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(54) Driving system of the opening/closing sequence of multiple-member telescopic stabilisers in a self-propelled machine

(57) A driving system of the opening/closing sequence of telescopic stabiliser beams comprising multiple mobile members in a self-propelled machine, and in particular in a concrete pump. During the extension movement of the telescopic beam, the different members (A,B,C) of the same are caused to become temporarily mutually fixed, except one only thereof at a time, sequentially starting from the largest intermediate member (B) down to the terminal resting member (C) and viceversa during the retraction mevement, thanks to a mechanical structure comprising a double cam hook (3) idly pivoted about a vertical wall of each intermediate member (B) and projecting from the two sides of said wall; and a guide and/or grip elements (1,2,7) projecting from the neighbouring corresponding walls of the other members, on which said hooks (3), are apt to slide and/or engage to cause said members to become mutually fixed. Actuation of the telescopic beam can therefore be performed also with a single cylinder/piston assembly, in any case keeping the desired extraction/retraction sequence of the beam members.

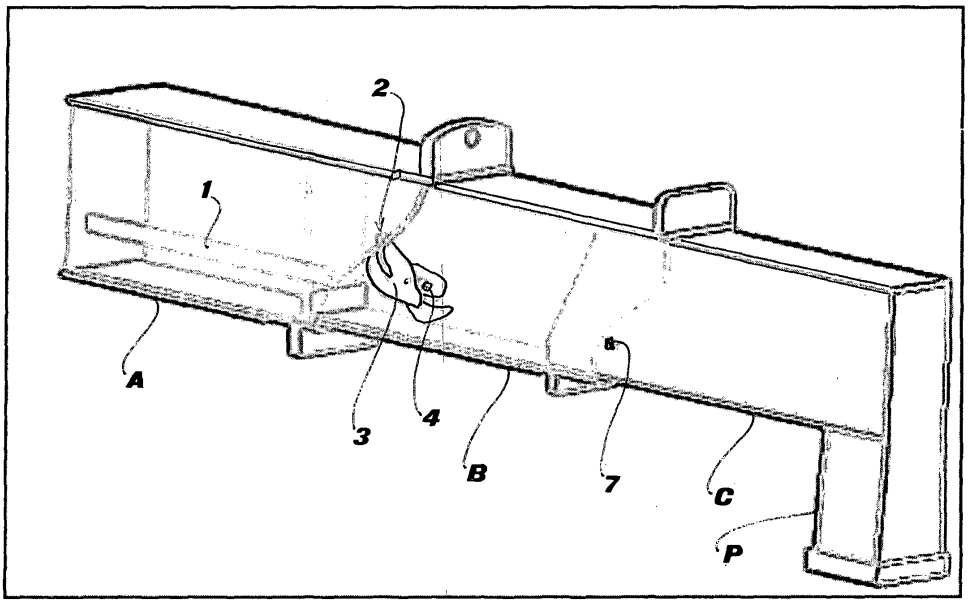

FIG.1

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Description

[0001] The present invention relates to a driving system to achieve the extraction, according to a preset sequence, of the various moving elements making up the telescopic stabilisation beam of a self-propelled machine, such as in particular a concrete pump or a truck mixer pump for concrete.

[0002] It is known that self-propelled machines of this kind consist of a machine body apt to propel itself autonomously on the road, onto which a central pivoting support is mounted, whereto a foldable arm is attached for concrete supply. Before the above-said arm is unfolded into its working position, it is of course necessary to stabilise the self-propelled machine, both to make it rigid against the floor, and to widen the resting area well beyond the perimeter of the machine itself, so as to allow to extend the arm even at a considerable distance from the machine without affecting stability of the latter.

[0003] For this purpose it is known to equip said self-propelled machines with horizontal telescopic stabilising beams (fixed or pivoting about vertical axes, and in the following simply referred to as "telescopic stabilisers"), provided with terminal feet, which are stabilisers that in a retracted position are comprised within the machine perimeter, and in an extended condition allow to achieve stabilisation of the machine itself during operational shifts of the foldable arm and operation of the concrete pump.

[0004] Each telescopic stabiliser is provided with multiple mobile elements (typically between one and three) which slide telescopically one inside the other so that, in the stabiliser position of maximum extension, the smallest member is located at the free end of the stabiliser itself. In this case there is the problem of the sequence of extraction (opening) and retraction (closing) of the stabiliser.

[0005] When the stabilisers are used in their condition of maximum extension, the extraction sequence of the individual elements is of no particular importance, i.e. it does not detect if the first member to move outwards is the largest or smallest one, since once stabiliser extension has been completed the individual elements are all in the position of maximum extension and hence in the correct position from the largest to the smallest one, moving outwards.

