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(71) Applicant: Inversiones Iglo, S.L.  
01010 Vitoria (Alava) (ES)

(72) Inventors:  
• Goya Arcelus, Inaki  
Zorrostea, 4, 01010 Vitoria, (Alava) (ES)  
• Cle Nogueras, Miguel  
Zorrostea, 4, 01010 Vitoria, (Alava) (ES)

(74) Representative: Carpintero Lopez, Francisco  
HERRERO & ASOCIADOS, S.L.  
Alcalá, 21  
28014 Madrid (ES)

### (54) Sand mote or mould conveying system

(57) The system is designed for conveying sand moulds or motes (3) from the exit from a moulding machine (2) up to the drawing area (4), conveyance taking place with the motes (3) lying on carriages (5) that travel on wheels (6) provided in the structure (1) as such of the installation. The transfer of motes (3) from the moulding machine (2) to the carriages (5) and from the carriages to the drawing area (4) takes place with the assistance of respective comb-like platforms (7) and (7')

that complement longitudinal projections and grooves on the carriages (5), in order for the motes (3) to lie at such areas on the plane determined by the top edges of both the profiles constituting the combs (7) and (7') and the respective edges of the carriage (5) projections, the carriages being moved in a closed circuit, in a top row or level loaded with the motes (3) and in a bottom return row or level empty, lifting (8) and lowering (8') devices being provided to position the carriages (5) at the comb (7) and (7') areas.

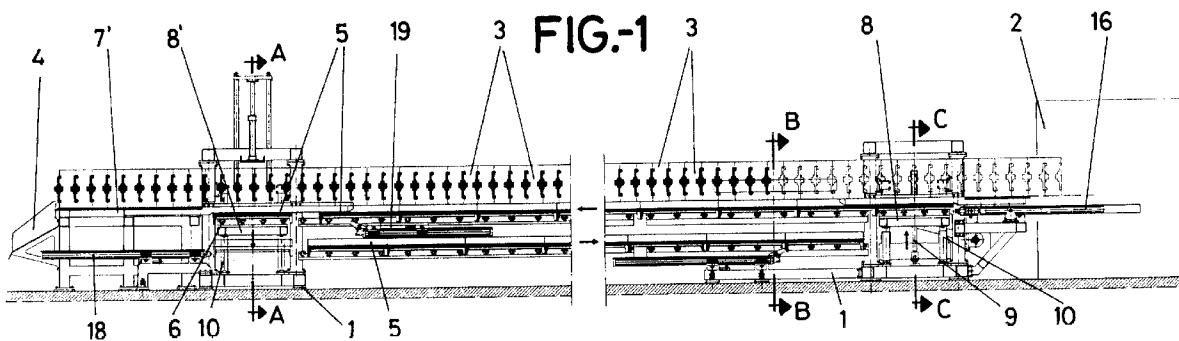


FIG.-1

**Description****OBJECT OF THE INVENTION**

The invention relates to a sand mote or mould conveying system, which is clearly designed to convey the sand motes obtained in a moulding machine to the drawing area, after the sand cores have gone through the respective coring, molten metal casting and cooling areas, the motes being conveyed by means of carriages travelling on wheels, in such a way that the motes move forward, pushed by the ejecting cylinder in the moulding machine, mounted on the carriages.

The object of the invention is to prevent the sand motes from being rubbed, worn and even damaged as they travel up to the drawing area, after leaving the moulding machine.

**BACKGROUND OF THE INVENTION**

It is well-known that in sand mould casting installations, after leaving the respective moulding machine, sand moulds move on to a conveying line in which several process operations are carried out, such as coring, molten metal casting and/or cooling as appropriate, and the moulds move forward along the conveying line until they arrive at the drawing area.

The conveying line will be longer or shorter, depending on the type of parts produced and the cooling needs, but the size of these installations will be substantial without exception, for a large number of moulds must be conveyed at a time.

In the above-mentioned type of installations, the sand moulds remain at all times within a metallic so-called moulding box, in which the above-mentioned operations are carried out, namely producing the mould as such, casting the molten metal and cooling as appropriate. Now, obviously, in order for the process to be continuous without any idle times, a large number of moulding boxes will be required, above all due to the long cooling times required.

Now then, the large number of moulding boxes required in the installations aforesaid and their high cost means that the installation investment expenses are very significant.

A technique exists to fully eliminate the use of said moulding boxes, special moulding machines being purposely provided to produce the sand moulds directly without any boxes, which moulds are called "motes", arranged on a conveying line and handled directly throughout the manufacturing process.

Now then, moulds without boxes of this kind leave the moulding machine pushed by an ejecting cylinder, which concurrently results in the whole line or row of motes located in the conveying installation being pushed and displaced.

Accordingly, the ejecting cylinder pushes the recently-produced mote out of the moulding machine and

the latter mote in turn pushes the last mote in the row and so on and so forth, causing the entire row to travel stepwise. In other words, each time the ejecting cylinder draws out a new mote, it pushes the entire row of motes in the conveying installation one step beyond.

Bearing in mind that these installations can be very long, friction between the motes and the surface on which they travel is so significant that said motes may be considerably worn and damaged upon arriving at the drawing area.

There are known systems or installations to serve the function described above and reference can in this sense be made to German patents numbers DE 4319078 and DE 442353, which describe a mote conveying system based upon a pusher ending in a plate-press, the system being complemented with a second plate-press that turns about one of its top ends, and upon the mote being obtained, the second plate is lowered turning about its articulated end, whereupon the first plate-press pushes the mote obtained, moving it right up to the line or row of motes, pushing and causing the entire row to move forward.

