



- (51) **International Patent Classification:**
B01D 46/00 (2006.01) *B01D 46/02* (2006.01)
- (21) **International Application Number:**
PCT/EP2016/059881
- (22) **International Filing Date:**
3 May 2016 (03.05.2016)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
15166402.6 5 May 2015 (05.05.2015) EP
- (71) **Applicant:** HALDOR TOPSØE A/S [DK/DK]; Haldor
Topsøes Allé 1, 2800 Kgs. Lyngby (DK).
- (72) **Inventor:** BOE, Michael; Taarbæk Strandvej 86, st., 2930
Klampenborg (DK).
- (81) **Designated States** (*unless otherwise indicated, for every
kind of national protection available*): AE, AG, AL, AM,
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,

DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR,
KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG,
MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM,
PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC,
SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN,
TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

- (84) **Designated States** (*unless otherwise indicated, for every
kind of regional protection available*): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ,
TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU,
TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE,
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).

Declarations under Rule 4.17:

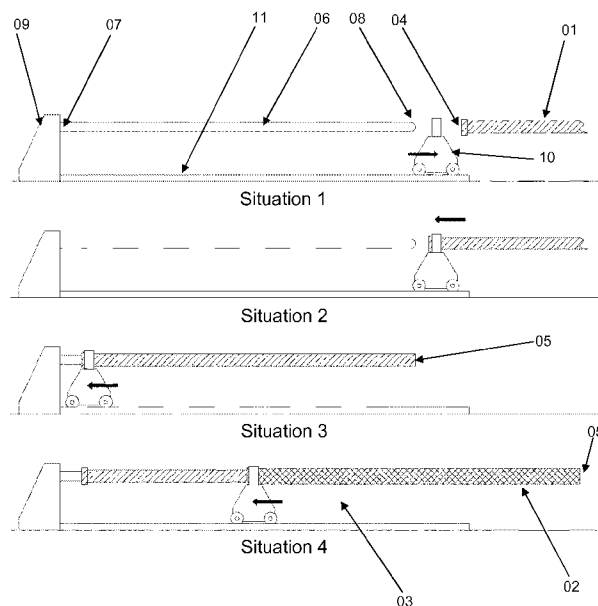
— as to the identity of the inventor (Rule 4.17(i))

Published:

— with international search report (Art. 21(3))

- (54) **Title:** METHOD AND SYSTEM FOR FILTER BAG UNIT ASSEMBLY AND FILTER BAG UNIT

Fig. 1
Filter bag assembly system



- (57) **Abstract:** A method and a system to assemble a plurality of filter bags within one another by means of a pole and a pulling guide, and a filter bag unit comprising a plurality of assembled filter bags with creases and stitches oriented relative to each other.

Method and system for Filter Bag Unit Assembly and Filter Bag Unit

The present invention relates to a method and system for
5 the assembly of multiple filter bags within each other.
Further the invention relates to a filter bag unit assembly
comprising a plurality of filter bags which are mounted
within one another. More particular, the present invention
relates to filter bags which are impregnated with catalyst
10 and assembled in a multilayer unit for effective filtration
and catalytic cleaning of exhaust gas.

Filter bags for separating particulate matter from a fluid
is known in the art. In challenging applications there may
15 be a need to apply a catalyst to the filter bags to obtain
not only mechanical filtration of the particles in the flu-
id, but also catalytic cleaning of the flue gas or product
gas in question. To achieve sufficient catalyst for the
catalytic cleaning, there is a need to apply two or more
20 filter bags within each other in a multilayer unit, thereby
providing sufficient effective catalytic cleaning of the
gas. Further With growing environmental protection rules,
this is the problem in some systems with a high particle
load in the gas stream e.g. cement production processes.

25 It is known in the art to provide filter bag assemblies
with a plurality of filter bags mounted within one another.
US5755962 discloses a pre-filter bag for insertion into a
standard filtration bag apparatus, having a filtration as-
30 sembly comprising a seamless filter membrane having uniform
pore openings preselected within the range of between about
2 and about 50 microns (μ) and a linearly channelled, non-

deformable, semi-rigid liquid transport thermoplastic sheet in the form of a moulded webbing or netting in contact with the upper surface of the filter membrane; said webbing having marginal edges which are coextensive with those of the
5 membrane; said assembly adapted to be shaped by continuous winding.