[0006] In practical application conditions, it often occurs, however, that the stabilisers are not extended up to their end stop, both because stabilisation requirements are limited due to the relative closeness of the casting areas to the machine, and because there are physical obstacles on the building site which make it impossible for one or more stabilisers to extend fully. In this case the sequence according to which the individual elements of the stabiliser move becomes extremely important, because when extension occurs starting from the largest elements, it is possible to guarantee conditions of greater safety and machine stability.

[0007] The stabilisers are then to be retracted, starting from the condition of maximum extension, when casting operations have ended and the machine is to be moved to a different site. Even in this case it is important for retraction to occur in a controlled manner, i.e. starting from the smallest elements (which means in the opposite sequence to the extension one).

[0008] The movement of the individual stabiliser elements which may be extracted is normally achieved by hydraulic actuating systems arranged between such elements and the largest member of the stabiliser, or fixed element. When the extractable elements are more than one, according to the known art it is hence possible to achieve movement thereof in a desired sequence only by using multiple oleodinamic cylinder-piston assemblies, one for each extractable element, said cylinder-piston assemblies requiring also a control and monitoring system which determines prompt actuation thereof, which system consists of corresponding separate actuation devices, or of a single actuation device provided with multiple sequence valves, or of differentiated thrust areas of the cylinder-piston assemblies. In any case, such a driving system comes with bulk problems, remarkable hydraulic complexity and extremely high costs.

[0009] In most of current applications, driving of the extractable elements of the stabilisers is hence performed through one or more oleodinamic cylinder-piston assemblies, but without sequence monitoring, with the result that opening and closing of the different elements occurs in a fully random way, depending on the extent of the mutual frictions between the extractable elements, determining a lower degree of safety in the stabilisation of the machine when said stabilisation is performed through a partial stabiliser opening.

[0010] It is hence an object of the present invention to provide a driving system for the opening/closing of extractable elements of a stabiliser beam of the type described above wherein the desired extraction sequence of said elements is univocally determined, i.e. starting from the largest member down to the smallest one for extension, and viceversa for retraction, using one or more oleodinamic cylinders driven by a single actuating device without sequence-monitoring valves.

[0011] Such object is achieved, according to the present invention, through a system driving the opening/closing sequence of multiple-member telescopic stabilisers in a self-propelled machine, having the features defined in the attached main claim.

[0012] Further features and details of the driving system for telescopic stabilisers of the present invention will in any case be more evident from the following detailed description of a preferred embodiment of the same, limited for clarity's sake to the case of two mobile elements with a double cam hook, wherein:

fig. 1 is a diagrammatic perspective view of a telescopic stabiliser according to the present invention comprising three elements, one fixed and two mobile, wherein for clarity's sake the oleodinamic actu-

ating cylinder/piston assembly is not shown;
fig. 2A is a side elevation view of the fixed member of the stabiliser;
fig. 2B is a cross-section view of such element, according to line B-B of fig. 2A;
fig. 3A is a side elevation view of the intermediate member of the stabiliser;
fig. 3B is a cross-section view of such element, according to line B-B of fig. 3A;
fig. 4A is a side elevation view of the end resting member of the stabiliser;
fig. 4B is a cross-section view of such element, according to line B-B of fig. 4A;
fig. 5 is an enlarged view of the double cam hook pivoting about the intermediate member of the stabiliser;
figs. 6A to 6E are diagrammatic side elevation views which show the opening movement of the stabiliser; and
figs. 7A to 7E are diagrammatic side elevation views which show the closing movement of the stabiliser.

[0013] A telescopic stabiliser comprising three elements - one fixed and two which may be extracted, the smallest extractable member bearing at its free end the resting foot - is diagrammatically shown in the drawings, which stabiliser incorporates the driving system of the present invention. Such system consists of the combination of a single actuating device, normally an oleodinamic cylinder/piston assembly, which is directly arranged between the fixed member and the smallest extractable element, or resting element, and a mechanical structure apt to render alternately mutually fixed two of the three elements, thereby allowing the actuating device to determine the shifting of a single member at a time. Thanks to the particular mechanical structure adopted, the different elements are left free to shift sequentially, and precisely starting from the largest member down to the smallest one during the opening movement of the telescopic stabiliser, and viceversa during the closing movement.

[0014] Fig. 1 shows an overall diagrammatic view of a telescopic stabiliser for self-propelled machines, incorporating the driving system of the present invention, or more precisely, exclusively the particular mechanical structure which allows to obtain extraction of the different members in the desired sequence in a fully automatic way and independently from the actuation of the elements themselves. In fact, for greater clarity, neither the actuating means of the stabiliser nor the attachment means of the same to the machine frame are shown.

