



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
**10.05.2017 Bulletin 2017/19**

(51) Int Cl.:  
**D06C 7/00** (2006.01) **D04H 1/54** (2012.01)  
**D04H 3/04** (2012.01) **F26B 13/10** (2006.01)  
**F26B 25/06** (2006.01) **F27B 9/00** (2006.01)

(21) Application number: **16198032.1**

(22) Date of filing: **09.11.2016**

(84) Designated Contracting States:  
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**  
 Designated Extension States:  
**BA ME**  
 Designated Validation States:  
**MA MD**

(71) Applicant: **SICAM S.r.l.**  
**20141 Milano (IT)**

(72) Inventor: **ZANARDI, Stefano**  
**20141 MILANO (IT)**

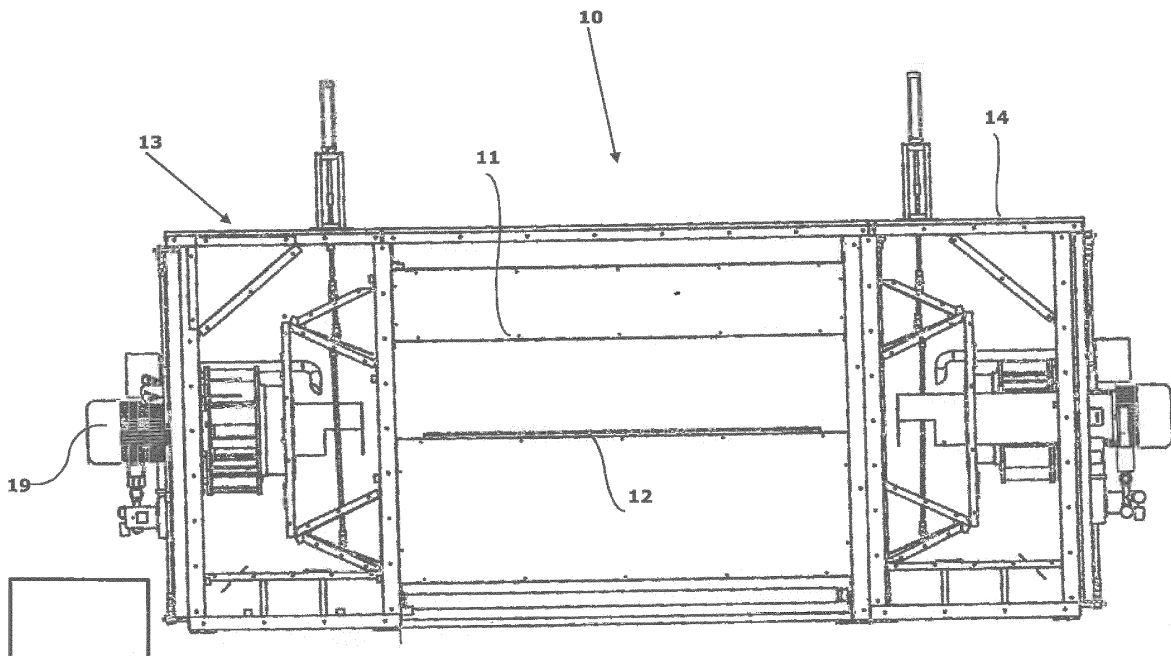
(74) Representative: **Vatti, Francesco Paolo et al**  
**Fumero S.r.l**  
**Pettenkofferstrasse 20/22**  
**80336 Munich (DE)**

(30) Priority: **09.11.2015 IT UB20155400**

(54) **OVEN FOR THE TEXTILE SECTOR**

(57) An oven (10) for the textile sector is disclosed, comprising an inlet head (13) and an outlet head (14). Said inlet head (13) is associated to a pre-heating device

(19) and, advantageously, said outlet head (14) is associated to a pre-cooling device (23), comprising an air suction unit (24).



**Fig. 3**

## Description

**[0001]** The present invention relates to an oven for the textile sector, to be used especially for the production of non-woven fabric.

**[0002]** The textile industry is one of the oldest areas in the history of technology, with processing based on weaving.

**[0003]** The so-called non-woven fabric was developed in more recent times. It is a textile material, obtained through processes different from classic weaving (which involve a weft and a warp) or knitting ones. In the case of fabrics, textile fibres are oriented in an orderly fashion, while in the non-woven fabric, fibres are arranged in a random and statistical manner.

