, will be annular around the outlet tube 22. The upper end of the tube 22 is stepped inwardly as indicated at 23 to form a seat for a gasket 24.

Extending partially into the liquid sump 21 is a downwardly and outwardly sloping baffle 25 the outer edge of which is spaced inwardly from the wall of the cylindrical part 20 of the lower section so as to leave a relatively narrow annular passage 26 through which sump liquid may be educed or aspirated by incoming air traveling over the upper face of the baffle. The baffle is annular, and the upper margin or portion of the baffle is engaged by an outwardly curved lower edge of the outlet tube 11, so that the baffle is firmly affixed to the outlet tube 11 and filter holding partition 6.

Thus, it will be seen that the cleaner includes three separable portions. The first of these portions is the lower casing section comprising the outlet tube portion 22, the gasket 24, and the wall portion 20 which together with the part 22 houses the liquid sump 21. The second removable portion includes the filter holding partition 6, the filter element 13, the outlet tube 11, and the baffle 25, all removable as a single unit. The third separable portion includes the upper casing section 1 for the gasket holding arrangement 17 and the gasket 18 at its lower end, the dome cover 7 together with its gasket 8, and an auxiliary outer reinforcing cover to be later described.

When the cleaner is assembled in operative position, the lower casing section is first seated upon an intake 27 to the carburetor of an internal combustion engine, or the manifold of a

motorcycle, or some other apparatus requiring a supply of clean air, as clearly seen in Figure 2.

The inner removable portion including the filter, baffle, and outlet conduit is then seated in position upon the gasket 24 with the outwardly turned lower edge of the outlet conduit later biting into the gasket, and the adjacent portion of the baffle resting on the gasket. The upper casing section is then placed in position with the gasket 8 carried by the inside dome cover 7 seating upon the upper edge of the filter holding partition 6, and the gasket 18 carried by the outer and lower portion of the upper section seating on the inwardly rolled upper edge 28 of the lower casing section.

The separable parts of the cleaner are then clamped together and the entire cleaner is held in position upon the intake 27 by a single fastening element. In the illustrated instance this fastening element is in the form of a bolt 29 extending entirely through the central composite outlet of the cleaner and the lower end of which is threaded into the central portion of a yoke 30 extending diametrically across the intake 27. The upper end of the bolt is headed as indicated at 31 and bears against an auxiliary top 32 attached to the closed top 4 of the upper section. The auxiliary top 32 is merely to enable the upper casing section to maintain the pressure from the tightening of the bolt without bending or other injury to the casing. When the bolt is anchored in position, it will be seen that the separable portions are held together by the bolt with air-tight joints at the gaskets 6, 18 and 24, and the entire cleaner is held in position upon the intake 27. It will be especially noted that when servicing of the cleaner is desired or necessary, it is a simple expedient to remove the bolt 29, no special tools otherwise than those customarily carried in a vehicle being necessary to accomplish this removal. Upon the removal of the bolt 29, the entire cleaner is not only free from the intake 27, but the two casing sections and separable interior parts of the cleaner are free for separation one from the other, so that no time or labor is wasted during the servicing of the cleaner, and the entire servicing and reassembly of the cleaner in position may be accomplished with very great facility.

In operation, the cleaner is highly efficient. The level of liquid placed in the sump 21 will customarily be substantially at the lowermost point of the partition 6 so that the incoming air path is sealed off at the bottom when operation begins. As soon as the internal combustion engine with which the cleaner is associated is started, incoming air will enter the louvered openings 5, pass downwardly through the inlet passage 16 and at the same time distribute itself substantially evenly throughout this passage in a lateral direction by virtue of the baffle flange formed by the bracket 17, and then contact the liquid in the sump. The initial rush of air will carry all of the liquid on top of the baffle 25 upwardly through the openings 12 into the filter mass. This liquid is sufficient to wet the lower portion of the filter mass and establish a circulation of the liquid in this lower portion. The commingling of the air and liquid removes a great part of the dirt carried by the incoming air, and the finer particles of dirt as well as entrained liquid are removed from the air by the upper portion of the filter mass, so that the air, substantially dry and clean, enters the space inside of the dome cover 7 and then descends through

the composite outlet tube into the intake 27 of the apparatus with which the cleaner is associated. As the liquid becomes heavy, due to the entrainment of dirt therein, it will fall out of the filter mass onto the baffle and gravitate over the upper surface of the baffle, passing back into the liquid sump through the passage 20 between the baffle and lower casing wall. While this is going on, incoming air passing over the upper face of the baffle is educing or aspirating sump liquid through the passage 26 over the upper face of the baffle and carrying some of it back into the filter mass. Obviously, as liquid is aspirated from the sump over the upper face of the baffle much of the dirt carried by the air will be removed and entrained by this liquid.

A particular feature of the instant invention resides in the fact that the cleaner may be inverted quickly in substantially any direction without loss of cleansing liquid and may be turned completely over in a sidewise direction without loss of cleansing liquid. It will be seen from Figure 2 that a considerable space 33 which is more than sufficient to hold all of the sump liquid when the cleaner is in inverted position is provided between the top of the upper casing section and the dome cover 7 therein. It will be seen that the louvered inlet openings 5 are disposed below the shoulder roll of the upper casing section so as not to interfere with the capacity of the space 33.

