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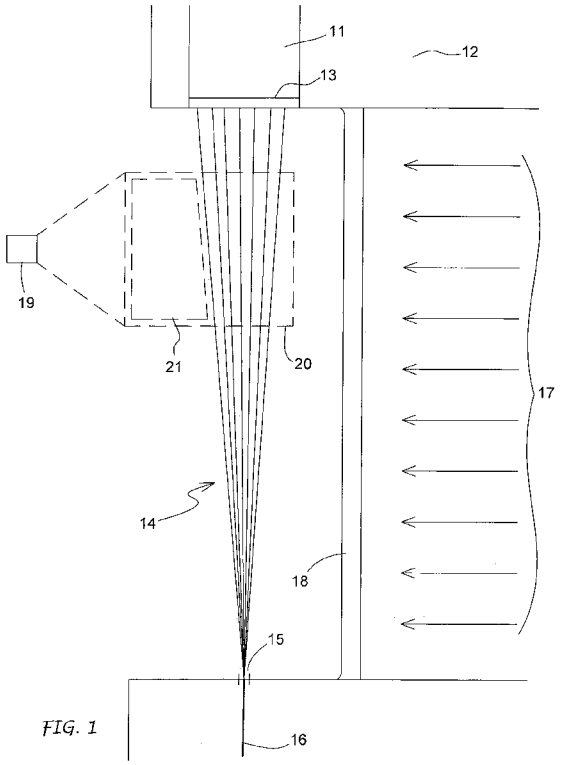

FIG. 1

(57) Abstract: The invention concerns a method and a device for detecting the breakage of one or more filaments in a synthetic fibre spinning process. The filaments come from an extrusion spinneret, and are cooled by a flow of air directed in a transversal direction to their path and converge in a linear manner in a grouped nozzle for the formation of a thread. The detection is carried out by continuous monitoring of the movement direction of the filaments on a level with the line of their cooling by air, the detection of a deviation caused by the flow of air from said movement direction even of a single filament significantly of a breakage of the latter, and the emission of at least a signal indicating the existence of at least a filament not included in the direction of the movement of the remaining filaments.

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"METHOD AND DEVICE FOR DETECTING THE BREAKAGE OF ONE OR MORE FILAMENTS IN SYNTHETIC FIBRE SPINNING PROCESSES"

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Field of the Invention

This invention concerns in general the spinning processes for the production of synthetic fibres, and refers in particular to a method for detecting the breakage of one or more filaments during a synthetic fibre spinning process.

State of the Art

The synthetic fibres are filamentary materials industrially produced starting from a synthetic polymer, that can be of a different nature, and by a spinning process that consists basically in the heating up to the fusion of the starting polymer, in thrusting under pressure the molten polymer through a spinneret for the formation of a plurality of filaments and in joining and coagulating the filaments by cooling them with air or by humidity.

The process is carried out in plants having several spinning stations, so-called cabs, each comprising, from the top to the bottom, the so-called extrusion "packs", an intermediate cooling part, and lower nozzles for the formation of the required filaments.

Every pack comprises a cylinder with the function of filtering and making the fused polymer homogenous, and a disk or spinneret provided with small extrusion holes. The fused polymer is loaded on a level with the

head "packs" and pressed under pressure through the holes in each spinneret, from which exits a number of filaments equal to the number of extrusion holes. These filaments move down the intermediate cooling part of the cabin where they are cooled.

In the case taken into consideration herein, the cooling of the filaments is carried out by means of a flow of air basically directed towards them in a transverse direction to their path. Then the filaments coming from each pack are grouped together in a corresponding nozzle positioned in the lower part of the cabin in order to form the final thread.

In its path through the nozzle, the yarn becomes oiled after which it is collected on bobbins on other machinery provided downstream of the spinning cabins.

Usually, in each cabin there are many head "packs" present, therefore many threads are created at the same time and the threads can be made up of different numbers of filaments.

The spinning process above is however affected by a problem deriving from a possible breakage of one or more filaments during the extrusion and/or cooling steps.

Due to such a breakage the or every broken filament is pushed away from the others by the cooling air flow and on dropping on its own tends to accumulate in a part of the cabin. Thus the resulting thread looses from one to more filaments, becoming irregular, therefore defective and of coarse-quality.

Consequently besides there being a loss of product due to the broken filament that goes lost, there it is also an economic loss of

compensation due to the drop in the commercial value of the article produced.

A present method for verifying possible breakage of filaments and by this the resulting quality of the product consists of a periodic at sight inspection on the part of an operator. When the operator realizes that there is a problem, he has the possibility of interrupting the production and/or of signaling the position of the bobbin that collects a thread of coarse-quality in that one or more filaments are missing.