European patent number 0 693 337 describes another system or type of installation using galloping beams to move the row of motes forward, but the system is very expensive because of the large size the installation has to have.

**DESCRIPTION OF THE INVENTION**

The system subject hereof has been devised to fully overcome the above-mentioned drawbacks, based upon the fact that, as they leave the moulding machine, pushed by the ejecting cylinder, the motes have direct access to carriages on which they lie, these carriages travelling on wheels, thereby for successive thrusts by the ejecting cylinder on the last mote to have the carriages, and hence the motes they support, move forward stepwise.

The motes can thus be more easily displaced than in traditional systems, potential wear due to friction being moreover eliminated.

In order to allow the motes to be transferred from the moulding machine to the carriages and from the carriages to the drawing area, comb-like platforms have been provided at each of both the exit point from the moulding machine or starting area of the conveying installation and the point of arrival of motes to the drawing area, the projections of the carriages arranged below said platforms playing within their slots, and therefore both the motes leaving the moulding machine and the motes arriving at the drawing area lie at all times on the projections of the carriages. Beyond the starting platform or comb, the carriages run normally along the conveying installation, carrying the motes on them, until they arrive at the drawing area where the carriages are once again positioned beneath the arrival comb-like platform, to which the motes are transferred as they ar-

rive at the final drawing point.

Accordingly, the comb-like platforms constitute supports for the motes, at the starting and arrival areas, at which areas of the conveying installation the actual carriages have to be handled in order to be lifted and take up their position, in the first case, and be lowered back to the return line, in the second case.

The top surface of the carriages, where the motes are received, is designed with a shape complementing the combs, and said carriages have therefore been provided with top projections that define grooves between them, respectively complementing the openings and ribs of the corresponding combs, and consequently the depth of the carriage grooves must essentially match the height of the profiles forming the comb, in order for the surface of both elements to lie flush with or slightly surpassed by the carriage projections, thereby for the motes to lie at all times at such starting and arrival areas on the longitudinal projections, i.e. on the carriages.

With this configuration, as of leaving the moulding machine, the motes are mounted on the wheeled carriages, and the force the ejecting cylinder needs to apply the row of motes in order for the carriages and hence the motes to travel up to the drawing area is therefore far less than in traditional installations, moreover preventing the motes from being worn and damaged whilst being conveyed.

The carriages travel in a closed circuit on two levels, and thus the carriages on the top level move forward from the moulding machine up to the drawing area, conveying the motes resting thereon stepwise, whereas on the bottom or carriage return level, as the carriages arrive at the drawing area, they move back empty to the starting area of the conveying line, where the moulding machine is located.

Two hydraulic cylinders are provided at the exit point from the moulding machine to push the last carriage, once the relevant motes are lying on it, until it contacts the row of carriages, being perfectly backed to it and preventing gaps from arising between successive carriages in the row. These cylinders might optionally, if necessary, assist the cylinder ejecting the motes to convey the top line of carriages.

In addition to the hydraulic cylinders provided at the exit point from the moulding machine, another cylinder is provided at an area right before the drawing area, which engages the first carriage in the row and places it on the lowering area, where a third cylinder, lying on a lower level, pushes this carriage, once it has been lowered, towards the return line, a further cylinder being provided at the starting area, likewise on a lower level, to place the first carriage on the return line on the relevant lifting device.

The said mote conveying carriages have rims, specifically two rims at their rear area or edge, acted on by the two cylinders pushing the last carriage, and a rim on the front of the carriage, acted on by the cylinder that places the first carriage on the lowering device, the cyl-

inder placing the first carriage on the lift and the cylinder pushing the row of empty return carriages.

## DESCRIPTION OF THE DRAWINGS

In order to provide a fuller description and contribute to the complete understanding of the characteristics of this invention, in accordance with a practical embodiment thereof, a set of drawings is attached hereto as an integral part of the specification which, while purely illustrative and not fully comprehensive, shows the following:

Figure 1.- Is a side elevation representation of the installation constituting the sand mote conveying system made in accordance with the object of the invention.

Figure 2.- Is a plan view of the installation shown in figure 1.

Figure 3.- Is a larger-scale side elevation view of what is deemed to be the starting part or front of the installation in which the moulding machine is located.

Figure 4.- Is another larger-scale side elevation view of the rear or drawing area.

Figures 5, 6 and 7.- Are three different views of the carriage constituting the element for conveying the motes.

Figure 8.- Is a sectional view along line A-A of figure 1.

Figure 9.- Is another sectional view, now along line B-B which is also shown in figure 1.

Figure 10.- Is a section along line C-C which is also shown in figure 1.

Figure 11.- Is, finally, the working sequence of the installation made in accordance with the system of the invention.

## PREFERRED EMBODIMENT OF THE INVENTION

With reference to these figures, the conveying system or installation subject of the invention can be seen to comprise a general structure or frame (1) located at the exit point from the respective moulding machine (2), the installation being designed for conveying the sand moulds or motes (3) obtained in such moulding machine (2), from the machine to the respective drawing area (4).

Now then, the motes (3) lie on carriages (5) that in turn travel on respective wheels (6) provided in the actual general structure or frame (1) of the installation, being particular in that comb-like platforms (7) and (7') are provided both at each of the exit point from the moulding machine (2) and the point of arrival to the drawing area (4), that enable the motes to be transferred from the moulding machine (2) to the carriages (5) and from such carriages to the drawing area (4).

