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(54) **COOLER SYSTEM AND MEANS FOR ASSEMBLING THEM IN CASTING MOLDS**

(57) The system of coolers is foreseen for its use in sand moulds in which cast pieces are obtained. The coolers are constituted by several units or modules (5) which are mounted in a support (4), with certain play and are fastened to this by means of a bar (7), forming a multiple cooler that, arranged on a pallet (3) on which in turn is superimposed a support pallet (1) of the mould, allows the displacement of the whole in the casting production line. That is, the assembly of the multiple cooler

on the mould, as well as its extraction and separation with regard to the casting that is obtained, is carried out in an automatic way. Each unit or module (5) of the cooler is capable of being constituted by a single piece, by two pieces (5') or by three pieces (5''), and assembly thereof on the corresponding support (4) will be carried out with play (6) to absorb the expansions and contractions caused by the heat transmitted by the molten metal.

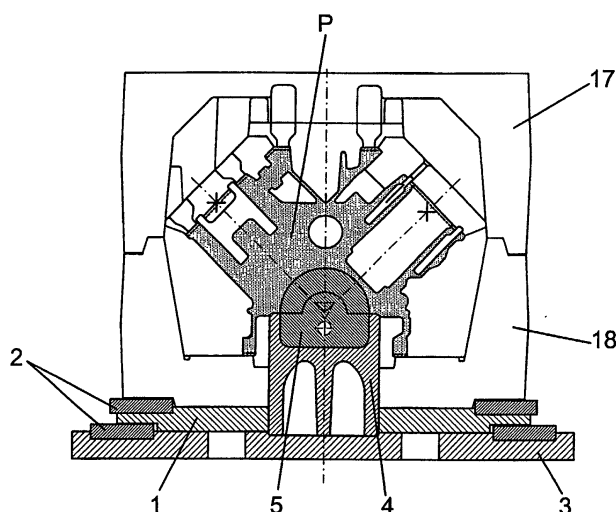


FIG. 2

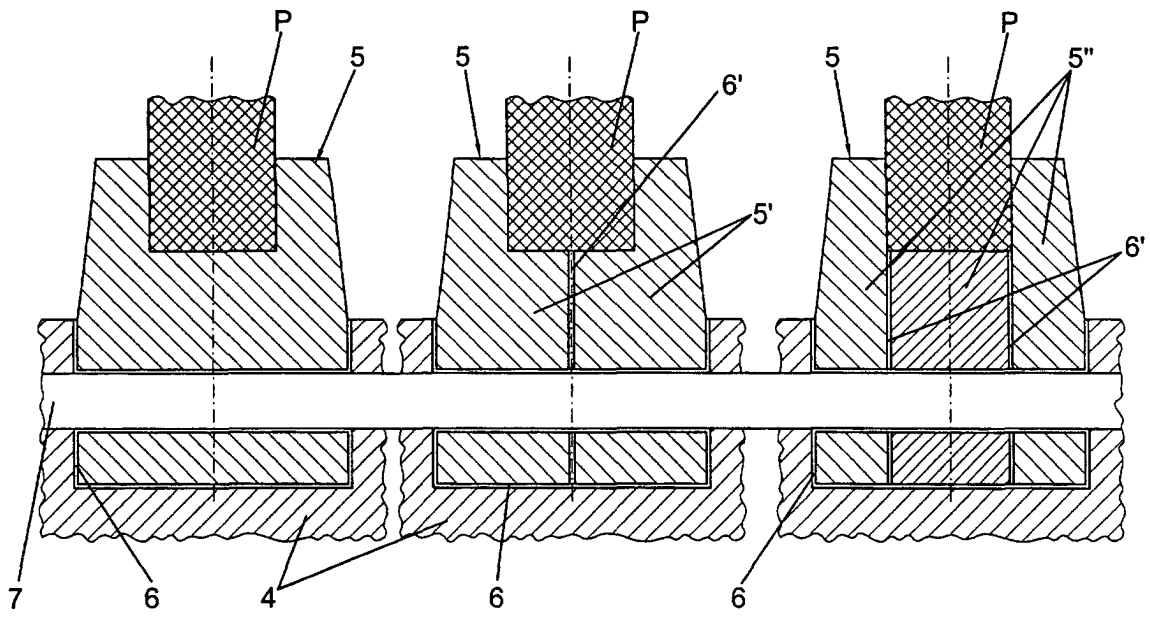


FIG. 3

Description

OBJECT OF THE INVENTION

[0001] The present invention relates to a system of coolers foreseen for its use in sand casting moulds to achieve the cooling of certain parts of the cast pieces that are obtained. The coolers are foreseen for their application in the obtaining of, for example, engine blocks obtained by casting aluminium in sand moulds, with the object of achieving an enhancement of the metallurgical properties in certain areas of the obtained piece.

[0002] The coolers will be mounted On a cooler holder and fastened to this in such a way that they form a multiple cooler that facilitates their automated assembly on the corresponding mould, as well as their extraction with respect to the casting, with return to the assembly area. Also part of the object of the invention are the means that intervene in the assembly/disassembly process.

BACKGROUND OF THE INVENTION

[0003] In the processes of casting aluminium pieces, such as certain engine blocks, the use is known of coolers that are arranged in certain areas of the casting mould, all of which is for the purpose of having the poured aluminium cool more quickly in the zone in contact with the cooler, thereby improving the metallurgical properties of the piece in those areas that have cooled more quickly.

[0004] In the casting of aluminium engine blocks, the use of coolers is known to cool more quickly those parts of the piece that will constitute the seat of the crankshaft, the coolers being constituted on the basis of a cylindrical body of cast iron that is placed in the mould before the metal is poured, with the object that said cylindrical body causes quicker cooling in the partitions that will conform the seat for the crankshaft.