[0015] The stabiliser shown in fig. 1 hence comprises a larger member A, also indicated as "fixed member" since it is integral with or hinged to the self-propelled machine and consequently has no degree of freedom in the longitudinal direction of the stabiliser. Inside fixed member A middle-sized member B is slidingly housed and, within the latter, smallest member C. At the free end of member C, a foot P is fixed having an adjustable height and a structure well-known per se and hence shown only in an extremely diagrammatic way in the drawings. For this reason member C is also referred to as "resting member" in the present description.

[0016] The particular mechanical structure of the driving system of the present invention consists of a double cam hook of a special design pivoting about intermediate member B and of guide or grip elements integral with fixed member A and with resting member C. The special construction and position of such elements will now be described in detail with reference to figs. 2 to 5, wherein the individual members of the stabiliser are shown separately.

[0017] Fixed member A, shown in figs. 2, has a longitudinal guide 1, consisting of a metal section bar integral with a vertical inner wall of member A extending along the same, and a gripping pin 2 fixed to the same wall of member A, at the free end of such member where intermediate member B comes in.

[0018] Intermediate member B, shown in figs. 3, is equipped with a double cam hook 3, idly pivoting in 3p about the vertical wall of member B adjacent to the wall of member A which bears guide 1 and pin 2, as well as with a stop 4 apt to cooperate with cam 3a to limit the travel thereof both in one direction and in the opposite one, to an arc of a circle slightly larger than 90°. Hook 3 comprises cams 3a and 3c, respectively arranged on both sides of the wall of member B whereto hook 3 is hinged. Both cams 3a and 3c have a profile design comprising a deep throat 5a, 5c for engagement with pins 2 and 7, respectively, projecting from the walls of the other members A and C of the telescopic stabiliser; cam 3a further has a planar part 6 of its profile apt to slidingly cooperate with guide 1.

[0019] The utterly simple mechanical structure described above is completely sufficient to guarantee automatic sequential extraction of the different members of the stabiliser, combined with a single actuating device apt to drive the shiftings of the end resting member of the stabiliser against the fixed member. The different steps of the opening sequence of the stabiliser are shown in detail in figs. 6A to 6E with reference to the different positions taken up by the guide and grip elements described above, and to the different functions performed thereby.

[0020] In the initial step, shown in fig. 6A, the stabiliser is fully closed, that is its members are completely housed one inside the other. In this step, cam 3c hooks with throat 5c pin 7 of resting member C, while rotation of cam 3 is prevented by the fact that the planar part 6 of cam 3a rests on guide 1. Members B and C are therefore mutually fixed and actuation of the cylinder-piston assembly arranged between fixed member A and resting member C determines the extraction of intermediate member B from member A, as shown in fig. 6B, while cam 3a slides on guide 1.

[0021] The length of such guide is preset so that the supporting action towards cam 3a ceases when such

cam begins to engage, though its throat portion 5a, with pin 2 projecting from fixed member A (fig. 6 B). At this point cam 3a is engaged with pin 2, while cam 3c is still engaged with pin 7 integral with smallest member C. The further action of the cylinder-piston assembly therefore determines the rotation of cam 3 about its own pin, while extraction of intermediate member B continues until it reaches its mechanical end stop (fig. 6C and 6D).

[0022] In this position also cam 3 has completed its own rotation ending up resting with planar part 6 against pin 4. In this position throat 5c of cam 3c is arranged with its axis in a horizontal position so as to free pin 7 of resting member C to sliding in such direction. Further actuation of the cylinder-piston assembly hence leads to full extraction of this member also (fig. 6E).

[0023] The entire opening step of the stabiliser has hence occurred according to the desired extraction sequence, i.e. starting from the largest extractable member (in the illustrated case, intermediate member B), to end with the smallest member or resting member C. The object of the invention has hence been fully achieved. In this respect, it must be appreciated that the system of the invention is not limited to the use in stabilisers with three members only as the one shown in the drawings, but also in stabilisers with a larger number of members. In such stabilisers, it is in fact sufficient for the particular mechanical structure illustrated above to be similarly reproduced on each intermediate member and on neighbouring members, of course alternately arranging on opposite vertical walls the individual components of such structure in order to avoid undesired interference between the components relative to hook 3 of an intermediate member and those relative to hook 3 of the following intermediate member.

[0024] Reverse steps to retract the stabiliser, are shown in figs. 7A to 7E. By activating the cylinder-piston assembly in a direction opposite to the previous one, end resting member C is made to go backwards, whereas intermediate member B is kept fixed in respect of fixed member A thanks to the fact that cam 3a is irreversibly engaged against pin 2 projecting from said member (fig. 7A).

[0025] The backward movement of member C continues until pin 7 of member C penetrates in throat 5c of cam 3c (fig. 7B), it unlocks cam 3a from contact with pin 2 and determines backward rotation thereof (fig. 7C) once it has reached its end-stop. During backward rotation of cam hook 3, the return movement of member B (fig. 7D) hence begins, which movement is completed after cam 3a, at the end of rotation of hook 3, has again engaged with guide 1, at the same time disengaging from pin 2 (fig. 7E).

