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(54) **SYSTEM FOR THE PRODUCTION OF COMPACTED ICE**

(57) The present invention relates to a system for producing compacted ice from crushed ice, comprising: a sub-system (1) for receiving crushed ice; a sub-system (3) for compacting the crushed ice, comprising at least a press module (4), and a compression module (5) provided with means for generating compression forces by means of the movement of one or more press rollers (6); and a sub-system (7) for actuating the compaction sub-system (3). Advantageously, the compaction sub-system (3) also comprises one or more rotary platforms (2) for moulding the crushed ice, arranged between the press module (4) and the compression module (5), such that the rotary movement thereof is used to convey the crushed ice and the compacted ice during production. The actuation sub-system (7) is provided with means for rotating the rotary platforms (2) while the crushed ice is being compacted.

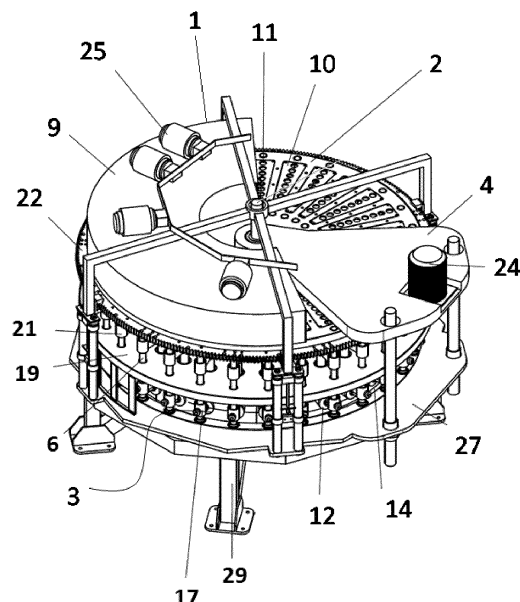


FIG. 1

Description

FIELD OF THE INVENTION

[0001] The present invention is comprised in the field of the ice production industry. More specifically, the invention relates to a system for making compacted ice from crushed or flake ice.

BACKGROUND OF THE INVENTION

[0002] Various processes for making compacted ice on an industrial level are known today. Said processes can generally be divided into two groups. The first group is based on a direct method for obtaining the compacted ice, which consists of generating ice blocks directly, through a thermodynamic cycle, in which cold is generated and the water gradually freezes. These methods have the drawback that thermal processes are slow, and the production of compacted ice from notable dimensions, such as the typical dimensions of ice cubes, is relatively low.

[0003] The second known group of processes is based on an indirect method in which compacted ice is obtained by compression from crushed or flake ice. Said flakes are obtained by applying the direct method, explained above, with the advantage that since the flakes are of a smaller size and since they do not require being produced in a specific manner, it is a much faster process than the process of forming ice cubes or blocks of compacted ice having larger dimensions. Among these processes, compaction of crushed ice known is performed from shipments processed in lots discontinuously. Therefore, the productivity of these processes is also low. An example of processes of this type is described in patent ES 2402968 B1.

[0004] Said patent discloses a system which has an upper hopper or receptacle where the crushed ice is stored. It is fed into a mould through an opening in the lower part of said hopper where, by the compression action of two linear and horizontal pistons, the ice is compressed and compacted ice cubes are formed. Finally, the pistons separate from one another and the cubes are removed. The described system, therefore, is a linear and discreet compression system which does not allow for high productivity rates.

[0005] The present invention aims to solve the problem of the low productivity rates present in the methods of the state of the art through a novel system for the production of compacted ice, based on rotary means for compacting crushed ice capable of operating continuously, thereby achieving productivity rates that are substantially higher than those of the known technologies.

BRIEF DESCRIPTION OF THE INVENTION

[0006] As described in the preceding section, the object of the invention relates to a system for producing

compacted ice from crushed and/or flake ice, intended for significantly increase the rate of production compared to the alternatives of the state of the art.

[0007] Said system preferably comprises:

- A receiving sub-system configured with means for feeding crushed ice into the system.
- A sub-system for compacting the crushed ice, comprising at least a press module against which the crushed ice is compacted, and a compression module provided with means for generating compression forces by means of the movement of one or more press rollers.
- A sub-system for actuating the compaction sub-system.

[0008] Although reference will mainly be made in the present description to the compaction of crushed ice, this term must also be understood to comprise flake ice as a possible base material for compaction, without altering the main object of the invention.

[0009] Advantageously, the compaction sub-system of the invention also comprises one or more rotary platforms for moulding the crushed ice, arranged between the press module and the compression module, such that the rotary movement thereof is used to convey the crushed ice and the compacted ice during production. Additionally, the actuation sub-system is provided with means for rotating the rotary platforms while the crushed ice is being compacted.

