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(54) Title: DECORING MACHINE

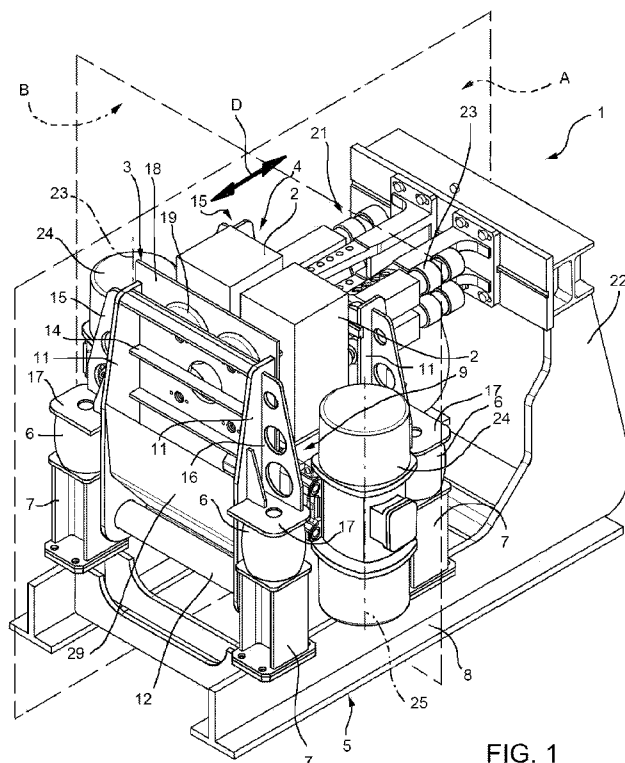


FIG. 1

(57) Abstract: A decorating machine (1) for removing residual moulding material from foundry castings (2); the machine (1) having a fork-shaped frame (3) defined by a bottom base member (13), and by two top shoulders (15) located on opposite sides of a vertical plane of symmetry (B) of the frame (3) and laterally defining a housing (4) for at least one casting (2) to be decorated; and the machine (1) also having two unbalanced motors (24) mounted on the frame (3) to rotate in phase opposition to each other about respective vertical axes of rotation (25) lying in the plane of symmetry (B), so as to impart a vibratory movement to the frame (3) in a given direction.

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DECORING MACHINE

TECHNICAL FIELD

The present invention relates to a decorating
5 machine.

BACKGROUND ART

More specifically, the present invention relates to
a decorating machine for removing residual moulding
material from foundry castings, the machine being of the
10 type comprising a frame defining a housing for at least
one casting to be decored; and two unbalanced motors or
electric vibrators fitted to the frame to rotate, in
use, about respective vertical axes of rotation and
impart to the frame a vibratory movement, which may be
15 straight or an oscillating movement about an axis,
depending on whether the unbalanced motors rotate in
opposite directions or the same direction.

Because effective decorating in a machine of the
above type depends on subjecting the casting to
20 relatively severe vibration, the frame is subjected, in
use, to severe shear and bending stress.

For this reason, and because the design of commonly
used known machines does not normally enable accurate
prediction of the degree and direction of such stress,
25 the frame is invariably massive, heavy, and normally
oversized.

This solution obviously poses many problems, mainly
due to high manufacturing cost, the massive size of the

machine, and the energy required to operate the machine.

A partial solution to the problem of the masses involved is provided in Patent Application US2006/0272792, which describes a decoring machine in
5 which the frame comprises two lateral supporting plates, each fitted with a respective unbalanced motor. Because the motors subject the respective plates to shear stress, i.e. in the planes of the plates themselves, the thickness of the plates may be greatly reduced.
10 Consequently, the frame may have a relatively lightweight, though strong, structure, thus reducing the vibrating force applied to achieve the same result.

Controlling vibration of a relatively lightweight structure, however, poses far more serious problems than
15 controlling vibration of a relatively heavy structure. These problems are not solved in Patent Application US2006/0272792, which describes a decoring machine so structured that the vibrating force applied to a casting in the housing may change direction and even result in a
20 combined rotation-translation movement that may even be counterproductive in terms of effectively decoring the casting.