[0026] The driving system for telescopic stabilisers of self-propelled machines according to the present invention has been described with reference to a preferred and diagrammatic embodiment of the same, but it is clear that the scope of protection of the invention is not limited to such embodiment, but comprises any possible variant within the reach of a person skilled in the field, provided it is comprised in the definitions of the attached claims.

Claims

1. A system driving the opening/closing sequence of multiple-member telescopic stabilisers in a self-propelled machine, of the type wherein the largest member or fixed member (A) is integral with the machine frame and the smallest member or resting member (C) bears a foot (P) at its free end, **characterised in that** it comprises: at least an actuation cylinder/piston assembly arranged between the fixed member (A) and the resting member (C) ; a double cam hook (3) idly pivoted about a vertical wall of each intermediate member (B) and projecting from the two sides of such wall; and guide and/or grip elements (1, 2, 7) projecting from the neighbouring corresponding walls of the other members, whereon said hooks (3) are apt to slide and/or engage to make all said members mutually fixed except one only thereof at a time, sequentially starting from the largest intermediate member (B) down to the resting member (C), during the opening movement of the telescopic stabiliser, and viceversa during the closing movement.

2. The driving system as in claim 1), wherein said double hooks (3) are alternately pivoted about opposite walls of subsequent intermediate members.

3. The driving system as in claim 1) or 2), wherein each of the two cams (3a, 3c) which make up said double hooks (3) comprises a deep throat (5a, 5c) for the engagement with one of said grip elements (2, 7).

4. The driving system as in claim 3), wherein the outer cam (3a) of said double hook (3) further comprises a planar part (6) of the profile apt to slidingly engage with said guide element (1).

5. The driving system as in claim 4), wherein said guide element (1) consists of a rectilinear section bar which extends longitudinally along the inner wall of the member/s (A) of the stabiliser upstream of the smallest intermediate member (B).

6. The driving system as in claim 4), wherein said grip elements consist of pins (2, 4) projecting internally from the wall of the member/s (A) of the stabiliser upstream of the smallest intermediate member (B), in the proximity of its free end.

7. The driving system as in claim 4), wherein said grip elements consist of pins (7) projecting externally from the wall of the member/s (C) of the stabiliser downstream of the largest intermediate member (B),

in such a position to allow engagement of the pin (7) of a member (C) of the stabiliser with the double hook (3) of the immediately preceding intermediate member (B), when such member (C) is fully housed in said intermediate member (B).