In US5417855 a filter apparatus having a filter bag sub-assembly for collecting contaminating material is described.
10 The filter bag sub-assembly includes five diametrically and axially-spaced bags and an integral collar. The five spaced bags form five spaced chambers and the integral collar has a stepped shape forming five cylinder support portions for the five spaced bags.

15 US2002056680 discloses a filter assembly including a filter vessel having an inlet and an outlet and defining a filter chamber there between. A basket assembly is removable supported within the filter chamber. The basket assembly has a
20 diameter less than the diameter of the filter chamber so as to define an annular flow passage about the basket assembly. The basket assembly includes an outer permeable member and an inner permeable member having a diameter which is less than the diameter of the outer permeable member such
25 that the inner permeable member is received within the outer permeable member.

US6179888 describes a filter bag assembly of hybrid construction is disclosed that reduces the height of the filter bag assembly as well as its overall cost. The assembly
30 indicates an elongated filter body portion, an end cap closing at one end of the filter body, a collar disposed at

the other end of the filter body. The collar is molded onto the filter body and an inner venturi portion molded therewith. The assembly also includes a fabric extension portion that is attached to the interior of the collar.

5

To mount the multiple filter bag units in a filter house is cumbersome and time-consuming. A known method is to first mount the outermost filter bag and thereafter mount the one or more inner filter bags by pressing them one at a time into the outer filter bag by means of a filter basket or other suitable tool. The present invention offers a solution to this problem by a method of assembly of a plurality of filter bags within each other. The present invention further presents a system for assembly of a plurality of filter bags within each other and a unit of assembled filter bags with inventive features with advantages over the known art.

Accordingly, the invention provides a method for assembly of a plurality of filter bags within each other comprising the steps of pulling a first filter bag on a pole until the filter bag is stretched in its length over said pole. Pulling at least a second filter bag over the first filter bag until the second filter bag is stretched in its length over the first filter bag and the pole. Retracting the assembled plurality of filter bags as one unit from the pole.

In an embodiment, the invention further comprises pulling a third filter bag over the first and second filter bag until the third filter bag is stretched in its length over the first filter bag, the second filter bag and the pole, be-

30

fore the step of retracting the assembled plurality of filter bags as one unit from the pole.

5 In a further embodiment, a first open end of each of the filter bags is attached to a pulling guide before they are being pulled. The pulling guide may comprises a claw or have a variable geometry adapted to connect to said first open end of each of said filter bags. The pulling guide can be adapted to pull the filter bags by means of an actuator.
10 Further the pulling guide may automatically release each of the filter bags when they have been pulled over the pole and then automatically return to its start position, ready to pull a further filter bag.

15 In an embodiment of the invention, the pole has a maximum outer diameter which is smaller than the inner diameter of any of the filter bags. More specifically, the pole may have a maximum outer diameter which is between 2 mm and 100 mm, preferably between 2 mm and 40 mm smaller than the inner diameter of any of the filter bags. The pole can be
20 mounted horizontally, fixed at a first end and with the second end and the length of the pole hanging freely. The second end of the pole can have a circular shaped head with rounded edges.

25

In an embodiment, this invention comprises a unit of assembled filter bags comprising at least two filter bags, one pulled over the other, each of the filter bags comprises longitudinal creases and at least one longitudinal stitch.
30 The filter bags are assembled one within the other with the orientation of the longitudinal creases of one filter bag matching the orientation of the longitudinal creases of the

one or more further filter bags in the unit, and the stitch of each filter bag in the unit is oriented differently than the stitch of the one or more other filter bags in the unit with respect to the longitudinal creases.

5

In a further embodiment, the unit of assembled filter bags has at least one filter bag which is catalyzed. The open end of each filter bag in the unit may be snap locked together with the one or more other filter bags in the unit.

10

In a particular embodiment, the unit of assembled filter bags consists of three filter bags assembled within each other. The filter bags may have a flat shape with two longitudinal creases, and a longitudinal stitch. Further, each filter bag may have at least one strap for handling placed at its closed end.

15

The invention also has an embodiment which is a filter bag assembly system. It comprises a pole for inserting within a filter bag, a movable guide for releasable connection to a first open end of a filter bag and pulling the filter bag, and an actuator for moving said guide along said pole. The pole is at least as long as the filter bag to be pulled and the maximum diameter of said pole is smaller than the inner diameter of the filter bag to be pulled.