The carriages (5) travel in a closed circuit, with a top line where they support the sand motes (3), conveying them from the point of exit from the moulding machine (2) to the point of arrival to the drawing area (4), and a bottom return line, the moulding machine exit area

being provided to have a lifting device (8), comprising a table driven by a hydraulic or pneumatic cylinder (9), that lifts the respective carriage (5) from its bottom or return level up to its position beneath the respective comb (7) located at the exit point from the machine, whereas the area before the drawing area is provided with another analogous device (8') for lowering the respective carriage (5) from the top or conveying line as such to the bottom carriage return line, which is similarly driven by a cylinder, just as the lifting device (8) aforesaid, which devices or tables that in both cases stand as the support for the respective carriage (5), therefore move along guides or vertical columns (10).

As for the construction of the carriage as such, the same is comprised by a sort of pallet or platform, the top surface of which is provided with a plurality of projections (11) between which respective grooves (12) are defined, whereas the opposite face or underside of the pallet constituting the carriage (5), and particularly what is considered to be the front of such underside, is provided with a rim (13) projecting vertically downwards, the rear of that same underside being provided with two rims (14).

For their part, the combs (7) and (7') are configured in order to mesh with the projections (11) and grooves (12) of the carriages (5), and figures 8 and 10 show how the respective grooves (12) of the carriages (5) house the respective projections or ribs defined by the combs (7) and (7').

The front of the installation at the moulding machine (2) proper is provided with a pusher that may be driven by the ejecting cylinder (15) designed to push the motes (3) stepwise up to the drawing area. The same exit area from the moulding machine is provided with a pair of cylinders (16) lying beneath the comb (7), their rods acting on the rims (14) lying at the rear end of the last carriage (5), moving it right up to the row of carriages in order to avoid gaps being formed between successive carriages in the row of carriages. Additionally, the cylinders (16) may at times, namely when the installation is very long, assist the ejecting cylinder (15) to convey the top carriage line. Another cylinder (17) is provided at an area before the drawing area whose function will be explained hereinafter, and a third cylinder (18) is provided at the very drawing area, beneath the level of the top carriage (5) conveying row and at the same height as the carriage (5) return line, a fourth cylinder (19) being also provided at such return line, close to the exit area from the moulding machine, whose function will also be explained hereinafter.

In accordance with the above-described features, operation is as follows:

The pusher is driven by the ejecting cylinder (15) provided at the exit point from the moulding machine (2) and pushes the entire row of motes (3) stepwise, causing the carriages (5), travelling on wheels (6) provided in the general frame or structure (1) of the installation, to move forward, and therefore the cylinder (15) pushes

the motes (3) for these to travel at all times lying on the carriages (5).

In order to transfer the motes (3) from the moulding machine (2) to the carriages (5), a comb-like platform (7) is provided, arranged at the exit point from the moulding machine, a lifting device (8) being arranged beneath the comb (7) to lift the conveying carriage (5) from the bottom or carriage return level, placing it at and beneath the said comb (7), the openings in the latter meshing with the projections (11) of the carriage (5). That is to say, a number of longitudinal projections (11) are provided on the supporting surface of the conveying carriages, whose depth matches or exceeds the height of the profiles making the comb (7), the foregoing such that when the lifting device (8) positions the carriage (5) right beneath the supporting comb (7), the ribs of the comb are housed in the longitudinal grooves (12) of the carriage, the surface of both elements lying flush with or slightly surpassed by the longitudinal projections (11) in order for the motes (3) to lie at all times on the longitudinal projections of the carriage (5).

The cylinder (15) acting on the last mote obtained in the moulding machine (2) thus also pushes the rest of the row, causing it to move one step forward, the last motes (3) produced being moved and mounted on the carriage (5) rising from the bottom level, and sliding above the comb (7), whereas the remaining motes (3) move forward in their respective carriages (5).

A second comb-like platform (7') is provided at the end of the conveying line, i.e. at the point of arrival to the drawing area (4), which allows the motes (3) to be evacuated from the carriages (5) to the drawing area, the motes (3) coming to lie on and slide over the platform in order to enable the carriage (5) on which they lay to be withdrawn, moving thereafter into the drawing area. Obviously, the motes (7) at this area lie on the comb (7') and on the longitudinal projections (11) of the carriage (5) until the lowering device (8') removes the first carriage (5) in the row from the line, transferring it to the bottom return level, whereupon the motes (3) will lie only on the comb (7').

Next, the movement of the row of motes (3) and carriages (5) causes the motes, which were lying on the comb (7'), to move into the drawing area (4), a new carriage (5) being simultaneously positioned beneath the inlet comb (7).

As explained hereinbefore, the transfer of carriages between the top and bottom levels takes place by means of the lifting device (8) and the lowering device (8'), which are respectively arranged at the exit area from the moulding machine (2) and before the drawing area (4), which devices (8) and (8') or the tables they constitute are therefore also provided with the respective wheels (6) upon which the carriages (5) travel during their transfer or passage onto the lifting device or the lowering device.

