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Air filter unit for an industrial vehicle.

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Description

This invention relates to an air filter for an industrial vehicle.

Industrial vehicles are known to normally comprise a filter unit for the engine intake air consisting of a filter chamber housing a porous means for separating the particles suspended in the air, and means for pretreating the air upstream of the filter chamber to separate water and coarse particles from the air. These pretreatment means generally comprise a vertical intake pipe or "snorkel" provided with an upper air inlet at a large distance from the ground, and means for separating water and powdery particles, such as cyclones and the like.

A filter unit known from the document FR-A-2 605 271 is provided with a plurality of cyclones each one including a set of inclined radial leafs to cause an helicoidal movement of the air. The cyclones are arranged in a pretreatment chamber, which is positioned side-by-side with a filter chamber and communicates therewith.

Another filter unit known from the document FR-A-2 599 272 is provided with an inner filter chamber coaxial with an outer pretreatment chamber, this latter being divided in two portions by a coaxial annular wall for reducing the acoustic waves. Two different centrifugal units formed of a plurality of helicoidal leafs are provided upstream and downstream of this wall to centrifuge the air.

These known filter units have certain drawbacks. Firstly, they result in substantial pressure drop in the intake air, resulting in higher fuel consumption and a more smoky engine; they are also rather bulky and costly.

The object of the present invention is to provide an air filter unit for an industrial vehicle which is free of the aforesaid drawbacks of known units.

Said object is attained according to the present invention by an air filter unit for an industrial vehicle, of the type comprising an outer casing defining a pretreatment chamber provided with an upper inlet port and with interception and channeling means arranged substantially to separate the water from the intake air, and a filter chamber housing a hollow cylindrical filter and provided with an upper outlet port communicating with a central cavity of said filter, said pretreatment and filter chambers communicating with each other through a first aperture, said interception and channeling means comprising a first partition disposed vertically inside said pretreatment chamber and defining therein a first compartment communicating with said inlet port and a second compartment communicating with said first aperture, said first and second compartments communicating to each other through another aperture formed between the lower edge of said first partition and a lower wall of said pretreatment chamber, characterised in

that said filter chamber is positioned externally to and side-by-side with said pretreatment chamber, said first aperture being provided in a wall of said pretreatment chamber facing said filter chamber; and in that said interception and channeling means also comprise a second partition extending from said facing wall below said first aperture to the interior of said second compartment.

The present invention will be more apparent from the detailed description of a preferred embodiment thereof given hereinafter by way of non-limiting example with reference to the accompanying drawing, which is an elevation view thereof shown in partial section.

In the accompanying drawing, the reference numeral 1 indicates an air filter unit for an industrial vehicle.

The unit 1 comprises an outer casing 2 constructed in several parts conveniently of pressed sheet metal or moulded plastics, to define overall a pretreatment chamber 3 and a filter chamber 4 which are disposed side-by-side and communicate with each other. In particular, the chamber 4 is substantially of barrel shape, whereas the chamber 3 is of parallelepiped shape with a height less than the chamber 4, and is bounded laterally by three substantially flat walls 5 and by a concave wall 6 which substantially reproduces the profile of a portion 7 of a lateral wall of the chamber 4, which it faces.

From the upper wall 8 of the casing 2 there branch, both in a horizontal direction, an air intake pipe stub 9, and an air delivery pipe stub 10 to be connected to the engine feed pipe.

The intake pipe stub 9 communicates with a zone of the chamber 3 which is external to the chamber 4 and has its mouth cross-section of elongated form in a horizontal and downwardly inclined direction. The delivery pipe stub 10 communicates through a circular aperture 15 with a central zone of the filter chamber 4 which houses a hollow cylindrical filter 16 of conventional type. Said filter 16 therefore defines an axial duct 17 which faces the aperture 15.

The chambers 3 and 4 communicate with each other through a horizontal oblong aperture 18 provided in proximity to the upper wall 8.

According to the present invention, the chamber 3 is divided transversely by a partition 19 which extends downwards from the upper wall 8 of the chamber 3, which is therefore divided into a first compartment 20 communicating with the intake pipe stub 9 and a second compartment 21 communicating with the aperture 18. The partition 19 is provided with a lower rounded edge 24 having a cross-section shaped substantially as a droplet inclined towards the compartment 21, to define with the lower wall 25 of the chamber 3 an aperture 26 giving communication between the first compartment 20 and the second compartment 21.

Within the aperture 18 there is fixed a hollow pipe stub 27 of corresponding section, which projects into the second compartment 21 and terminates with an outwardly rounded edge 28.