DISCLOSURE OF INVENTION

It is an object of the present invention to provide
25 a decoring machine of the type described above designed to eliminate the above drawbacks.

According to the present invention, there is provided a decoring machine as claimed in Claim 1 and

preferably in any one of the following Claims depending directly or indirectly on Claim 1.

BRIEF DESCRIPTION OF THE DRAWINGS

A number of non-limiting embodiments of the invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a view in perspective of a preferred embodiment of the decoring machine according to the present invention;

Figures 2 and 3 show side and end views respectively of the Figure 1 machine;

Figure 4 shows a plan view of the Figure 1 machine;

Figure 5 shows a larger-scale view in perspective of a detail of the Figure 1 machine.

BEST MODE FOR CARRYING OUT THE INVENTION

Number 1 in Figure 1 indicates as a whole a decoring machine for removing residual moulding materials from foundry castings 2 by subjecting castings 2 to a combination of vibratory movement and hammering. This type of machine is used to advantage, for example, for decoring aluminium alloy cast engine cylinder heads.

Machine 1 comprises an upward-facing, fork-shaped supporting frame 3 defining a housing 4 for castings 2 to be decored. In the example shown, machine 1 is set to simultaneously decore two castings 2 arranged side by side in housing 4, but may obviously also be used to decore one casting 2 at a time, or more than two castings 2 simultaneously, depending on the size of

castings 2.

Frame 3 rests on a base block 5 with the interposition of four elastic bearings 6, which are fitted to respective uprights 7 integral with a horizontal portion 8 of base block 5, are in the form of convex cylinders coaxial with respective parallel vertical axes, and flex elastically in a direction crosswise to their respective axes.

This system reduces the force resisting vibration, and at the same time reduces downtime of machine 1.

As shown in more detail in Figure 5, frame 3 comprises two U-shaped metal plates 9 located on opposite sides of and parallel to a vertical plane of symmetry A of frame 3, and each defined by a substantially rectangular bottom portion 10, and by two upright portions 11 extending upwards from respective opposite lateral portions of the free top edge of bottom portion 10.

The two bottom portions 10 are connected rigidly to each other by a number of tubes 12 perpendicular to plane A, so as to define as a whole a rigid base member 13 of frame 3.

The upright portions 11 of each plate 9 are connected to the upright portions 11 on the opposite side of plane A by bars 14, so as to define two shoulders 15, which define housing 4 laterally, and are located on opposite sides of a vertical plane of symmetry B perpendicular to plane A.

Each upright portion 11 of each plate 9 is fitted, with the interposition of a respective brace 16, with an appendix 17 projecting outwards of frame 3 and perpendicular to plate 9. As shown in Figure 1, the four
5 appendices 17 are connected integrally to the top of respective bearings 6, and define respective coplanar feet by which frame 3 rests on base block 5.

To lock castings 2 inside housing 4, frame 3 comprises a gripping device comprising a plate 18, which
10 is connected to one of the two shoulders 15, and is located inside housing 4, adjacent to said shoulder 15. Plate 18 is parallel to plane B, and is movable, parallel to itself and by means of four pneumatic actuators 19 located between said shoulder 15 and plate
15 18, towards the other shoulder 15 to grip castings 2 against fixed locators 20 fitted to bars 14 of the other shoulder 15.

As shown in Figures 1 to 3, machine 1 also comprises a known percussion unit 21 for vigorously
20 hammering castings 2 to break off the moulding material compacted inside castings 2 and so enable its removal by vibration.

Percussion unit 21 is fitted to a vertical portion 22 of base block 5 facing the shoulder 15 fitted with
25 locators 20, and comprises a number of known pneumatic hammers 23, which extend from vertical portion 22 towards said shoulder 15 in a direction perpendicular to plane B, and have respective heads which, when hammers

23 are operated, move between bars 14 to strike castings 2.

Machine 1 also comprises a vibration unit in turn comprising two known unbalanced motors 24, each of which has a vertical axis of rotation 25, and is mounted on base member 13, at a respective plate 9, so that respective axis 25 lies in plane B. Each motor 24 is fitted to and projects from respective plate 9 by means of four fastening members 26 which, in addition to supporting motor 24, also prevent it from moving crosswise to respective axis 25.