[0010] In a preferred embodiment of the invention, the receiving sub-system comprises an upper receiving hopper, provided with manual or automatic ice feeding means.

[0011] In another preferred embodiment of the invention, the moulding rotary platforms comprise one or more interchangeable templates provided with one or more moulding openings.

[0012] In another preferred embodiment of the invention, the compression module comprises a plurality of wheels connected with the compression rollers, and guided by one or more corresponding guiding tracks, such that the passage of the wheels over the guiding tracks generates the linear movements of said compression rollers.

[0013] In another preferred embodiment of the invention, the wheels are distributed as a group of outer wheels and a group of inner wheels in the compression module.

[0014] In another preferred embodiment of the invention, the guiding tracks have paths of travel of different heights on which slide the wheels.

[0015] In another preferred embodiment of the invention, the compression module also comprises an assembly of lower press pistons, and an assembly of lower wheel-carrying arms and of corresponding upper pushing arms, which accompany the linear movement of the wheels, to exert compression of the crushed ice against the press module.

[0016] In another preferred embodiment of the invention, the compression module comprises at least one divisional rotary platform, configured for isolating against water the part of the compaction sub-system that is located between the inner wheels and the moulding rotary platforms. More preferably, the module comprises, between said divisional rotary platform and the moulding rotary platform, a plurality of substantially vertical structural arms.

[0017] In another preferred embodiment of the invention, the moulding rotary platform is connected to one or more connecting rollers. More preferably, said connecting arms are located radially in relation to the moulding rotary platforms.

[0018] In another preferred embodiment of the invention, the actuation sub-system comprises a ring gear fixed integrally to the moulding rotary platforms, engaged with a pinion and a motor.

[0019] In another preferred embodiment of the invention, the actuation sub-system comprises one or more secondary motors for providing movement to respective impellers, located on the moulding rotary platform.

[0020] In another preferred embodiment of the invention, the system comprises a bed sub-system configured for supporting the assembly of said system. More preferably, said bed sub-system comprises a platform and a bed base with a plurality of supporting legs, and/or an inspection window with lower access to the system.

DESCRIPTION OF THE FIGURES

[0021] To better understand that described herein, eight figures depicting a preferred embodiment of the invention, as well as of the different sub-systems integrating same are appended hereto.

Figure 1 shows a general perspective view of a preferred embodiment of the system for the production of compacted ice from crushed ice.

Figure 2 shows a perspective view of the sub-system for receiving crushed ice of the invention according to a preferred embodiment thereof.

Figure 3 shows a perspective view of the moulding rotary platforms of the invention according to a preferred embodiment thereof.

Figure 4 shows a perspective view of the press platform of the invention according to a preferred embodiment thereof.

Figure 5 shows a perspective view of the compression module of the invention according to a preferred embodiment thereof.

Figure 6 shows a perspective view of the guiding tracks of the inner and outer wheels of the invention

according to a preferred embodiment thereof.

Figure 7 shows a perspective view of the actuation sub-system of the invention according to a preferred embodiment thereof.

Figure 8 shows a perspective view of the bed sub-system of the invention according to a preferred embodiment thereof.

REFERENCE NUMBERS USED IN THE FIGURES

[0022] For the purpose of helping to better understand the technical features of the invention, the mentioned figures include a series of reference numbers where the following is depicted in an illustrative and non-limiting manner:

1	Sub-system for receiving crushed ice
2	Moulding rotary platform
3	Compaction sub-system
4	Press module
5	Compression module
6	Press rollers
7	Actuation sub-system
8	Bed sub-system
9	Upper Hopper
10	Interchangeable moulding templates
11	Moulding openings
12	Outer wheels
13	Inner wheels
14	Guiding tracks of the outer wheels
15	Guiding tracks of the inner wheels
16	Lower pistons
17	Lower wheel-carrying arms
18	Upper pushing arms
19	Divisional rotary platform
20	Vertical structural arms
21	Connecting rollers
22	Ring gear
23	Pinion
24	Motor
25	Secondary motors
26	Impellers
27	Bed platform

(continued)

28	Bed base
29	Supporting legs
30	Inspection window

DETAILED DESCRIPTION OF THE INVENTION

[0023] As described in the preceding sections, the present invention relates to a system for the production of compacted ice from crushed ice. A detailed description of the invention in reference to a preferred embodiment thereof shown in Figures 1 to 8 is described below.