From the wall 6 of the chamber 3, below the pipe stub 27, there projects a downwardly inclined flow breaker partition 29 which projects into the compartment 21 for a length slightly greater than the pipe stub 27.

In proximity to the opposing side ends of the lower wall 25 of the chamber 3 there are disposed two bleed valves 30 of known type, of which only one is partly visible in Figure 1.

Finally, a projection 33 forming a drip ledge described hereinafter projects into the compartment 21 from the upper wall 8 of the casing 2.

The operation of the unit 1 is as follows. Air enters the unit 1 through the intake port 14 of the pipe stub 9 and passes into the compartment 20 of the chamber 3. The purpose of the vertical partition 19 is to prevent any direct entry of water into the chamber 4 and to determine, within the chamber 3, a U-shaped path (compartment 20 - aperture 26 - compartment 21) which is able to separate the water droplets by centrifugal action onto the lower wall 25 of the chamber 3.

The purpose of the lower rounded edge 24 is to reduce the local pressure drop caused by breaking up the fluid flow. The air then passes into the compartment 21, and most of the droplets which remain after the centrifugal action are entrained upwards by the fluid flow along the wall 6. These droplets are then intercepted by the flow breaker partition 29, from which they precipitate onto the bottom wall 25. The air, now almost free of water, proceeds upwards passing beyond the flow breaker wall 29. Any minute droplets still present in suspension tend to concentrate on the upper wall 8, again by centrifugal effect, and to run along it to the drip ledge 33, which concentrates them into droplets of larger mass so that they fall by gravity.

The rounded edge 28 of the pipe stub 27 has the double purpose of reducing pressure drop through the mouth and to form a collection channel for conveying downwards by gravity the water which adheres to the outer walls of the pipe stub 27, including by the effect of the drip ledge 33. The substantially "dry" air then passes through the pipe stub 27 and into the chamber 4 in which it is filtered by the filter 16, which retains the suspended impurities, after which it flows through the duct 17 and pipe stub 10 to the vehicle engine.

The water which collects on the base wall 25 of the chamber 3 is evacuated through the valves 30, provided for this purpose in the regions of low suction.

The advantages of the unit 1 constructed in accordance with the present invention are apparent from an examination of its characteristics.

Firstly, the shape and arrangement of the inter-

nal elements of the chamber 3 (vertical partition 19, flow breaker partition 29, pipe stub 27, drip ledge 33) ensure almost total separation of the water or mud before the proper filtration. This means that the filter clogging problems are eliminated and that the snorkel can be dispensed with. Said effects combined with particular expedients in the construction of the elements (edge 24 of the partition 19, edge 28 of the pipe stub 27) result in considerable overall reduction of the intake pressure drop.

The partitions 29 and 19, conveniently dimensioned in relation to the dimensions of the chamber 3, provide an effective silencing of the engine intake noise.

Further advantages are the constructional simplicity and reduced overall cost of the filter unit.

Finally, it is apparent that modifications can be made to the unit 1 which do not leave the scope of protection of the present invention. For example, a partition can be placed in the chamber 4 between the pipe stub 27 and that portion of the filter 16 facing it, to prevent rapid clogging of that zone. In addition, the unit 1 can comprise a conventional snorkel either in place of the intake pipe stub 9 or connected to it.

Claims

1. An air filter unit for an industrial vehicle, of the type comprising an outer casing (2) defining a pretreatment chamber (3) provided with an upper inlet port (9) and with interception and channeling means (19, 29) arranged substantially to separate the water from the intake air, and a filter chamber (4) housing a hollow cylindrical filter (16) and provided with an upper outlet port (10) communicating with a central cavity (17) of said filter (16), said pretreatment and filter chambers (3, 4) communicating with each other through a first aperture (18), said interception and channeling means (19, 29) comprising a first partition (19) disposed vertically inside said pretreatment chamber (3) and defining therein a first compartment (20) communicating with said inlet port (9) and a second compartment (21) communicating with said first aperture (18), said first and second compartments (20, 21) communicating to each other through another aperture (26) formed between the lower edge (24) of said first partition (19) and a lower wall (25) of said pretreatment chamber (3), characterised in that said filter chamber (4) is positioned externally to and side-by-side with said pretreatment chamber (3), said first aperture (18) being provided in a wall (6) of said pretreatment chamber (3) facing said filter chamber (4); and in that said interception and channeling means (19, 29) also comprise a second partition (29) extending from said facing wall

(6) below said first aperture (18) to the interior of said second compartment (21).