20

25

In an embodiment of the invention, the guide has a variable geometry adapted to connect to the first open end of a filter bag. The pulling distance of the guide can be adapted to fit the filter bag length, and the guide releases the filter bag when it has been pulled in its length over the pole, where after the guide returns to its starting posi-

30

tion, ready to pull another filter bag. The filter bag assembly system may have a pulling force of the guide which is variable and adapted to be set, and the pulling of the guide stops if the pulling force exceeds the set value of the pulling force. The system may comprise a plurality of sets of poles and pulling guides.

A more detailed description of the method and system will be apparent from the following description of a specific embodiment with reference to the drawing where

Fig.1 shows a step by step performing of a specific embodiment of the invention.

Position numbers

- 01. First filter bag.
- 02. Second filter bag.
- 03. Filter bag unit.
- 04. First open end of filter bag.
- 05. Second closed end of filter bag.
- 06. Pole.
- 07. First end of pole.
- 08. Second end of pole.
- 09. Pole fixture.
- 10. Pulling guide.
- 11. Pulling guide tracks.

Referring now to Fig. 1, a filter bag assembly system is shown in four different situations where a unit of filter bags 03 (in this embodiment two bags in total) is assembled. In the top situation, the pole 06 is hanging freely

in a horizontal position fixed at the first end of the pole 07 by the pole fixture 09. The pole is ready to receive a first filter bag 01 which may be provided after catalyst impregnation and drying (not shown). A pulling guide 10 is moved towards the first filter bag (indicated by the arrow) by means of an actuator (not shown). The actuator can be of any kind known in the art, e.g. a belt drive, chain drive, a piston or the like. The pulling guide can move on horizontal pulling guide tracks 11. The pulling guide is adapted to attach to the first open end of the filter bag 04 by means of a claw, a variable geometry such as a crib shape or any suitable connection means (not shown).

In the second situation of Fig. 1, the pulling guide has been connected to the first open end of the filter bag and is now pulling the first filter bag towards the pole, as indicated by the arrow. The pulling guide is adapted in height and side wards position to center the first open end of the filter bag with the pole. The pulling guide continues to pull the first filter bag onto the pole, the bag enclosing the pole, until the second closed end of the filter bag 05 contacts the second end of the pole 08 as seen in the third situation of Fig. 1. The travelling distance of the pulling guide may be controlled by any suitable means such as a physical or electronic stop of the pulling guide which corresponds to the length of the first filter bag or by means of a maximum pulling force measurement or the like as common known in the art (not shown).

In the fourth situation of Fig. 1 a second filter bag 02 is pulled onto the first filter bag which is still hanging on the pole in a manner corresponding to the pulling of the

first filter bag. The dimension of the open end of the second filter bag and the inner dimension of the second filter bag is adapted to fit onto the first filter bag. Further the open ends of the first and the second filter bags may
5 be provided with fittings (not shown) which allow them to be fixed together when the second filter bag has been pulled onto the first filter bag.

Claims:

1. Method for assembly of a plurality of filter bags
within each other comprising the steps of
- 5
- pulling a first filter bag on a pole until said filter bag is stretched in its length over said pole,
 - pulling at least a second filter bag over the first
10 filter bag until said at least second filter bag is stretched in its length over said first filter bag and said pole, and
 - retracting the assembled plurality of filter bags as
15 one unit from the pole.
2. Method according to claim 1 further comprising the step of pulling a third filter bag over the first and second filter bag until said third filter bag is stretched in its
20 length over said first filter bag, said second filter bag and said pole, before the step of retracting the assembled plurality of filter bags as one unit from the pole.
3. Method according to any of the preceding claims, wherein
25 a first open end of each of said filter bags is attached to a pulling guide before they are being pulled.
4. Method according to claim 3, wherein said pulling guide comprises a claw.

5. Method according to claim 3 or 4, wherein said pulling guide has a variable geometry adapted to connect to said first open end of each of said filter bags.

5 6. Method according to any of the claims 3 - 5, wherein said pulling guide is pulling said filter bags by means of an actuator.

10 7. Method according to any of the claims 3 - 6, wherein said pulling guide automatically releases each of the filter bags when they have been pulled over the pole and where said pulling guide then automatically returns to its start position, ready to pull a further filter bag.

15 8. Method according to any of the preceding claims, wherein said pole has a maximum outer diameter which is smaller than the inner diameter of any of said filter bags.

20 9. Method according to any of the preceding claims, wherein said pole has a maximum outer diameter which is between 2 mm and 100 mm, preferably between 2 mm and 40 mm smaller than the inner diameter of any of said filter bags.