Castings 2 and motors 24 are preferably fitted to frame 3, so that the centre of each motor 24 is substantially on a level with the barycentre of frame 3 and castings 2 as a whole.

By virtue of this symmetric and barycentric arrangement, the stress generated by each motor 24 is discharged in the plane of respective plate 9, which is thus subjected to mainly shear stress and practically no bending stress, and can therefore be made relatively thin; and the resultant of the forces generated by motors 24 is perfectly controlled.

In fact, in the event motors 24 are operated in phase opposition to each other (as in the example shown), the resultant of the forces generated by motors 24 is a force substantially in plane A and extending in a direction D perpendicular to plane B; and the forces in other directions are eliminated by compensation.

Conversely, in the event, as in a variation not shown, motors 24 are operated in phase with each other, the resultant of the forces generated by motors 24 is a pure moment which causes frame 3 to oscillate about an axis parallel to axes 25 of motors 24 and defined by the intersection of planes of symmetry A and B.

In other words, by virtue of the symmetric and barycentric arrangement described above, motors 24 subject frame 3 to a controlled movement in a given direction, as opposed to separate, uncontrolled movements.

As shown in Figures 2 to 5, machine 1 also comprises a crumbling device for crumbling the moulding material removed from castings 2. The crumbling device comprises a grate 27, which is fitted to frame 3, extends between plates 9, perpendicularly to planes A and B, is positioned facing housing 4, and has a rough surface on the side facing housing 4. Grate 27 being integral with and therefore vibrating together with frame 3, the moulding material detached from castings 2 is "grated" on grate 27 into powder or small pieces, which drop through the openings in grate 27 into a fixed bin 28 underneath.

To prevent the moulding material removed from castings 2 from falling outside frame 3 before reaching grate 27, frame 3 is equipped with two deflectors 29, each located beneath a respective shoulder 15 and extending between and crosswise to plates 9.

Operation of machine 1 will be clear from the above description, with no further explanation required.

CLAIMS

1) A decorating machine for removing residual moulding material from foundry castings (2), the machine
5 (1) comprising a frame (3) defining a housing (4) for at least one casting (2) to be decored; and two unbalanced motors (24) mounted on the frame (3) to rotate about respective vertical axes of rotation (25) and impart a vibratory movement to the frame (3); the machine (1)
10 being **characterized in that** the frame (3) has a vertical axis of symmetry (B), and comprises two parallel U-shaped plates (9) connected rigidly to each other to define a bottom base member (13), and two top shoulders (15) located on opposite sides of said plane of symmetry (B) and bounding said housing (4) laterally; **and in that** each motor (24) is fitted to the respective said plate (9) so that the respective axis of rotation (25) lies in the plane of symmetry (B).

2) A machine as claimed in Claim 1, wherein each
20 motor (24) is connected to the respective plate (9) at the base member (13) of the frame (3).

3) A machine as claimed in Claim 1 or 2, wherein the frame (3) has a further plane of symmetry (A) perpendicular to said plane of symmetry (B) and parallel
25 to said axes of rotation (25); the motors (24) being arranged symmetrically with respect to the further plane of symmetry (A).

4) A machine as claimed in Claim 3, wherein the

plates (9) are arranged symmetrically with respect to the further plane of symmetry (A), and the motors (24) are located outside the assembly defined by the plates (9).

5 5) A machine as claimed in one of the foregoing Claims, wherein each motor (24) has a centre; the frame (3) and the casting (2) define, in use, an assembly having a barycentre; and locking means (18) are provided inside the housing (4) to lock the casting (2), with
10 respect to the frame (3), in such a position that the centre of each motor (24) is substantially on a level with the barycentre of said assembly.

 6) A machine as claimed in one of the foregoing Claims, and also comprising a fixed base block (5); the
15 frame (3) being supported by the base block (5) with the interposition of elastic bearings (6).

 7) A machine as claimed in Claim 6, wherein the base block (5) comprises two pairs of uprights (7); each upright (7) supporting a respective elastic bearing (6);
20 and each pair of uprights (7) being associated with a respective said plate (9).

