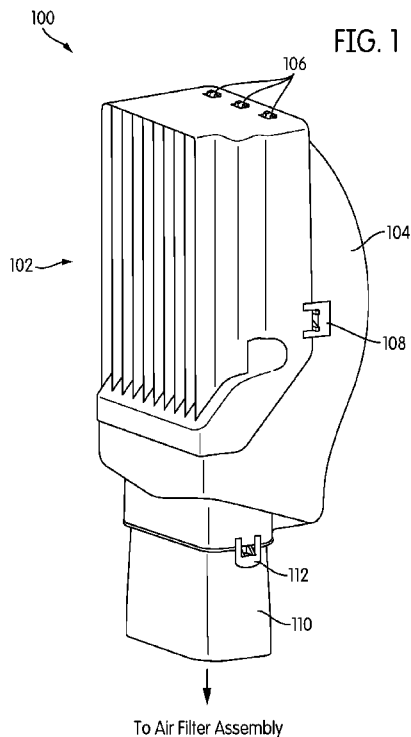




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[Continued on next page]

(54) Title: AIR INTAKE WATER SEPARATOR



(57) Abstract: Various embodiments relate to an air intake duct. The duct includes louvers forming an air inlet to a housing. Each louver includes an inlet section and an angled section, the angled section inclined with respect to the inlet section. The duct includes the housing positioned downstream of the louvers in an air flow direction. The housing includes a drain configured to permit separated water from an intake air passing through the louvers and into the housing to be drained from the housing. The duct includes an inner inlet duct that provides the intake air to a component. The inner inlet duct extends into the housing and positioned downstream of the louvers in the air flow direction. The inlet duct extends above the drain by a distance thereby forming a well in the housing between a top of the inner inlet duct and the drain.



DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT,
LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE,
SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA,
GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

— *before the expiration of the time limit for amending the
claims and to be republished in the event of receipt of
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 15/33720

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - F02M 35/022 (2015.01)

CPC - F02M 35/10013

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC(8): F02M 35/022 (2015.01)

CPC: F02M 35/10013

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
IPC(8): F02M 35/02, F02M 35/00, F02M 35/16, F02M 35/10, B60K 13/02, B04D 45/00 (2015.01) CPC: F02M 35/022, F02M 35/10, F02M 35/00, F02M 35/02, B60K 13/02, F02M 35/10144, F02M 35/10262, B01D 45/00 USPC: 123/184.21, 55/385.3, 123/198

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

PatBase; ProQuest Dialog; Google Patents; Google Web; Google Scholar

Search Terms: air, filter*, cleaner*, water, moisture, liquid, internal combustion, IC, louver*, louvre*, blade*, vane*, drain*, sump*, water, droplet*, moisture*, liquid, ramp*, slop*, inclin*, pressure, drop*, loss*, reduc*, decreas*, inlet*, intake*, pressure drop, moisture

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 4,373,940 A (Petersen). 15 February 1983 (15.02.1983). Figs. 3-5; col 2, ln 27-29, 34-42, 47-68; col 3, 51-56.	1, 4-7, 9, 12-13 ----- 2-3, 8, 10-11
Y	US 5,104,431 A (Fewel, Jr.). 14 April 1992 (14.04.1992). Fig. 3; col 3, ln 20-26.	2-3, 10-11
Y	WO 2011/094334 A1 (Baseotto). 04 August 2011 (04.08.2011).	8
A	US 7,069,893 B2 (Cusumano et al.). 04 July 2006 (04.07.2006). Fig. 2; col 3, ln 18-34.	1-13

 Further documents are listed in the continuation of Box C.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

07 October 2015 (07.10.2015)

Date of mailing of the international search report

19 NOV 2015

Name and mailing address of the ISA/US

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 15/33720

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

- 1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

- 2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

- 3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I: Claims 1-13, directed to an air intake duct having an inlet section and an angled section.

Group II: Claims 14-19, directed to an air intake duct having a cylindrical separator.

-*-Continued on extra sheet*-*

- 1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
- 2. As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
- 3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
- 4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-13

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 15/33720

-*-Continuation of Box III-Observations where unity of invention is lacking--*

The inventions listed as Groups I-II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical feature(s) for the following reasons:

Group I requires the special technical feature(s) of a housing downstream from a plurality of louvers, the housing including a drain, not required by Group II.

Group II requires the special technical feature(s) of a cylindrical separator, not required by Group I.

The only technical feature(s) that would otherwise unify Groups I-II are an inlet defined at least in part by a plurality of louvers that are at least in part angled to separate water from the air, and a tube or duct downstream from the louvers to convey the air to a component. However, these technical features do not represent a contribution over the prior art, because they are anticipated by US 7,069,893 B2 to Cusumano et al. (hereinafter 'Cusumano').

Cusumano teaches an air intake duct (22 in Fig. 2, generally; col 2, ln 48-55) having an inlet (the left end of 36 in Fig. 2) defined at least in part by a plurality of louvers (38 in Fig. 2; col 3, ln 18-22) that are at least in part angled (as illustrated in Fig. 2) to separate water from the air (col 3, ln 30-34), and a tube or duct (23 in Fig. 2; col 2, ln 58-66) downstream from the louvers to convey the air to a component (e.g., air compressor 66 in Fig. 1; col 5, ln 21-24).

As the common technical features of Groups I-II were known in the art at the time of the invention, they cannot be considered to be common technical feature(s) that would otherwise unify Groups I-II.

Therefore, Groups I-II lack unity under PCT Rule 13.