**[0004]** The non-woven fabric can be obtained by the processing of both natural and synthetic fibres.

**[0005]** Some typical characteristics of non-woven fabrics are water-repellence, resistance to low and high temperatures, non-abrasiveness. These features make the non-woven fabrics suitable for many applications, in various technical fields. In the building industry, they can be used to coat or set up ceilings and false ceilings and in the production of so-called geotextile materials, used for the construction of roads, airports, tunnels, embankments and the like. In furniture, they can be used for the production of wallpaper, sofas, armchairs, chairs, furniture accessories. In the medical field, they are used for the production of white coats and other sterile surgical drapes. They are also used for the production of disposable caps and shoe covers for pools. There are daily use objects, made with non-woven fabrics, such as bags, shopping bags and more. In agriculture, they are used for plant protection sheeting, for the collection and the protection of fruit and vegetables, for the development of seeds, for greenhouse cultivation, to prevent the growth of weeds and pests, to protect the most delicate plants from weather, animals and pests. In clothing, they are used to line shoes and for dress straps. In industry, they are used for packaging and for the production of filters. They also may be excellent materials for photography backcloths. They are also used to improve the terrain for obstacle jump in horse riding tracks.

**[0006]** As just seen from the above overview, which is even not completely exhaustive, these materials have a wide use and it is therefore important to obtain their production under favourable conditions, both from the economical and from the industrial point of view.

**[0007]** As already said, the non-woven fabric can be composed of natural and/or synthetic fibres. Normally, it is produced by means of carding machines. The types of traditional cards are those associated to a folding unit, or airlay cards may be used. However, the non-woven fabric that comes out from these machines is totally devoid of mechanical consistency.

**[0008]** A common way to confer consistency to these materials is to mix the fibres with low-melting fibres which, by melting, will then bind to other fibres, thus creating a

strong structure. Once the low-melting fibres are mixed with the other fibres, they are melted, placing the material in an oven where a flow of hot air passes through the material. Among the low-melting-point fibres, polypropylene and polyester can be mentioned, although there are many others.

**[0009]** Such hot air flow is created by fans and burners, generally placed on the internal face of one of the longitudinal walls of the oven.

**[0010]** The traditional ovens currently used for these operations are realised as rectangular blocks, with power on to the front faces for the entry and exit of a conveyor belt, in order to insert and extract the material before and after the operation. To obtain flow characteristics suitable to give a uniform melting of the low melting point fibres, the air flow must be periodically reversed during the movement of the material from entry to exit. For this purpose, shut-off valves are normally arranged inside the conventional oven to programme the sequence of the air directions according to the variation of the characteristics of the various materials to be processed. The longitudinal sides of these traditional ovens are therefore normally blind, except for small inspection openings. The shut-off valve groups of such traditional ovens have bulky transverse dimensions (1.5 -2m) with respect to the useful width of the oven itself, sometimes making the installation difficult and occupying, in an oven with a useful width of 2m, 100% more of the space actually needed for material passage. In addition, air passage treatment of the fibres involves that a part of the fibres exits from the veil of non-woven fabric in formation and deposits on the oven parts, soiling them. It is therefore necessary to remove some of the parts of the oven, to extract the dirty parts from it and clean them. For these operations, since the internal parts of the oven are not accessible, except to the extent permitted by the inspection opening, long and difficult cleaning operations are required. This makes the interruption times to clean the parts of the oven relatively long, with remarkable consequences on productivity.

**[0011]** However, there is still the problem of fibre heating time. Normally, the oven is fed with cold material to be melted and fibres to be processed into non-woven fabric, subjecting them to heating inside the oven. The first heating of the fibres currently takes place in the first module (or parallelepiped block), after entering the real oven. This results in rather long heating times, with consequent energy consumption.

**[0012]** In addition, there is still the problem of energy loss due to the disposal to the outside of part of the air heated inside the oven, in order to maintain the balance of air masses in circulation.

**[0013]** The ovens normally used for these operations have inlet heads, to allow the tension and the driving of the conveyor belts that carry the fibres into the oven, and outlet heads, which perform the function of pulling the same conveyors by means of suitable rollers. Normally, the inlet heads have a length of 1.5 m, the outlet heads of about 800 mm.