[0005] In accordance with the practice employed up until now, the cooler only acts on the surface of the piece that will be in contact with it, so that its effectiveness is limited practically to one side of the piece.

[0006] In a production line of aluminium engine blocks, the basic operative sequences are the following:

[0007] Firstly the cores are placed inside the sand mould and subsequently the coolers, the latter being positioned and secured in the most convenient and opportune way. Subsequently the metal is poured into the mould, the latter passing to the cooling station and then to the de-moulding station.

[0008] The de-moulding of the casting can be carried out by means of vibration, although at present it is carried out by means of a heat treatment that causes the melting of the binder resin, loosening the sand and producing the destruction of the mould in a simple manner, all of this such that after said destruction of the mould the casting will be obtained which will continue on its way to receive the treatments it requires, and moreover

the sand with the coolers, sand which before returning it to the recovery plant thereof, it is necessary to separate from the coolers, an operation that is generally carried out by vibration. Said operation of separating the sand from the coolers requires time and appropriate means to carry it out, which results in an additional economic cost.

[0009] Keeping in mind these operative sequences, the destruction of the mould by means of heat treatment, implies heating the coolers, whereby the energy efficiency is impaired.

[0010] To all those inconveniences it is necessary to add the fact that in the traditional system the number of coolers that are required is very high.

DESCRIPTION OF THE INVENTION

[0011] The system of coolers that is proposed, has been conceived to resolve the problem explained above, it being foreseen that the cooler as a whole is multiple and is mounted on a cooler holder, so that all the units or modules that constitute the cooling assembly are joined or anchored to the cooler holder, by means of a bar or similar element, what permits that the assembly of the multiple cooler on the mould, as well as its disassembly, can be carried out automatically, since the cooler holders will be mounted on a pallet that can be handled by robotic means moveable on the production line, the same as the mould transporting pallet.

[0012] Each unit or module of the cooler will be materialized in one, two or three pieces, positioned in such a way that between them a certain play is determined to absorb possible expansions and contractions.

[0013] Furthermore, the positioning of the coolers on the corresponding support or cooler holder will be carried out also with a certain play, with the object of likewise absorbing the expansions and contractions that are caused by the heat or temperature rise transmitted by the molten metal.