[0024] As shown in said figures, the system for compacting ice of the present invention, in said preferred embodiment, generally comprises a plurality of sub-systems which define the main functions thereof: a receiving sub-system (1) (Figure 2) configured with means for feeding crushed ice the system; one or more moulding rotary platforms (2) (Figure 3), the function of which is to serve as a compaction mould for the crushed ice, in addition to conveying the crushed ice and the compacted ice throughout the production process; a sub-system (3) for compacting (Figures 4, 5 and 6) the crushed ice, comprising, in its preferred embodiment, at least a press module (4) (Figure 4), which is preferably fixed and rigid, against which the crushed ice will be compacted, and a compression module (5) (Figure 5) capable of generating compression forces by means of the movement of one or more press rollers (6); an actuation sub-system (7) (Figure 7) which generates the movement for the compaction sub-system (3); and, optionally, a bed sub-system (8) (Figure 8) structurally supporting the assembly of the system. Each of the identified sub-systems is described below.

[0025] The receiving sub-system (1) (Figure 2) comprises, in its preferred embodiment, an upper receiving hopper (9). The function of said upper hopper (9) is to feed crushed ice for the moulding rotary platforms (2) through at least one opening in the lower region of the upper hopper (9). To restock the crushed ice of said upper hopper (9) manual or automatic feeding means can be used in various embodiments of the invention. Likewise, another function of the upper hopper (9) is to act as a limiting surface for the crushed ice that is located on the moulding rotary platforms (2) at the beginning of the production process. Preferably, the upper hopper (9) will not completely cover the upper part of the assembly so as to leave free space for the press module (4), as well as for removing the compacted ice from the system as it is formed as part of the production process.

[0026] Figure 3 shows, in a preferred embodiment of the invention, a moulding rotary platform (2) the function of which is to serve as a mould for crushed ice, in addition to being used as a conveying surface for the crushed ice and compacted ice throughout the production process.

Said moulding rotary platform (2) preferably comprises a plurality of interchangeable templates (10) provided with one or more moulding openings (11). The functions of said templates (10) are, primarily, to be readily replaceable in the event of malfunction or maintenance, and to offer the capacity to accommodate different technical specifications for the moulds of the compacted ice, both in size and in shape, which are determined in a corresponding manner by size and shape of the moulding openings (11), which can adopt a cylindrical design, prismatic design, etc. The mentioned interchangeable templates (10) are integrated in their respective moulding rotary platforms (2), forming the mould of the compacted ice itself. The crushed ice that is located on the moulding rotary platform (2) will thus fall into said moulding openings (11), and as it passes through the press module (4), it will be compacted by the pressure exerted by the press rollers (6) until it is compacted to the desired shape.

[0027] Figures 5 and 6 show the elements of the compression module (5) in addition to the moulding rotary platform (2) in a preferred embodiment. In a preferred embodiment of the invention, said compression module (5) comprises: a plurality of wheels (12, 13), distributed preferably as a group of outer wheels (12) and a group of inner wheels (13), guided by the corresponding guiding tracks (14, 15) (Figure 6) which together generate the linear movements necessary for compressing the crushed ice; an assembly of lower pistons (16) and press rollers (6), and an assembly of lower wheel-carrying arms (17) and upper pushing arms (18), which accompany the linear movement of the outer wheel (12) and inner wheel (13) and exert compression of the crushed ice against the press module (4). Furthermore, said compression module (5) comprises at least one divisional rotary platform (19), the function of which is to isolate against water the lower part of the compaction sub-system (3) that is located between the inner wheel (13) and outer wheel (12) and the moulding rotary platform (2). In a preferred embodiment, there is a series substantially vertical structural arms (20) which integrally attach the elements of said compression module (5) between said divisional rotary platform (19) and the moulding rotary platform (2).

[0028] In said preferred embodiment, the moulding rotary platform (2) is connected by means of one or more connecting rollers (21) located on the outer diameter and/or on the inner diameter of the interchangeable templates (10). Said connecting rollers (21) thereby serve as an attachment element for the elements of the compression module (5).

[0029] Preferably, the connecting rollers (21) are connected to the upper pushing arms (18). More preferably, said arms (18) are located radially with respect to the divisional rotary platforms (19), in the free space between the lower part of the moulding rotary platform (2) and the upper part of the divisional rotary platform (19). Said divisional platform (19) consists of openings for housing and serving as a guide for both the vertical structural arms (20) and for the lower pistons (16). In turn, in addition

tion to serving as a guide and as reinforcement for the vertical structural arms (20), the upper pushing arms (18) are for carrying and exerting pressure on the press rollers (6), as the latter are pushed linearly by the upper pushing arms (18), obtaining as a result compaction against the press module (4) of the crushed ice, located inside the moulding openings (11). Likewise, the upper pushing arms (18) will be raised by the lower pistons (16), each of them being supported at its lower end on the lower wheel-carrying arms (17) which will move linearly, guided by the movement of the outer wheels (12) and inner wheels (13), when sliding over the guiding tracks of the outer wheels (14) and inner wheels (15) having a variable section.

