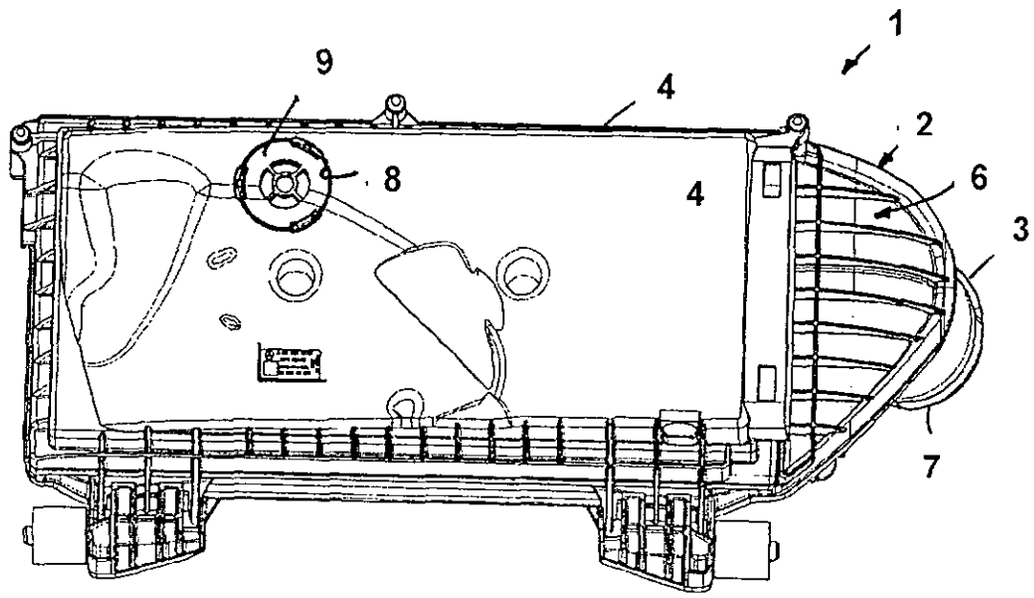
ABSTRACT

Title: Air Intake Filter for an Internal Combustion Engine

The invention relates to an air intake filter for internal combustion engines, comprising a filter element (5) received in a filter housing (2) to which air can be fed via a main intake opening (6). An air intake opening (8) is provided in the filter housing (2), wherein said air intake opening communicates with the raw side of the filter element (5) and is arranged spaced apart from the main intake opening (6).

To,
The Controller of Patents,
The Patent Office,
Mumbai

[Figure 2]



WE CLAIM:

1. Air intake filter for an internal combustion engine comprising a filter element (5) which is received in a filter housing (2) and to which air can be supplied through a main intake opening (6) in the filter housing (2), characterized in that an auxiliary intake opening (8) is provided in the filter housing (2) and communicates with the raw side of the filter element (2) and is arranged at a spacing to the main intake opening (6), wherein into the auxiliary intake opening (8) an insert part (9) is inserted, wherein the insert part (9) has a prefiltering function in that, for example, a screen or another filter element is inserted into the insert part.

2. Air intake filter according to claim 1, characterized in that the insert part (9) is embodied as a flow guiding part.

3. Air intake filter according to claim 1 or 2, characterized in that the insert part (9) is supported by a sealing element (12) on the raw side of the filter element (2).

4. Air intake filter according to one of the claims 1 to 3, characterized in that into the auxiliary intake opening (8) a prefiltering element is inserted.

5. Air intake filter according to one of the claims 1 to 4, characterized in that the auxiliary intake opening (8) is introduced into the same housing part of the filter housing (2) as the main intake opening (6).

6. Air intake filter according to one of the claims 1 to 5, characterized in that the main intake opening (6) is connected with an intake passage and the auxiliary intake opening (8) is arranged outside of the intake passage.

7. Air intake filter according to one of the claims 1 to 6, characterized in that the auxiliary intake opening (8) and the main intake opening (6) are provided on opposite sides in the filter housing (2).

8. Air intake filter according to one of the claims 1 to 7, characterized in that the auxiliary intake opening (8) relative to the mounted position of the air intake filter (1) is positioned at a higher location in the filter housing (2) than the main intake opening (6).

9. Air intake filter according to one of the claims 1 to 8, characterized in that a discharge opening (13) is provided in the filter housing (2) in the area of the raw air side of the filter element (5).

Dated this 21st day of February, 2013

HIRAL CHANDRAKANT JOSHI
AGENT FOR
MANN+HUMMEL GMBH

Technical Field

The invention concerns an air intake filter for an internal combustion engine according to the preamble of claim 1.