[0014] If the coolers are constituted by two or more pieces, on one hand, the absorption of expansions and contractions will be facilitated and, on the other, the play between the parts that form each unit of the cooler constitutes escape paths for the air when pouring the molten metal, the operation of filling the mould being facilitated, even in the corners or at conflictive points.

[0015] Another feature of the coolers of the invention, is that the design thereof is such that they partially envelope the piece to be obtained, whereby the contact between the latter and the cooler not only affects the front area of one of its faces but extends likewise to part of its sides, achieving the cooling on said frontal and lateral parts.

[0016] As for the automation of the assembly/disassembly, it has been foreseen that the function installation that operates with the type of coolers according to the system of the invention, carries out first a transfer of the mould for cooling, and subsequently an extraction

of the cooler and corresponding separation and evacuation with regard to the casting, the transport of the coolers being carried out to the station for placement and insertion in the mould, after previously passing through a treatment area in which the cleaning and painting are carried out, as well as other operations on the cooler itself.

[0017] Among the benefits offered by the described system of coolers, the following can be mentioned:

- It improves the energy efficiency in the system of treating the casting.
- It resolves the problem of separation of piece-cooler-sand, in the return circuit of the casting line.
- It allows the process followed by the cooler in itself to be kept under control, eliminating vibrations, impacts, etc.
- It facilitates control in the reference change in production.

DESCRIPTION OF THE DRAWINGS

[0018] To complete the description that is being made and with the object of assisting in a better understanding of the characteristics of the invention, in accordance with a preferred practical embodiment thereof, accompanying as an integral part of this description, is a set of drawings wherein by way of illustration and not restrictively, the following is shown:

Figure 1. - It shows a longitudinal section of a moulding box and its parts with the multiple cooler of the invention installed therein, as well as the piece to be cooled.

Figure 2. - It shows a transversal section of the assembly represented in the previous figure.

Figure 3. - It shows a detail in the manner of how the coolers are located on the corresponding support and fastened to this by means of a transversal bar, a cooler being seen of a single piece, another consisting of two pieces and a third constituted by three pieces, in all cases it is possible to see the corresponding play.

Figure 4. - It shows a schematic representation of the route followed by the coolers through the facilities of the foundry line.

Figure 5. - It shows a view in section of a specific embodiment of the coolers and corresponding cooler holder, on a pallet that can be handled by power-assisted means.

PREFERRED EMBODIMENT OF THE INVENTION

[0019] As can be seen in the referenced figures, the system of coolers object of the invention, is foreseen for its assembly on a sand mould, the latter being located on a pallet (1) which is superimposed and fastened, by means of corresponding keys (2), to a pallet (3) below to which is fastened the support (4) or cooler holder, the latter being constituted by the modules or units (5), as is shown in figure 1. The sand mould comprises the cover or top core (17), the base or bottom core (18) and the core assembly (19) that forms the frame.

[0020] In the support (4) are located the modules or units of coolers (5) that can be constituted by a single piece, by two pieces (5') or by three pieces (5''), as is represented in figure 3, so that in any case the cooling units or modules (5) are mounted with a certain play (6) on the support (4) and fastened to this by means of a bar or similar (7) that traverses transversally both the support (4) and all the modules or units of coolers (5), it having been foreseen also that these last come with a recess so that the cast piece (P) cools down, not only through its front face, but also through its side ones as is represented in said figure 3. That is, the modules or units of the coolers are designed to grasp the castings (P) by those parts that must receive the benefit of the use of the cooler, so that the cooling takes place not only on the front part of the piece (P), but also extends to the adjacent side parts.

[0021] Between the module or modules of the cooler (5) and the support (4) or cooler holder as well as between the modules themselves, there exists a play (6-6''), respectively, to absorb possible expansions and contractions, as well as for the escape of the air contained in the mould when casting the piece.

