(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 260 260 A1

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
27.12.2017 Bulletin 2017/52

(21) Application number: **17175631.5**

(22) Date of filing: **13.06.2017**

(51) Int Cl.:
B28B 3/02 (2006.01) ***B28B 5/02*** (2006.01)
B28B 13/02 (2006.01) ***B30B 5/04*** (2006.01)
B30B 11/02 (2006.01)

(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

(30) Priority: **16.06.2016 IT UA20164452**

(71) Applicant: **System S.p.A.**
40142 Fiorano Modenese (Modena) (IT)

(72) Inventors:
- **STEFANI, FRANCO**
  41049 SASSUOLO (IT)
- **GOZZI, FRANCO**
  41043 FORMIGINE (IT)

(74) Representative: **Casadei, Giovanni**
Bugnion S.p.A.
Via Vellani Marchi, 20
41124 Modena (IT)

(54) **COMPACTING DEVICE FOR PRESSING CERAMIC ARTICLES**

(57) Compacting device for pressing ceramic articles, usable in a pressing device provided with a conveyor belt (T) that is movable along a main direction (X) for the forward movement of a load (S) of incoherent ceramic material, comprising a first leveler (2), which is structured to come into contact with two lateral zones of the load (S) and to push such lateral zones towards one another, perpendicular to the main direction (X).

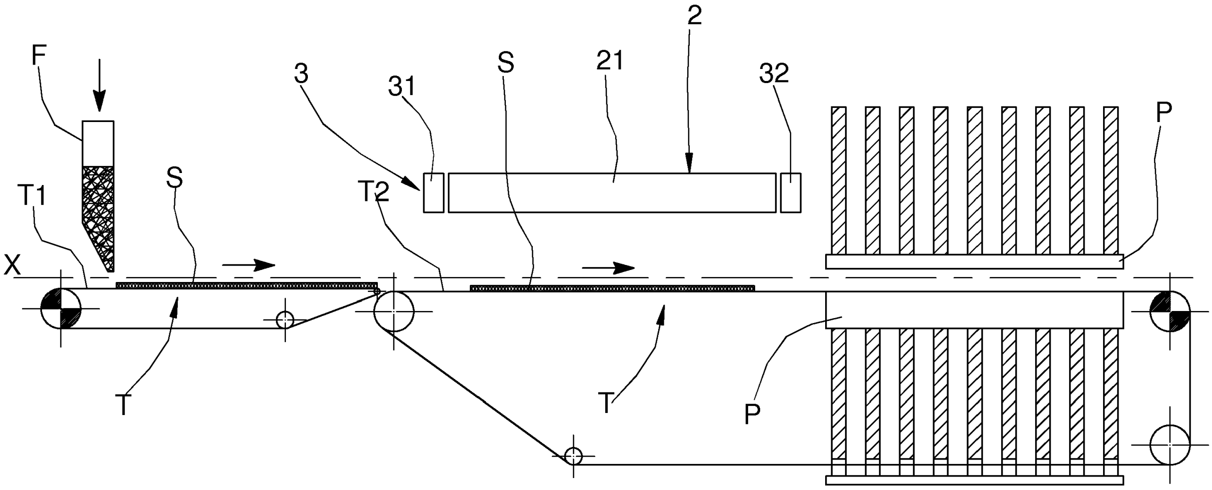

Fig.1

Printed by Jouve, 75001 PARIS (FR)

Description

[0001] The object of the present invention is a compacting device for pressing ceramic articles, in particular plates, tiles and the like.

[0002] The invention also refers to a pressing device for ceramic articles.

[0003] The invention is particularly advantageous in a device for pressing ceramic articles, ideated by the applicant itself and known in the field from the publication EP1500480, in which the powder material to be pressed is arranged in layer form on an abutment plane constituted by the upper face of a conveyor belt, which is slidably supported on a pressing member or lower pad. The pressing is executed with a pressing member or upper pad through the interposition of a closed-loop belt, whose external surface is directed towards the conveyor belt.

[0004] For the purpose of delimiting the perimeter of a pressing zone, the upper pad is provided with a frame, fixed or replaceable, that projects downward. In addition to delimiting the perimeter of the pressing zone, such forming frame also has the task of generating in the load, following the pressing, an edge characterized by a compaction or material density greater than that of the internal zones, wherein by greater material density it is intended a reduction of the overall space occupied by the material. As is known, the presence of denser and more compact lateral zones considerably simplifies the removal and trimming of the loads after pressing. This occurs since the denser zones can perfectly withstand, without crumbling, the removal of the incoherent material that is situated along the external edges of the pressed load, allowing the obtainment of precise, clear edges of the load.

[0005] The currently available device, while being effective and functional, can be improved regarding flexibility with respect to the change of size of the articles to be pressed. Indeed, in the currently available device, changing the size of the ceramic article requires changing the projecting frame with a frame shaped for executing the pressing of the new size. This represents a drawback both regarding processing times, since the substitution of the frame requires stopping the pressing line, and regarding costs, since it requires the availability of a certain number of different-size frames.

[0006] The object of the present invention is to offer a compacting device that allows overcoming the abovementioned drawbacks.

[0007] One advantage of the compacting device according to the present invention is to allow a change of size in considerably lower times with respect to those of the currently available devices.