**[0014]** An example of inlet and outlet heads for such ovens is represented, respectively, in Figs. 1 and 2.

**[0015]** As seen in Fig. 1, the inlet head 1 is presented as a casing 2 which contains in its inner a series of rollers 3, 4, 5 for tensioning and driving of the conveyor belts at the inlet to the oven.

**[0016]** As seen in Fig. 2, the outlet head 6 is constituted by a housing 7 which contains in its inner the rollers 8, 9 for pulling the conveyor belts which extract the material from the oven.

**[0017]** US 4,133,636 describes an oven for textile material, aimed at removing traces of volatile fuels from the same fabric. The volatiles that are evaporated are then burnt, to obtain part of the heat required for the continuation of operations.

**[0018]** US 4,551,378 relates to a process for the preparation of non-woven fabric, comprising a multi-stage oven, each stage having a different temperature.

**[0019]** GB 2,140,837 relates to a process for the production of non-woven fabric from fibres of a thermoplastic material. The oven includes a heating and a cooling section.

**[0020]** US 5,997,287 refers to an oven for textile materials, comprising a heating and a cooling section; the temperature being raised gradually in the heating section.

**[0021]** EP 2840178 describes an oven for fibres, with an inlet and an outlet opening. The hot air inside the oven is provided at a higher flow rate than the feed rate of the fibres to be heated.

**[0022]** The German utility model No. 203 15 984 describes a textile machine which provides for the heating of the textile material, in which the machine walls are formed by doors provided with a window, which may be partially open.

**[0023]** It should be noted that none of the mentioned prior art documents provides for an inlet section as a separate unit, connected to the oven itself. It should also be noted that all the above-mentioned documents maintain unchanged the size of the oven compared with conventional ones and that none of them substantially increases productivity.

**[0024]** The problem underlying the invention is to propose an oven structure for the textile sector, which overcomes the above mentioned drawbacks and which allows to reduce size and/or to increase productivity. This object is achieved through an oven for the textile sector, comprising an inlet head and an outlet head, characterized in that said inlet head and outlet heads are units external to the oven chamber and connected to it, and in that said inlet head comprises a pre-heating device for the product, which uses as a heating source the air disposed by the oven that, before being evacuated, will pass through the material, transferring its heat to it and thus pre-heating it. The subclaims describe preferred features of the invention.

**[0025]** Further features and advantages of the invention will anyhow be more evident from the following de-

tailed description of a preferred embodiment, given by mere way of non-limiting example and illustrated in the accompanying drawings, wherein:

5 Fig. 1 is a cross sectional view, showing the inlet head of an oven for the textile sector, according to prior art;

10 Fig. 2 is a cross sectional view of the outlet head of an oven for the textile sector, according to the prior art;

15 Fig. 3 is a side, cross sectional view of an oven for the textile sector, according to the present invention; Fig. 4 is a cross sectional view of an inlet head of an oven for the textile sector, according to the present invention; and

20 Fig. 5 is a cross sectional view of an outlet head of an oven for the textile sector, according to the present invention.

**[0026]** An oven 10 according to the present invention is represented in Fig. 3.

**[0027]** In known manner, the oven 10 includes an internal area 11, where fibres, placed on a bed 12 carried by a conveyor belt are heated, and where low-melting-point fibres are melted.

**[0028]** The oven also includes an inlet head 13 and an outlet head 14, separated from, but connected to, the internal area 11 of the oven.

**[0029]** The inlet head 13 is shown in Fig. 4. Similarly to the head 1 of the prior art (see again Fig. 1), the inlet head 13 includes a housing 15 and a series of rollers 16, 17, 18 for tensioning and driving the conveyor belts that carry the fibres into the oven 10 and towards the internal part 11 of the oven 10. According to the present invention, the inlet head 13 also comprises a pre-heating device 19.

**[0030]** The outlet head 14 is shown in detail in Fig. 5. Similarly to the outlet head 6 according to the prior art (see again Fig. 2), the head 14 has a casing 20, inside which there are pulling rollers 21, 22 of the conveyor belts to extract the non-woven fabric 12 from the heating unit 11. According to a preferred embodiment of the present invention, the outlet head 14 also comprises a pre-cooling device 23, including an air suction unit 24. Said unit 24 may consist, preferably, in a fan.