25 10. Method according to any of the preceding claims, wherein said pole is mounted horizontally, fixed at a first end and with the second end and the length of the pole hanging freely, and wherein the second end of the pole has a circular shaped head with rounded edges.

30 11. Method according to any of the preceding claims, wherein the filter bags to be pulled have a flat shape with two longitudinal creases, and a longitudinal stitch, and where-

in the stitch of each filter bag in a unit of assembled plurality of filter bags is oriented differently with respect to the longitudinal creases.

5 12. Method according to any of the preceding claims, wherein each filter bag has at least one strap for handling placed at its closed end.

10 13. Unit of assembled filter bags comprising at least two filter bags, one pulled over the other, each of the filter bags comprises longitudinal creases and at least one longitudinal stitch, wherein the filter bags are assembled one within the other with the orientation of the longitudinal creases of one filter bag matching the orientation of the
15 longitudinal creases of the one or more further filter bags in the unit, and the stitch of each filter bag in the unit is oriented differently than the stitch of the one or more other filter bags in the unit with respect to the longitudinal creases.

20

14. Unit of assembled filter bags according to claim 13, wherein at least one of the filter bags are catalyzed.

25 15. Unit of assembled filter bags according to claim 13 or 14, wherein the open end of each filter bag in the unit is snap locked together with the one or more other filter bags in the unit.

30 16. Unit of assembled filter bags according to any of the claims 13 - 15, wherein the unit consists of three filter bags assembled within each other.

17. Filter bag assembly system comprising a pole for inserting within a filter bag, a movable guide for releasably connecting to a first open end of a filter bag and pulling the filter bag, and an actuator for moving said guide along said pole, wherein said pole is at least as long as the filter bag to be pulled and wherein the maximum diameter of said pole is smaller than the inner diameter of the filter bag to be pulled.

18. Filter bag assembly system according to claim 17, wherein the guide has a variable geometry adapted to connect to said first open end of a filter bag.

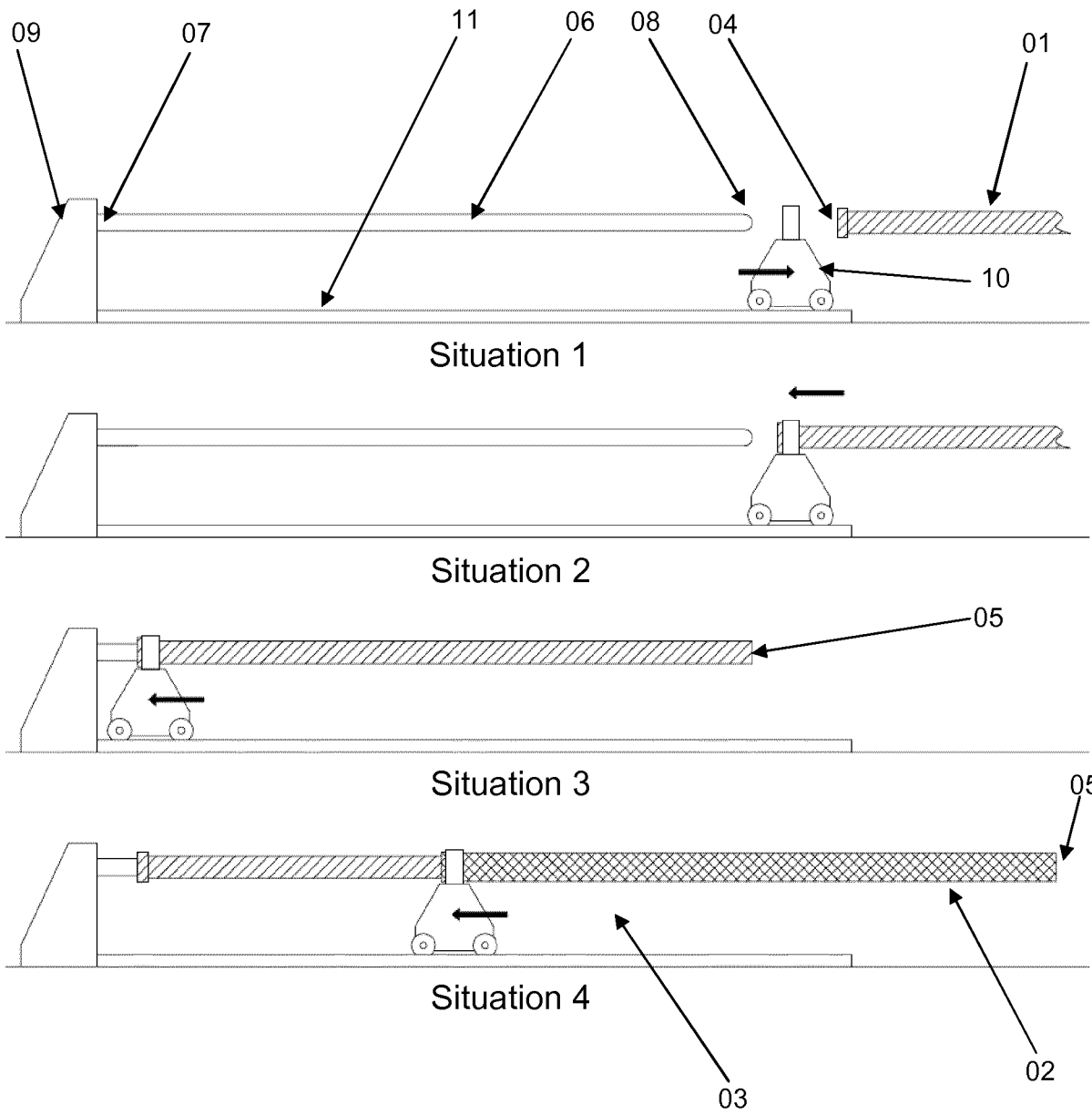
19. Filter bag assembly system according to claim 17 or 18, wherein the pulling distance of the guide can be adapted to fit the filter bag length, and wherein the guide releases the filter bag when it has been pulled in its length over the pole, where after the guide returns to its starting position, ready to pull another filter bag.