Figure 11 shows the moving sequence of the carriages (5), the cycle starting with the cylinders (16) push-

ing the new carriage (5) right up to the row of carriages and clearing the position it was taking up beneath the exit comb (7) from the moulding machine, the end of the rod of such cylinders (16) acting on the rims (14) of said carriage (15), driving the lot, in the direction marked by the arrows, until the end of the cylinder 17 engages the rim (13) of the first carriage, transferring the latter to the lowering area, as shown at stage (d) of the operating sequence of figure 11. At this point, the first carriage (5) is lowered by the respective lowering device (8') and upon the bottom return level being reached, the cylinder (18) acts, through the end of its respective rod, on the rim (13) of said carriage (5), pushing the latter and hence the remaining carriages towards the front area, a new carriage (5) being placed at the lifting device (8), which will lift the carriage until it lies beneath the comb (7). This positioning of the carriage (5) beneath the lifting device (8) is effected by the end of the respective rod of the cylinder (19), the end of such rod engaging the rim (13) of the carriage (5) as such.

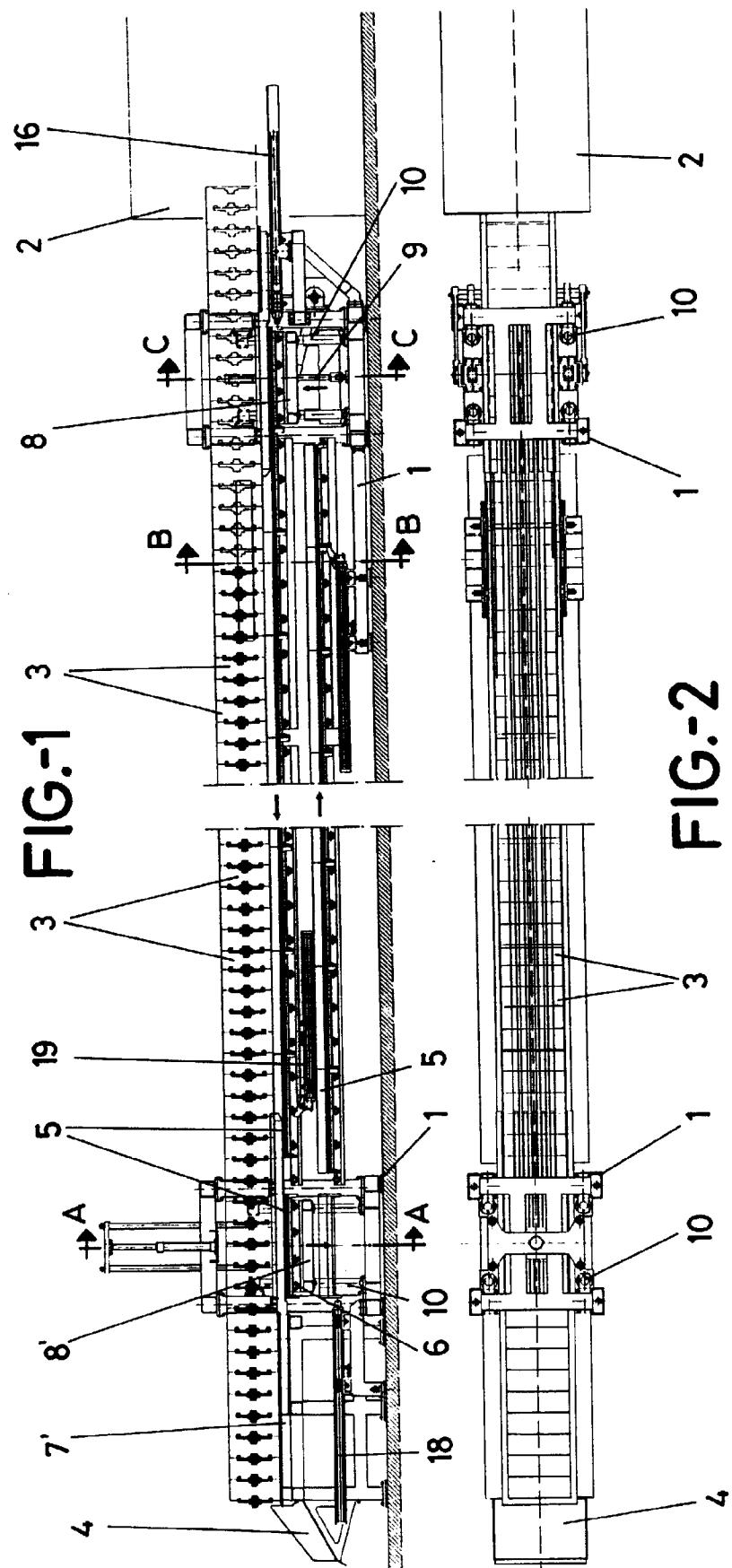
After lifting this carriage under the respective comb (7), the cycle is begun yet again, namely at the position of stage (h) shown in figure 11, which shows the correlative working stages or sequences, from the starting stage (a) to the final stage (h).