However, the operator can note the breakage of the filament by means of the accumulation of this at a distance from the regular path of the other filaments, but he cannot be able to quantify precisely the number of thread produced and considered as being of minor quality if he is not present at the moment of the breakage.

Object of the Invention

The present invention was conceived to effectively resolve such a problem and has as an objective to allow an immediate chick of the breakage of one or more filaments during the spinning processes.

This object is achieved, according to the invention, by a method consisting in continuative optical monitoring of the direction of a plurality of filaments during their regular moving between the extrusion spinneret and the grouping nozzle of the filaments for the formation of the thread, and at the right moment detecting an anomalous deviation of the regular path, even of a single thread, significative of a breakage of said filament and in signaling the present process anomaly so as to be able to remedy.

This method is carried out by an electronic sensor in order to

acquire images of the filaments in movement at least in a section of their regular cooling path between the spinneret and the grouping nozzle, said device being programmed to distinguish the irregular direction of at least a filament compared to the regular path of the other filaments and to emit indicative signals of an irregular direction of at least a filament.

The advantages brought about by the invention appear to be evident and in fact:

- the operator is freed from the task of having to visibly check at least now and then the presence of broken filaments coming from every extrusion "pack",

- the breakage of filaments is immediately signaled so as to be able to intervene and restore without delay the regularity of the process, by means of which,

- the loss of material coming from the breakage of filaments is annulled or at least minimized,

- besides limiting, it is possible to control precisely the production of second choice threads from the moment that the time past from the warning is indicative of the breakage of filaments.

Brief Description of the Drawings

Further details of the invention will become evident from the description that follows made in reference to the enclosed exemplifying drawing, in which:

Fig. 1 is a scheme of an extrusion "pack" with a monitoring device when the filaments are integral; and

Fig. 2 is the scheme in Fig. 1, but in the breakage condition of a

filament.

Detailed Description of the Invention

In said drawing, the reference number 11 indicates an extrusion "pack" in the ambit of a cabin 12 of a spinning plant. Said "pack" basically comprises a spinneret 13 from which exits a bundle of filaments 14 converging downwards towards a nozzle 15, which designed to receive and grouped to form a thread 16 which will then be wound onto spools in an apparatus, not shown, downstream.

Along their path from the spinneret 13 to the nozzle 15, the filaments 14 are basically tight, follow an almost stable direction F and they are cooled by a flow of air 17 passing through a cooling radiator 18.

In accordance with the invention, on a level with a part of said path for the filaments 14, preferably adjacent to the exit of the spinneret 13, an optical sensor 19 is positioned to detect the integrity or not of the filaments depending on their regular or irregular trend compared to the movement direction F. Said optical sensor 19 can be made, for example, out of a digital video camera or the like able to acquire and enlarge images of the filaments in motion.

The optical sensor or video camera 19 is positioned on one side of the bundle of filaments 14 opposite the one the flow of cooling air comes from compared with the radiator 18, facing substantially in the transversal direction to the direction F of the movements of the filaments. Furthermore the optical sensor or video camera is programmed to also detect the presence of one of the filaments that actually deviates and moves away from their correct movement direction F towards the nozzle 15.

The dotted lines in both the figures of the drawings indicate the shot 20 of the optical sensor or video camera 19 that invest the bundle of filaments 14 in a part of their path and which includes an area which is provided with an alarm 21. This alarmed area will be as adjacent as possible to the bundle of filaments and positioned so that when it is crossed by at least a filament that deviates from the regular path of the remaining filaments emits an alarm signal, both luminous and/or acoustic, convertible into another suitable signal so as to activate other electric or mechanical control devices.

All together, the optical sensor, that is the video camera 19, or the like, acquires in continuation the enlarged image of the filaments exiting from the extrusion spinneret, filaments that follow all the F directions, almost stable as regards to convergence, towards the grouping nozzle.

As long as there are no anomalies in the regular path of the filaments, the optical sensor or video camera simply detect the images, meaning that the spinning process is being carried out normally –Fig. 1.

On the contrary, should any filament 14' break, it no longer remains taught and the flow of cold air 17 moves it away from the other integral filaments–Fig. 2. Consequently, given that the flow of cold air 17 is directed towards the video camera 19, the filament 14' is diverted towards the latter and as soon as the image in the ambient of the alarmed area 21 is detected the system activates an indicative signal regarding the anomaly. This signal, then, may also be converted into another signal provided, for example, so as to determine where and when the breakage of the filament happened, so as to interrupt the production locally, and

define the production of a second quality thread based on the time which has passed since the signal of the breakage and the stop of the spinning process.