 8) A machine as claimed in one of the foregoing Claims, and comprising a percussion unit (21) located outside the frame (3) and having a number of hammers
25 (23), which are movable, in a direction perpendicular to said plane of symmetry (B), through one of the shoulders (15) to strike the casting (2) inside the housing (4).

 9) A machine as claimed in one of the foregoing

Claims, and comprising crumbling means (27) for crumbling the moulding material removed from the casting (2).

10) A machine as claimed in Claim 9, wherein said
5 crumbling means (27) comprise a grate (27), which is fitted to the frame (3), extends between the plates (9), under the housing (4), and has a rough surface facing the housing (4).

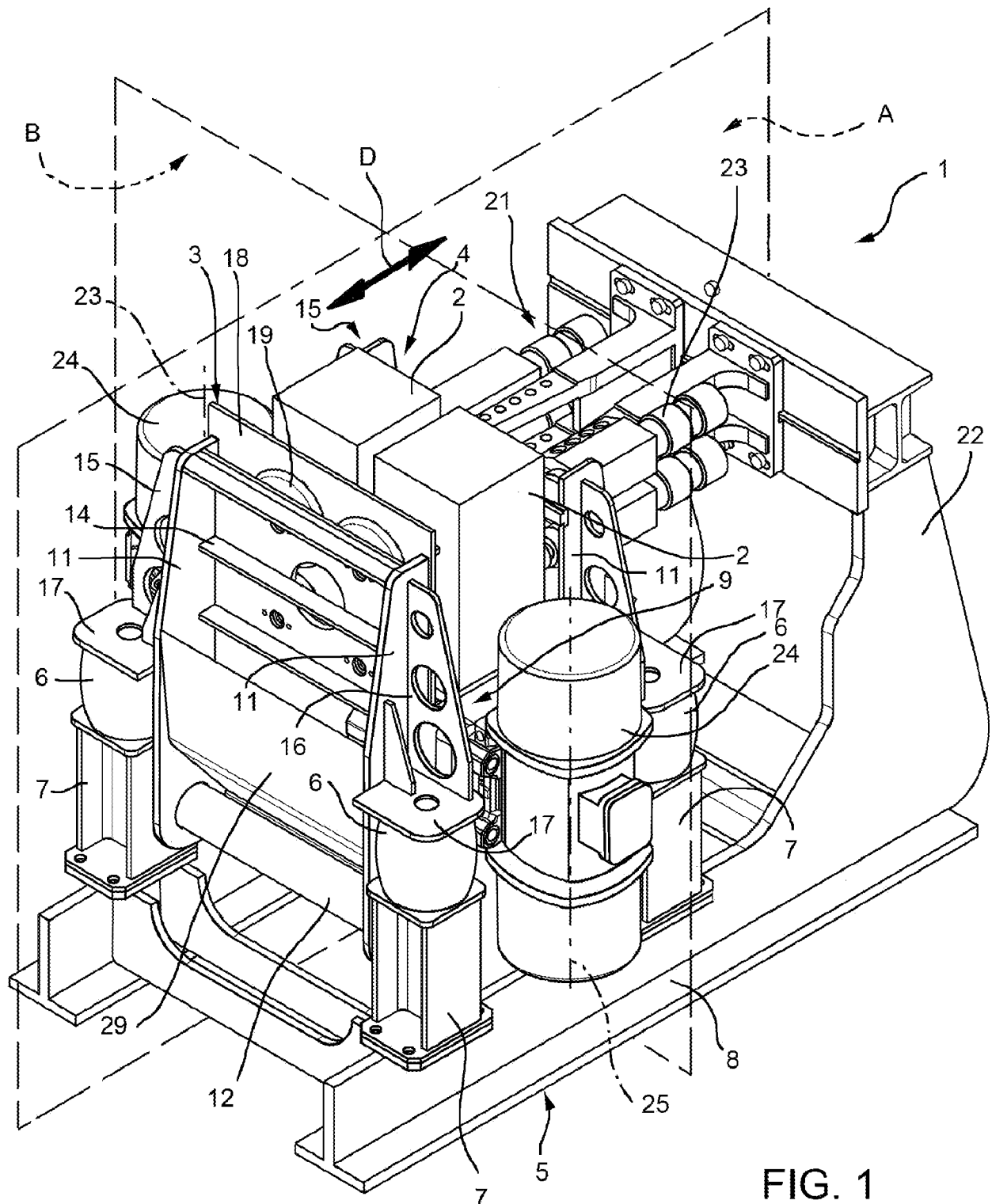


FIG. 1

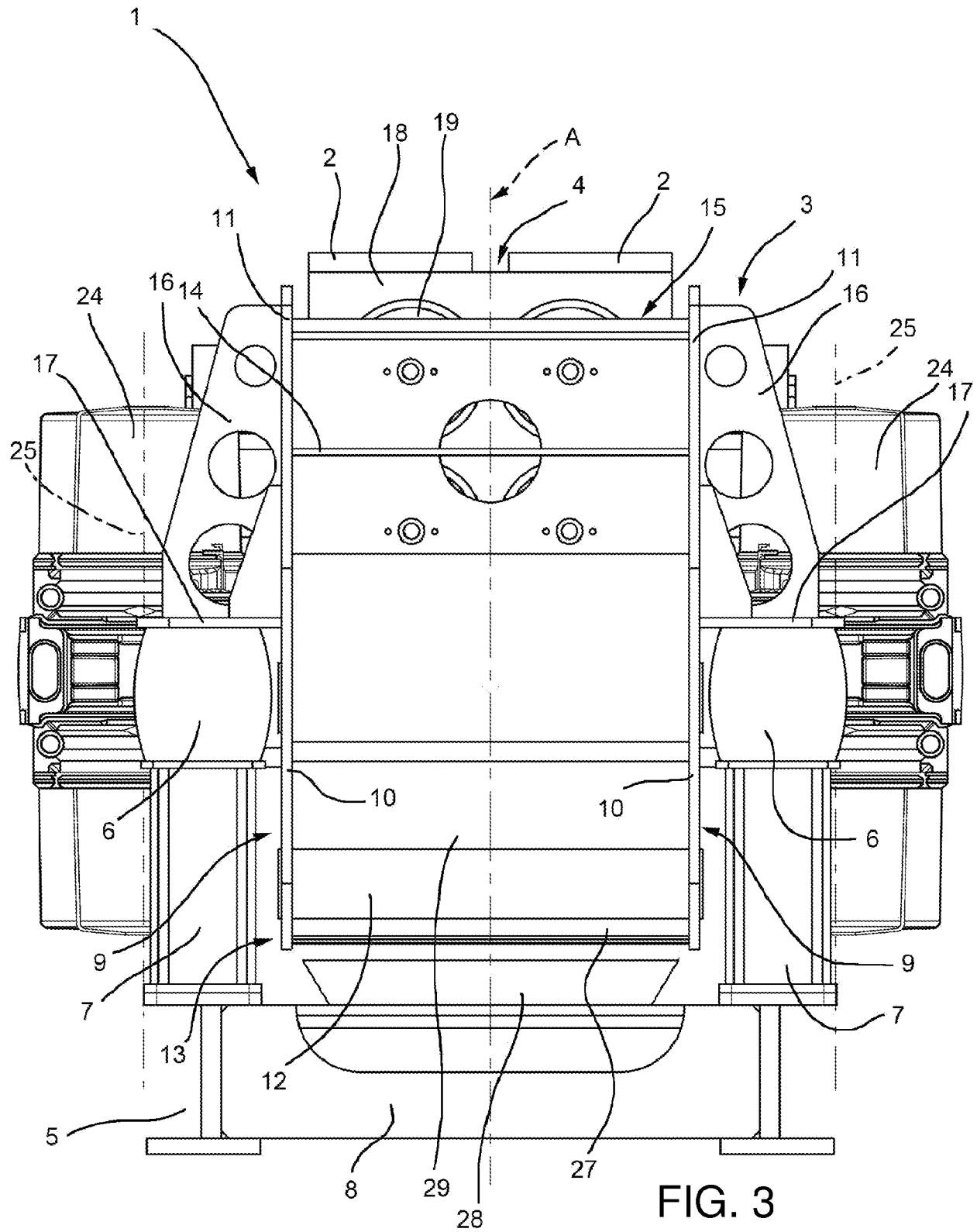


FIG. 3