**[0031]** In operation, the oven 10 should be fed the fibres and the low-melting-point fibres -for example, polypropylene or polyester-, for the production of a non-woven fabric. They are introduced through the inlet head 13 and placed on conveyor belts, tensioned and driven by the rollers 16, 17 and 18. In this way, on the same conveyor belts, a bed 12 of fibres is created. According to the present invention, the pre-heating device 19 sends hot air taken from the oven, being exhaust air to be evacuated, to the bed 12, following the direction of arrows F and P (see Fig. 4), thus raising its temperature, pre-heating the material and recovering a substantial part of energy that would otherwise be lost. Air passage through the material is favoured by the suction action of two fans,

maintaining in depression the area around the material. In this way, the main heating device of the oven 10 will be more thoroughly exploited, since it also recovers the heat that would otherwise be lost with exhaust fume discharge. This involves a clear economic and ecological benefit and does not require to consume additional energy to lower the temperature of exhaust fumes before they are vented to atmosphere. The pre-heating device 19 may also be any type of heater with air flow, where the air can be heated by an electrical resistance, a gas or liquid fuel burner, and others.

**[0032]** In this way, furthermore, the bed 12 enters already at a temperature higher than what normally occurs in prior art ovens in the internal area 11 of the oven 10, where actual heating and the melting of low-melting-point fibres occur. In this way, it is possible, among other things, to reduce the residence time inside the internal area 11 compared to the prior art, thus increasing the productivity of the oven 10. Alternatively, it is possible to reduce the heating power inside the internal area 11, maintaining an equal residence time, thus reducing energy consumption and thermal losses. In any case, a greater energy efficiency is achieved without remarkably increasing the size of the oven 10, since the pre-heating and recovery device is installed in an area traditional ovens have always included, but never used for pre-heating purposes, and this is the invention related to this patent.

**[0033]** Once the melting of the low melting point fibres is completed, the bed 12, now constituting a bonded non-woven fabric, is extracted from the oven 10. This happens through the outlet head 14. The bed 12 in solidification is extracted from the internal area 11 by means of the conveyor belts moved by the rollers 21, 22. As mentioned, it is advantageously possible to provide that the outlet head 14 has pre-cooling means 23.

**[0034]** The pre-cooling means 23 provide the suction of air coming from outside and at room temperature, making it pass through the bed 12, due to the air suction unit 24. Although it entails load losses, this results in the external air being partially heated by cooling the non-woven fabric 12, which in this way is consolidated. The air sucked by the pre-cooling device 23 has two specific functions.

**[0035]** First, for a good balance in the ventilation of the oven, since in the heating with burners it is necessary to feed comburent air in the burner, it is therefore necessary to discharge the same quantity of air from inside the oven and such air will feed the pre-heater in the inlet head. The use of the pre-cooling device 23 ensures that burners can be fed with comburent air which is already heated and not at the external temperature, thus reducing the need to heat it to make it reach the temperature of the internal area 11 of the oven; in other words, this air that has cooled the non-woven tissue 12 can be used as comburent for the heating device of the oven 10, at a higher than normal temperature, closer to the ignition temperature of the fuels used. This makes the employed burners more efficient, with a remarkable reduction of gas con-

sumption.

**[0036]** An improvement in the functioning of the burners will have benefits only on the ovens that use this source of heating. In ovens that must instead evaporate water, it is necessary to evacuate this water to the outside by means of a strong flow of moisture-rich air. Such flow must be reintegrated by a same amount of incoming environment air which may be pre-heated in the outlet head, passing through the material, allowing a lower energy consumption of the oven, which would be benefit also ovens using diathermic oil exchangers or electric heat exchangers as a heating source. A considerable versatility is thus achieved.

**[0037]** Note that, according to the present invention, the pre-heating of fibres does not occur inside the internal area 11 of the oven 10, as is done in some ovens of the prior art, but inside the feeding head 13 of the fibres themselves, thus outside the oven and at its entry. Thanks to that, which was not predictable based on the prior art, the present invention allows to obtain an increase of the operational length of the oven 10 (normally about 1,5 m) of the inlet head 13, without increasing the overall length of the same oven 10. This involves a not negligible increase in speed, and therefore in productivity, of the oven 10. Alternatively, keeping the oven productivity constant compared to prior art ovens, it is possible to reduce their size, which is a considerable advantage as well, with space issues normally found in industrial plants. None of the above advantages is found in none of the prior art ovens.

