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(54) SYSTEM FOR COOLING OBJECTS

(57) A system (1) for cooling objects comprising: a fixed scaffolding (2) which supports a moveable structure (3) comprising a lower base (6) abutting against the fixed scaffolding (2), an upper base (7) spaced from the lower base (6) and a lateral surface (8) which perimetrically delimits the lower base (6) and the upper base (7) to define a ventilation chamber (5); a plurality of ventilation nozzles (9) present in the upper base (7) and communicating with the ventilation chamber (5); a plurality of bas-

kets (10) each having a mouth (10a) for introducing the objects to be cooled and a bottom (11) provided with a plurality of through holes (12) configured for communicating with the ventilation nozzles (9) when the baskets (10) rest against the upper base (7). There are provided for ventilation means (13) connected to the ventilation chamber (5) for conveying cooling air from the ventilation chamber (5) into the baskets (10) through the ventilation nozzles (9) and the through holes (12).

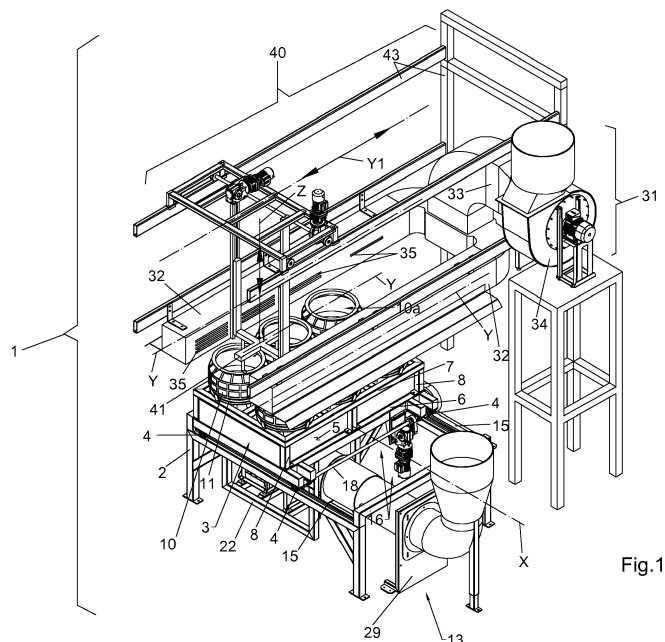


Fig.1

EP 3 388 768 A1

Description

[0001] The present invention regards a system for cooling objects of various types exiting from heating furnaces.

[0002] The system is especially suitable to be used in lines for obtaining the superficial zinc-flake coating of products and/or objects, where provided for upon exit from drying furnaces that form such lines.

[0003] As known, the superficial zinc-flake coating treatment for objects is obtained in production lines that provide for different operating steps comprising, among others, impregnation and heat treatment operations with heating cycles in a furnace and subsequent cooling.

[0004] During the aforementioned operations, the objects are contained in special baskets that enable transferring them from one machine to the other.

[0005] Furthermore, upon exit from the heating furnaces the objects contained in the baskets are transferred into special containers with greater capacity where they are cooled using air which is conveyed into the containers through the upper opening thereof.

[0006] This method of operating reveals a first drawback which lies in waste of time and thus the increase of production costs due to the need to transfer the objects from the baskets to the containers.

[0007] Furthermore, though efficient, the cooling carried out according to the aforementioned method reveals, however, the drawback lying in the fact that the in-flowing air which is blown into the containers through the upper opening thereof generates a counter-current flow of the out-flowing air, overheated by the contact with the components to be cooled, thus slowing the cooling process.

[0008] Last but not least, a drawback lies in the fact that such counter-current flow complicates the collection of the overheated air coming from the containers and loaded with pollutant substances deriving from the residues of the products used in the operations that stick against the objects.

[0009] Patent documents FR 2 917 752 and DE 10 2009 048797 describe systems for the heat treatment of objects that provide for a ventilation system which generates a cooling airflow in a process chamber which is arranged in fixed position.

[0010] Above all, such systems reveal the drawback lying in the fact that they are of the static type and the containers of the objects to be treated remain fixed in position over the entire period of time during which the cooling of the objects that they contain occurs.

[0011] Such systems also have a low cooling efficiency.

[0012] The aim of the present invention is to overcome the aforementioned drawbacks.

[0013] In particular, one of the objects of the invention is to provide a system for cooling objects, products and components which, with respect to the prior art, enables accelerating the cooling times considering the same type and number of objects, products and components to be

cooled.

[0014] Another object of the invention is to provide a system for cooling objects, products and components which, with respect to the prior art, facilitates the collection of the air loaded with possible pollutant substances which, after cooling the objects, exits overheated from the containers in which the objects are contained.

[0015] Another object of the invention lies in the fact that the cooling of the objects is carried out using the same baskets that are used for holding the objects during the other operating steps.

[0016] Another object of the invention is to simplify and automate the operations for transferring the objects to be cooled.

[0017] Last but not least, another object of the invention is to provide for a better quality of drying.

[0018] The aforementioned objects are attained by a system for cooling products and/or components according to the main claim to which reference will be made.

[0019] The dependent claims describe other characteristics of the system of the invention.

[0020] The aforementioned objects and any other objects will be outlined in detail in the description that follows, which regards a preferred but non-exclusive embodiment of the invention and which is provided by way of non-limiting example with reference to the attached drawings, wherein:

- figure 1 represents the system of the invention in axonometric view;
- figure 2 represents a lateral view of the system of figure 1;
- figure 3 represents the section of the system of figure 2 carried out according to the section plane III - III;
- figure 4 represents another lateral view of the system of figure 1;
- figure 5 represents the section of the system of figure 4 carried out according to the section plane V - V;
- figure 6 represents the plan view of the system of figure 1;
- figures 7 and 8 represent the system of figure 1 in two bottom axonometric views.

[0021] The system for cooling subject of the invention, in figures 1 to 8 that represent it, is indicated in its entirety with **1**.

[0022] According to the invention, and in particular with reference to figures 1 to 5, it is observed that the system comprises a fixed scaffolding **2** to which there is associated a moveable structure **3** which comprises a lower base **6** abutting against the fixed scaffolding **2**, an upper base **7** spaced from the lower base **6** and by a lateral surface **8** which perimetrically delimits the lower base **6** and the upper base **7**.

[0023] In this manner, the moveable structure **3** takes a substantially box and parallelepiped shape, inside which there is defined a ventilation chamber **5**.

[0024] It is clear that in different embodiments the

moveable structure **3** may take a different configuration with respect to the parallelepiped-shaped configuration described above and represented in the figures.