Now, if the cleaner is turned over sidewise, due to the falling of the motorcycle or other vehicle, liquid contained in the sump will gravitate through the passage 26 and upwardly through the air inlet passage 16 to the space 33. The baffle will prevent all but a negligible part of this liquid from entering the filter mass through the openings 12. The liquid normally entrained in the filter mass during operation should not be sufficient to gravitate entirely through the filter mass when upside down and thus enter the space inside the dome 7 and ultimately descend through the outlet for clean air. The outward extent of the annular angle member 14 prevents such passage of liquid to a material degree, since liquid within the filter mass will tend to hug the wall of the outlet tube 11. When the cleaner is again placed in upright position, the sump liquid from the space 33 will gravitate through the air inlet passage and the passage 26 around the outer edge of the baffle back into its proper position in the sump, and the cleaner is immediately ready for efficient operation.

It will also be noted that the cleaner may be inclined rearwardly to a considerable angle, usually in excess of 65°, before any of the sump liquid will tend to flow out of the lowermost inlet opening 5. A 65° angle is, of course, greater than a motorcycle or other vehicle will climb when in operation. Thus, it will be apparent that substantially regardless of what happens to the motorcycle or other vehicle during operation, as soon as the motorcycle or other vehicle is placed again in upright position the air cleaner is ready for efficient operation. It will also be noted that even though the engine of the motorcycle is running when the motorcycle falls over or turns upside down, there will be no more than a negligible pullover of cleansing liquid into the engine of the motorcycle, there will be no jamming or plugging of the air cleaner by virtue of the inlet coming in contact with the ground, and the filtering action will remain at a high degree of efficiency even though the motorcycle is lying down.

From the foregoing, it will be apparent that I have provided an economical and durable liquid bath air cleaner construction which is highly desirable and suitable for use in connection with motorcycles and similar vehicles. The air cleaner is so designed as to avoid turbulence of incoming air and yet maintain a relatively small inlet opening in a sheltered location. It is also apparent that the air cleaner may be extremely easily serviced and remounted in position, only one fastening element, requiring no special tools to manipulate, being utilized to join the separable parts of the cleaner and mount the entire cleaner in position upon the structure to be supplied with clean air.

It will, of course, be understood that various details of construction may be varied through a wide range without departing from the principles of this invention, and it is, therefore, not the purpose to limit the patent granted hereon otherwise than necessitated by the scope of the appended claims.

I claim as my invention:

1. In an air cleaner, a casing having a closed top and a liquid sump at the bottom, a filter holding partition in said casing and spaced from said casing to define a downwardly leading air path therebetween, a closed top on said partition shaped to define a chamber beneath the closed top of said casing and outside said partition equivalent in capacity to said liquid sump, and said casing having an inlet opening at one side below said chamber, said chamber receiving and retaining liquid from said sump in the event said chamber is inverted while in use.

2. In an air cleaner, a casing having a closed top and a liquid sump at the bottom, a filter holding partition in said casing and spaced from said casing to define a downwardly leading air path therebetween, a closed top on said partition shaped to define a chamber beneath the closed top of said casing and outside said partition equivalent in capacity to said liquid sump, and said casing having an inlet opening at one side below said chamber, said inlet opening being sufficiently high that the cleaner may be inclined toward said opening at an angle in excess of that capable of being climbed by a vehicle without sump liquid flowing out said opening.

3. In an air cleaner, a casing having a closed top and a liquid sump at the bottom, a filter holding partition in said casing and spaced from said casing to define a downwardly leading air path therebetween, a closed top on said partition shaped to define a chamber beneath the closed top of said casing and outside said partition equivalent in capacity to said liquid sump, and said casing having an inlet opening at one side below said chamber, and baffle means below said partition positioned to prevent discharge of liquid from said sump into the filter carried by said partition in the event the cleaner is overturned.

4. In an air cleaner, a casing having a closed top and a liquid sump at the bottom, a filter holding partition in said casing and spaced from said casing to define a downwardly leading air path therebetween, a closed top on said partition shaped to define a chamber beneath the closed top of said casing and outside said partition equivalent in capacity to said liquid sump, and said casing having an inlet opening at one side below said chamber, said casing being generally polygonal and said partition being cylindrical so said air path varies in width, and means projecting into said air path below said inlet to further narrow the path in this region to a capacity much less than the capacity of said inlet and cause a lateral distribution of incoming air in said path.

5. In an air cleaner, a casing having an inlet arrangement on one side only and shaped to provide a liquid sump in the bottom thereof, a tubular partition in said casing having an imperforate wall spaced from said casing to provide a downwardly leading air passage therebetween, the relative shaping of said casing and said partition being such that said passage varies in width, imperforate means extending into said passage in a manner to further narrow said passage, said inlet arrangement being above a narrower part of said passage and of much greater capacity than said narrower part to insure an even distribution of air through said passage, filter means in said partition, an imperforate cover over said filter means and said partition and shaped to define a space between itself and the top of said casing substantially equivalent in capacity to said sump, said casing having an outlet for clean air communicating with the interior of said cover, and said inlet arrangement being below said space to permit complete inverting of said cleaner without loss of sump liquid.

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