[0030] Additionally, the lower wheel-carrying arms (17) have a dual function. On one hand, in a preferred embodiment each arm carries an outer wheel (12) and another inner wheel (13), guiding the assembly of the compression module (5). On the other hand, they act as a support for the lower pistons (16). Said lower wheel-carrying arms (17) are distributed radially in the space between the divisional rotary platform (19) and the inner guiding track (15) and outer guiding track (14).

[0031] Figure 6 shows a preferred embodiment in which there can be observed the inner guiding track (15) and outer guiding track (14), having a circular path of travel and with different heights on which both the outer wheels (12) and the inner wheels (13) slide. When travelling across the space projected by the press module (4) on the guiding tracks (14, 15), they generate an upward movement in the outer wheels (12) and inner wheels (13), therefore raising the position of the entire assembly formed by the outer wheels (12) and inner wheels (13), lower wheel-carrying arms (17), lower pistons (16), upper pushing arms (18), and press rollers (6), with the latter exerting pressure and compacting against the press module (4) the crushed ice which will be located inside the moulding openings (11).

[0032] Figure 7 shows the actuation sub-system (7) of the invention, the main function of which is to generate the main rotational movement of the system, as described above. To that end, the actuation sub-system (7) comprises in a preferred embodiment a ring gear (22) fixed integrally to outer diameter of the moulding rotary platforms (2), engaged with a pinion (23) and a motor (24) capable of rotating the assembly. Optionally, in said preferred embodiment, the invention has one or more secondary motors (25) capable of providing movement to respective impellers (26) located on the moulding rotary platform (2) the purpose of which is to aid in the crushed ice not being compacted before beginning the actual mechanical compaction process of the invention.

[0033] Figure 8 shows, in a preferred embodiment, the bed sub-system (8) configured for supporting the assembly of the system. Said bed sub-system (8) preferably comprises a platform (27) and a bed base (28) with a plurality of supporting legs (29) for being supported on the ground or any other bearing surface. Additionally, the

sub-system (8) may optionally comprise an inspection window (30), which facilitates repairs and changing of parts in the event of a possible malfunction, from the lower part of the system.

[0034] In this manner and as described, the invention provides a system for compacting crushed ice capable of forming compacted ice by means of a continuous process, thereby improving the limitations of the state of the art.

Claims

1. System for the production of compacted ice from crushed ice, comprising:

- a receiving sub-system (1) configured with means for feeding crushed and/or flake ice into the system;
- a sub-system (3) for compacting the crushed ice, comprising at least a press module (4) against which the crushed ice is compacted, and a compression module (5) provided with means for generating compression forces by means of the movement of one or more press rollers (6);
- a sub-system (7) for actuating the compaction sub-system (3);

and **characterised in that** the compaction sub-system (3) also comprises one or more rotary platforms (2) for moulding the crushed ice, arranged between the press module (4) and the compression module (5), such that the rotary movement thereof is used to convey the crushed ice and the compacted ice during production; and **in that** the actuation sub-system (7) is provided with means for rotating the rotary platforms (2) while the crushed ice is being compacted.

2. System according to the preceding claim, wherein the receiving sub-system comprises an upper receiving hopper (9), provided with manual or automatic ice feeding means.

3. System according to any of the preceding claims, wherein the moulding rotary platforms (2) comprise one or more interchangeable templates (10) provided with one or more moulding openings (11).

4. System according to any of the preceding claims, wherein the compression module (5) comprises a plurality of wheels (12, 13) connected with the compression rollers (6), and guided by one or more corresponding guiding tracks (14, 15), such that the passage of the wheels (12, 13) over the guiding tracks generates the linear movements of said compression rollers (6).