Prior Art

Air intake filters are used in the intake manifold of internal combustion engines in order to subject the sucked-in external air to a filtration before being introduced into the cylinders of the internal combustion engine. Air intake filters comprise a filter element that is received in a filter housing and through which the air to be filtered passes. The filter housing has an intake opening that is connected to the intake passage of the intake manifold.

When it rains heavily, there is in principle the risk of water breakthrough where water passes through the intake opening of the filter housing and through the filter element until it reaches the cylinders of the internal combustion engine. In case of water breakthrough, there is the risk of destruction of the engine.

Problems may also occur in winter when snow or ice closes the intake opening partially or completely so that no longer a sufficient intake air stream through the filter element is ensured.

It is the object of the present invention to configure with simple constructive measures an air intake filter for internal combustion engines in such a way that when it rains heavily as well as in winter conditions the risk of performance reduction or even destruction of the motor is reduced.

Summary of the Invention

This object is solved according to the invention with the features of claim 1. The dependent claims provide expedient further embodiments.

The air intake filter according to the invention is used in the intake manifold of internal combustion engines for filtering the sucked-in ambient air and comprises a filter element arranged in a filter housing and supplied with air by means of a main intake opening provided in the filter housing. In addition to the main intake opening, the filter housing is provided with an auxiliary intake opening that, like the main intake opening, is communicating with the raw side of the filter element and is arranged at a spacing to the main intake opening. The filter housing comprises therefore at least two intake openings by means of which air is supplied to the filter element. In the normal situation, the air supply takes place, at least predominantly, through the main intake opening; the auxiliary intake opening is either disabled, for example, is closed off by a check valve, or, as a result of an expediently smaller cross-section of the auxiliary intake opening, only a small partial air stream passes through this opening to the filter element.

When it rains heavily, the situation may occur that water passes to the main intake opening in the filter housing of the air intake filter through the intake manifold of the internal combustion engine so that the air supply via the main intake opening is interrupted. In this case, the pressure difference across the filter element increases suddenly; this is utilized for taking in combustion air through the auxiliary intake opening. In case that the auxiliary intake opening is locked by a valve, the valve is moved into the open position as a result of the pressure difference so that the auxiliary intake opening is released and air can flow to the filter element. Even when no valve is used in the auxiliary intake opening, the closure of the main intake opening and the resulting pressure change causes a strong suction effect of combustion air through the auxiliary intake opening that compensates thus at least partially the loss of intake action through the main intake opening.

The air supply through the auxiliary intake opening functions not only upon penetration of water into the intake manifold of the internal combustion engine but also in case of other difficult weather conditions, for example, upon penetration of snow and ice into the intake manifold and clogging of the main intake opening.

In order to ensure that the auxiliary intake opening does not also become clogged by water or snow or ice, the intake opening is preferably positioned at a significant spacing relative to the main intake opening to the filter housing. Expediently, the auxiliary intake opening relative to the regular mounting position of the air intake filter in the engine compartment of the vehicle is positioned at a higher location than the main intake opening so that the risk is also reduced that water can penetrate into the auxiliary intake opening. Moreover, it is advantageous to not supply the auxiliary intake opening via the same intake passage as the main intake opening with air but to arrange it outside of the intake manifold so that the auxiliary intake opening is supplied with air immediately from the engine compartment of the vehicle.

The filter housing of the air intake filter is comprised expediently of a basic housing and a cover to be placed thereon or a hood. The auxiliary intake opening is located preferably in the hood. Also, the main intake opening can be provided in the hood but at a spacing to the auxiliary intake opening.

In principle, it is however also possible to provide the main intake opening and the auxiliary intake opening in the basic housing of the filter housing. Moreover, it is possible to provide the main intake opening in the basic housing and the auxiliary intake opening in the hood, or in reverse.

The auxiliary intake opening is preferably arranged at the raw air side.

It is provided that in the auxiliary intake opening an insert part is inserted. The insert part serves, for example, for flow guiding; in this case the insert part is embodied as a flow guiding part. It may be expedient to provide by means of the insert part an air deflection of the air that is supplied through the auxiliary intake opening, for example, a deflection by 90 degrees.

The insert part takes on a prefiltering function in that, for example, a screen or another filter element is inserted into the insert part. In the case of a screen, the latter is advantageously comprised, like the insert part, of plastic material, for example, polyamide (PA). Also, a screen of plastic material fabric is suitable, for example, of PA. A screen or plastic material fabric has a prefiltering function but mainly serves for reducing hot air intake from the engine compartment.