"METHOD AND DEVICE FOR DETECTING THE BREAKAGE OF ONE OR MORE FILAMENTS IN SYNTHETIC FIBRE SPINNING PROCESSES"

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CLAIMS

1. Method for detecting the breakage of one or more filaments in a synthetic fibre spinning process, where a plurality of filaments come from an extrusion spinneret, are cooled by a flow of air directed transversally to their path and converge linearly in a grouping nozzle for the formation of a thread, the method comprising

a continuous monitoring of the normal movement direction of the plurality of filaments on a level with the path of their cooling by air,

the detecting of a deviation from said movement direction, caused by the flow of air, even of a single filament, meaning the breakage of said filament, and

the transmitting of at least a signal indicating the presence of a filament of the movement direction of the remaining plurality of filaments.

2. Method according to claim 1, wherein said continuous monitoring of the movement direction of the plurality of filaments and the detection of the presence of at least one filament that deviates due to breakage from said movement direction is of the optical type.

3. Method according to claim 1 or 2, wherein said continuous monitoring and said detection are carried out either by an optical sensor or a digital video camera with a framing field that transversally covers the plurality of filaments exiting from the extrusion spinneret from an opposite direction to the cooling air flow direction.

4. Method according to claim 3, wherein the optical sensor or digital video camera is programmed to detect at least a filament that deviates due to the breakage from the regular movement direction of the other filaments in combination with the cooling air flow, this air flow blowing said filament towards the optical sensor or digital television camera.

5. Method according to any of the previous claims, wherein the framing field of the plurality of filaments includes an alarm area managed to emit an alarm signal as soon as it is crossed by at least one filament which deviated due to breakage from the movement direction of the other filaments.

6. A method according to any of the previous claims, wherein the alarm signals are the luminous and/or acoustic and/or convertible into temporal or command signals so as to be able to interrupt the filaments process and quantify the production of incomplete fibre, or the like.

7. Device for the carrying out of a method for detecting the breakage of one or more filaments in a synthetic fibre spinning process according to the previous claims, characterized by an electronic sensor for the acquisition of images of the filaments in movement at least in a section of their cooling path between the extrusion spinneret and the batching nozzle, where said sensor is programmed to discriminate the irregular direction of at least one filament compared to the regular movement direction of the other filaments and to emit signals indicating an irregular direction of said filament.

8. Device according to claim 7, wherein said electronic sensor is an optical sensor or a digital video camera set up to frame transversally the

plurality of filaments exiting from the extrusion spinneret from an opposite direction to the air cooling flow direction .

9. Device according to claim 8, wherein the optical sensor or a digital video camera has a framing field of the plurality of filaments that includes an alarm system managed to emit at least an alarm signal as soon as it is crossed by at least a deviated filament, due to breakage, from the movement direction of the other filaments.

10. Device according to any of the claims from 7 to 9, comprising furthermore means emitting at least a luminous and/or acoustic and/or other alarm signal convertible into temporal or command signals so as to be able to interrupt the filament process, quantify the production of incomplete fibre, or the like.