[0022] The placement on the mould of the multiple cooler that the different units or modules (5) constitute and their disassembly with regard to the former, can be carried out automatically since the support (4) or cooler holder will be mounted in turn on the pallet (3) which can be handled by robotic means moveable on the production line, as is illustrated schematically in figure 4, wherein the casting station (8) can be seen facing logically the casting furnace (9), so that after said casting station (8) there is a cooling area (10), followed by a cooler extraction station (11), and after this station (11) a station (12) corresponding to the area for removing the casting, whilst the cooler continues on a return path (13), with changes of direction, until reaching the station (14) for placement or insertion of the cooler itself on the mould, the latter coming from the disassembly area (15); with the particularity that in the return path (13) of the cooler from the exit station (11) to the placement station (14), there exists an area or sector (16) in which the treatment of the cooler itself takes place, corresponding to the cleaning, painting, etc. thereof.

[0023] In figure 4, corresponding to the schematic representation of the part of the casting plant line which

operates with the system of coolers object of the invention, in station (11) the automatic extraction of the coolers takes place, it being only the mould that is routed to the de-moulding station or evacuation area (12) in which the casting is obtained, all this in a such manner that with a limited number of coolers, for example 40 or 50, it is possible to cater for the plant, which is important given their high cost and maintenance.

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Claims

1. System of coolers and means for their assembly in casting moulds, which being applicable in the processes of casting aluminium pieces, such as engine blocks, the casting being carried out in sand moulds by means of pouring aluminium therein, and in those in which coolers are used to cool quickly certain parts of the piece to be obtained, **characterised in that** it comprises a series of coolers (5) that as a whole determine a multiple cooler mounted on a support (4) or cooler holder, the different modules or units (5) of the coolers being coupled to the support (4) itself by means of a bar or similar, running through all of them; it having been foreseen that the support (4) of the coolers is mounted on a pallet (3) that can be handled by robotic means moveable in the corresponding production line together with the respective support pallet (1) of the corresponding mould, all of which permitting the automatic assembly of the coolers (5), as well as their separation or disassembly with regard to the casting (P) that is obtained.
2. System of coolers and means for their assembly on casting moulds, according to claim 1, **characterised in that** the modules or units of coolers (5) are mounted on the support (4) with play (6), to absorb the expansions and contractions originated by the heat transmitted by the molten metal.
3. System of coolers and means for their assembly on casting moulds, according to previous claims, **characterised in that** each unit or module of coolers (5) is capable of being constituted in a single piece, in two pieces (5') or in three pieces (5''), with play (6') between them in order to determine escape paths for the air, in the pouring of the molten metal into the mould.
4. System of coolers and means for their assembly in casting moulds, according to previous claims, **characterised in that** the units or modules constituting the coolers (5) present an appropriate configuration to grasp the casting (P) in a such way that the cooling of the latter takes place both on its front part and on its side and adjacent parts.

