[0037] FIGS. 2B, 2C. 2D, and 2E show side cross sections through the lines 2B-2B, 2C-2C, 2D-2D, and 2E-2E respectively in FIG. 2A.

[0038] FIGS. 3A and 3B show front and side views of a filter assembly of the filter modules in use.

[0039] FIG. 4A shows an alternate front view of a filter module.

[0040] FIGS. 4B and 4C show side cross sections through the lines 4B-4B and 4C-4C respectively in FIG. 4A.

[0041] FIG. 4D shows a side view through the lines 4D-4D in FIG. 4A.

[0042] FIGS 5A and 5B show an alternate side view of the view of FIG. 4D.

[0043] FIGS. 6A, 6B, 6C, and 6D show an alternative filter media.

[0044] FIG. 6E shows yet an alternate filter media arrangement.

[0045] FIGS. 7A, 7B, 7C, 7D, and 7E show another alternative filter module.

[0046] FIGS. 8A and 8B show a filter housing.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0047] FILTER MEDIA MODULE

[0048] As shown in FIGS. 2A-2E, 3A and 3B, 4A-4D, 5A, 5B, an air filter module 200, 400, may be removably placed within in an air filter system 300 (generally called “air filter” herein) that itself may be removably placed within an air duct or passage 90 to filter air passing therethrough. In order to maximize the filter media 214, 414 exposure to the air flow to be filtered, and to minimize pressure drop, a filter module 200, 400 may be angled to the air flow, with it being appreciated that the shortest path for air flow from a front of the filter module (facing the air flow) to the back of the filter module is defined as the thickness 213 through the cross sectional line 2B, 2C, 2D, 2E - 2B, 2C, 2D, 2E, which contrasts with the longer channel air flow path lengths through the channels as described throughout this application.

[0049] For example, channels 212, 212a, 412, 412a through the filter module 200, 400 may be oriented parallel to the air flow to minimize pressure drop through the filter module 200, 400 and increase path length of air flow (and media 214 exposure to the air flow). In the parallel channel arrangement, the possible path length is defined within the area within the channel 212 exposed to filter media 214

CLAIMS

[CLAIM 1] A filter media module for use in an air filter to filter contaminants comprising:

a filter frame; and

a filter media removably mounted within the filter frame and defining a thickness of the filter media, wherein the filter media comprises channels therethrough,

wherein the channels are defined by spacers, wherein the channels and the spacers are shaped in predetermined arrangements, wherein the channels define a channel path length that is longer than the thickness of the filter media, wherein the channels extend through the thickness of the filter media, wherein the filter media comprises more than two layers of filter media, wherein the more than two layers of filter media are separated by the spacers, and wherein the more than two layers of filter media are parallel to each other.

[CLAIM 2] The filter media module for use in the air filter of claim 1, wherein the spacers have a circular shape.

[CLAIM 3] The filter media module for use in the air filter of claim 1, wherein the spacers have an elongated shape.

[CLAIM 4] The filter media module for use in the air filter of claim 1, wherein the spacers are an adhesive.

[CLAIM 5] The filter media module for use in the air filter of claim 4, wherein the adhesive connects the more than two layers of filter media.

[CLAIM 6] The filter media module for use in the air filter of claim 4, wherein the adhesive does not emanate VOCs.

[CLAIM 7] The filter media module for use in the air filter of claim 1, wherein the spacers between the more than two layers of the filter media form the channels.

[CLAIM 8] The filter media module for use in the air filter of claim 1, wherein the filter media comprises an activated carbon material.

[CLAIM 9] The filter media module for use in the air filter of claim 8, wherein the activated carbon material comprises carbon granules or powder that is located between nonwoven media.

[CLAIM 10] The filter media module for use in the air filter of claim 1, wherein the more than two filter media layers are stacked horizontally.

[CLAIM 11] The filter media module for use in the air filter of claim 1, wherein the more than two filter media layers are stacked vertically.

[CLAIM 12] The filter media module for use in the air filter of claim 1, wherein the filter media is angled to a direction of airflow at an angle of 18-21 degrees.

[CLAIM 13] The filter media module for use in the air filter of claim 1, wherein the filter media comprises a pleated filter material.

[CLAIM 14] The filter media module for use in the air filter of claim 1, wherein the channels are entirely oriented parallel to airflow.

[CLAIM 15] The filter media module for use in the air filter of claim 1, wherein the channels are oriented such that they terminate before a trailing end of the filter media module.

[CLAIM 16] The filter media module for use in the air filter of claim 1, wherein the channels are partially oriented at an angle to airflow.

[CLAIM 17] The filter media module for use in the air filter of claim 1, wherein the spacers define the bottom and tops of the channels and also space apart the more than two layers of filter media.

[CLAIM 18] The filter media module for use in the air filter of claim 1, wherein the spacers are circular beads formed in parallel rows.

[CLAIM 19] The filter media module for use in the air filter of claim 1, wherein the channels are shaped in parallel arrangements.