**[0038]** A preferred embodiment also involves the use, in the oven 10 according to the present invention, of the structure with completely opening side walls, described in a patent application recently filed by the same Applicant of the present application. Furthermore, the oven 10 may include dampers present on the opening walls, able, thanks to their operation, to perform the inversion of the air flow within the oven 10. In this way, the oven 10 reaches an efficiency not only never experienced, but also not conceivable up to now, on the basis of the currently known art.

**[0039]** It is understood, however, that the invention is not to be considered as limited by the particular arrangement illustrated above, which represents only an exemplary embodiment of the same, but different changes are possible, all within the reach of a person skilled in the art, without departing from the scope of the invention itself, as defined by the following claims.

#### LIST OF REFERENCE NUMERALS

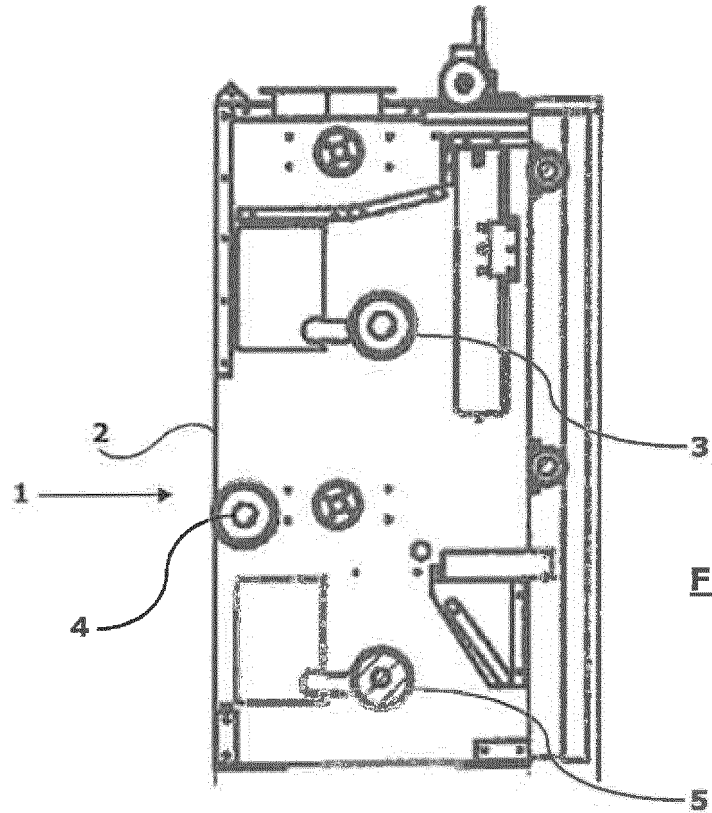
##### [0040]

- 1 Inlet head (prior art)
- 2 Casing (of 1 - prior art)
- 3 Tensioning roller (of 1 - prior art)
- 4 Tensioning roller (of 1 - prior art)
- 5 Tensioning roller (of 1 - prior art)