According to yet another expedient embodiment, in the filter housing in the area of the raw air side of the filter element a discharge opening is provided by means of which water that has penetrated and has been coming in via the intake passage can be discharged from the filter housing. Into the discharge opening an insert part can also be inserted that is optionally provided with a filter element, for example, a screen, in order to make difficult an air supply through the discharge opening, and that, in case that air is still sucked in via the discharge opening takes, on a prefiltering function. The discharge opening is located expediently at a low location in the filter housing relative to the regular mounting position of the air intake filter in the engine compartment of the vehicle.

Brief Description of the Drawings

Further advantages and expedient embodiments can be taken from the further claims, the figure description, and the drawings.

It is shown in:

Fig. 1 an air intake filter in a perspective illustration;

Fig. 2 an air intake filter in a side view;

Fig. 3 a view of the inner side of a hood of the air intake filter;

Fig. 4 the air intake filter in a section view with an insert part in an auxiliary intake opening which is introduced in the hood;

Fig. 5 in an enlarged illustration the insert part in the auxiliary intake opening in the hood;

Fig. 6 the insert part in a perspective view;

Fig. 7 in an enlarged illustration a discharge opening with an insert part in the hood of the filter housing;

Fig. 8 the insert part which is to be inserted into the discharge opening in a perspective view;

Fig. 9 a filter housing of an air intake filter in a further illustration, comprising a main intake opening and an oppositely positioned auxiliary intake opening;

Fig. 10 the filter housing according to Fig. 9 in a further perspective illustration;

Fig. 11 a complete air intake filter with a filter housing according to Figs. 9 and 10;

Figs. 12, 13 different views of the filter housing with an insert part that is inserted into the auxiliary intake opening;

Fig. 14 the insert part in perspective view;

Fig. 15 the insert part in plan view.

In the Figures, same components are provided with the same reference characters.

Embodiments of the Invention

In the Figures 1 to 8, a first embodiment of an air intake filter for an internal combustion engine is illustrated. As can be seen in Fig. 1, the air intake filter 1 comprises a filter housing 2 which is of a two-part configuration with a basic housing 3 and a hood 4 as well as a filter element 5 received in the basic housing 3 through which the combustion air to be filtered passes. The hood 4 to be placed onto the basic housing 3 forms a cover and is provided with a main intake opening 6 through which the unfiltered combustion air is passed into the interior of the filter housing 2 and guided to the raw side of the filter element 5. After passing through

the filter element 5, the purified air is then discharged through discharge socket 7 in the direction of the internal combustion engine.

As can be seen in the side view of the air intake filter 1 according to Fig. 2, at a lateral spacing to the main intake opening 6 an auxiliary intake opening 8 is provided in the hood 4 of the filter housing 2. An insert part 9 is inserted into the auxiliary intake opening 8 and is assigned an air guiding and filtering function. The main intake opening 6 is positioned with the discharge socket in a first plane that is perpendicular to a second plane in which at least approximately the outer wall side of the hood 4 with the main intake opening 6 and the auxiliary intake opening 8 is located.

The auxiliary intake opening 8 has a significant spacing relative to the main intake opening 6 as well as to the discharge socket 7. In the mounted position, the auxiliary intake opening 8 is positioned at a high location of the filter housing so that it is ensured that penetrating water or snow or ice which may cause clogging of the main intake opening 6 does not also clog the auxiliary intake opening 8. The main intake opening 6 opens either immediately into the engine compartment of the vehicle in which the air intake filter 1 is installed or is supplied by means of an intake passage in the engine compartment with combustion air wherein in this case the auxiliary intake opening 8 is positioned outside of this intake passage so that air out of the engine compartment can flow in through the auxiliary intake opening 8.

As shown in Fig. 3 in connection with the enlarged illustration according to Fig. 5, on the inner side of the hood 4 a plurality of reinforcement ribs 10 are provided. The insert part 9 is preferably inserted from the interior into the auxiliary intake opening 8 in the hood 4. As shown in Figures 3 to 6, the insert part 9 has a ring shape and has a central cutout through which the auxiliary air can flow into the interior of the filter housing to the raw side of the filter element. A support part 11 is inserted into the central cutout in the insert part 9. The support part 11 is provided with a central support ring and radially extending webs. It has a prefiltering function and prevents

that coarse dirt or snow and ice can pass via the auxiliary intake opening 8 into the interior of the air intake filter. In addition, in the central cutout of the insert part 9 a screen can be inserted, for example, a screen of plastic material fabric. The support part 11 serves in a further function as a support grid for a screen, for example, of PA fabric. The support part 11 can be formed monolithically with the hood 4.