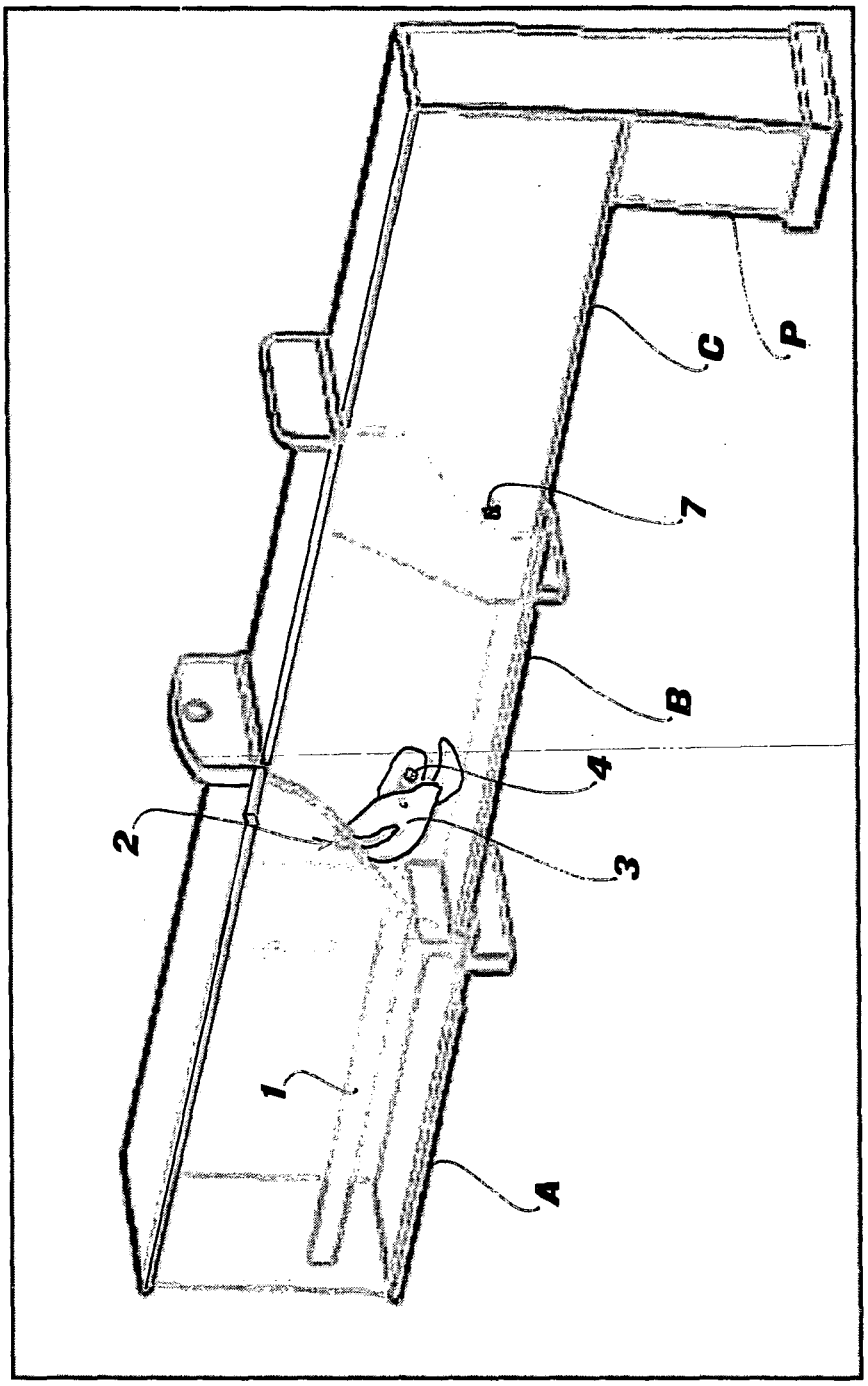

FIG.1

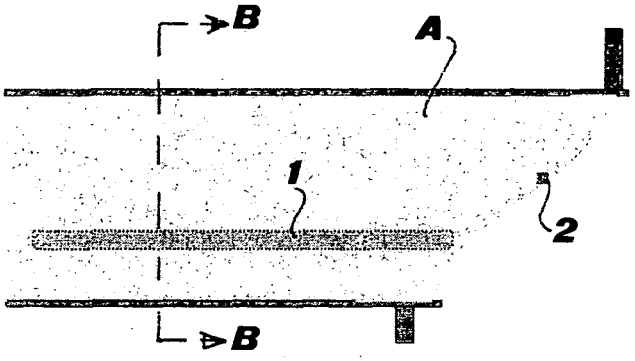

FIG.2A

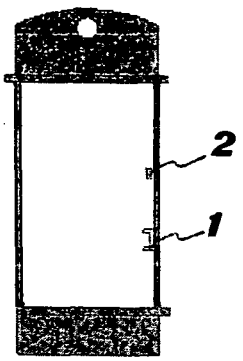

FIG.2B

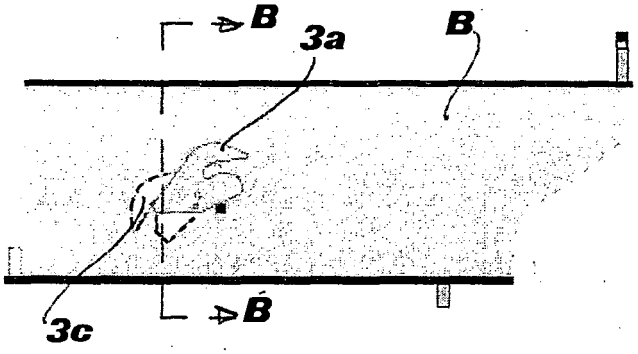

FIG.3A

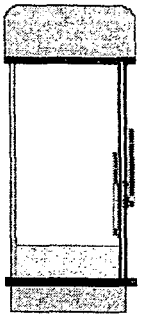

FIG.3B

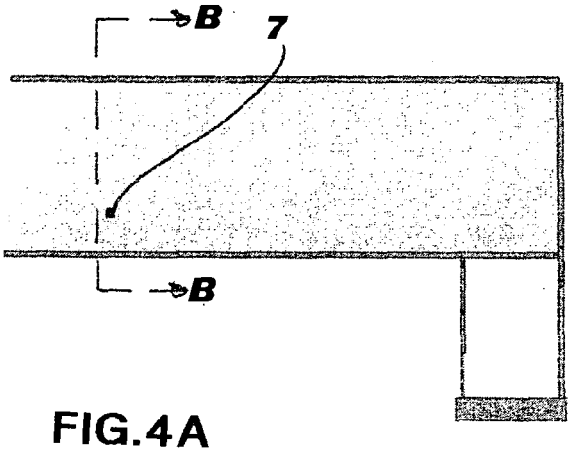

FIG.4A