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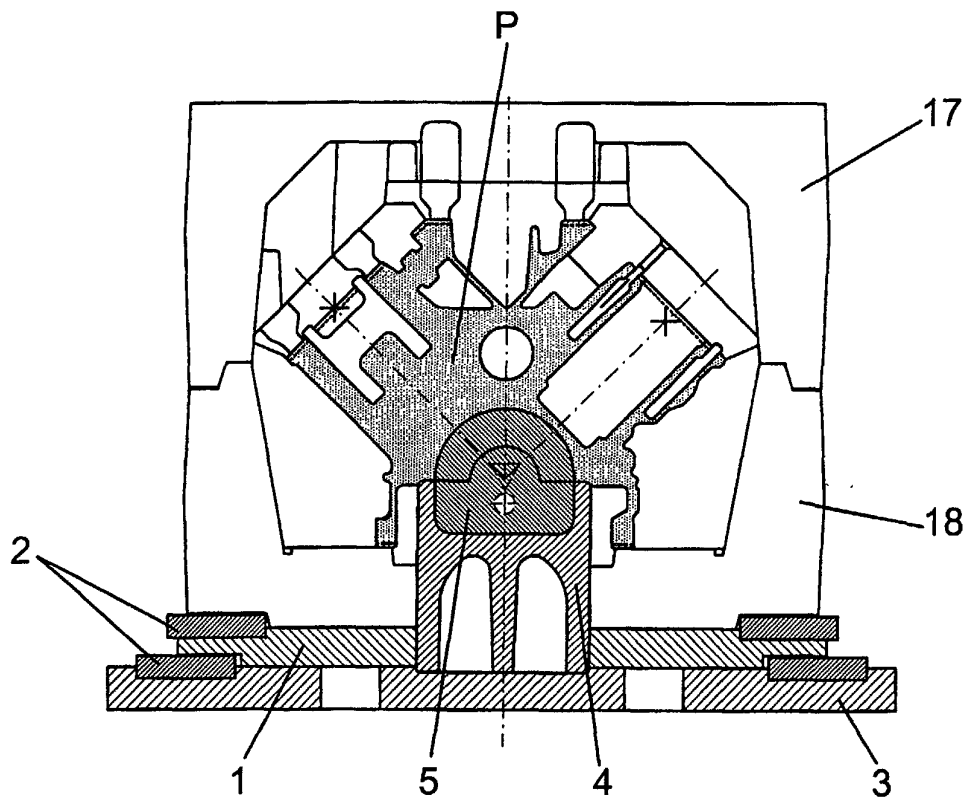