[0008] Further characteristics and advantages of the present invention will be clearer from the following detailed description of one embodiment of the present invention, illustrated as a non-limiting example in the enclosed figures in which:

- figure 1 shows a schematic representation of a pressing device provided with a compacting device according to the present invention;
- figure 2 shows the compacting device of figure 1 in a different operating configuration;
- figure 3 shows a top view of the device of figures 1 and 2;
- figures 4 and 5 show two different operating steps of the compacting device shown in figure 3;
- figure 6 shows a schematic representation, in top view, of a different embodiment of the compacting device according to the present invention;
- figure 7 shows a sectional view according to the plane VII-VII of figures 4 and 6.

[0009] The compacting device according to the present invention is particularly but not exclusively recommended for being used in a pressing device provided with a conveyor belt (T) that is movable along a main direction (X), for the forward movement of a load (S) of incoherent ceramic material to be pressed. A press (P) is arranged along the conveyor belt (T) in a manner so as to receive the load (S) carried forward by the conveyor belt (T). Both the belt (T) and the load (S) arranged on the belt (T) move between the two pads of the press (P), such that the load (S) is pressed directly on the belt (T).

[0010] For greater clarity, in the following description it is specified that "width" will indicate a size measured on a horizontal plane perpendicular to the main direction (X), while "height" or "thickness" will indicate a size measured along a vertical direction.

[0011] The compacting device comprises a first leveler (2), which is structured to come into contact with two lateral zones of the load (S) and to push such lateral zones towards one another, perpendicular to the main direction (X).

[0012] The first leveler (2), in other words, compacts the load (S) perpendicular to the main direction (X), pushing the two lateral zones thereof, which are overall parallel to the main direction (X), towards one another. The incoherent material of the lateral zones of the load is collected, forming two stacks (As), substantially parallel to the main direction (X), whose maximum level exceeds the level of the remaining zones of the load (S) itself. Since the travel of the pressing pad is the same over the entire load (S), during pressing the stacks in the lateral zones of the load (S), formed due to the action of the first leveler (2), undergo a compaction that is considerably greater than that of the other zones of the load (S), and they assume a material density likewise greater than that of the other zones of the load (S). As is known, the presence of denser and more compact lateral zones considerably simplifies the removal and the trimming of the incoherent material that is situated outside the lateral zones, allowing the obtainment of precise and clear edges of the load (S).

[0013] In one possible embodiment, illustrated in figures 1 to 5, the first leveler (2) comprises a pair of side walls (21,22) movable towards and away from one another along a horizontal direction, perpendicular to the main direction (X). In this embodiment, the intervention of the side walls (21,22) is actuated during a rest phase of the load (S), i.e. during a stop of the conveyor belt (T). In substance, a load (S) is carried into and stopped in an intermediate position with respect to the side walls (21,22). Starting from a position of maximum mutual distance, in which they do not interfere with the load (S), the side walls (21,22) are moved closer together by means of actuators that are not illustrated in detail, for example pneumatic or hydraulic cylinders. By moving closer together up to a minimum distance position (figure 4), the side walls (21,22) come into contact with the lateral zones of the load (S), creating the previously-described stacks of greater height. Once the step of compaction of the lateral zones of the load (S) has terminated, the side walls (21,22) return to the maximum distance position, such that the load (S) can once again be moved forward and a new load (S) can be carried to the side walls (21,22). The actuators which drive the side walls (21,22) can advantageously be remotely controlled by means of a control module, for example in order to adapt the travel of the side walls (21,22) to different-size loads (S).

[0014] The side walls (21,22) have a front surface, intended to come into contact with the load (S), which is arranged in a substantially vertical position. For example, the side walls (21,22) can have the form of laminas or strips, arranged with the greater surface thereof vertical. The front surface of the side walls (21,22) could also assume a different shape, e.g. convex or tilted.

[0015] In an alternative embodiment, shown in figure 6, the first leveler (2) comprises a pair of side walls (21,22) arranged to converge with each other in a forward direction of the load (S). In this manner, the lateral zones of the load (S) come into contact with the side walls (21,22), and are compacted, during the transport of the load (S). Preferably, the side walls (21,22) remain fixed during the forward movement of the load (S). Each side wall (21,22) comprises a front surface, directed towards the belt (T) and towards the other side wall, situated above the belt (T), at a height such to be able to come into contact with the load (S). The height of the side walls (21,22) can be adjustable with respect to the conveyor belt (T), in order to adapt the position of the side walls (21) to the thickness or height of the load (S). The position of the side walls (21,22) can be adjustable along a horizontal direction perpendicular to the main direction (X), in order to allow adapting the position of the side walls (21,22) to the width of the load (S), as well as adjusting the level of compaction on the lateral zones of the load (S), and hence adjusting the height of the stacks that are formed in the lateral zones of the load (S). In order to adjust the position of the side walls (21,22), it is possible to arrange motorized or manual regulators, as is within the capacity of the man skilled in the art. The use of motorized regulators allows modifying the position of the side walls (21,22) by means of remote controls, for example for an adaptation to loads (S) of different size.

[0016] In the embodiment represented in figure 6, the side walls (21,22) are in the form of laminas or strips, arranged with the greater surface thereof in substantially vertical position.