20. Filter bag assembly system according to any of the claims 17 - 20, wherein the pulling force of the guide is variable and adapted to be set, and wherein the pulling of the guide stops if the pulling force exceeds the set value of the pulling force.

21. Filter bag assembly system according to any of the claims 17 - 21, wherein the system comprises a plurality of sets of poles and pulling guides.

Fig. 1

Filter bag assembly system



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/059881

A. CLASSIFICATION OF SUBJECT MATTER
INV. B01D46/00 B01D46/02
ADD.

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)
B01D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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

EP0-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2014/246055 A1 (EBERT JOHANNES [DE] ET AL) 4 September 2014 (2014-09-04) abstract paragraphs [0007], [0012], [0037] -----	1-21
A	JP 2003 126654 A (SUMITOMO HEAVY INDUSTRIES) 7 May 2003 (2003-05-07) abstract; figure 2 -----	1-21
A	US 5 636 422 A (PYRON DONALD [US] ET AL) 10 June 1997 (1997-06-10) abstract; figures 1-3 -----	1-21



Further documents are listed in the continuation of Box C.



See patent family annex.

* 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

6 July 2016

Date of mailing of the international search report

02/08/2016

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Sembritzki, Thorsten

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2016/059881

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:

see additional 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 an 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.:

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.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-21

Claims 1-12 and 17-21 refer to a method for assembly of a plurality of filter bags and a corresponding manufacturing device, wherein a pole is present onto which the individual sleeves are stretched one after the other. The problem underlying this group of claims can be regarded as to improve the handling of the filter bags during their installation in a filter assembly. Claims 1 and 17 neither mention creases in the filter bags nor stitches.

1.1. claims: 13-16

Claims 13-16 refer to a unit of assembled filter bags, wherein each bag comprises longitudinal creases and a longitudinal stitch, wherein the filter bags are arranged within each other so that the creases of the bags match whereas the stitches are at different positions. This arrangement solves the problem to avoid negative influences of the seams of the individual filter bags on each other. Claim 13 does neither explicitly nor implicitly mention a pole or its use. There is no indication in present claim 13 that a pole is necessary during the manufacturing procedure. In other words, there is no indication in present claim 13 that the defined orientation of creases and stitches requires the use of a pole.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2016/059881

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2014246055 A1	04-09-2014	CN 104014207 A	03-09-2014
		EP 2772293 A1	03-09-2014
		JP 2014168775 A	18-09-2014
		SG 11201506715P A	29-09-2015
		US 2014246055 A1	04-09-2014
		WO 2014131864 A2	04-09-2014

JP 2003126654 A	07-05-2003	NONE	

US 5636422 A	10-06-1997	NONE	