[0025] On the upper base **7** there are arranged a plurality of baskets **10** containing the objects to be cooled and the lower base **6** is provided with wheels **4** which rest against the tracks **15** of the fixed scaffolding **2**.

[0026] Furthermore, the lower base **6** also supports a drive unit **16** which places the aforementioned wheels **4** in rotation to displace the moveable structure **3** with the baskets **10** along the tracks **15**.

[0027] In particular, as observable in figures 2 and from 6 to 8, the lower base **6** is provided with four wheels **4** each arranged at a corner thereof.

[0028] Only two of the aforementioned wheels **4**, as observable especially in figure 6, are driven by means of the aforementioned drive unit **16** which comprises a gear-motor **17** associated to a transmission shaft **18** which mutually connects the aforementioned two wheels **4**, each resting against a respective track **15**. In particular as regards the arrangement of the baskets **10** on the upper base **7** which receives them, according to the configuration described herein and represented in the figures, there are six baskets **10** and they are arranged aligned with respect to each other in two rows adjacent to each other and identifying an alignment direction **Y** wherein each row is made up of three baskets **10**.

[0029] It is clear that the number and arrangement of the baskets represented in the drawings is purely by way of example, given that such number and such arrangement could be of any type depending on the needs of the user.

[0030] By means of the drive unit **16** the entire moveable structure **3** with the baskets **10** associated thereto can thus be displaced along the displacement direction **X**, orthogonal to the alignment direction **Y** of the baskets **10**, in both directions indicated by the arrows in figure 6.

[0031] Each basket **10** is provided with a mouth **10a** for loading the objects to be cooled and with a bottom **11** provided with a plurality of through holes **12**.

[0032] In the upper base **7** there are provided ventilation nozzles **9** communicating with the ventilation chamber **5**, which convey air to the through holes **12**, obtained in the bottoms **11** of the baskets **10** resting against the upper base **7**. To this end, as observable in figures 3, 5 and 6, on the upper base **7** there are provided a plurality of housings **19** which are configured so that each receives a respective basket **10** with the through holes **12** of the bottom **11** positioned so as to communicate with the ventilation nozzles **9**.

[0033] Also provided are ventilation means **13** which are connected to the ventilation chamber **5** for conveying - thereinto - cooling air which, as previously mentioned, through the ventilation nozzles **9** and through holes **12**, flows into the baskets **10** to cool the objects contained therein.

[0034] As regards the ventilation means **13**, it should be observed that they comprise a fan **20** and a motor **21**

both of which are supported by a framework **22** which, as observable in particular in figures 7 and 8, is positioned in the fixed scaffolding **2** and it is fixed beneath the lower base **6**.

[0035] In particular, figure 2 shows that the frame **22** is spaced from the support surface of the system and thus the fan **20**, the motor **21** and the framework **22** are stably hung on the lower base **6** and the fan **20** has the suctioning mouth **23** connected to a suctioning duct **24**.

[0036] The latter, with particular reference to figure 5, comprises a first tubular section **24a** which is fixed to the suctioning mouth **23** and a second tubular section **24b** which is fixed to a fixed support **29** where the first tubular section **24a** and the second tubular section **24b** are coupled to each other by means of a telescopic tubular section **30**.

[0037] The presence of the telescopic tubular section **30** enables maintaining the connection of the suctioning duct **24** with the suctioning mouth **23** of the fan **20** when the actuation of the drive unit **16** displaces the moveable structure **3**, alongside the fan **20** and the respective motor **21** fixed to the lower base **6**, in both ways of the displacement direction **X**.

[0038] With particular reference to figures 2, 3 and 5, it should also be observed that the delivery mouth **25** of the fan **20** is connected to a delivery hole **28** obtained on the lower base **6** and communicating with the ventilation chamber **5**. Substantially, the embodiment of the ventilation means **13** now described and particularly the presence of the telescopic tubular section **30** enable suctioning cooling air from the environment in which the system is located and conveying it into the ventilation chamber **5** and from the latter into the baskets **10** by means of the ventilation nozzles **9** and the through holes **12** present on the bottom **11** of the baskets **10**, regardless of the position that the moveable structure **3** takes with respect to the displacement direction **X**.

[0039] The air that cools the objects contained in the baskets **10** then flows out through the mouth **10a** thereof dragging along any pollutant substances constituted by the residues of the products of the previous treatments that were left stuck on the objects.

[0040] This air is overheated and loaded with pollutant substances which - if released into the environment - could cause serious pollution in the environment in which the system for cooling is installed.

[0041] To this end, there are provided suctioning means, generally indicated with **31**, which enable collecting the air flowing out from the mouths **10a** of the baskets **10** and conveying it to a possible treatment plant or, alternatively, discharging it in an environment outside the working zone where the system for cooling is installed.

[0042] The suctioning means **31**, in the embodiment described herein, comprise a pair of suctioning ducts **32** arranged adjacent to each other extending according to the same alignment direction **Y** of the baskets **10**, orthogonal to the displacement direction **X** of the moveable structure **3**.

[0043] Each suctioning duct **32** is arranged above the baskets **10** and it is displaced laterally with respect to the centre of the mouth **10a** of each one of them, for example as observable in figures 2 and 5.

[0044] Both suctioning ducts **32** are connected to the inlet path **33** of a fan **34** and each suctioning duct **32** is provided with lateral suctioning slots **35** arranged at the mouth **10a** of a corresponding basket **10**.

[0045] It is clear that the number and arrangement of the suctioning ducts **32** may vary as a function of the number and arrangement of the baskets **10**.

[0046] Furthermore, as observable in the figures, the distance **D** between the suctioning ducts **32** is greater than the transversal dimension of the baskets **10**, particularly than the diameter thereof in the case described herein, wherein the baskets **10** are cylindrical-shaped so as to enable loading/unloading them onto/from the upper base **7**.

[0047] The operations for loading/unloading the baskets **10** may be carried out manually but preferably, especially considering the fact that their weight may be considerable, the system for cooling **1** also comprises a unit for displacing the baskets **10** indicated in its entirety with **40**.

[0048] It should be observed that the displacement unit **40** comprises a gripper **41** for grasping the baskets **10** one at a time and it is supported by a fixed structure **43** configured to enable the movement of the displacement unit **40** according to the horizontal direction **Y1**, parallel to the alignment direction **Y** of the baskets **10**, in both directions indicated by the arrows.