## Claims

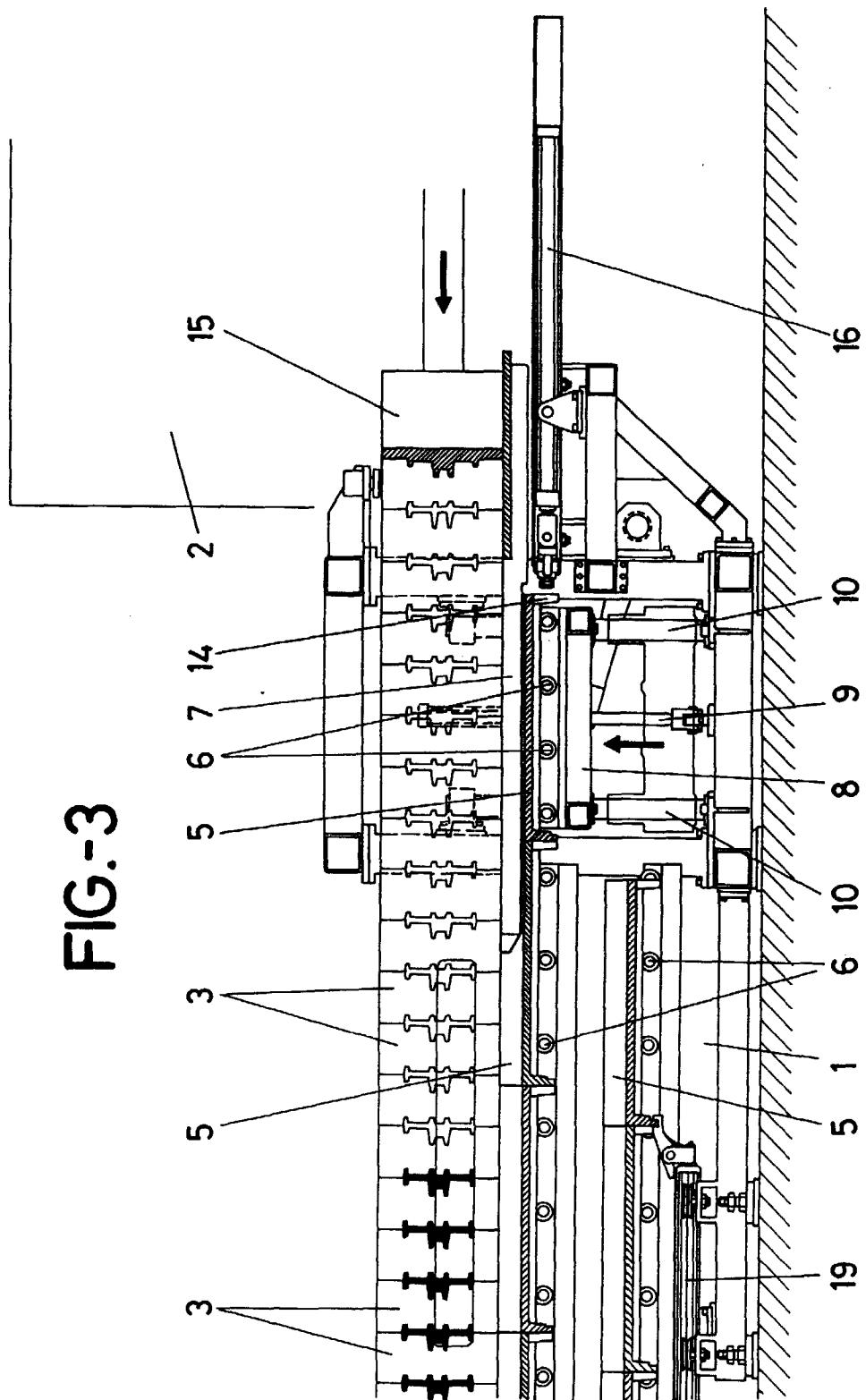
1. A sand mote or mould conveying system, which comprises an installation having a general frame or structure (1) provided at the exit from a sand mould (3) moulding machine (2), the sand moulds being conveyed along the installation for molten metal casting and respective cooling operations to be carried out, said motes (3) moving forward from the exit area from the moulding machine (2) to the respective drawing area, stepwise, pushed by an ejecting cylinder (2), characterised in that a number of carriages (5) are included to convey the motes (3), which motes lie on the carriages (5) that travel on wheels (6) provided in the installation frame (1), from the front area or exit point from the moulding machine (2) up to the drawing area (4) or arrival point, the said empty carriages (5) returning on a bottom level from the drawing area (4) to the machine exit area, the motes (3) and consequently the carriages (5) being designed to be pushed by an ejecting cylinder (15), being particular in that comb-like platforms (7) and (7') are provided at exit and arrival points of the motes (3), which enable the motes (3) to be transferred from the moulding machine (2) to the carriages (5) and from the carriages to the drawing area (4).
2. A sand mote or mould conveying system, as in claim 1, characterised in that the carriages (5) comprise a pallet-like body with projections (11) alternating

5 with grooves (12) that complement the ribs and/or spacing between ribs as defined in the actual combs (7) and (7'), in such a way that the depth of the carriage (5) grooves (12) matches or slightly surpasses the height of the profiles making up the actual comb (7) or (7'), in order to define a roughly coplanar top surface between both elements to ensure that the motes (3) lie on the carriages (5); the underside of the body constituting the carriage (5) being moreover provided with a rim (13) centrally at the front, whereas the rear has two rims (14).