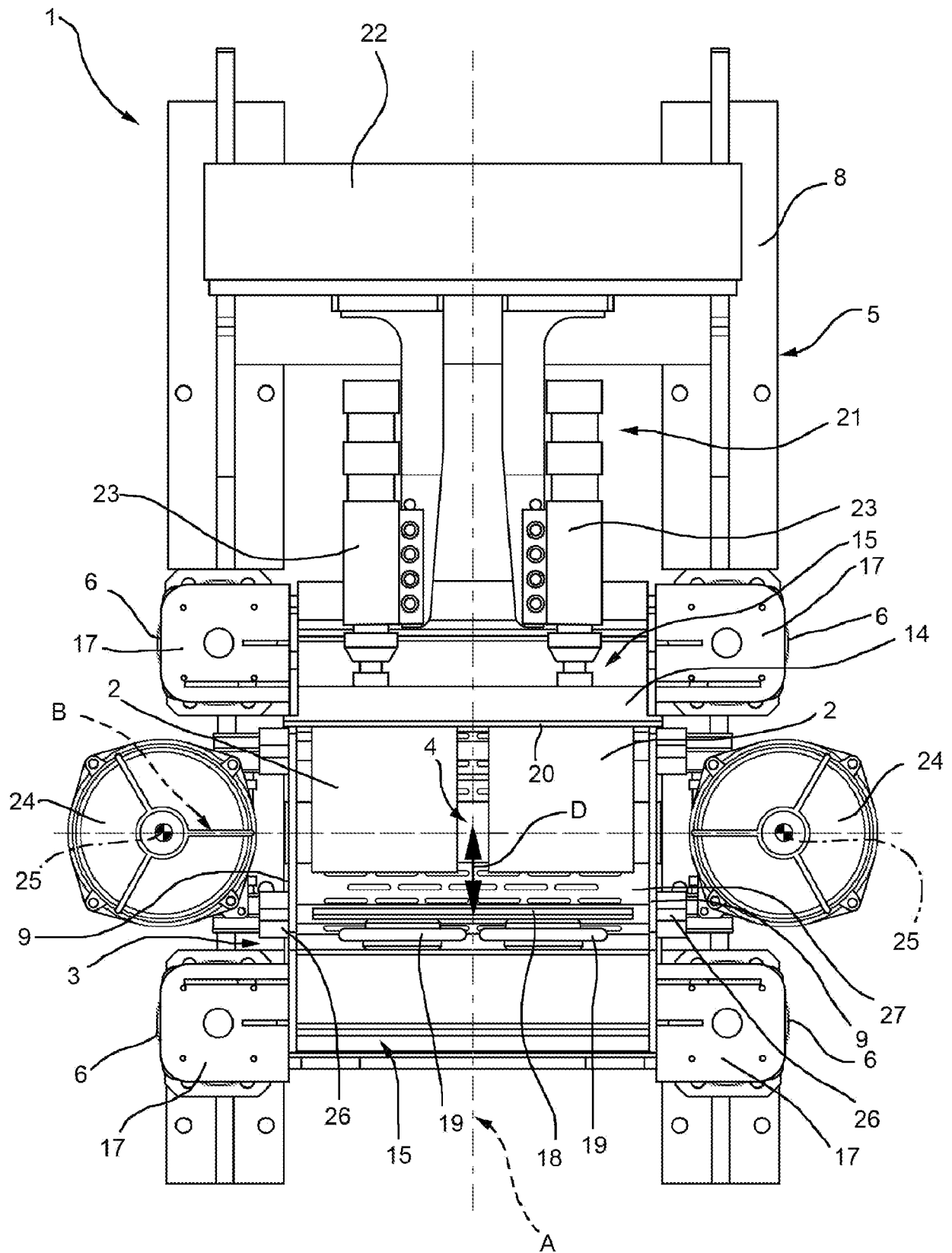


FIG. 4

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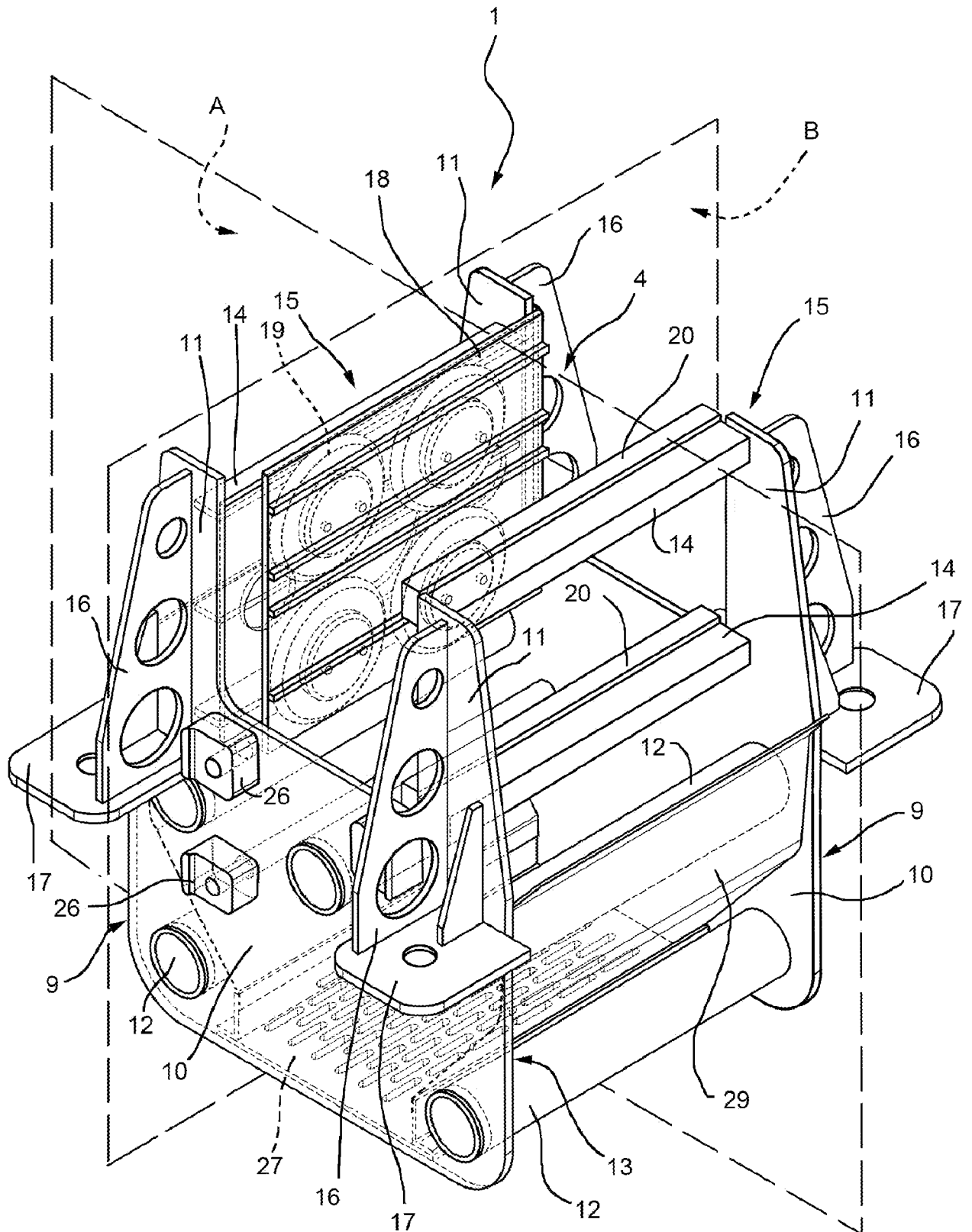


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2010/058094

A. CLASSIFICATION OF SUBJECT MATTER

INV. B22D29/00

ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B22D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	FR 2 850 890 A1 (DUPUIS REMI [FR]) 13 August 2004 (2004-08-13)	1-3,5-10
A	figures 1-4	4
Y	US 2006/272792 A1 (MASSIN MARCEL [FR]) 7 December 2006 (2006-12-07)	1-3,5-10
A	cited in the application figures 1-6	4
A	FR 2 901 161 A1 (DISA SERF [FR]) 23 November 2007 (2007-11-23)	1
	figure 3	

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

6 September 2010

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2010/058094

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