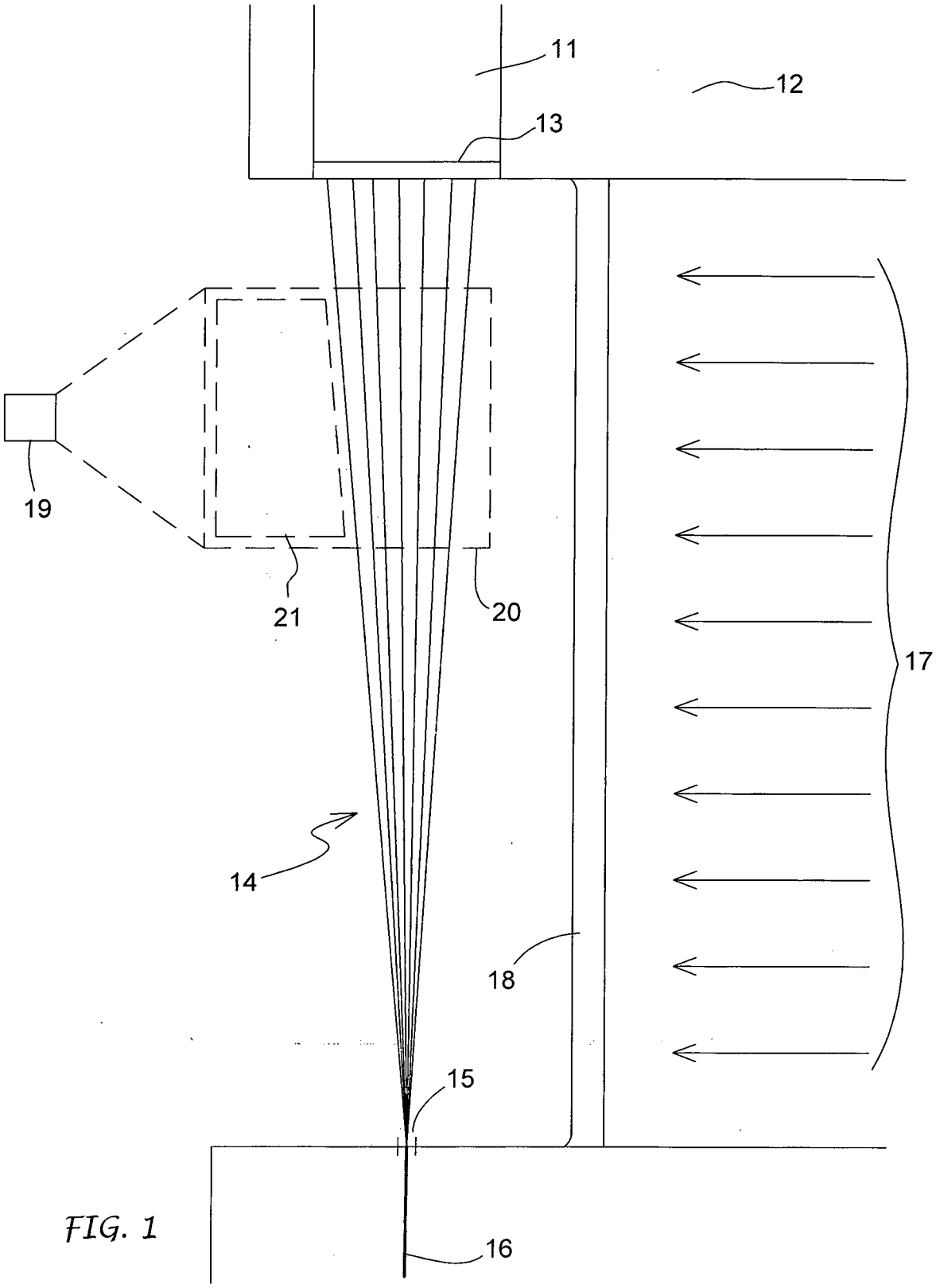

FIG. 1

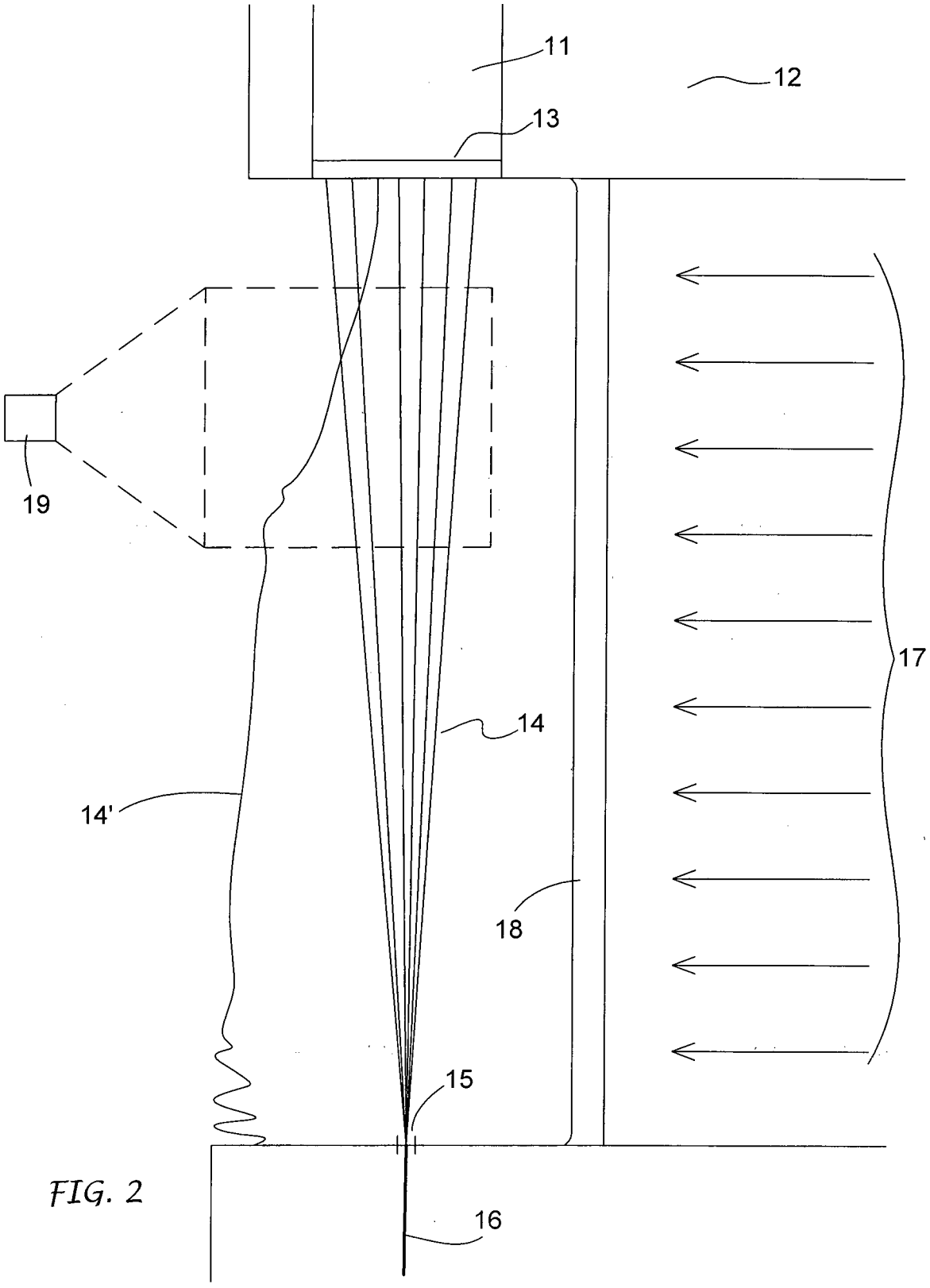

FIG. 2

INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER
INV. D01D11/00 B65H63/024 D01D13/02
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)
D01D B65H

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 practical, search terms used)

EPO-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	WO 98/13288 A1 (DU PONT [US]) 2 April 1998 (1998-04-02) page 3, line 24 - page 5, line 6 page 6, line 20 - line 32 page 7, line 33 - page 8, line 6 figures 1,2	1-10
A	US 3 999 695 A (BRADLEY WALTER EUGENE ET AL) 28 December 1976 (1976-12-28) column 2, line 11 - line 18 column 2, line 31 - line 35 column 3, line 31 - line 68	1-10

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
17 August 2011	24/08/2011

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International application No
PCT/IT2011/000089

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 94/25870 A1 (BARMAG BARMER MASCHF [DE]; NEUMANN BERND [DE]) 10 November 1994 (1994-11-10) page 4, line 15 - page 5, line 10 page 7, line 25 - page 8, line 15 figure 1	1-10