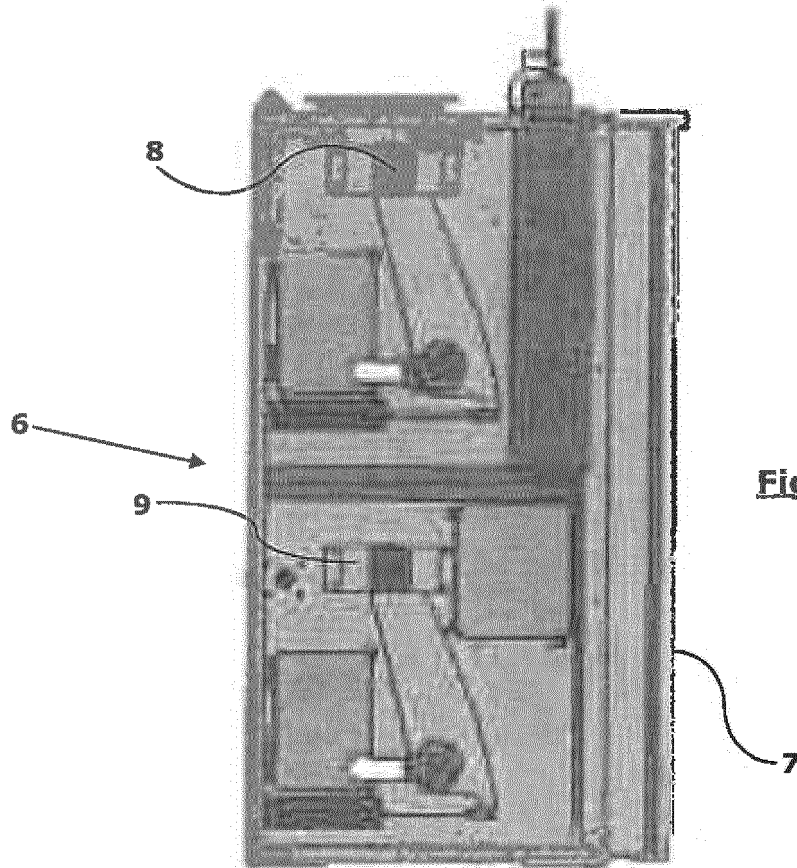
6	Outlet head (prior art)		<b>characterised in that</b> the side walls thereof can be fully opened.
7	Casing (of 6 - prior art)		
8	Pulling means (of 6 - prior art)		
9	Pulling means (of 6 - prior art)		
10	Oven	5	<b>10.</b> Oven (10) as in 9), <b>characterised in that</b> said wall carries dampers capable of performing, through the manoeuvre thereof, the inversion of the air flow within the oven (10).
11	Internal area (of 10)		
12	Fibre bed		
13	Inlet header (of 10)		
14	Outlet header (of 10)		
15	Casing (of 13)	10	
16	Tensioning roller (of 13)		
17	Tensioning roller (of 13)		
18	Tensioning roller (of 13)		
19	Pre-heating device (of 13)		
20	Casing (of 14)	15	
21	Pulling means (of 14)		
22	Pulling means (of 14)		
23	Pre-cooling means (of 14)		
24	Hot air suction unit (of 23)	20	