[0017] The compacting device can also be provided with a second leveler (3), which is structured to come into contact with a front zone and with a rear zone of the load (S) and to push such zones towards one another, parallel to the main direction (X). The second leveler performs, on the front zone and on the rear zone of the load (S), the same action that the first leveler (2) performs on the lateral zones of the load (S).

[0018] Following the intervention of the second leveler (3), the incoherent material of the front and rear zones of the load is collected, forming two stacks (Af,Ar), substantially perpendicular to the main direction (X), whose maximum level exceeds the level of the remaining zones of the load (S) itself.

[0019] Following the intervention of the first and second leveler (2,3), the load (S) then has a substantially rectangular perimeter zone, comprising a stack (As,Af,Ar) of incoherent material whose maximum level exceeds the level of the remaining zones of the load (S) itself. During pressing, both the stacks in the front and rear zones of the load (S), formed due to the action of the second leveler (3), and the stacks formed in the lateral zones of the load (S), formed due to the action of the first leveler (2), undergo a compaction that is considerably greater than that of the other zones of the load (S), assuming a material density that is likewise greater than that of the other zones of the load (S). In this manner, at the end of the pressing, the load (S) comprises a closed perimeter zone, which follows the entire border of the load (S) itself, in which the incoherent material has greater compaction and material density. This allows facilitating and making more precise the trimming operations of the entire border of the load (S).

[0020] Preferably the second leveler (3) is movable along a vertical direction between a lower position (figure 1), in which it is able to come into contact with a load (S), and an upper position (figure 2), in which it does not interfere with the load (S). In the upper position (figure 2), the second leveler (3) allows the transit of the load (S) on the conveyor surface (T). Actuators of known type, not illustrated in detail, are arranged for allowing the vertical movement of the second leveler (3).

[0021] In the illustrated embodiment, the second leveler (3) comprises a pair of side walls (31,32) movable towards and away from one another, parallel to the main direction (X). Preferably, but not exclusively, the side walls (31,32) have a front surface, intended to come into contact with the load (S), which is arranged in a substantially vertical position. For example, the side walls (31,32) can have the form of laminas or strips, arranged with the greater surface thereof vertical. Actuators that are within the capacity of the man skilled in the art can be used for driving the side walls (31,32). Such actuators can advantageously be remotely controlled by means of a control module, for example for adapting the travel of the side walls (31,32) to different-size loads (S).

[0022] The intervention of the side walls (31,32) is actuated during a rest phase of the load (S), or during a stop of the conveyor belt (T). Starting from a configuration in which the second leveler (3), and the side walls (31,32), are situated in upper position, a load (S) can be carried into and stopped in a zone comprised between the side walls (31,32). Subsequently, the second leveler (3) is moved into its lower position (figure 2), in which the side walls (31,32) can come into contact with the load (S). Starting from a position of maximum mutual distance, in which they do not interfere with the load (S), the side walls (31,32) are moved closer together by means of actuators not illustrated in detail, e.g. pneumatic or hydraulic cylinders. By moving closer to each other up to a position of minimum distance (figure 5), the side walls (31,32) come into contact with the front and rear zones of the load (S), creating the previously-described stacks of greater height. Once the step of compaction of the front and rear zones of the load (S) has terminated, the side walls (31,32) return to the position of maximum distance and they are lifted towards the upper position, such that the load (S) can once again be moved forward and a new load (S) can be carried to the side walls (31,32).

[0023] In the embodiment represented in figures 1 and 2, also the first leveler (2) is movable along a vertical direction between a lower position (figure 2), in which it is able to come into contact with a load (S), and an upper position (figure 1), in which it does not interfere with the load (S). Preferably the first leveler (2), in the embodiment comprising the side walls (21,22), can be associated with the second leveler (3) in order to form a group that is integral with respect to the vertical translation. In this embodiment, the intervention of the two levelers (2,3) is actuated during a stop of the conveyor belt (T). The two levelers, which are initially found in upper position, are lowered into lower position. In such position, each successively executes its own compaction travel. Once the compaction travels have terminated, the two levelers (2,3) are brought back into upper position and the conveyor belt (T) once again moves forward towards the press (P).

[0024] In a variant of the represented embodiment, the first leveler (2) could also not be integral with the second leveler (3) with respect to the vertical translation. This occurs since the second leveler (2) does not obstruct the forward movement of the load (S) when the side walls (21,22) are situated in widened position. The second leveler (2), during the operation of the pressing device, could therefore always remain in lower position, and be lifted for example for the execution of maintenance operations.

[0025] The compactor according to the present invention is particularly effective in a pressing device in which the conveyor belt (T) assumes a continuous configuration, or in a configuration in which it comprises a first portion (T1) and a second portion (T2), consecutive with respect to each other, which are movable independently of one another. In both cases, a feeding device (F) is arranged along an initial portion of the conveyor belt (T). If the conveyor belt (T) comprises the two portions (T1,T2), the feeding device (F) is arranged along the first portion (T1) in order to deposit a load (S) on the first portion (T1) itself. The feeding device (F) is, for example, in the form of a hopper provided with a lower discharge opening.

[0026] The feeding device (F) operates on the first portion (T1), i.e. the loads (S) are deposited on the first portion (T1).