3. A sand mote or mould conveying system, as in preceding claims, characterised in that the carriage (5) lifting (8) and lowering (8') devices are each comprised by a table that may be driven by a hydraulic cylinder (9), which table is guided along vertical columns (10); being particular in that both devices (8) and (8') include the respective wheels (6) for the carriages (5) to slide thereon.
4. A sand mote or mould conveying system, as in preceding claims, characterised in that the rear rims (14) of the carriage (5) constitute supports for the ends of the respective rods of the positioning cylinders (16) acting on the last carriage (5), moving it until it is backed to the row of carriages, whereas the front rim (13) of the carriages (5) constitutes the means supporting the end of the respective rod of cylinders (17), (18) and (19) in order to position the first carriage in the top conveying row at the area in which the lowering device (8') lies, and to position the first carriage (5) in the bottom return row at the area in which the respective lifting device (8) lies; being moreover particular in that the cylinder (18) provided at the end or drawing area (4) constitutes a pushing means for the carriages (5) in the bottom carriage return row, and in that, in addition to acting on the last carriage (5), backing it to the row of carriages, the positioning cylinders (16) can optionally, in very long installations, assist the ejecting cylinder (15) in moving the top line of carriages.



**FIG.-3**



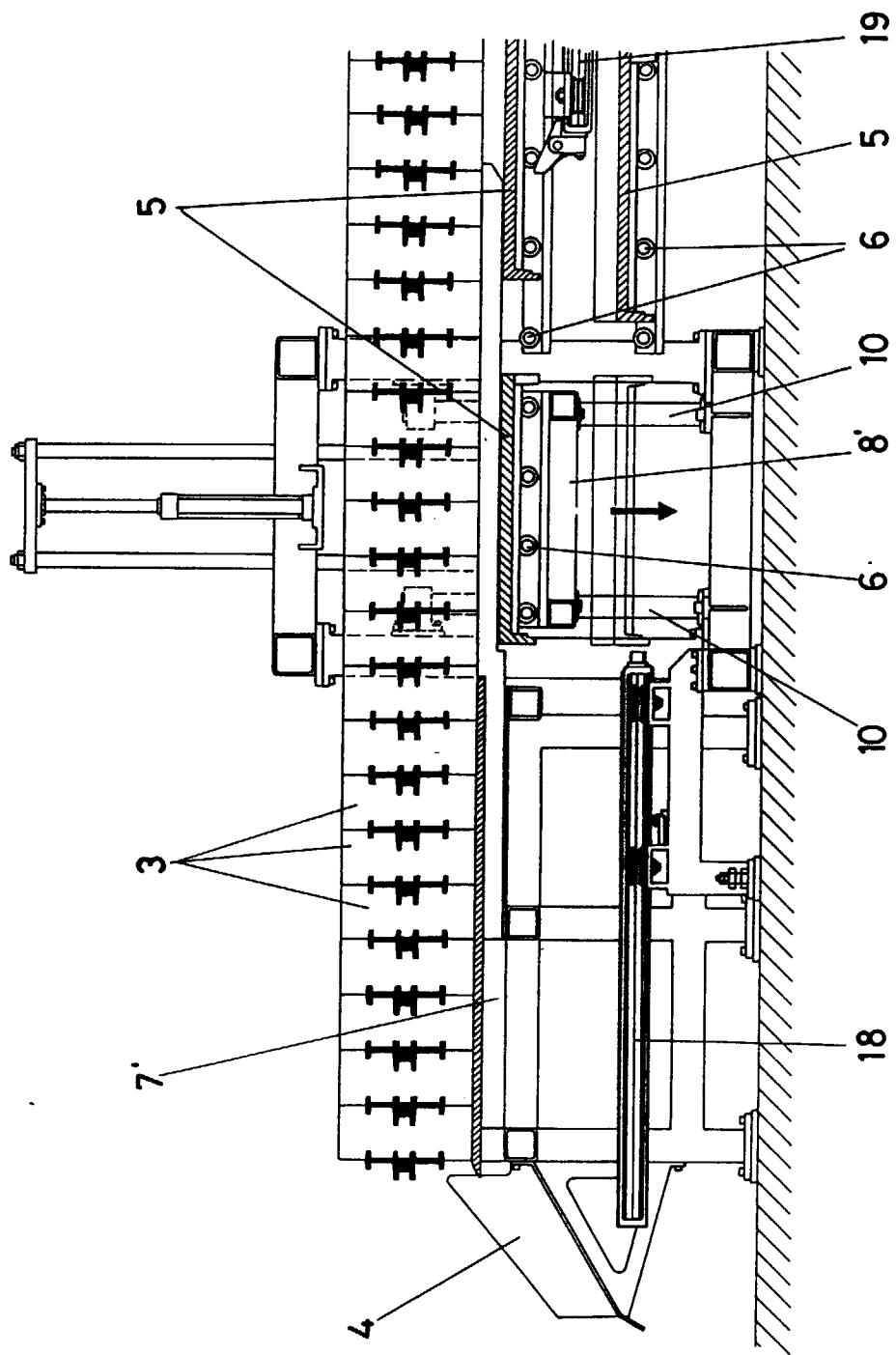
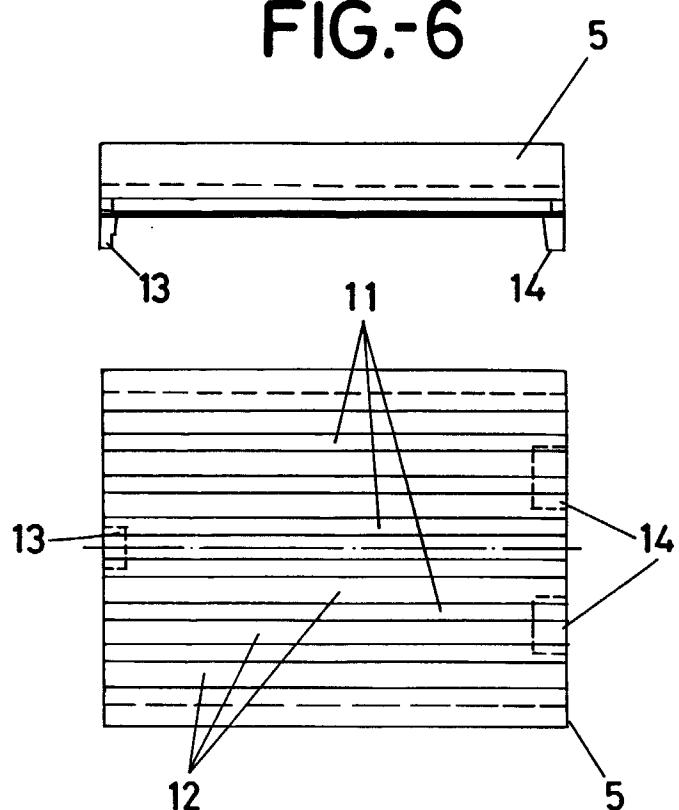
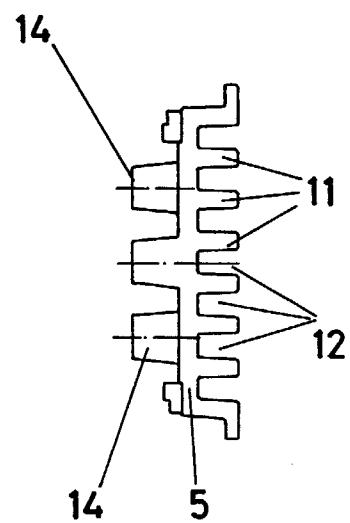