### Claims

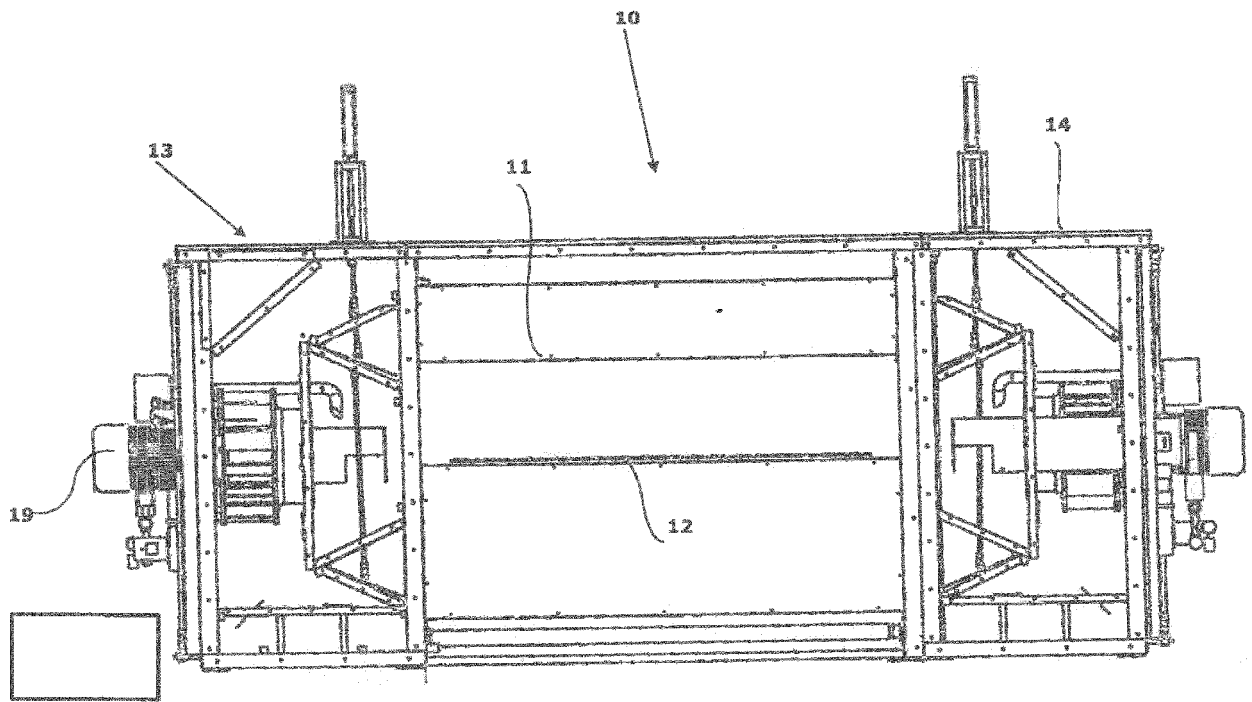
1. Oven (10) for the textile sector, comprising an inlet head (13) and an outlet head (14), **characterised in that** said inlet head (13) and said outlet head (14) are units external to the oven chamber and connected to it and **in that** said inlet head (13) comprises a pre-heating device (19) for the product. 25
2. Oven (10) as in 1), **characterised in that** the outlet head (14) comprises a pre-cooling device (23). 30
3. Oven (10) as in 2), **characterised in that** said pre-cooling device (23) comprises an air suction unit (24). 35
4. Oven as in 3), **characterised in that** said air suction unit (24) consists of a fan. 40
5. Oven (10) as in any one of claims 1) to 4), **characterised in that** said pre-heating device (19) is a heater with air flow.
6. Oven (10) as in 5), **characterised in that**, in said heater with air flow, the hot air used is the one which is evacuated by the oven after passing into the material to which it transfers its own heat. 45
7. Oven (10) as in 5), **characterised in that** such device is installed in the inlet head of the oven. 50
8. Oven (10) as in any one of claims 2) to 7), **characterised in that** the air which has cooled the non-woven fabric (12) is employed as comburent for the heating device of said oven (10). 55
9. Oven (10) as in any one of the preceding claims,