As shown in Fig. 4, the insert part 9 is supported by means of an annular sealing element 12 on the raw side of the filter element 5. The sealing element 12 ensures that water or snow or ice introduced through the main intake opening cannot reach the area of inflow at the raw air side with which the auxiliary intake opening 8 communicates. The ring-shaped sealing element 12 is inserted into an annular groove at the end face of the insert part 9. For an application only as a protection against water, an embodiment without seal is suitable.

As shown in Figures 7 and 8, the hood 4, in the area of the lowermost location relative to the regular mounting position in the engine compartment, can be provided with a discharge opening 13 into which an insert part 14 is inserted. Through the discharge opening 13 water that has penetrated into the filter housing in the area of the raw air side is discharged again. The insert part 14 has a central cutout into which, similar to the insert part 9 that is inserted into the auxiliary intake opening, a sealing screen can be inserted.

In Figures 9 to 15, a second embodiment is illustrated. In the box-shaped basic housing 3 into which the filter element is insertable, the main intake opening 6 as well as the auxiliary intake opening 8 are provided. The main intake opening 6 is positioned at a lateral passage of the box-shaped basic housing 3; the auxiliary intake opening 8 is positioned opposite the main intake opening 6; the two intake openings 6 and 8 are located at or in immediately vicinity of the narrow sides of the basic housing 3. Auxiliary intake opening 8 is located at the bottom side of the base housing 3 that is facing away from the open side.

In the assembled position, as shown in Fig. 11, the hood 4 is placed onto the basic housing 3 and is connected to the basic housing 3 and together with the basic housing forms the filter housing 2. The discharge socket 7 by means of which the filtered combustion air is discharged in the direction toward the internal combustion engine is provided in the hood 4.

As can be seen in Figures 12 and 13 in combination with Figures 14 and 15, the auxiliary intake opening 8 has inserted therein an insert part 9 of plastic material which is provided in the area of the auxiliary intake opening 8 with a monolithically formed support part 11 in the form of a cross. The cutout in the insert part 9 which corresponds with the auxiliary intake opening 8 can be covered by a screen.

The insert part 9 effects a flow deflection by 90 degrees. The combustion air is supplied from the exterior through the flow opening in the insert part 9 in which the cross-shaped support part 11 is inserted. The cross-shaped support part 11 is provided for protecting the screen fabric against mechanical damage from the exterior. In the flow direction, a housing part in a pyramid shape adjoins which is open in the upward direction, wherein the open side is positioned at an angle of 90 degrees relative to the inflow side of the insert part 9. In the mounted state (Figs. 12, 13), the open side of the insert part 9 is facing the interior of the box-shaped basic housing 3 so that the incoming combustion air flowing in through the auxiliary intake opening 8 is introduced via the inflow side of the insert part 9 and subsequently is deflected in the insert part by 90 degrees and guided into the interior of the basic housing 3.

WE CLAIM:

1. Air intake filter for an internal combustion engine comprising a filter element (5) which is received in a filter housing (2) and to which air can be supplied through a main intake opening (6) in the filter housing (2), characterized in that an auxiliary intake opening (8) is provided in the filter housing (2) and communicates with the raw side of the filter element (2) and is arranged at a spacing to the main intake opening (6), wherein into the auxiliary intake opening (8) an insert part (9) is inserted, wherein the insert part (9) has a prefiltering function in that, for example, a screen or another filter element is inserted into the insert part.

2. Air intake filter according to claim 1, characterized in that the insert part (9) is embodied as a flow guiding part.

3. Air intake filter according to claim 1 or 2, characterized in that the insert part (9) is supported by a sealing element (12) on the raw side of the filter element (2).

4. Air intake filter according to one of the claims 1 to 3, characterized in that into the auxiliary intake opening (8) a prefiltering element is inserted.

5. Air intake filter according to one of the claims 1 to 4, characterized in that the auxiliary intake opening (8) is introduced into the same housing part of the filter housing (2) as the main intake opening (6).

6. Air intake filter according to one of the claims 1 to 5, characterized in that the main intake opening (6) is connected with an intake passage and the auxiliary intake opening (8) is arranged outside of the intake passage.

7. Air intake filter according to one of the claims 1 to 6, characterized in that the auxiliary intake opening (8) and the main intake opening (6) are provided on opposite sides in the filter housing (2).

8. Air intake filter according to one of the claims 1 to 7, characterized in that the auxiliary intake opening (8) relative to the mounted position of the air intake filter (1) is positioned at a higher location in the filter housing (2) than the main intake opening (6).

9. Air intake filter according to one of the claims 1 to 8, characterized in that a discharge opening (13) is provided in the filter housing (2) in the area of the raw air side of the filter element (5).

Dated this 21st day of February, 2013

HIRAL CHANDRAKANT JOSHI
AGENT FOR
MANN+HUMMEL GMBH