[0049] The displacement unit **40** in turn carries out the movement of the grasping gripper **41** according to the vertical direction **Z**, orthogonal to the upper base **7** for supporting the baskets **10**, in both directions indicated by the arrows. Substantially, this enables obtaining a Cartesian movement of the gripper **41** for grasping the baskets **10** according to a plane orthogonal to the upper base **7** for supporting the baskets **10** and comprising the horizontal **Y1** and vertical **Z** directions.

[0050] Thus, by combining the movement of the moveable structure **3** generated by the drive unit **16** according to the displacement direction **X** with the movement of the grasping gripper **41** generated by the displacement unit **40** according to the horizontal **Y1** and vertical **Z** directions, the gripper **41** can deposit and pick up any basket **10** into and from any housing **19** present on the upper base **7**. Operatively, by actuating the displacement unit **40** with the gripper **41** combined with the drive unit **16** which displaces the moveable structure **3**, the baskets **10** can be loaded on the upper base **7** of the moveable structure **3** so as to be subjected to the cooling treatment which, as previously mentioned, occurs by insufflating air into the ventilation chamber **5** through the ventilation means **13**.

[0051] Simultaneously, the suctioning slots **35** of the suctioning ducts **32** shut off the overheated and polluted air flowing out from the mouths **10a** of the baskets **10**

and move it away avoiding polluting the environment.

[0052] At the end of the cooling treatment, by activating the displacement unit **40** with the gripper **41** once again and displacing the moveable structure **3**, the baskets containing the objects - cooled by now - can be unloaded so that the system returns to the initial conditions so as to be able to repeat a new cooling cycle.

[0053] Obviously, all these operations can be easily managed by control means that operate according to dedicated programmes and this enables improving the cooling process making it qualitatively repeatable and safer given that it enables reducing the direct action of the operators.

[0054] Thus, in the light of the above, it is clear that the system for cooling subject of the invention attains all pre-set objects.

[0055] First and foremost, as mentioned above, the system of the invention enables improving the cooling process making it qualitatively repeatable and safer. Furthermore, the possibility of simultaneously cooling a high number of baskets enables, with respect to the prior art, increasing the production of cooled objects.

[0056] Besides this, the possibility of shutting off the overheated air loaded with possible pollutant substances at the outflow mouths of the baskets avoids creating pollution in the work environment.

[0057] Furthermore, the system of the invention improves the cooling of the objects given that it prevents the formation of the counter-current airflows that are instead generated when cooling objects according to the prior art by blowing air into the containers through the loading mouth.

[0058] It has also been observed that the objects are cooled in the baskets that are used during other operating steps, thus eliminating inoperative times required - in the prior art - to transfer them into the containers in which they are cooled.

[0059] It has also been observed that the system of the invention can be managed by control means which operate based on dedicated programmes so as to make all operations aimed at cooling the objects safer, comprising the operations for loading and unloading the baskets.

[0060] It is important to observe that the system of the invention, which is particularly suitable for obtaining the cooling of heat-treated objects, can also be advantageously used for drying any objects that could be wet at the end of the treatments to which they were subjected.

[0061] In the implementation step, the system for cooling outlined in the current description may be subjected to modifications and variant embodiments aimed at improving the functionality thereof or making the manufacturing thereof easier and more economic.

[0062] However, it shall be understood that should such variants and modifications, that have not been described and represented in the drawings, fall within the scope of protection of the claims that follow, they shall all be deemed to fall within the scope of protection of the

present patent.

Claims

1. System (1) for cooling objects **characterised in that** it comprises:

- a fixed scaffolding (2);
- a moveable structure (3) slidably associated to said fixed scaffolding (2) and comprising a lower base (6) abutting against said fixed scaffolding (2), an upper base (7) spaced from said lower base (6) and a lateral surface (8) which perimetrically delimits said lower base (6) and said upper base (7) to define a ventilation chamber (5);
- a plurality of ventilation nozzles (9) present in said upper base (7) and communicating with said ventilation chamber (5);
- a plurality of baskets (10) each one of which has a mouth (10a) for introducing said objects to be cooled and a bottom (11) provided with a plurality of through holes (12) configured to communicate with said ventilation nozzles (9) when said baskets (10) are rested against said upper base (7);
- ventilation means (13) connected to said ventilation chamber (5) for conveying the cooling air from said ventilation chamber (5) into said baskets (10) through said ventilation nozzles (9) and said through holes (12).

2. System for cooling (1) according to claim 1, **characterised in that** said lower base (6) is provided with wheels (14) abutting against tracks (15) belonging to said fixed scaffolding (2) and it supports at least one drive unit (16) suitable to drive one or more of said wheels (14) in rotation to displace said moveable structure (2) along said tracks (15).

3. System for cooling (1) according to claim 2, **characterised in that** said drive unit (16) comprises at least one gear motor (17) associated to a transmission shaft (18) that mutually connects two of said wheels (14) arranged adjacent to each other and each abutting against a respective track (15).

4. System for cooling (1) according to any one of the preceding claims, **characterised in that** said upper base (7) is provided with a plurality of housings (19) each of which is configured for receiving one of said baskets (10) and communicates with at least one of said corresponding ventilation nozzles (9).

5. System for cooling (1) according to any one of the preceding claims, **characterised in that** said ventilation means (13) comprise at least one fan (20) and

a motor (21) both supported by a framework (22) positioned in said fixed scaffolding (2) and fixed beneath said lower base (6), said fan (20) having the suctioning mouth (23) connected to a suctioning duct (24) and the delivery mouth (25) connected to a delivery hole (28) obtained in said lower base (6) and communicating with said ventilation chamber (5).

6. System for cooling (1) according to claim 5, **characterised in that** in said suctioning duct (24) there are identified a first tubular section (24a) fixed to said suctioning mouth (23) and a second tubular section (24b) fixed to a fixed support (29), said first tubular section (24a) and said second tubular section (24b) being coupled to each other by means of a telescopic tubular section (30).

7. System for cooling (1) according to any one of the preceding claims, **characterised in that** it comprises means (31) for the suctioning of air flowing out from said mouths (10a) of said baskets (10) and overheated by the contact with said objects to be cooled.

8. System for cooling (1) according to claim 7, **characterised in that** said suctioning means (31) comprise at least one suctioning duct (32) arranged above said baskets (10) at the mouth (10a) thereof, said at least one suctioning duct (32) being connected to the inlet path (33) of a fan (34) and being provided with a plurality of suctioning slots (35), each faced towards the mouth (10a) of a corresponding basket (10).

9. System for cooling (1) according to any one of the preceding claims, **characterised in that** it comprises a displacement unit (40) provided with at least one gripper (41) for grasping said baskets (10) one at a time and moveable on a fixed structure (43) that supports it, said displacement unit (40) being configured to obtain the Cartesian displacement of said gripper (41) according to a plane orthogonal to said upper base (7) for supporting said baskets (10).