5. System according to the preceding claim, wherein the wheels (12, 13) are distributed as a group of outer wheels (12) and a group of inner wheels (13) in the compression module (5). 5
er access to the system.
6. System according to any of claims 4-5, wherein the guiding tracks (14, 15) have paths of travel of different heights on which the wheels (12, 13) slide.
7. System according to any of claims 4-6, wherein the compression module (5) also comprises an assembly of lower press pistons (16), and an assembly of lower wheel-carrying arms (17) and of corresponding pushing upper arms (18), which accompany the linear movement of the wheels (12, 13), to exert compression of the crushed ice against the press module (4). 10 15
8. System according to any of claims 4-7, wherein the compression module (5) comprises at least one divisional rotary platform (19), configured for isolating against water the part of the compaction sub-system (3) that is located between the wheels (12, 13) and the moulding rotary platforms (2). 20 25
9. System according to the preceding claim comprising, between the divisional rotary platform (19) and a moulding rotary platform (2), a plurality of substantially vertical structural arms (20). 30
10. System according to any of the preceding claims, wherein the moulding rotary platform (2) is connected to one or more connecting rollers (21).
11. System according to the preceding claim, wherein the connecting rollers (21) are located radially in relation to the moulding rotary platforms (2). 35
12. System according to any of the preceding claims, wherein the actuation sub-system (7) comprises a ring gear (22) fixed integrally to the moulding rotary platforms (2), engaged with a pinion (23) and a motor (24). 40
13. System according to any of the preceding claims, wherein the actuation sub-system (7) comprises one or more secondary motors (25) for providing movement to respective impellers (26), located on the moulding rotary platform (2). 45 50
14. System according to any of the preceding claims, comprising a bed sub-system (8) configured for supporting the assembly of said system.
15. System according to the preceding claim, wherein the bed sub-system (8) comprises a platform (27) and a bed base (28) with a plurality of supporting legs (29), and/or an inspection window (30) with low-