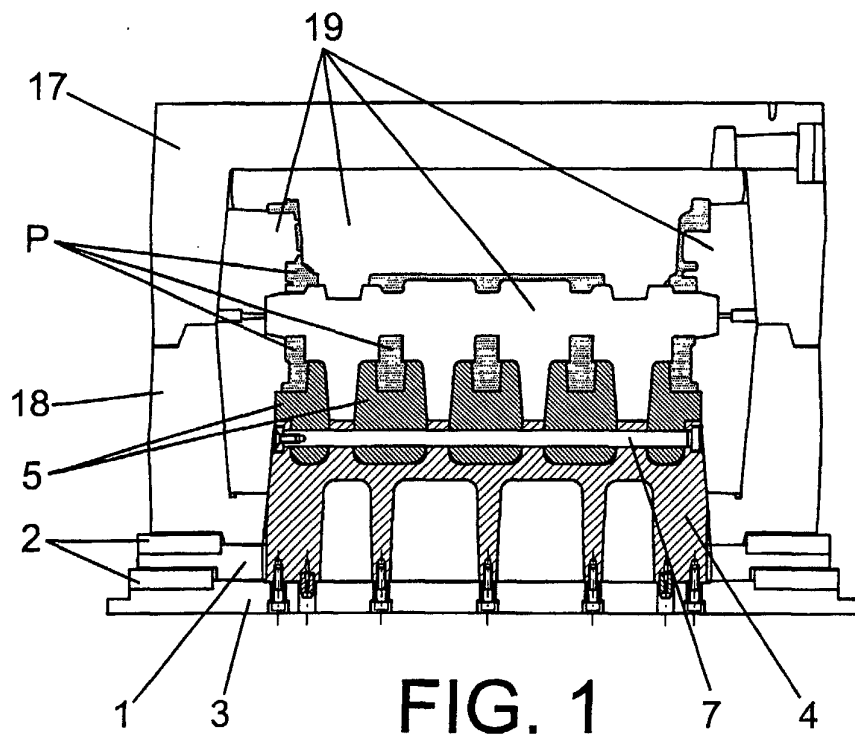
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