[0027] The front end of the first portion (T1) is at least partially above a rear end of the second portion (T2), at a height slightly greater than the second portion (T2). By driving the first and the second portion (T1,T2) in a synchronized forward-moving manner, i.e. at the same forward movement velocity, the load (S) is transferred from the first portion (T1) to the second portion (T2) by executing a small downward jump at the front end of the first portion (T1).

[0028] The presence of a first and a second portion (T1,T2), independent of one another, allows managing the intervention of the compacting device with considerable flexibility. In particular, while the second portion is stopped in order to allow the intervention of the compacting device, or in order to allow the intervention of the press (P), the first portion (T1) can be driven to move forward in order to allow the deposition of a load (S). The step of depositing a load (S) can be synchronized with the intervention of the compacting device, so as to terminate before or simultaneously with the intervention of the compacting device. In this manner, once the intervention of the compacting device has terminated, the first and the second portion (T1,T2) can be driven forward in order to execute the transfer of the load (S) deposited on the first portion, and to simultaneously transfer the load (S) that has undergone compaction towards the press (P).

[0029] If the conveyor belt (T) comprises the first and the second portion (T1,T2) that are movable independently of one another, it is possible to form the stacks (Af,Ar) in the front and rear zones of the load by modifying the forward movement velocity of the two portions, in a manner such that, during the transfer of the front zone and of the rear zone of the load (S) from the first portion to the second portion, a reduction of the forward movement velocity of the load is produced. This causes the formation of the stacks (Af,Ar). For example, while the front zone of the load (S) transits from the first portion (T1) to the second portion (T2), it is possible to increase the velocity of the first portion (T1) with respect to the second portion (T2), and/or reduce the velocity of the second portion (T2) with respect to the velocity of the first portion (T1). In this manner, it is possible to obtain the stack (Af) in the front zone, without requiring the second leveler (3). In the same manner, it is possible to obtain the stack (Ar) in the rear zone of the load (S), by increasing the velocity of the first portion (T1) with respect to the second portion (T2), and/or reducing the velocity of the second portion (T2) with respect to the velocity of the first portion (T1).

[0030] The compacting device according to the present invention allows obtaining important advantages. First of all, the compacting device allows attaining loads (S) with a perimeter zone of greater material density, without arranging pressing pads provided with projecting edges or frames. This allows reducing the cost of the pressing pads and simultaneously reducing the adaptation times with a change of size of the loads (S) to be pressed. Indeed, it is sufficient to modify the travel and/or the mutual distance of the side walls (21,22,31,32) in order to be able to attain the stacks (As,Af,Ar) in loads (S) of different size. In fact, the changes of size of the loads (S) can be managed without having to stop the pressing line so to execute adaptation interventions; rather, it will suffice to simply adjust the travel or the mutual distance between the side walls (21,22,31,32). Such adjustment can occur through remote controls on the actuators set for driving the side walls themselves, or on suitable regulators that can be arranged for the levelers (2,3).

Claims

1. A compacting device for pressing ceramic articles, usable in a pressing device provided with a conveyor belt (T) that is movable along a main direction (X), for the forward movement of a load (S) of incoherent ceramic material, **characterized in that** it comprises a first leveler (2), which is structured to come into contact with two lateral zones of the load (S) and to push such lateral zones towards one another, perpendicular to the main direction (X), so as to form two stacks (As), substantially parallel to the main direction (X), whose maximum level exceeds the level of the remaining zones of the load (S) itself.

2. The compacting device according to claim 1, wherein the first leveler (2) comprises a pair of side walls (21,22) arranged to converge with each other in a forward direction of the load (S).

3. The compacting device according to claim 1, wherein the first leveler (2) comprises a pair of side walls (21,22) movable towards and away from one another perpendicular to the main direction (X).

4. The compacting device according to claim 1, wherein the first leveler (2) is movable along a vertical direction between a lower position, in which it is able to come into contact with a load (S), and an upper position, in which it does not interfere with the load (S).

5. The compacting device according to claim 1, comprising a second leveler (3), structured to come into contact with a front zone and with a rear zone of the load (S) and to push such zones towards one another, parallel to the main direction (X).

6. The compacting device according to claim 5, wherein the second leveler (3) comprises a pair of side walls (31,32) movable towards and away from one another, parallel to the main direction (X).

7. The compacting device according to claim 5, wherein the second leveler (3) is movable along a vertical direction between a lower position, in which it is able to come into contact with a load (S), and an upper position, in which it does not interfere with the load (S).

8. A pressing device for ceramic articles, comprising: a conveyor belt (T), movable along a main direction (X), for the forward movement of a load (S) of incoherent ceramic material; a press (P), arranged along the conveyor belt (T) for receiving the load (S); **characterized in that** it comprises a compacting device (1) according to one or more preceding claims, arranged along the conveyor belt (T) upstream of the press (P) with respect to the forward direction of the conveyor belt (T).

9. The pressing device according to claim 8, comprising a feeding device (F), arranged along an initial portion of the conveyor belt (T) for depositing a load (S) onto the conveyor belt (T) itself.

10. The pressing device according to claim 9, wherein the conveyor belt (T) comprises a first portion (T1) and a second portion (T2), consecutive with respect to each other, which are movable independently of one another, and wherein the feeding device (F) is arranged along the first portion (T1) in order to deposit a load (S) onto the same first portion (T1).