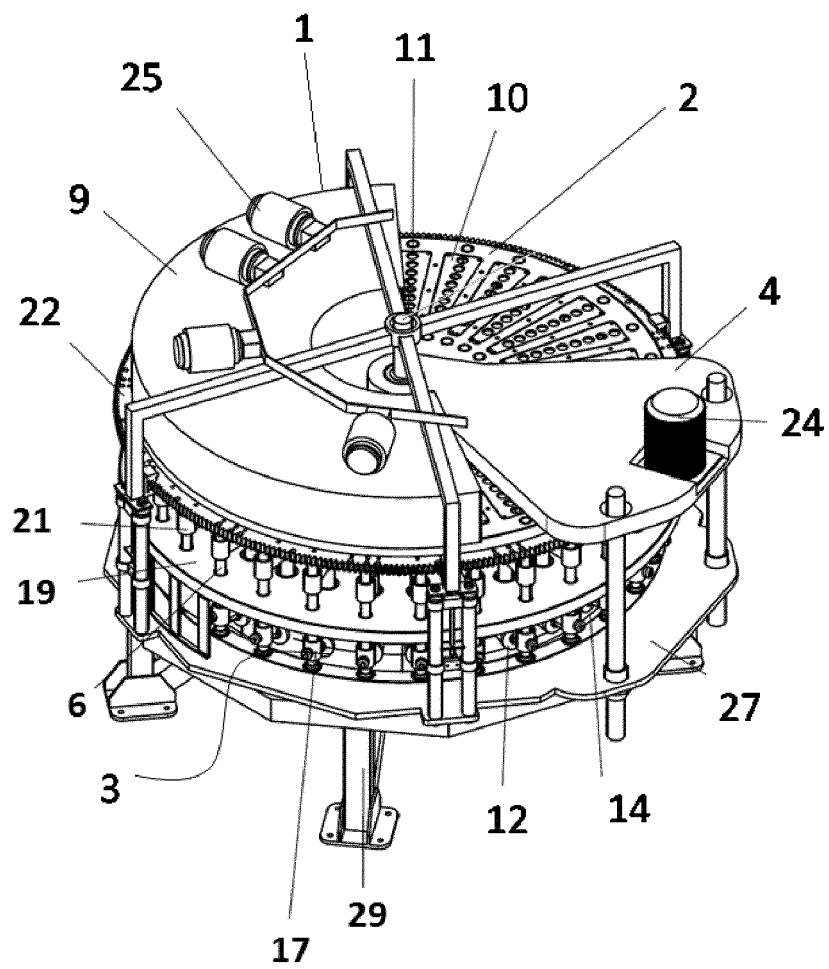


FIG. 1

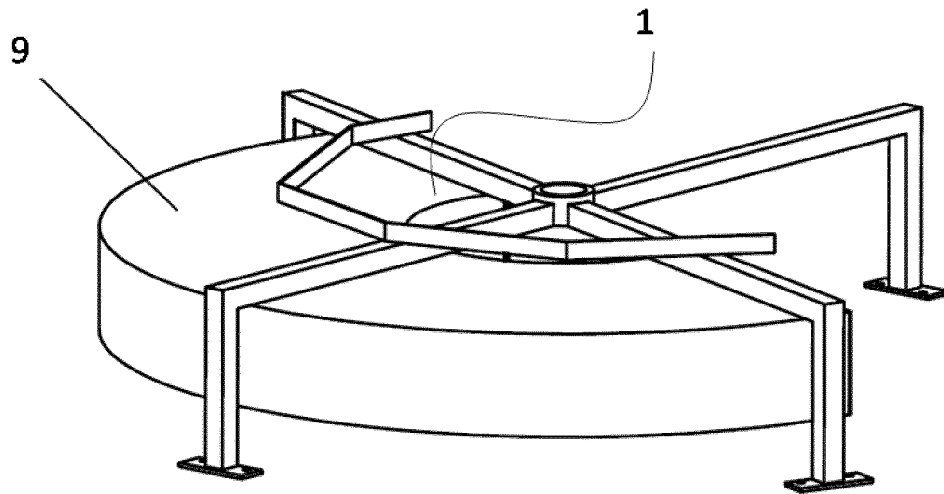


FIG. 2

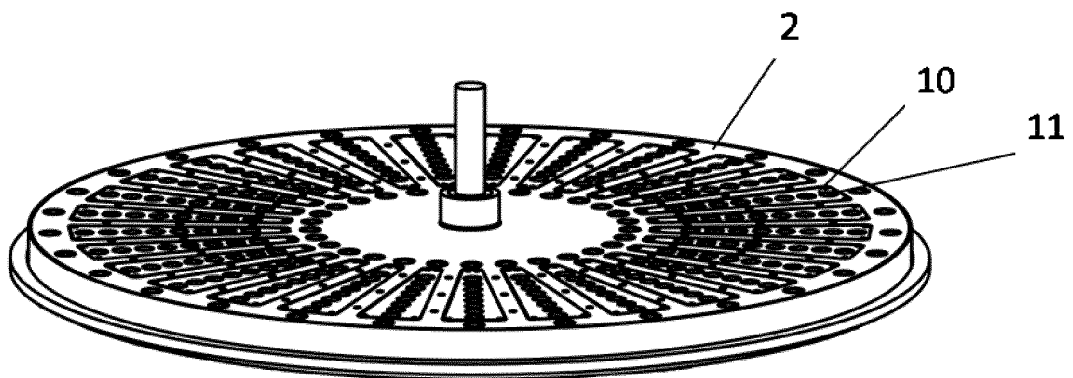


FIG. 3

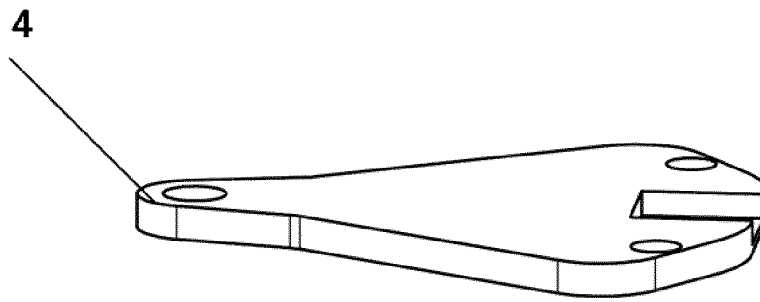


FIG. 4

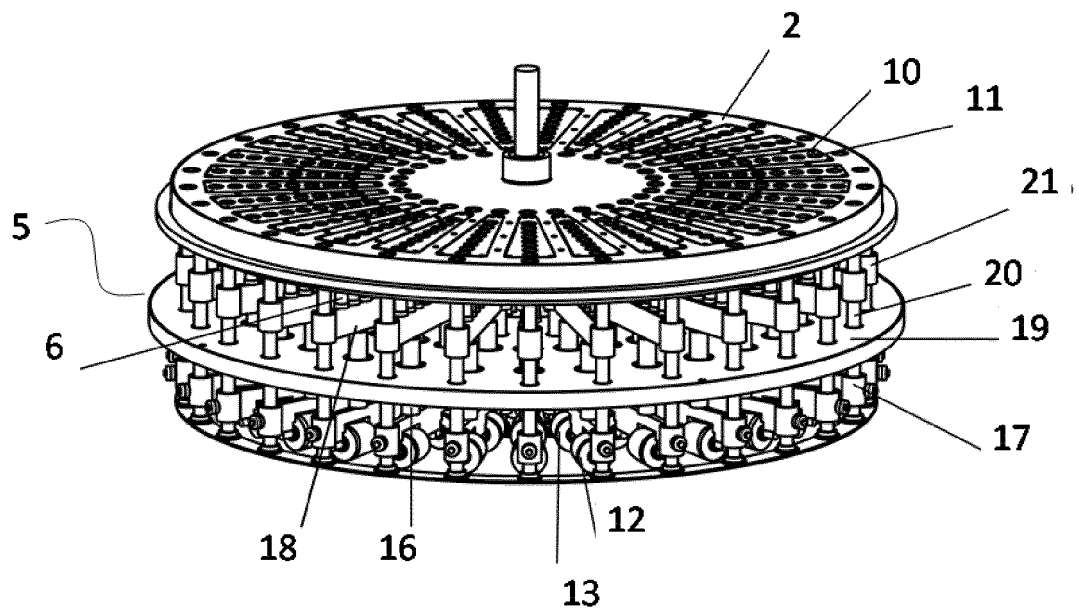


FIG. 5

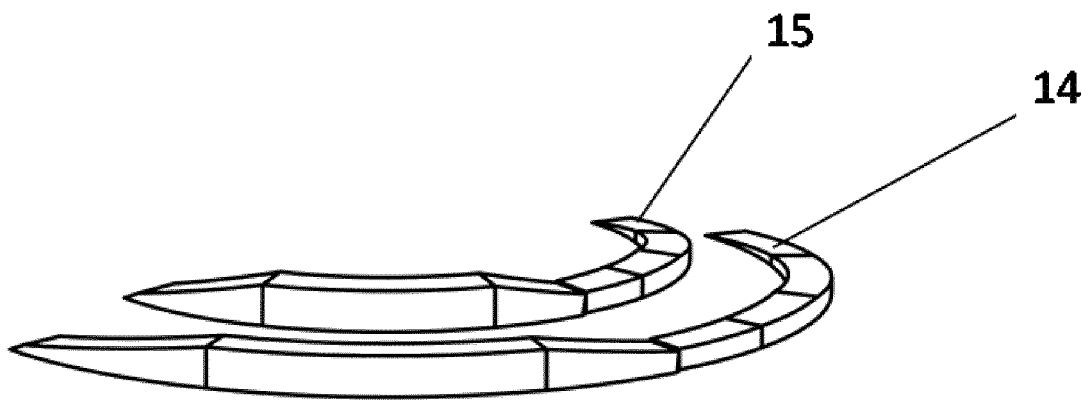


FIG. 6

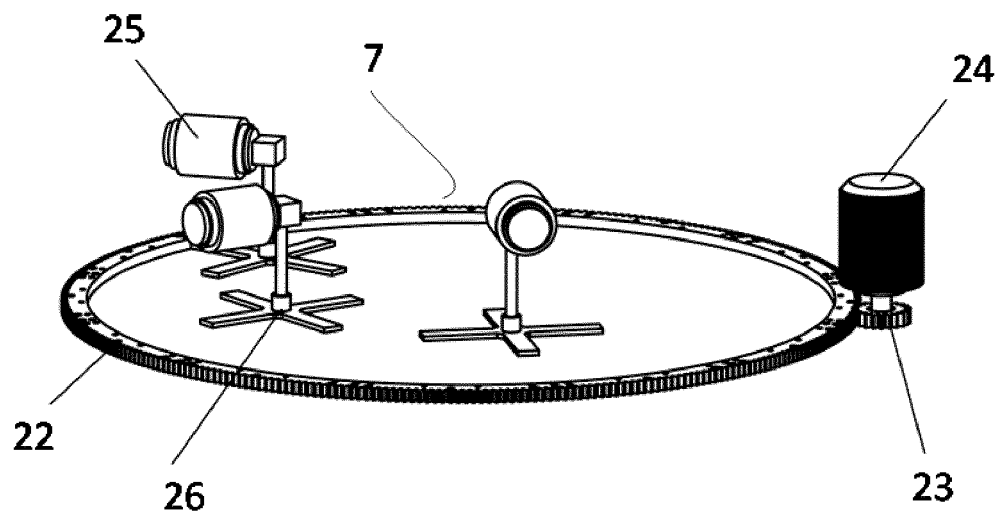


FIG. 7

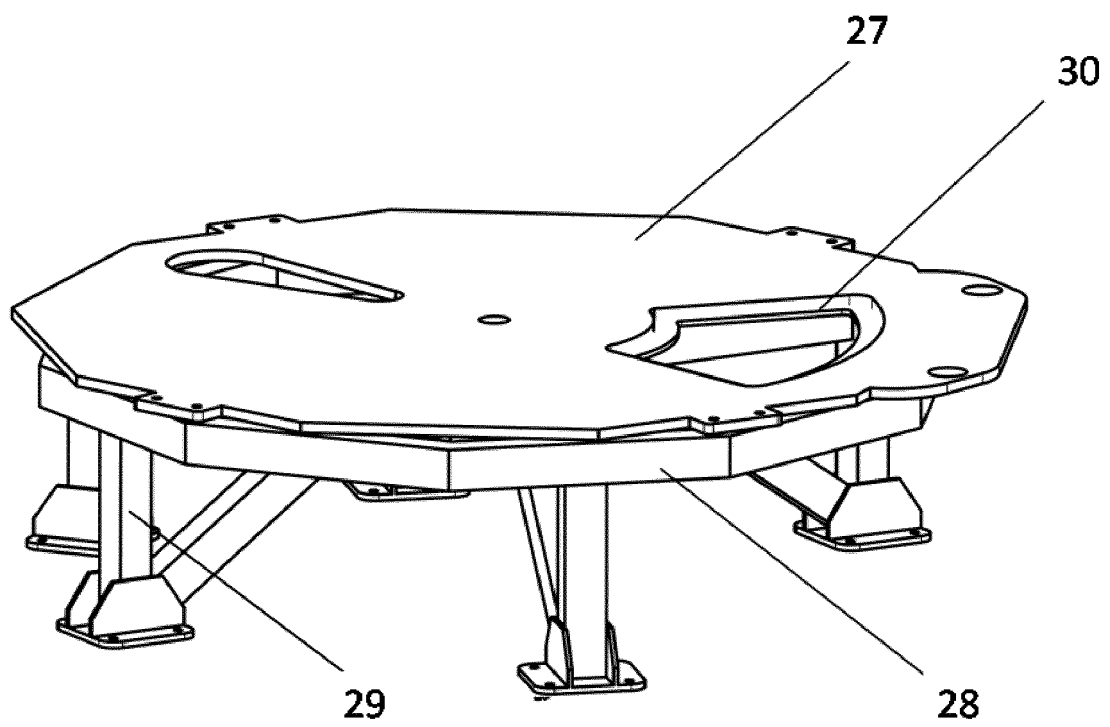


FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.

PCT/ES2018/070353

A. CLASSIFICATION OF SUBJECT MATTER

F25C5/14 (2006.01)

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)

F25C

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)

EPODOC, INVENES

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2006034990 A1 (HERMANSEN CARSTEN) 16/02/2006, the whole document.	1-3, 14-15
A	US 2006070392 A1 (HEUSER JOHN E) 06/04/2006, figures 1 - 4; description paragraph [0021].	14-15
A	WO 0221059 A1 (COLD BLASTING APS ET AL.) 14/03/2002, abstract; figures.	1-15
A	US 3803869 A (NEUMANN C ET AL.) 16/04/1974, the whole document.	1-15