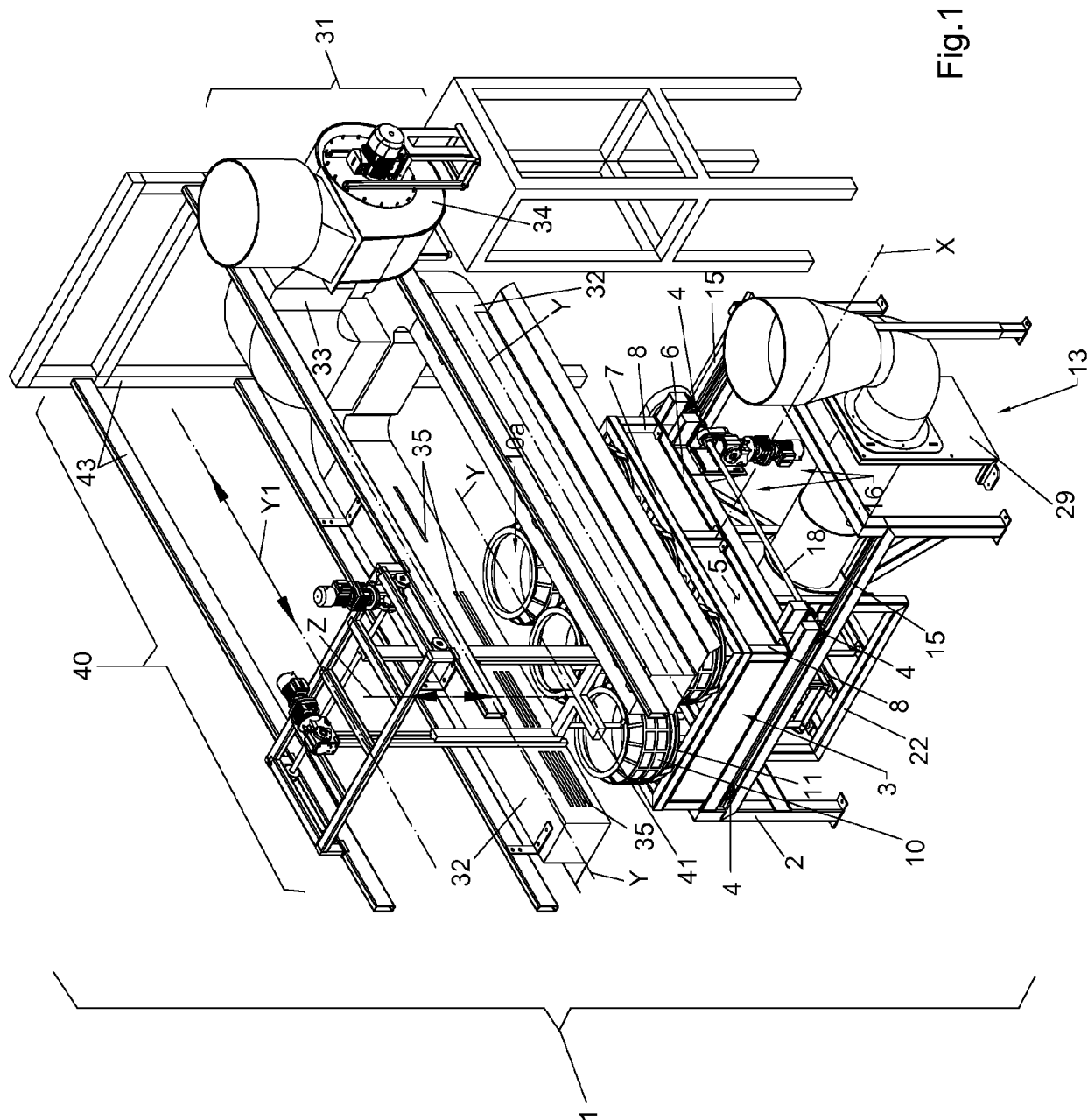
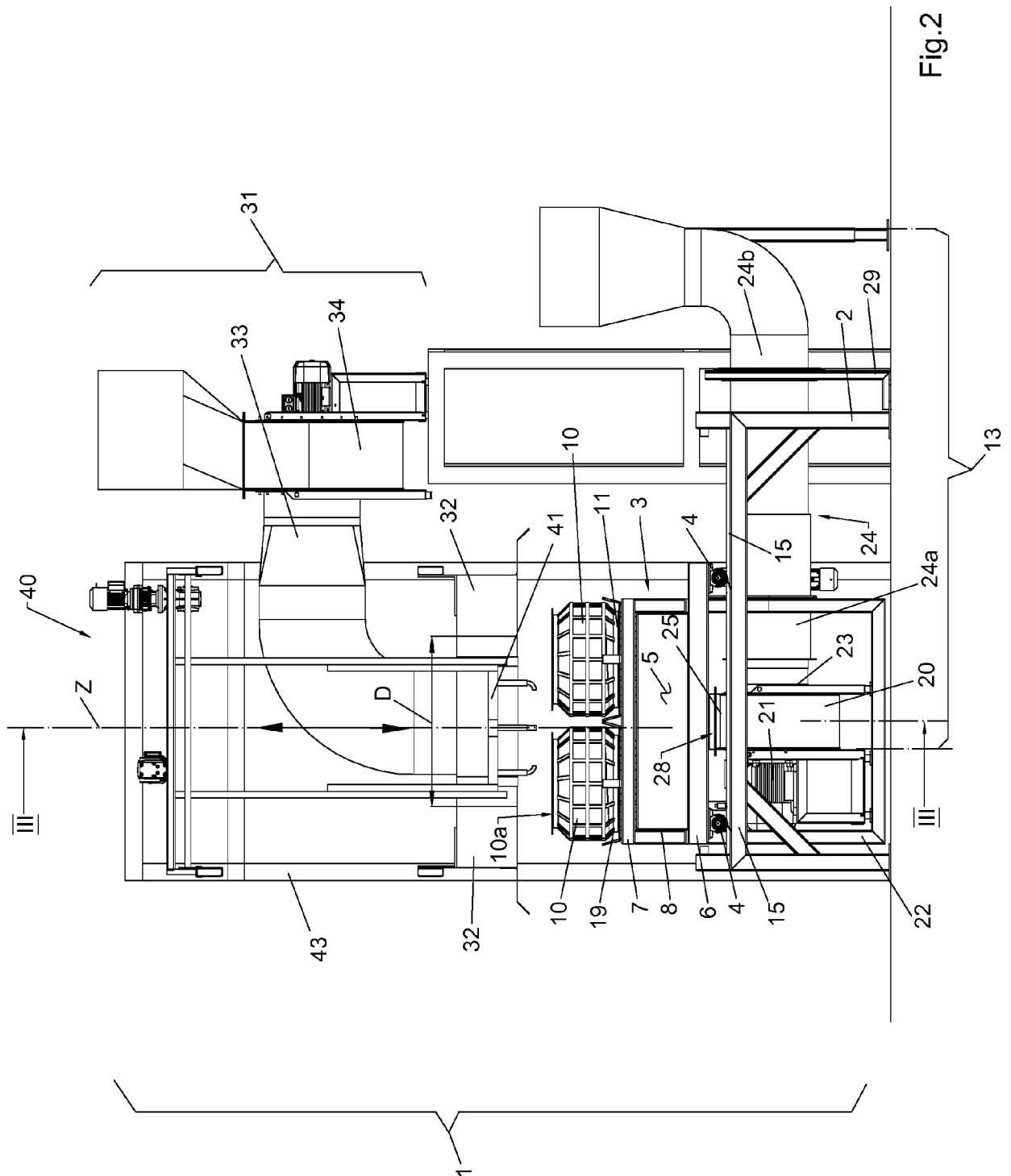