11. A method for pressing ceramic articles, comprising the following steps: depositing a load (S) of incoherent material on a conveyor belt (T); conveying the load (S) along a main direction (X); by means of a first leveler (2), pushing two lateral zones of the load (S) towards one another, perpendicular to the main direction (X), so as to form two stacks (As), substantially parallel to the main direction (X), whose maximum level exceeds the level of the remaining zones of the load (S); pressing the load (S) following the formation of the stacks (As).

12. The method according to claim 11, wherein, before pressing the load (S), a step is provided for pushing a front zone and a rear zone of the load (S), parallel to the main direction (X), towards one another by means of a second leveler (3), so as to form two stacks (Af,Ar) that are substantially perpendicular to the main direction (X), whose maximum level ex-

ceeds the level of the remaining zones of the load (S).

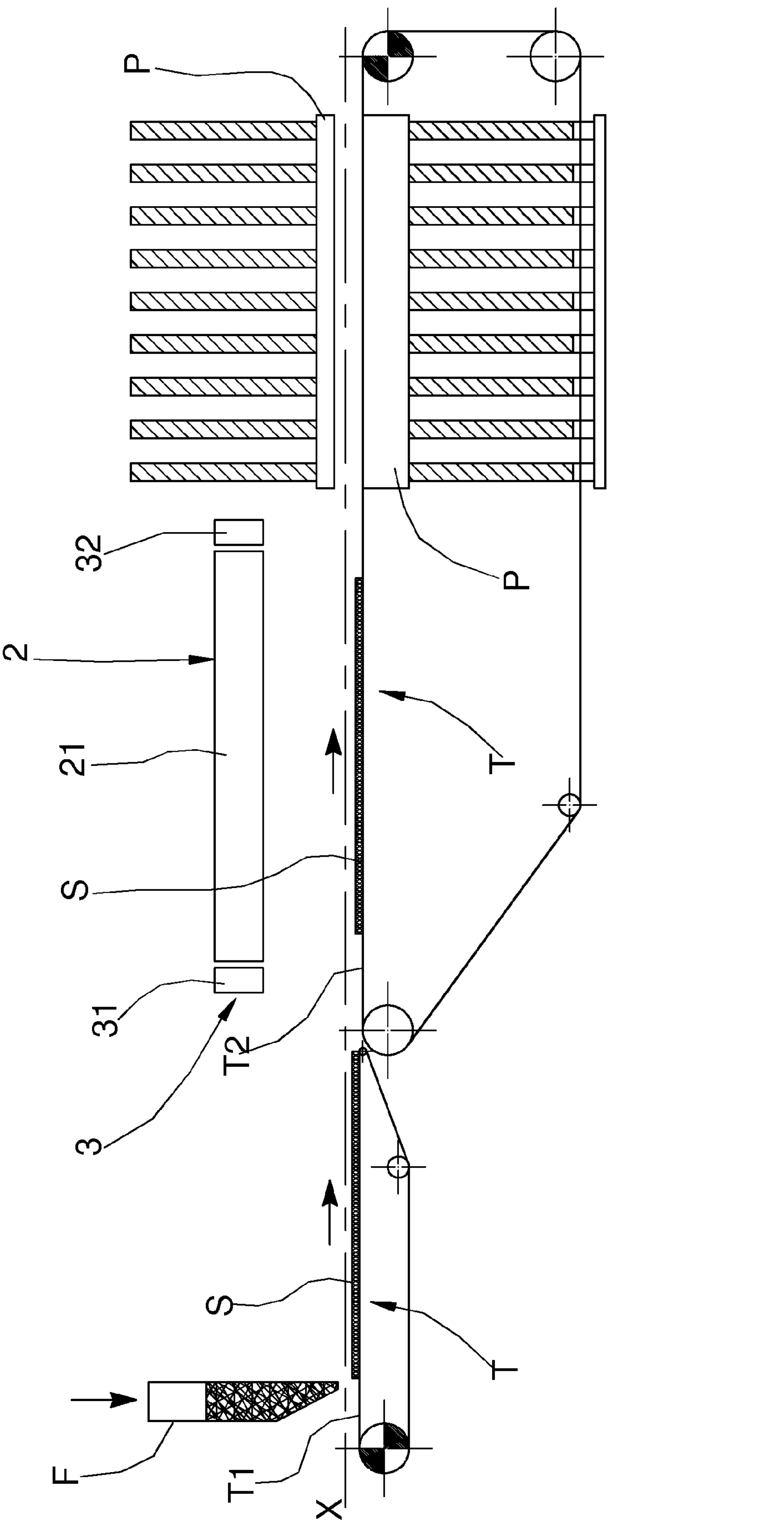

Fig.1

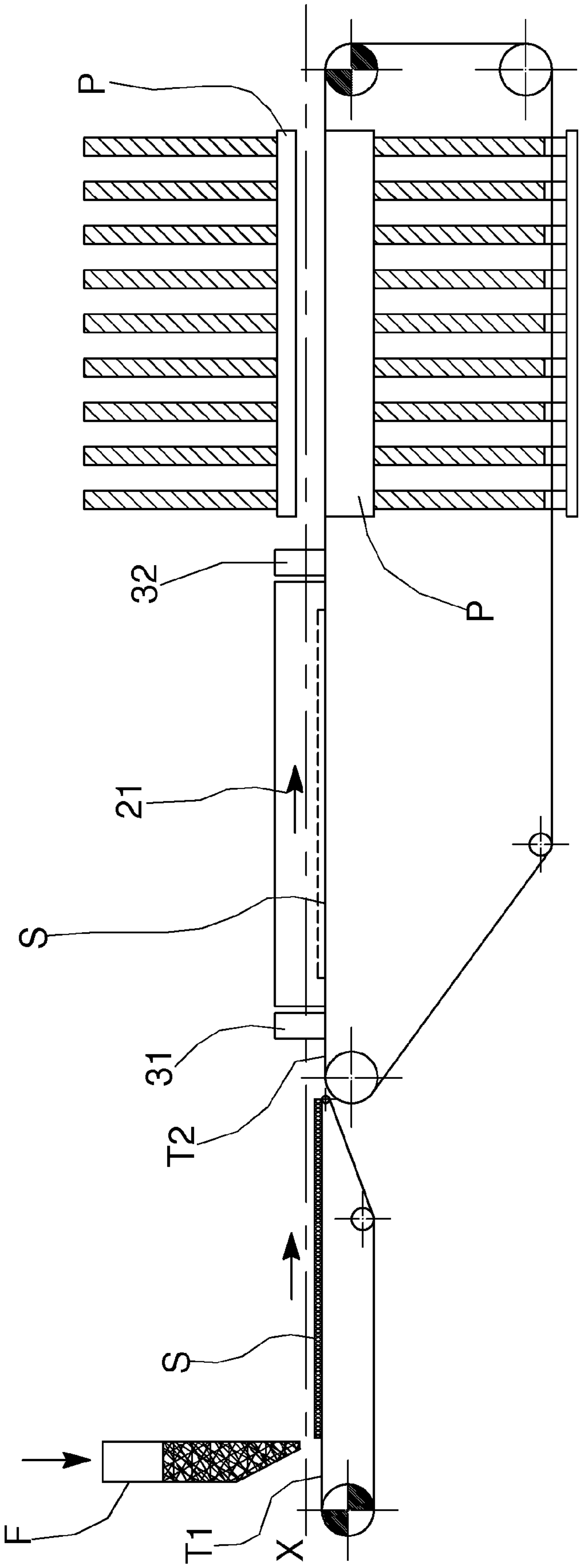

Fig.2

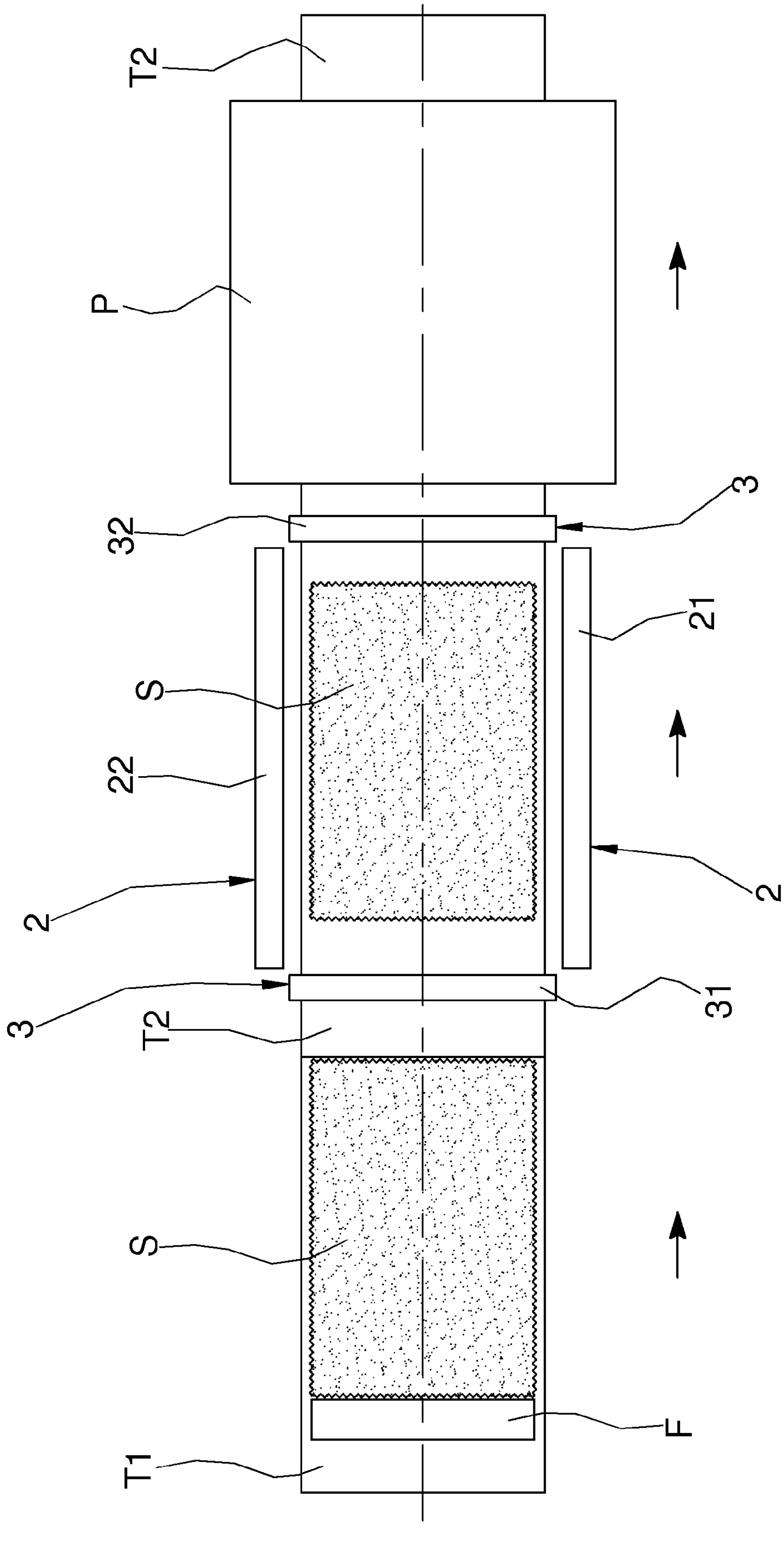

Fig.3

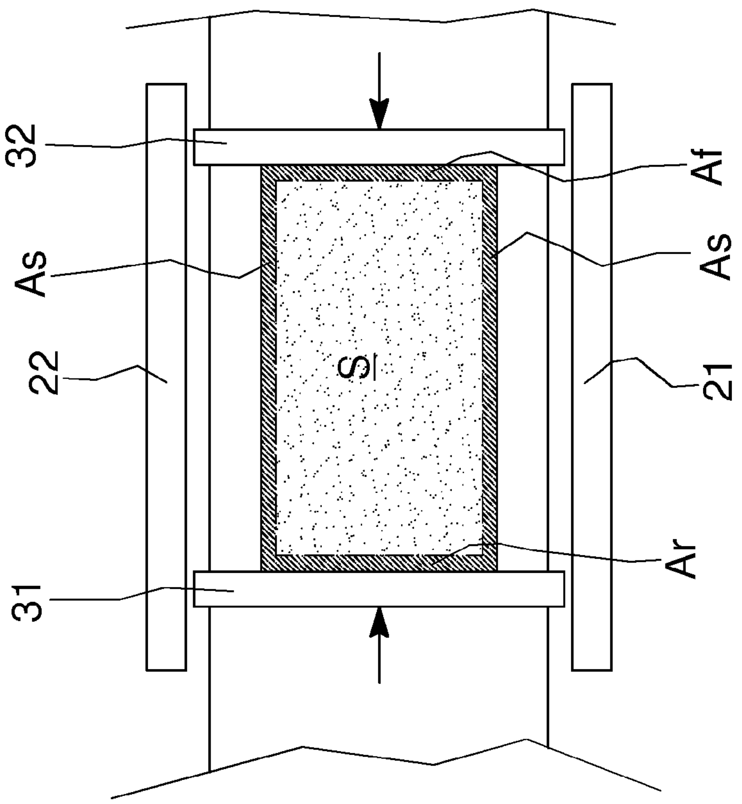

Fig.5

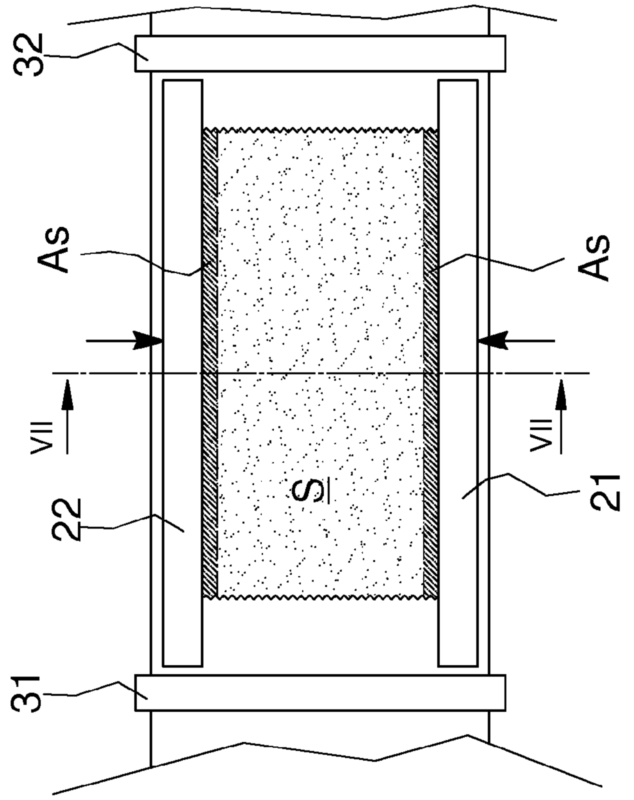

Fig.4

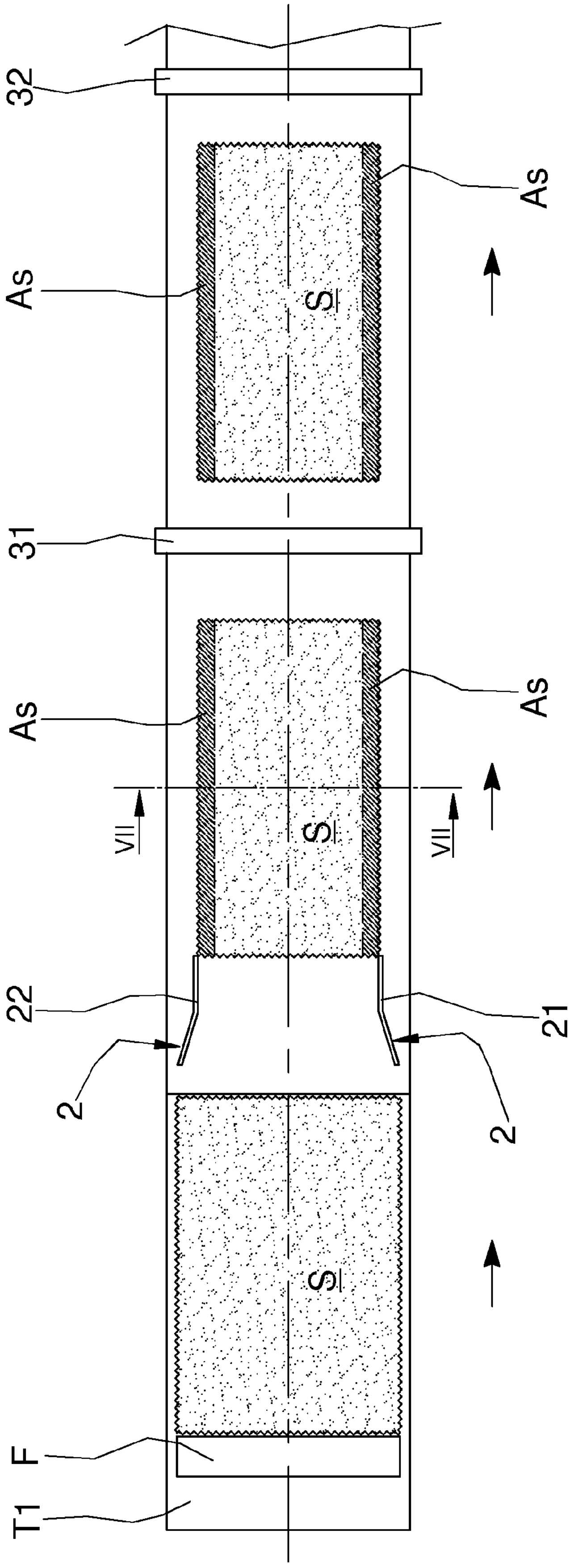

Fig.6

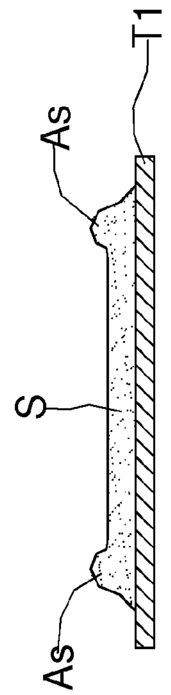

Fig.7

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 17 17 5631

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 A	WO 2006/095249 A2 (MIRA DI ALGERI MARIS [IT]; CAMORANI CARLO ANTONIO [IT]) 14 September 2006 (2006-09-14) * figure 22 * * page 17, lines 22-35 *	1,2,4,5, 7-9,11 6,12	INV. B28B3/02 B28B5/02 B28B13/02 B30B5/04 B30B11/02