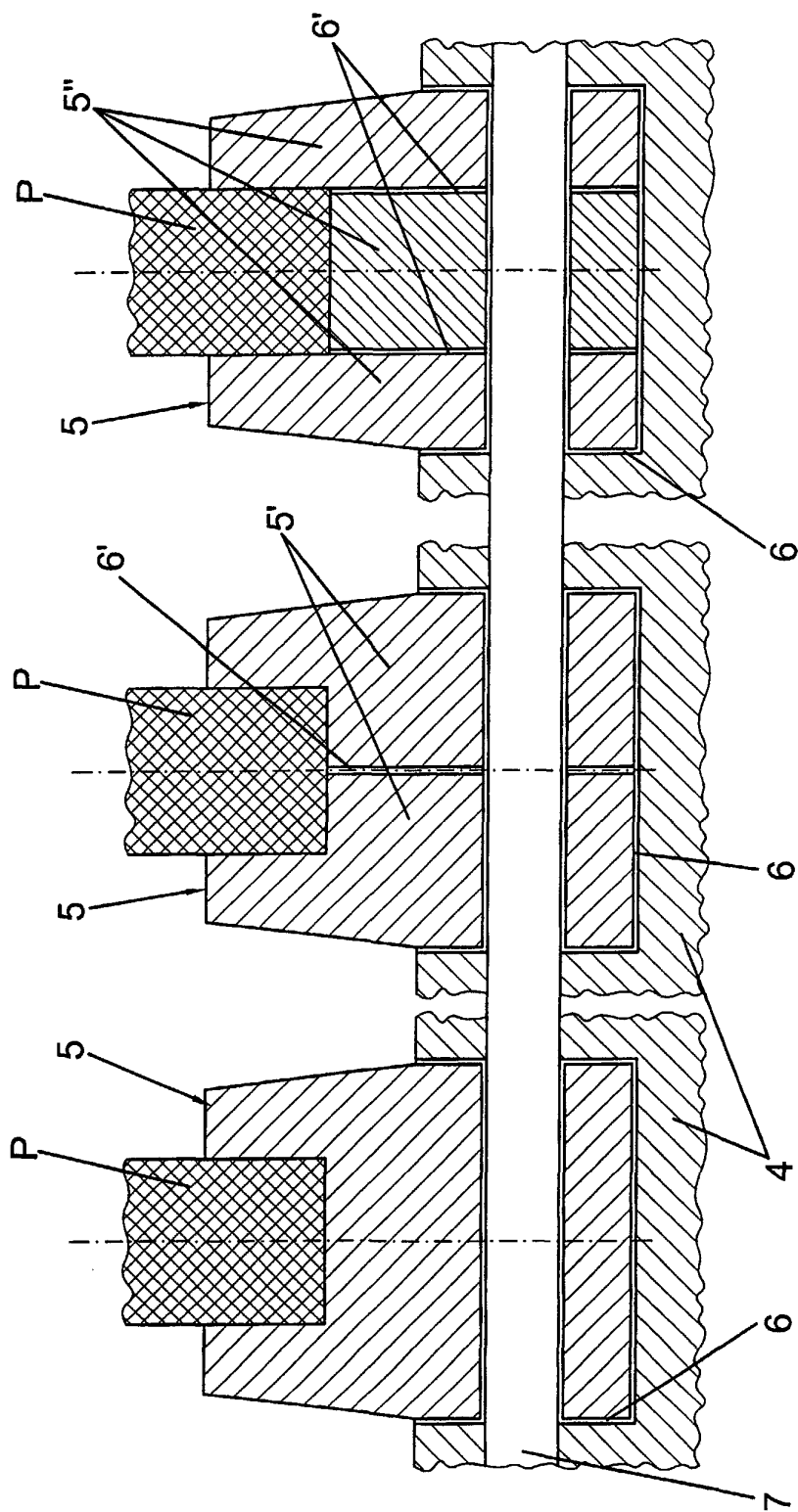
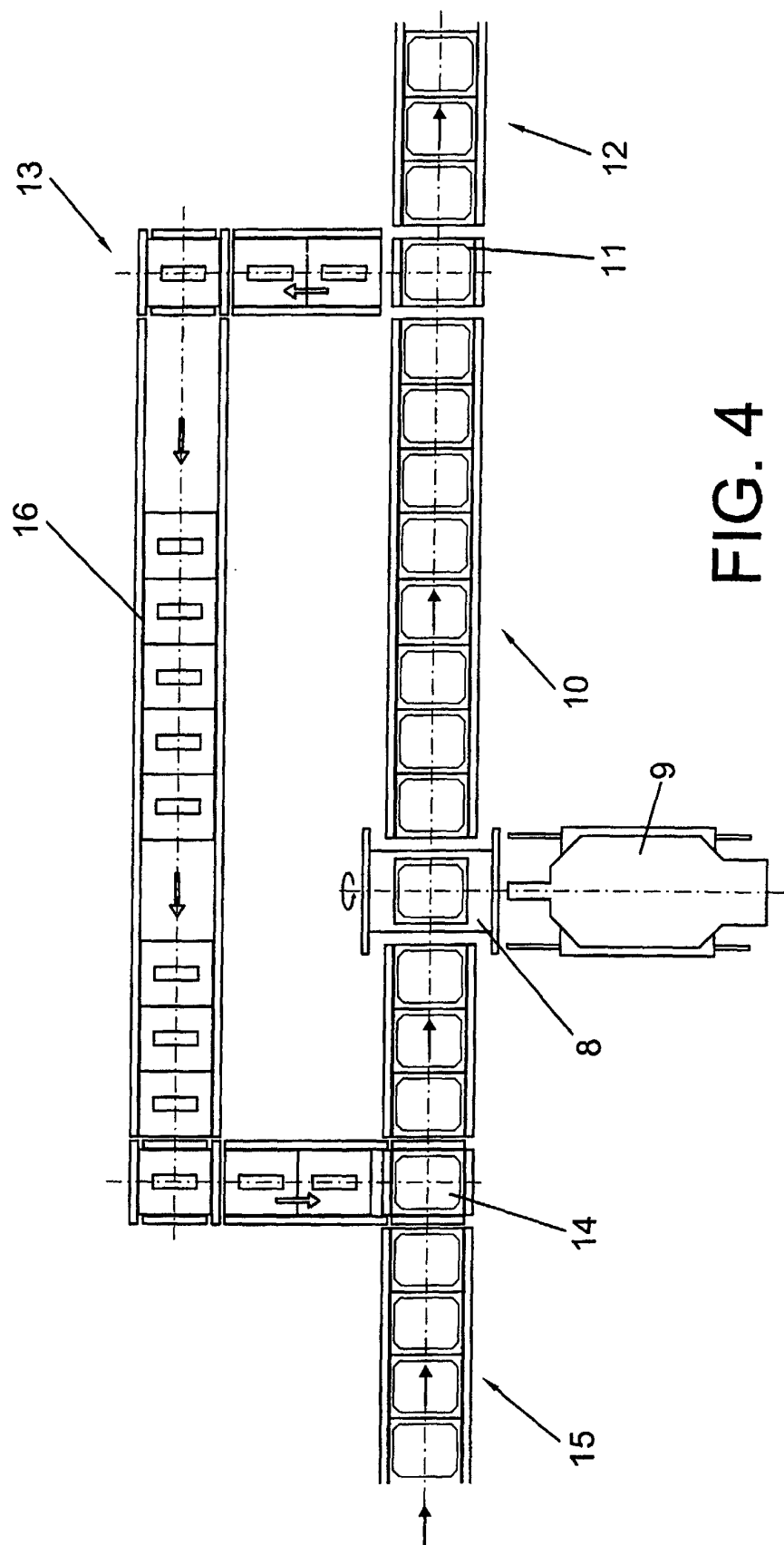