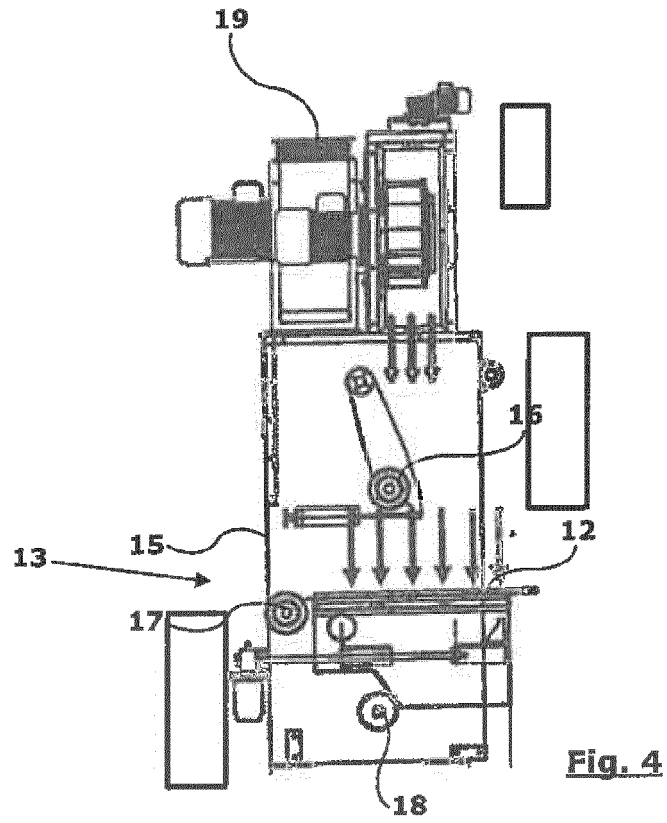
**Fig. 1**



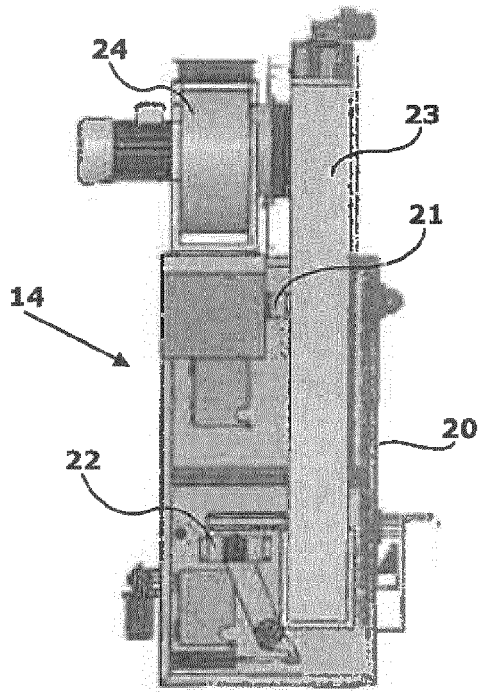
**Fig. 2**



**Fig. 3**



**Fig. 4**



**Fig. 5**



EUROPEAN SEARCH REPORT

Application Number  
EP 16 19 8032

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 4 133 636 A (FLYNN CHARLES S) 9 January 1979 (1979-01-09) * claims 1,5,6,10 * * column 4, line 4 - column 5, line 60 * -----	1,2,5-8, 10 3,4,9	INV. D06C7/00 D04H1/54 D04H3/04 F26B13/10 F26B25/06 F27B9/00
Y	US 4 551 378 A (CAREY JR PATRICK H [US]) 5 November 1985 (1985-11-05) * column 5, line 1 - column 6, line 7; figure 4 * -----	1-10	
A	GB 2 140 837 A (ALLEN IND) 5 December 1984 (1984-12-05) * page 5, line 113 - page 7, line 14; figures 23,24 * -----	1-10	
A	US 5 997 287 A (PARMENTIER PHILIPPE [FR] ET AL) 7 December 1999 (1999-12-07) * column 3, line 48 - column 4, line 59 * -----	1-10	
Y	EP 2 840 178 A1 (UNICHARM CORP [JP]) 25 February 2015 (2015-02-25) * paragraph [0068]; figure 6 * -----	3,4	TECHNICAL FIELDS SEARCHED (IPC)
Y	DE 203 15 984 U1 (MONFORTS TEXTILMASCHINEN GMBH [DE]) 11 December 2003 (2003-12-11) * the whole document * -----	9	D06C D04H F26B F27B
The present search report has been drawn up for all claims			
Place of search <b>Munich</b>		Date of completion of the search <b>9 February 2017</b>	Examiner <b>Bichi, Marco</b>
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... & : member of the same patent family, corresponding document	

EPO FORM 1503 03.02 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.

EP 16 19 8032

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

09-02-2017

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4133636 A	09-01-1979	NONE	
US 4551378 A	05-11-1985	CA 1267273 A DE 3582280 D1 EP 0168225 A2 HK 75891 A JP H0784694 B2 JP S6134268 A US 4551378 A	03-04-1990 02-05-1991 15-01-1986 04-10-1991 13-09-1995 18-02-1986 05-11-1985
GB 2140837 A	05-12-1984	DE 3420218 A1 GB 2140837 A IT 1174107 B	06-12-1984 05-12-1984 01-07-1987
US 5997287 A	07-12-1999	DE 19647366 A1 FR 2741363 A1 GB 2307233 A JP 3948637 B2 JP H09279472 A US 5928986 A US 5997287 A	22-05-1997 23-05-1997 21-05-1997 25-07-2007 28-10-1997 27-07-1999 07-12-1999
EP 2840178 A1	25-02-2015	CN 103492626 A CN 106012396 A EP 2840178 A1 JP 5777558 B2 JP 2013224501 A TW 201404964 A US 2015067996 A1 WO 2013157611 A1	01-01-2014 12-10-2016 25-02-2015 09-09-2015 31-10-2013 01-02-2014 12-03-2015 24-10-2013
DE 20315984 U1	11-12-2003	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

**REFERENCES CITED IN THE DESCRIPTION**

*This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.*

**Patent documents cited in the description**

- US 4133636 A [0017]
- US 4551378 A [0018]
- GB 2140837 A [0019]
- US 5997287 A [0020]
- EP 2840178 A [0021]
- DE 20315984 [0022]