A	WO 2004/048651 A1 (SAURER GMBH & CO KG [DE]) 10 June 2004 (2004-06-10) page 2, line 1 - line 13 page 3, line 8 - line 13 figure 1	1-10
A	DE 10 2004 052669 A1 (SAURER GMBH & CO KG [DE]) 30 June 2005 (2005-06-30) paragraph [0032] - paragraph [0034] figure 1.2	1-10
A	US 3 844 497 A (HARRILL J ET AL) 29 October 1974 (1974-10-29) column 1, line 1 - column 2, line 26 figures 1,2	1-10

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IT2011/000089

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9813288 A1	02-04-1998	AU 4485197 A	17-04-1998
		BR 9712105 A	31-08-1999
		CN 1231647 A	13-10-1999
		DE 69710203 D1	14-03-2002
		DE 69710203 T2	08-08-2002
		EP 0929493 A1	21-07-1999
		ES 2170966 T3	16-08-2002
		ID 22034 A	26-08-1999
		KR 20000048641 A	25-07-2000
		TR 9900659 T2	21-06-1999
		TW 418265 B	11-01-2001
		US 5718854 A	17-02-1998
US 3999695 A	28-12-1976	NONE	
WO 9425870 A1	10-11-1994	CN 1107644 A	30-08-1995
		EP 0648332 A1	19-04-1995
		ES 2114194 T3	16-05-1998
		RU 2073865 C1	20-02-1997
		US 5682146 A	28-10-1997
WO 2004048651 A1	10-06-2004	CN 1714178 A	28-12-2005
		EP 1563128 A1	17-08-2005
DE 102004052669 A1	30-06-2005	CN 1616723 A	18-05-2005
US 3844497 A	29-10-1974	NONE	