FIG. 3



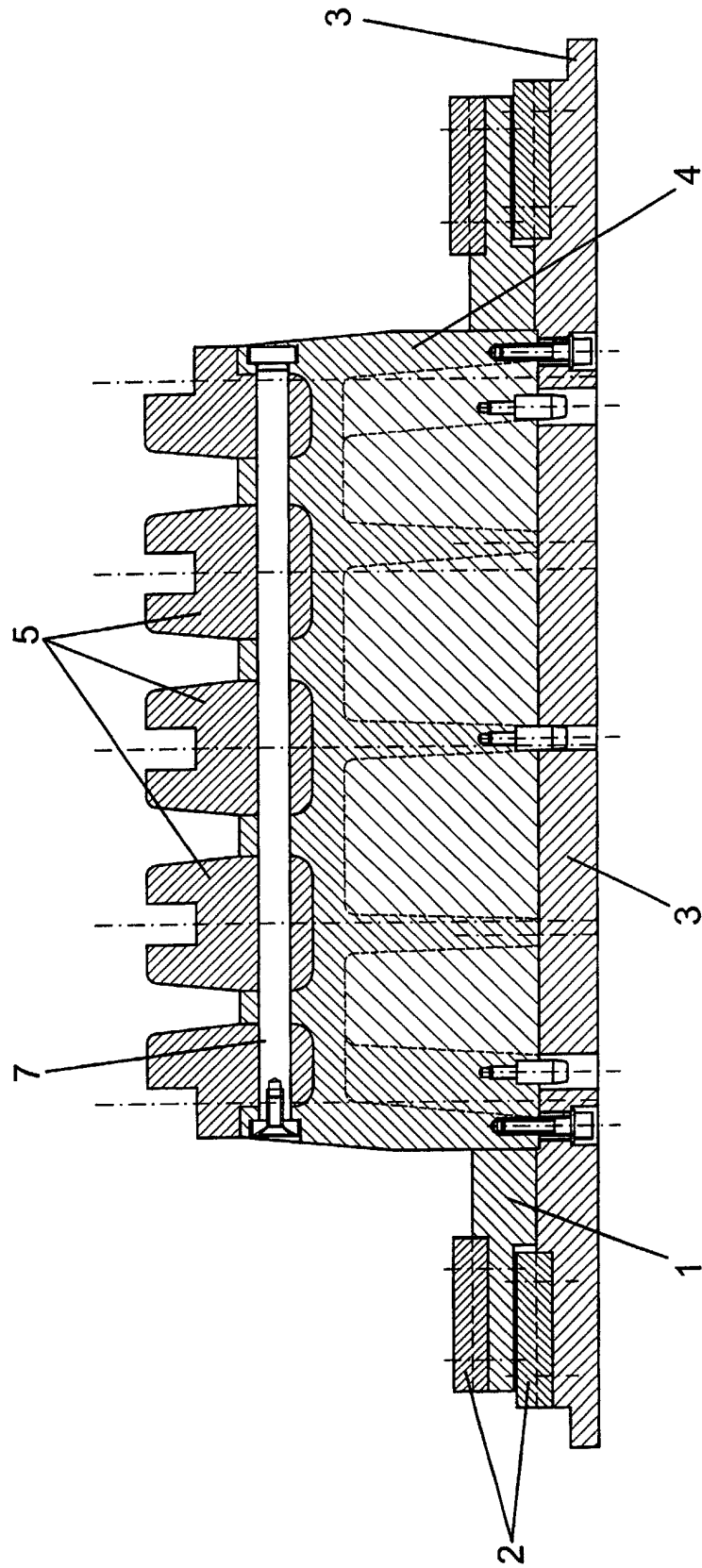


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.

PCT/ ES 00/00477

A. CLASSIFICATION OF SUBJECT MATTER

CIP⁷ B21D 15/00

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)

CIP⁷ B21D 15, B22C 9

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, CIBEPAT, WIP, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Patent Abstracts of Japan, vol 5 n° 170 (m.092) 1981, JP 56095446 A (Mitsubishi Motors corp.)	1-4
A	Patent Abstract of Japan, vol 9 n° 11 (M. 351) 1984, JP 59159245 A; (Rikenkk)	1-4
A	US 5704412 A (Gurdebete) 6 January 1998 (06.01.96) column 2, line 3, line 32; figures	1-4

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

* Special categories of cited documents:

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"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

13 February 2001 (13.02.01)

Date of mailing of the international search report

16 March 2001(13.03.01)

Name and mailing address of the ISA/

S.P.T.O

Authorized officer

Facsimile No.

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/ ES 00/00477

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Patent Abstracts of Japan Vol. 11, n° 183 (M-598). 1987, JP 62013237 A (Riken Corp.)	1
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A	US 5533563 A (Lee, Sr.) 9 July 1996 (16.07.96) Column 3, line 13 column 13, lines 54; figure 1-6	1

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/ ES 00/00477

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JP 59159245 A	08.09.1984	NONE	
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US 5533563 A	09.07.1996	NONE	

Form PCT/ISA/210 (patent family annex) (July 1992)