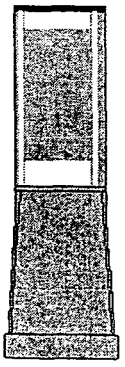

FIG.4B

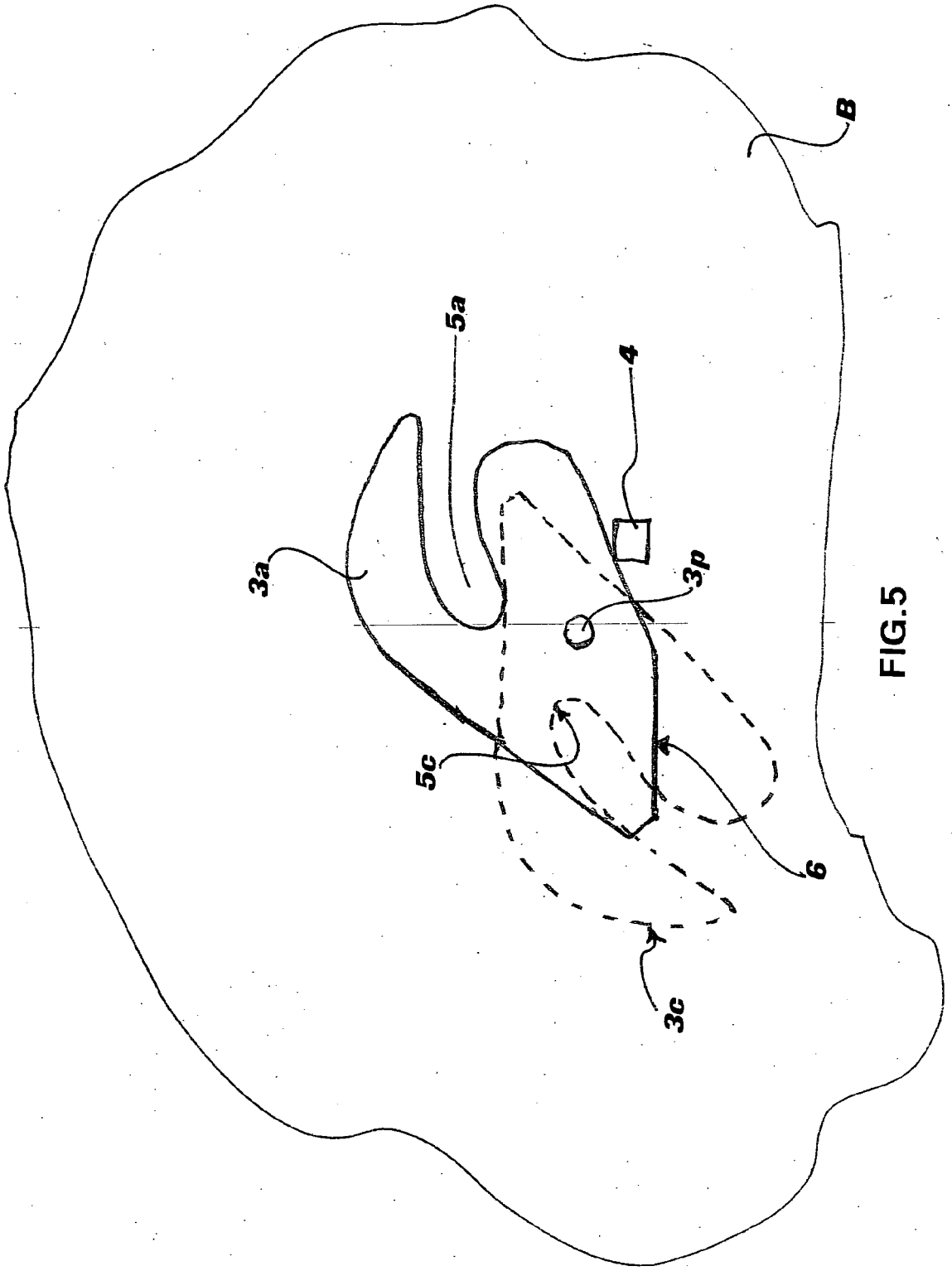

FIG.5

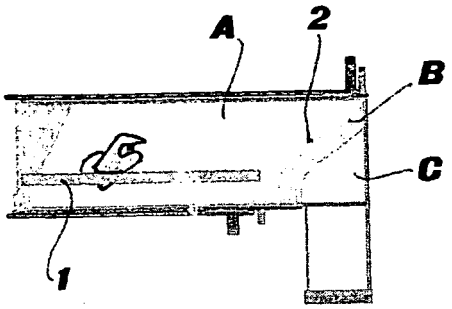

FIG.6A

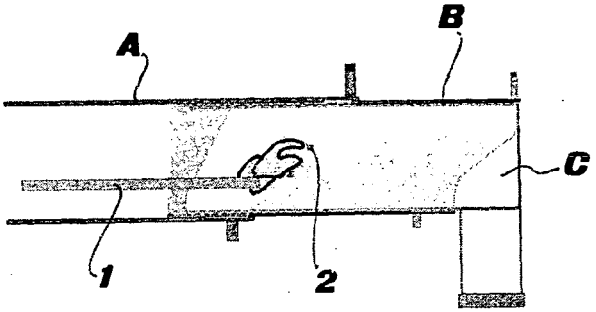

FIG.6B

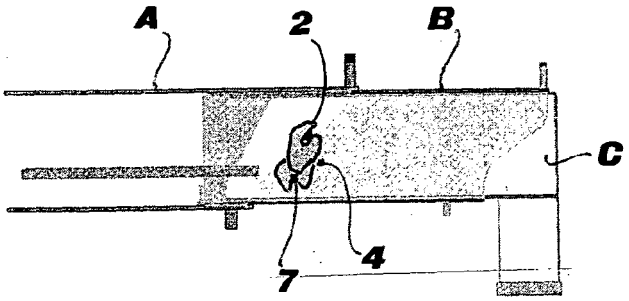

FIG.6C

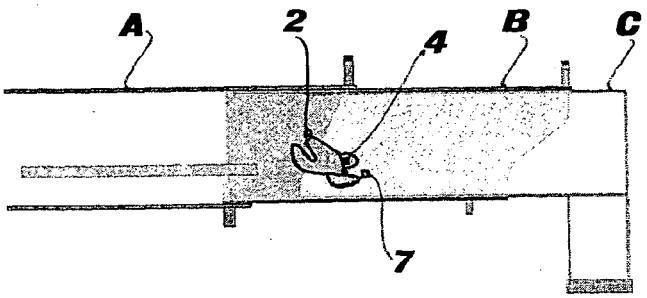

FIG.6D

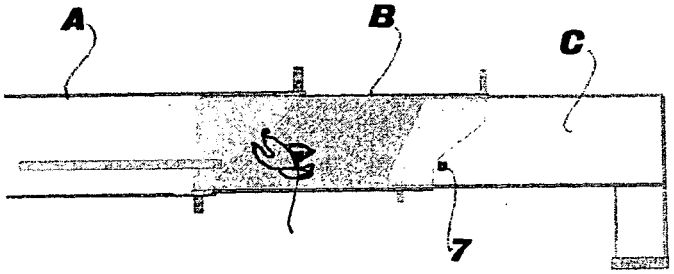