Fig.1



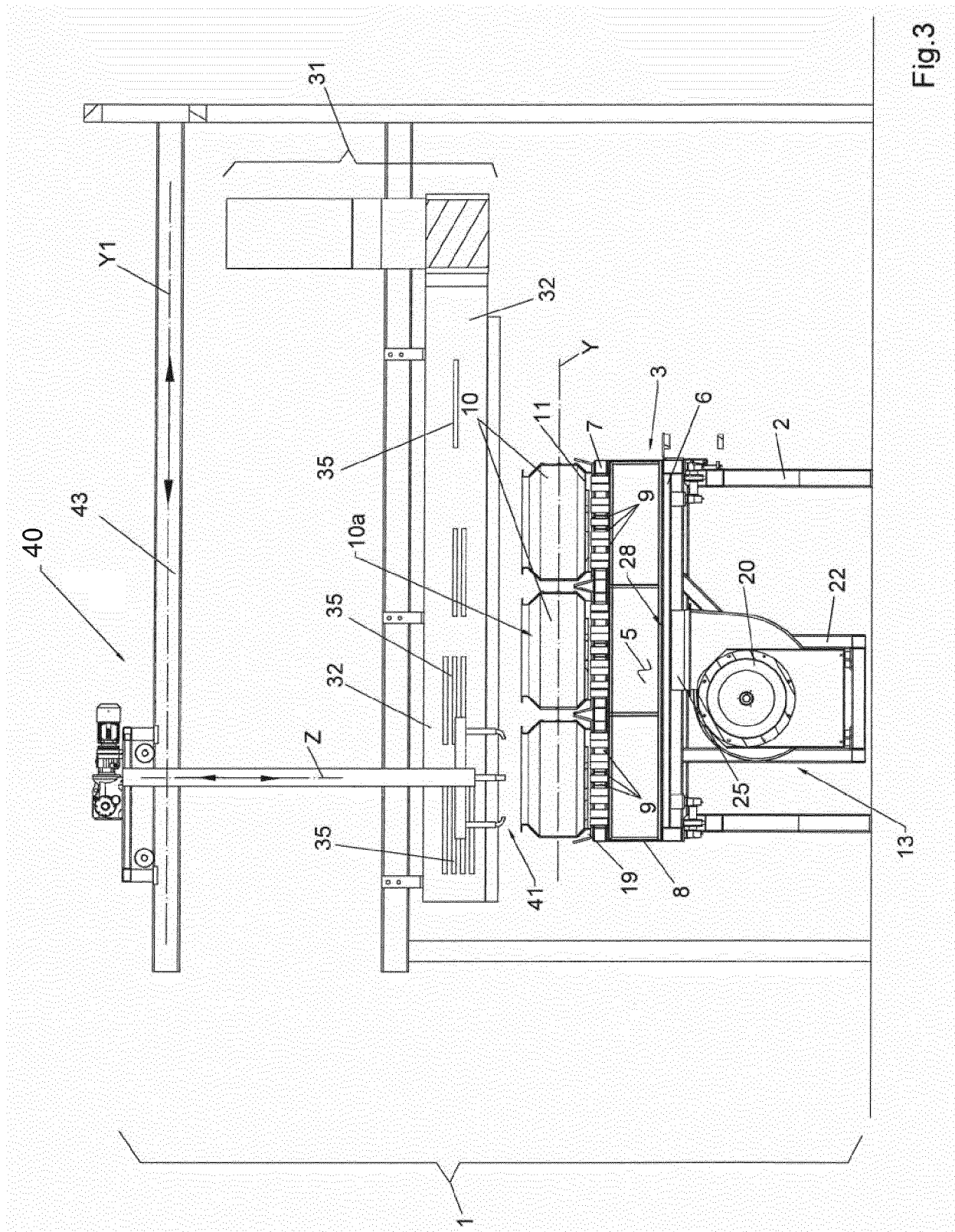
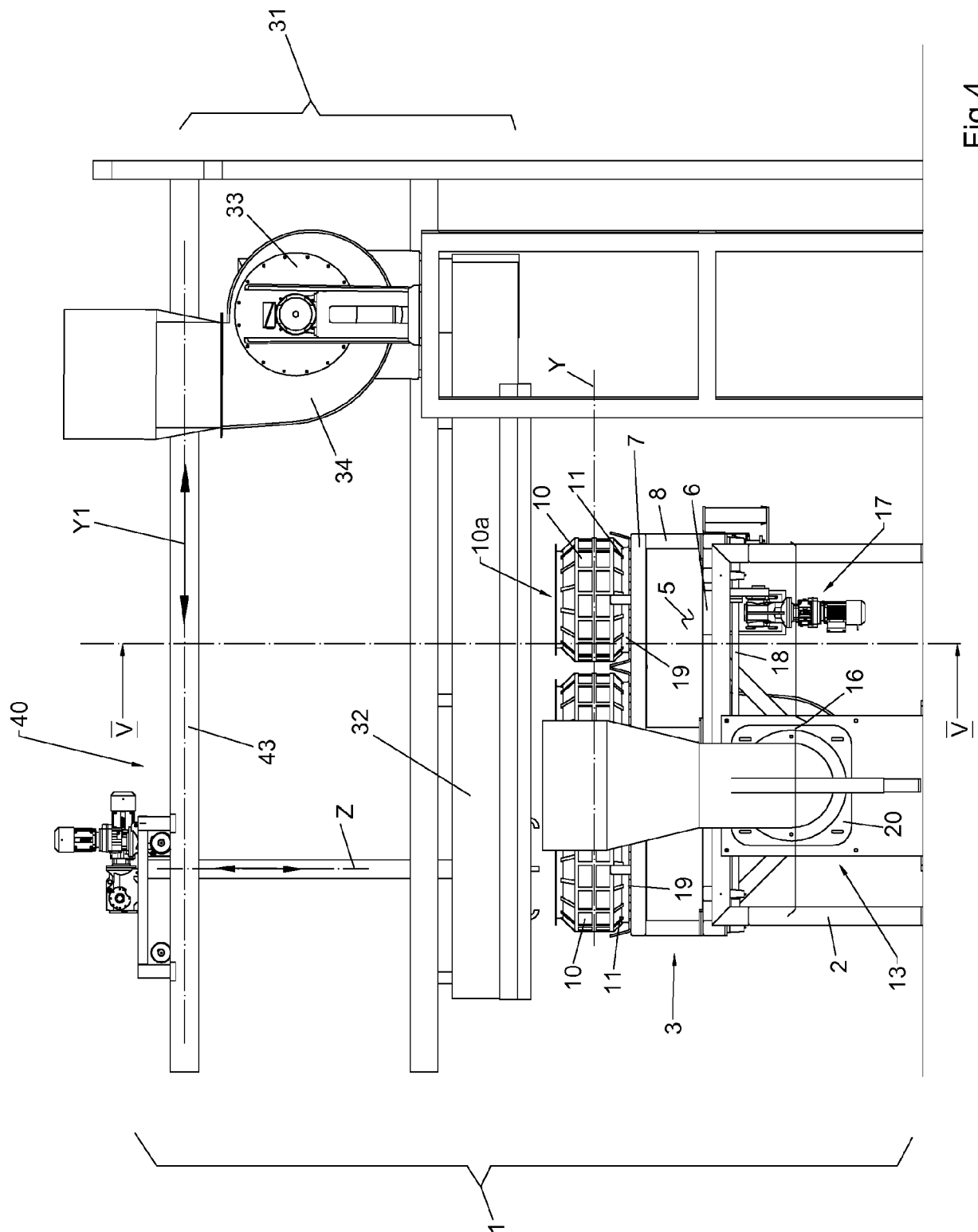