A	US 2006168983 A1 (TATSUI HIROSHI ET AL.) 03/08/2006, the whole document.	1-15

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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Date of the actual completion of the international search
17/09/2018Date of mailing of the international search report
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Name and mailing address of the ISA/

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Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.

Information on patent family members

PCT/ES2018/070353

Patent document cited in the search report	Publication date	Patent family member(s)	Publication date
US2006034990 A1	16.02.2006	DK1507459T T3 US7572472 B2 EP1507459 A1 EP1507459 B1 DK200200814 A DK175108B B1 WO03099033 A1 AU2003233778 A1 AT406107T T	12.01.2009 11.08.2009 23.02.2005 27.08.2008 28.11.2003 07.06.2004 04.12.2003 12.12.2003 15.09.2008
US2006070392 A1	06.04.2006	WO2006041951 A2 WO2006041951 A3 US7293426 B2	20.04.2006 26.10.2006 13.11.2007
WO0221059 A1	14.03.2002	KR20030046425 A KR100829916B B1 DE60132346T T2 US2004035146 A1 US6986265 B2 JP2004508270 A ES2299503T T3 EP1328765 A1 EP1328765 B1 DK1328765T T3 CA2421261 A1 CA2421261 C AU8174801 A AT383556T T	12.06.2003 16.05.2008 15.01.2009 26.02.2004 17.01.2006 18.03.2004 01.06.2008 23.07.2003 09.01.2008 26.05.2008 14.03.2002 25.11.2008 22.03.2002 15.01.2008
US3803869 A	16.04.1974	USRE28924E E JPS49105248 A JPS5145098B B2 GB1448172 A DE2402292 A1 DE2402292 B2 CA996362 A	10.08.1976 04.10.1974 02.12.1976 02.09.1976 15.08.1974 08.12.1977 07.09.1976
US2006168983 A1	03.08.2006	TW200506297 A JPWO2004081470 A1 JP4572833B B2 US7318323 B2 JP2005188919 A JP4479485B B2 JP2005188913 A JP4461857B B2 JP2005188912 A WO2004081470 A1 CN1759283 A CN1759283B B	16.02.2005 15.06.2006 04.11.2010 15.01.2008 14.07.2005 09.06.2010 14.07.2005 12.05.2010 14.07.2005 23.09.2004 12.04.2006 12.05.2010

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- ES 2402968 B1 [0003]