FIG.-4

**FIG.-6**



**FIG.-5**



**FIG.-7**

FIG.-9  
*B-B*

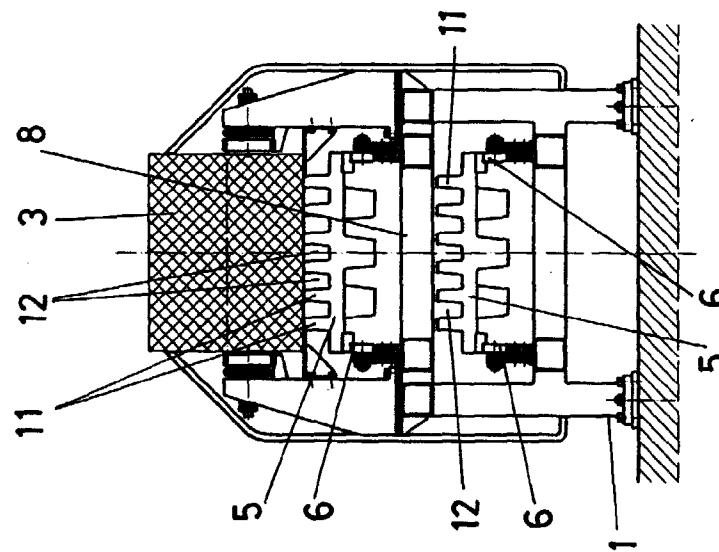


FIG.-10  
*C-C*

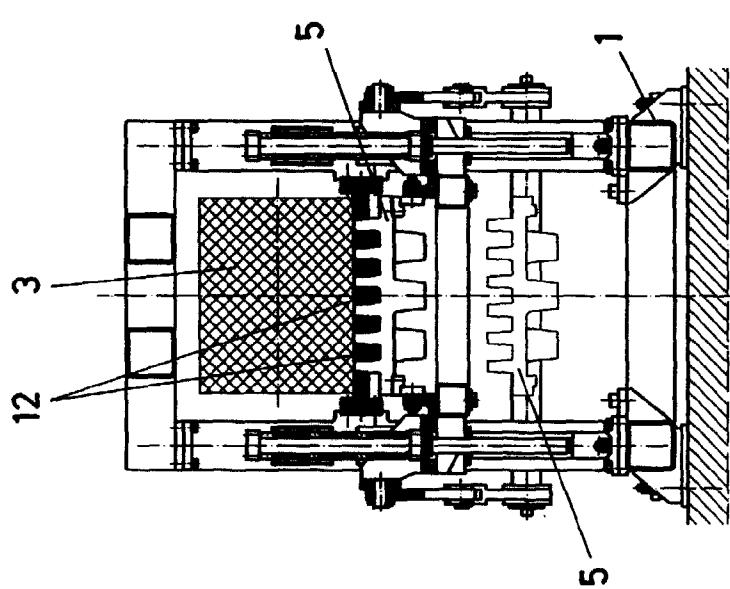
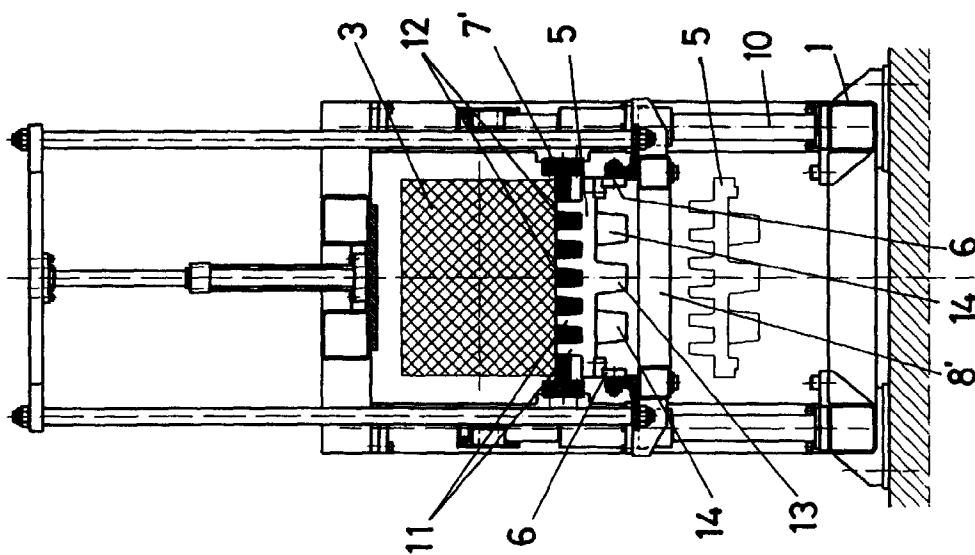