FIG.6E

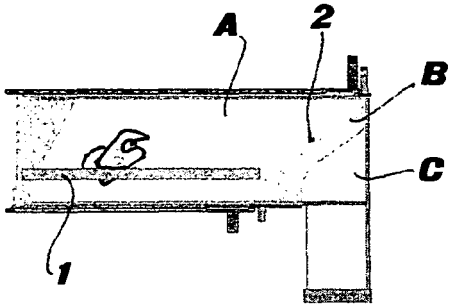

FIG.6A

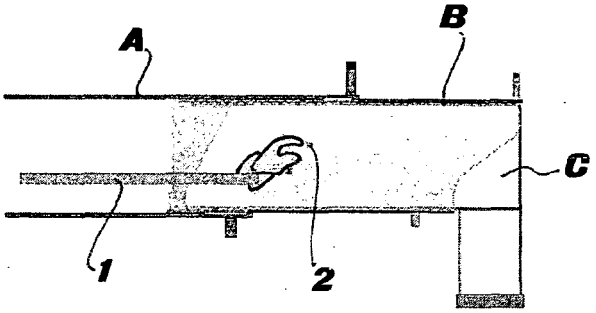

FIG.6B

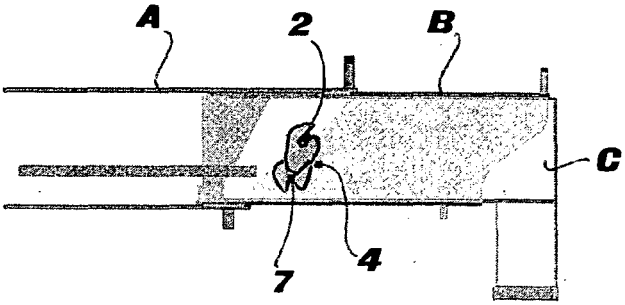

FIG.6C

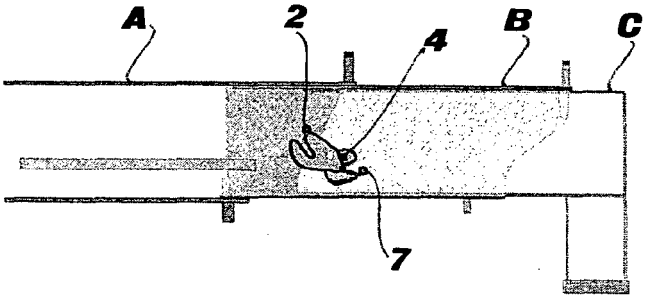

FIG.6D

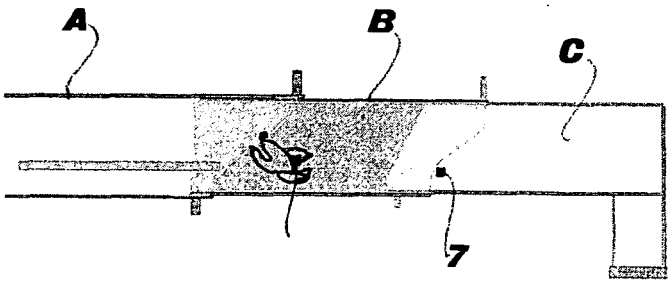

FIG.6E

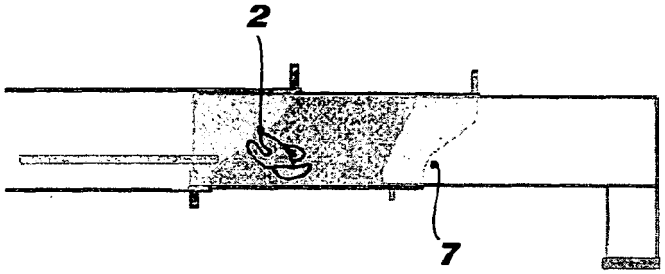