X	US 2001/017428 A1 (KLASTERKA STANISLAV [DE]) 30 August 2001 (2001-08-30) * figures 1-3 * * paragraphs [0050] - [0053] *	1-3,8-11	
X	US 2014/096887 A1 (KROLL DETLEF [DE]) 10 April 2014 (2014-04-10) * figures 1,7 * * paragraphs [0030], [0034] *	1,8-11	
A	CN 1 451 524 A (XU JIAN [CN]) 29 October 2003 (2003-10-29) * abstract * * figures 1-3 *	1-12	
A	CN 105 563 630 A (ZHONG XIHUAN) 11 May 2016 (2016-05-11) * abstract * * figure 1 *	1-12	TECHNICAL FIELDS SEARCHED (IPC) B28B B30B B27N

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
The Hague	16 November 2017	Voltz, Eric

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 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 17 17 5631

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.

16-11-2017

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2006095249 A2	14-09-2006	NONE	
US 2001017428 A1	30-08-2001	AT 235356 T	15-04-2003
		AU 2284000 A	03-07-2000
		BR 9916231 A	04-09-2001
		CN 1330584 A	09-01-2002
		DE 19858096 A1	21-06-2000
		DK 1140447 T3	30-06-2003
		EP 1140447 A1	10-10-2001
		ES 2196915 T3	16-12-2003
		JP 3858059 B2	13-12-2006
		JP 2002532278 A	02-10-2002
		PT 1140447 E	29-08-2003
		RU 2208515 C2	20-07-2003
		US 2001017428 A1	30-08-2001
		WO 0035644 A1	22-06-2000
US 2014096887 A1	10-04-2014	BR 112013030434 A2	01-03-2017
		CA 2836846 A1	06-12-2012
		CN 103547418 A	29-01-2014
		DE 102011076655 A1	29-11-2012
		EP 2714351 A1	09-04-2014
		RU 2013158692 A	10-07-2015
		US 2014096887 A1	10-04-2014
		WO 2012163867 A1	06-12-2012
CN 1451524 A	29-10-2003	NONE	
CN 105563630 A	11-05-2016	NONE	

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

• EP 1500480 A **[0003]**