FIG.-8  
*A-A*



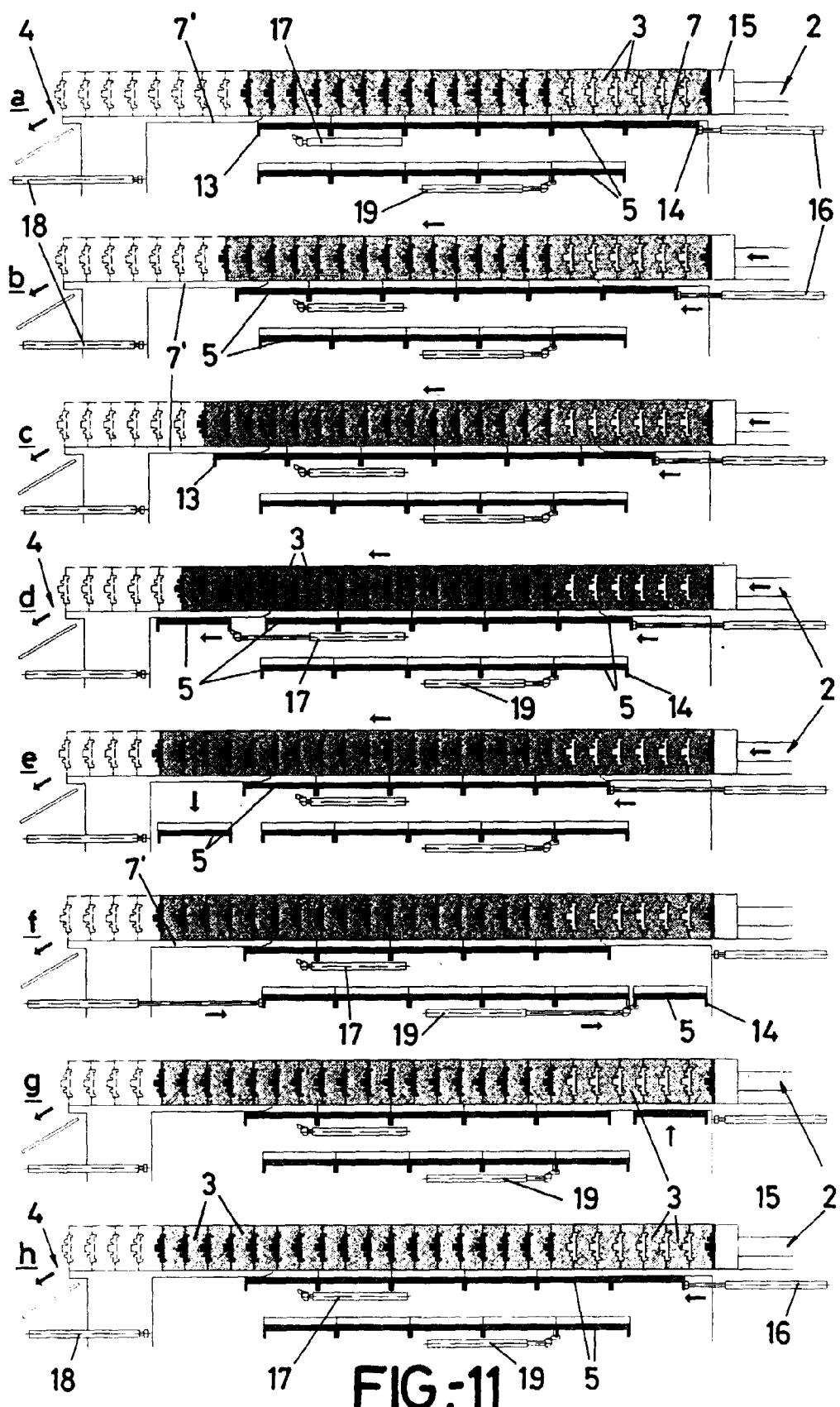


FIG.-11



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## EUROPEAN SEARCH REPORT

Application Number  
EP 97 50 0216

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	DE 21 38 578 A (BANGOR PUNTA OPERATIONS INC) * figures * -----	1	B22D33/00 B22C11/10
D, A	EP 0 693 337 A (FISCHER GEORG GIESSEREIANLAGEN) * abstract; figure 1 * -----	1	
TECHNICAL FIELDS SEARCHED (Int.Cl.6)			
B22D B22C			
The present search report has been drawn up for all claims			
Place of search	Date of completion of the search		Examiner
THE HAGUE	23 March 1998		WOUDENBERG, S
CATEGORY OF CITED DOCUMENTS		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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