2. A unit as claimed in claim 1, characterized in that said second partition (29) is inclined from said facing wall (6) downwards into said second compartment (21). 5
3. A unit as claimed in claim 1 or 2, characterized in that said lower edge (24) of said first partition (19) is rounded. 10
4. A unit as claimed in any one of the preceding claims, characterised in that said lower edge (24) of said first panel (19) has a cross-section shaped substantially as a droplet inclined towards said second compartment (21). 15
5. A unit as claimed in any one of the preceding claims, characterised by comprising a pipe stub (27) fixed to the interior of said communication aperture (18) between said chambers (3, 4) and projecting into said second compartment (21) of said pretreatment chamber (3). 20
6. A unit as claimed in claim 5, characterised in that that end of said pipe stub (27) which projects into said second compartment (21) has its edge (28) rounded outwards. 25
7. A unit as claimed in one of the preceding claims, characterised by comprising a drip ledge (33) consisting of a projection extending downwards from the upper wall (8) of said casing (2) and into said second compartment (21) of said pretreatment chamber (3). 30
8. A unit as claimed in claim 7, characterised in that said drip ledge (33) is disposed vertically above said pipe stub (27). 40
9. A unit as claimed in any one of the preceding claims, characterised by comprising discharge valves (30) disposed in proximity to opposing lower ends of said pretreatment chamber (3). 45

Patentansprüche

1. Luftfilter-Einheit für ein Arbeitsfahrzeug, mit einem äußeren Gehäuse (2), das eine Vorbehandlungskammer (3) bildet, die mit einem oberen Einlaß (9) sowie Abscheide- und Kanalisierungseinrichtungen (19,29) versehen ist, die im wesentlichen zum Abtrennen des Wassers von der Eintrittsluft vorgesehen sind, und einer Filterkammer (4), die einen hohlen, zylindrischen Filter (16) aufnimmt und mit einem oberen Auslaß (10) verse-

hen ist, der mit einem zentralen Hohlraum (17) des Filters (16) in Verbindung steht, welche Vorbehandlungs- und Filterkammern (3,4) miteinander durch eine erste Öffnung (18) verbunden sind, welche Abscheide- und Kanalisierungseinrichtungen (19,29) eine erste Trennwand (19) umfassen, die senkrecht innerhalb der Vorbehandlungskammer (3) angeordnet ist und in dieser einen ersten Raum (20) bildet, der mit dem Einlaß (9) in Verbindung steht, sowie einen zweiten Raum (21), der mit der ersten Öffnung (18) verbunden ist, welche ersten und zweiten Räume (20,21) miteinander durch eine weitere Öffnung (26) in Verbindung stehen, die zwischen der unteren Kante (24) der ersten Trennwand (19) und einer unteren Wand (25) der Vorbehandlungskammer gebildet ist, dadurch **gekennzeichnet**, daß die Filterkammer (4) außerhalb der und seitlich neben der Vorbehandlungskammer (3) angeordnet ist, daß die erste Öffnung (18) in einer Wand (6) der Vorbehandlungskammer (3) auf der der Filterkammer (4) zugewandten Seite ausgebildet ist, und daß die Abscheide- und Kanalisierungseinrichtungen (19,29) eine zweite Trennwand (29) umfassen, die sich von der der Filterkammer zugewandten Wand (6) unterhalb der ersten Öffnung (18) in das Innere des zweiten Raumes (21) erstreckt.

2. Einheit nach Anspruch 1, dadurch **gekennzeichnet**, daß sich die zweite Trennwand (29) von der der Filterkammer zugewandten Wand (6) aus abwärts geneigt in den zweiten Raum (21) erstreckt.
3. Einheit nach Anspruch 1 oder 2, dadurch **gekennzeichnet**, daß die untere Kante (24) der ersten Trennwand (19) abgerundet ist.
4. Einheit nach einem der vorhergehenden Ansprüche, dadurch **gekennzeichnet**, daß die untere Kante (24) der ersten Trennwand (19) einen Querschnitt aufweist, der im wesentlichen tropfenförmig ausgebildet und in den zweiten Raum (21) geneigt ist.
5. Einheit nach einem der vorhergehenden Ansprüche, dadurch **gekennzeichnet**, daß ein Rohrstutzen (27) im Inneren der Verbindungs-Öffnung (18) zwischen den Kammer (3,4) befestigt ist und in den zweiten Raum (21) der Vorbehandlungskammer (3) hineinragt.
6. Einheit nach Anspruch 5, dadurch **gekennzeichnet**, daß das Ende des Rohrstutzens (27), das in den zweiten Raum (21) hineinragt, einen nach außen gerundeten Rand (28) aufweist.
7. Einheit nach einem der vorhergehenden Ansprü-

che, **gekennzeichnet**, durch eine Tropfleiste (33), die aus einem Vorsprung besteht, der sich nach unten von der oberen Wand (8) des Gehäuses (2) in den zweiten Raum (21) der Vorbehandlungskammer (3) erstreckt.