Fig.3



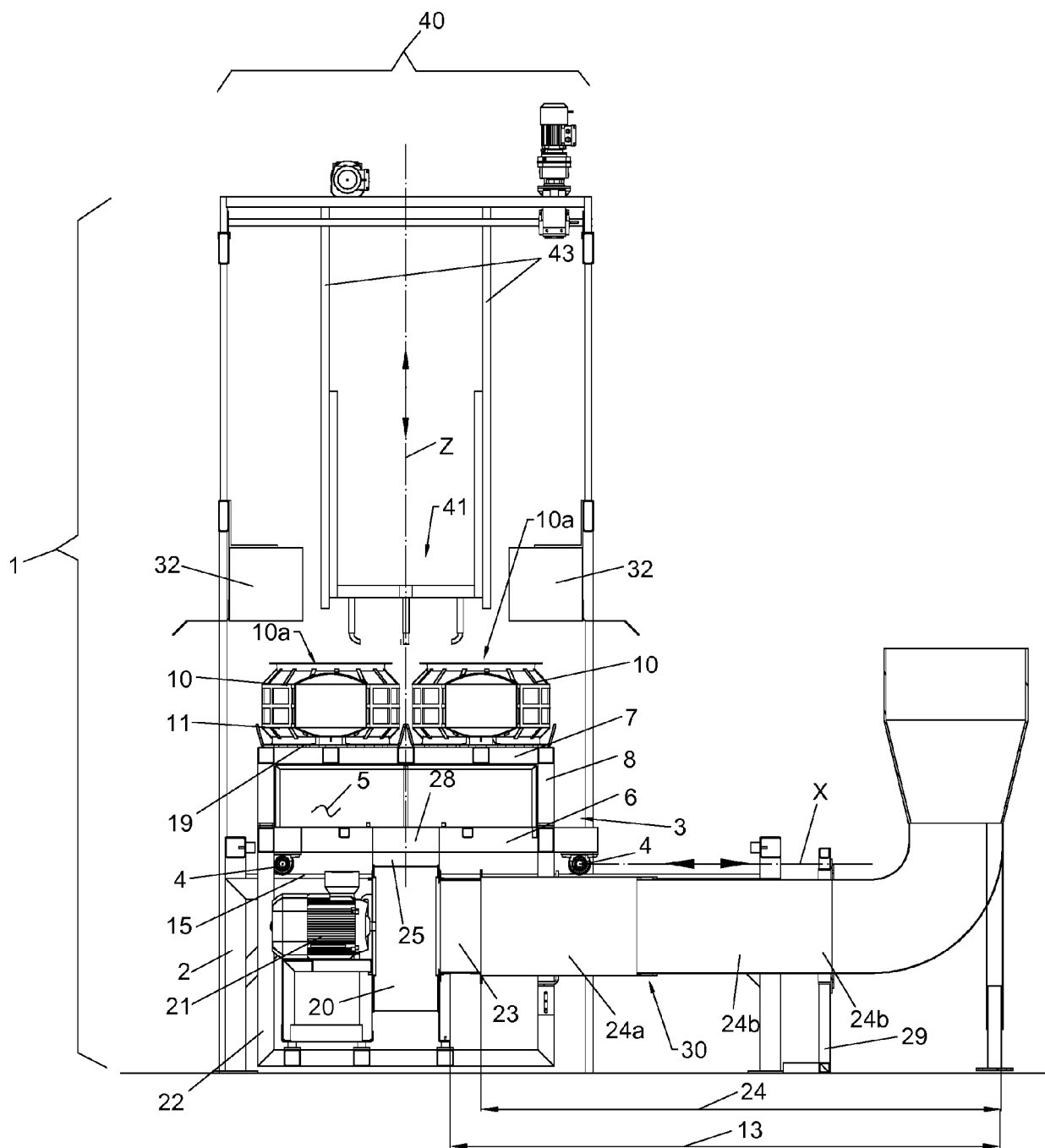


Fig.5

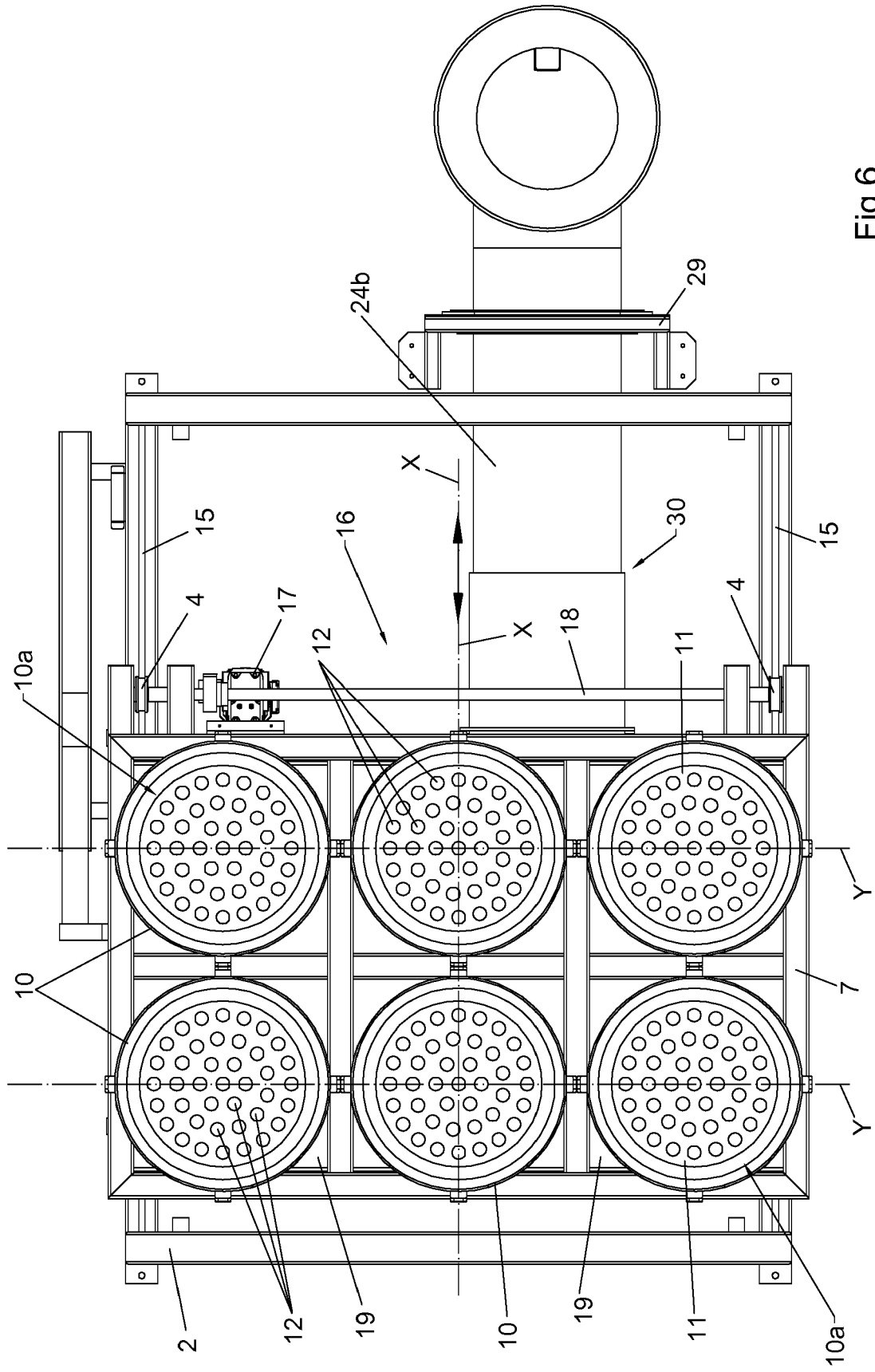


Fig. 6

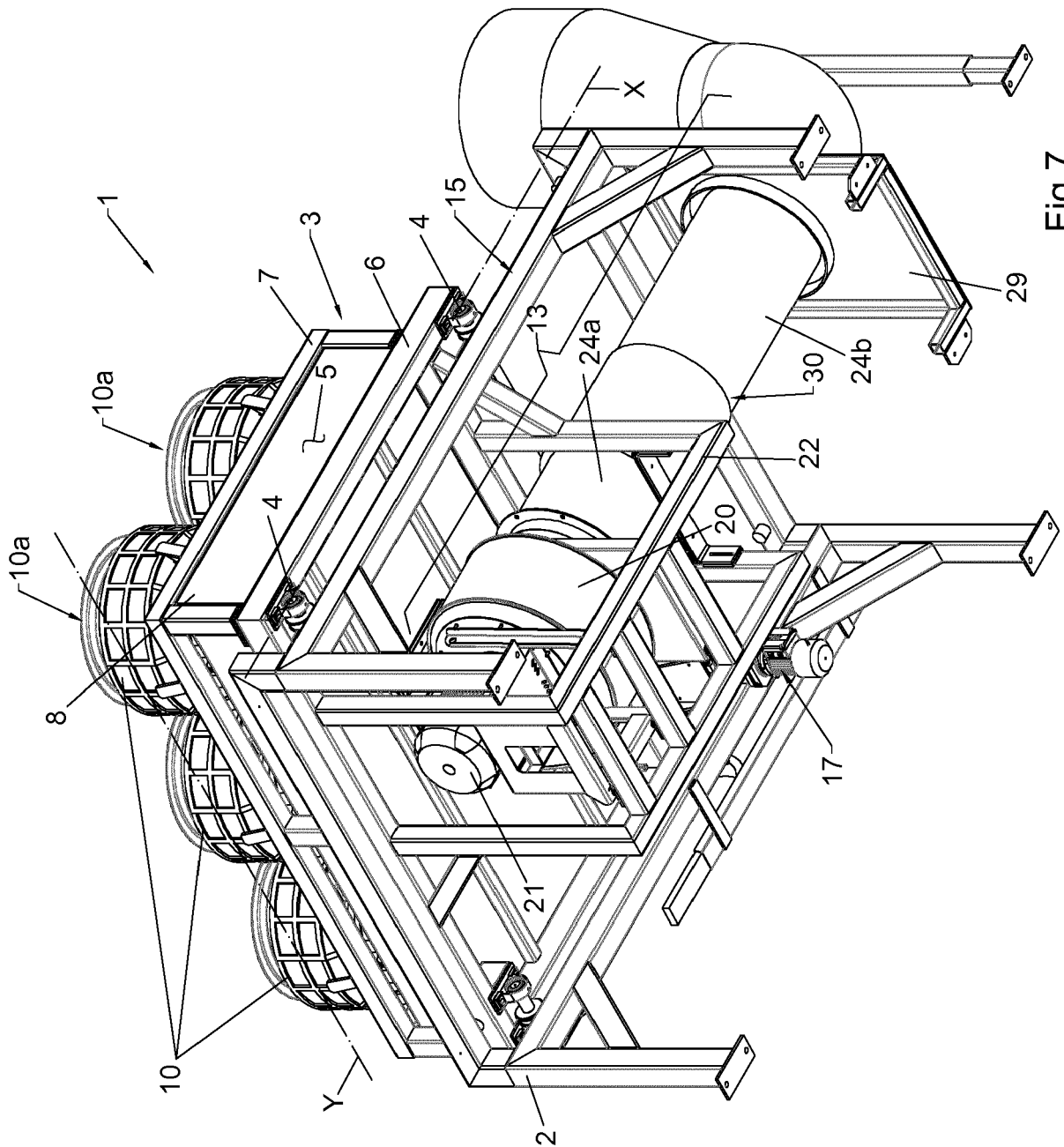


Fig.7

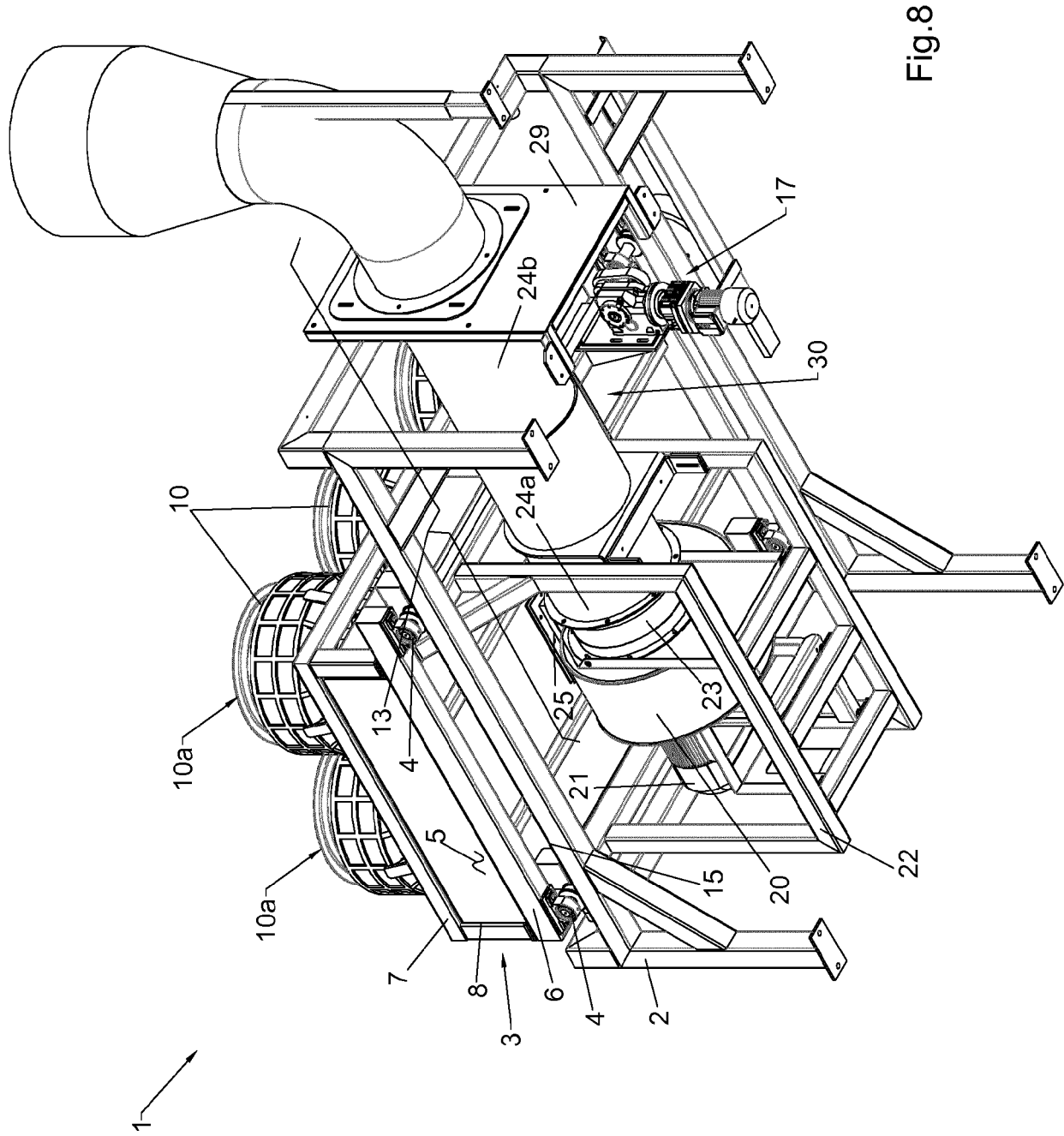


Fig.8



EUROPEAN SEARCH REPORT

Application Number
EP 18 16 5768

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	FR 2 917 752 A1 (MONTUPET SA SA [FR]) 26 December 2008 (2008-12-26) * figures 1, 3, 5, 6 * * page 1, line 1 - line 5 * * page 1, line 18 - line 26 * * page 2, line 24 - line 31 * * page 3, line 1 - line 11 * * page 8, line 1 - line 31 * * page 10, line 6 - line 7 * * page 11, line 13 - line 31 * * page 12, line 10 - page 13, line 2 * -----	1-9	INV. F27D15/02 F27D17/00 C23C2/28
A	DE 10 2009 048797 B3 (WIELAND WERKE AG [DE]) 3 March 2011 (2011-03-03) * figures 1, 2, 5 * * paragraph [0001] - paragraph [0002] * * paragraph [0033] - paragraph [0039] * * paragraph [0042] * -----	1-9	TECHNICAL FIELDS SEARCHED (IPC) F27D C21D F26B C23C
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 13 July 2018	Examiner Jung, Régis
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	

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ON EUROPEAN PATENT APPLICATION NO.**

EP 18 16 5768

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR 2917752 A1	26-12-2008	EP 2167693 A1	31-03-2010
		FR 2917752 A1	26-12-2008
		US 2010236669 A1	23-09-2010
		WO 2009000751 A1	31-12-2008

DE 102009048797 B3	03-03-2011	NONE	

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Patent documents cited in the description

- FR 2917752 [0009]
- DE 102009048797 [0009]