8. Einheit nach Anspruch 7, dadurch **gekennzeichnet**, daß die Tropfleiste (33) senkrecht oberhalb des Rohrstutzens (27) angeordnet ist.

9. Einheit nach einem der vorhergehenden Ansprüche, **gekennzeichnet** durch Auslaßventile (30) in der Nähe gegenüberliegender unterer Enden der Vorbehandlungskammer (3).

Revendications

1. Ensemble à filtre à air pour un véhicule industriel, du type comportant une enveloppe extérieure (2) définissant une chambre (3) de prétraitement pourvue d'un orifice supérieur (9) d'entrée et de moyens (19, 29) d'interception et de canalisation agencés de façon à séparer sensiblement l'eau de l'air d'admission, et une chambre de filtre (4) logeant un filtre cylindrique creux (16) et pourvue d'un orifice supérieur (10) de sortie communiquant avec une cavité centrale (17) du filtre (16), lesdites chambres (3, 4) de prétraitement et de filtre communiquant entre elles par une première ouverture (18), lesdits moyens (19, 29) d'interception et de canalisation comprenant une première cloison (19) disposée verticalement à l'intérieur de ladite chambre (3) de prétraitement et définissant dans celle-ci un premier compartiment (20) communiquant avec ledit orifice d'entrée (9) et un second compartiment (21) communiquant avec la première ouverture (18), lesdits premier et second compartiments (20, 21) communiquant entre eux par une autre ouverture (26) formée entre le bord inférieur (24) de ladite première cloison (19) et une paroi inférieure (25) de ladite chambre (3) de prétraitement, caractérisé en ce que ladite chambre (4) de filtre est placée extérieurement à ladite chambre (3) de prétraitement et côte à côte avec elle, ladite première ouverture (18) étant prévue dans une paroi (16) de ladite chambre (3) de prétraitement opposée à ladite chambre de filtre (4); et en ce que lesdits moyens (19, 29) d'interception et de canalisation comprennent aussi une seconde cloison (29) s'étendant depuis ladite paroi opposée (6) au-dessous de ladite première ouverture (18) vers l'intérieur dudit second compartiment (21).

2. Ensemble selon la revendication 1, caractérisé en ce que ladite seconde cloison (29) est inclinée vers le bas depuis ladite paroi opposée (6) jusque

dans ledit second compartiment (21).

3. Ensemble selon la revendication 1 ou 2, caractérisé en ce que ledit bord inférieur (24) de ladite première cloison (19) est arrondi.

4. Ensemble selon l'une quelconque des revendications précédentes, caractérisé en ce que ledit bord inférieur (24) dudit premier panneau (19) présente une section transversale de forme sensiblement en goutte d'eau inclinée vers ledit second compartiment (21).

5. Ensemble selon l'une quelconque des revendications précédentes, caractérisé en ce qu'il comporte un embout tubulaire (27) fixé à l'intérieur de ladite ouverture (18) de communication entre lesdites chambres (3, 4) et faisant saillie dans ledit second compartiment (21) de ladite chambre (3) de prétraitement.

6. Ensemble selon la revendication 5, caractérisé en ce que le bord (28) de l'extrémité dudit embout tubulaire (27) qui fait saillie dans ledit second compartiment (21) est arrondi vers l'extérieur.

7. Ensemble selon l'une des revendications précédentes, caractérisé en ce qu'il comporte un jet d'eau (33) constitué d'une saillie s'étendant vers le bas depuis la paroi supérieure (8) de ladite enveloppe (2) et vers l'intérieur dudit second compartiment (21) de ladite chambre (3) de prétraitement.

8. Ensemble selon la revendication 7, caractérisé en ce que ledit jet d'eau (33) est disposé verticalement au-dessus dudit embout tubulaire (27).

9. Ensemble selon l'une quelconque des revendications précédentes, caractérisé en ce qu'il comporte des clapets (30) de décharge disposés à proximité des extrémités inférieures opposées de ladite chambre (3) de prétraitement.