FIG.7A

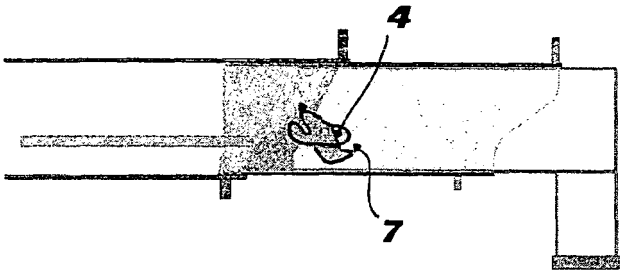

FIG.7B

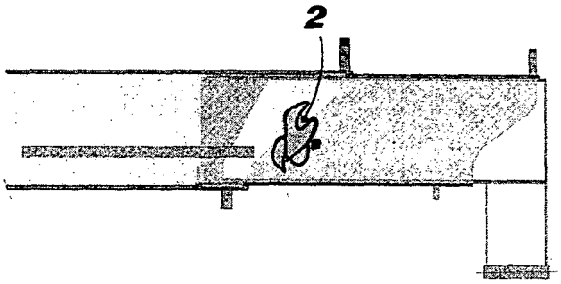

FIG.7C

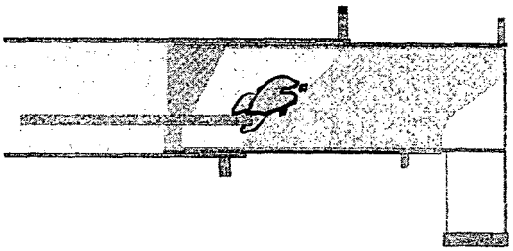

FIG.7D

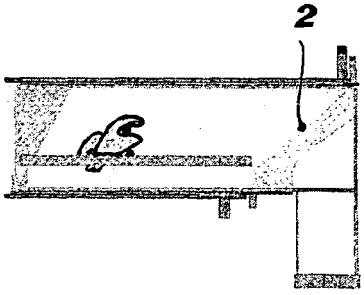

FIG.7E

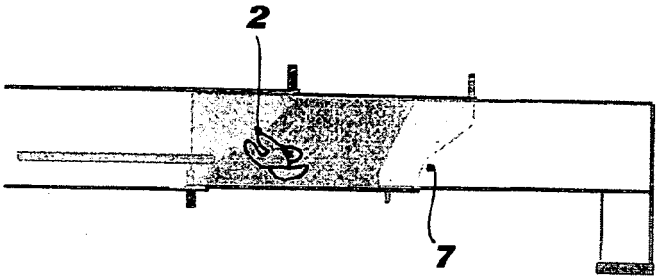

FIG.7A

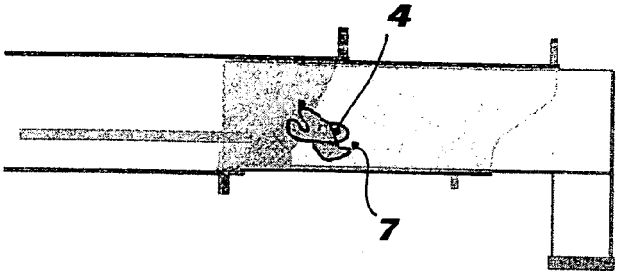

FIG.7B

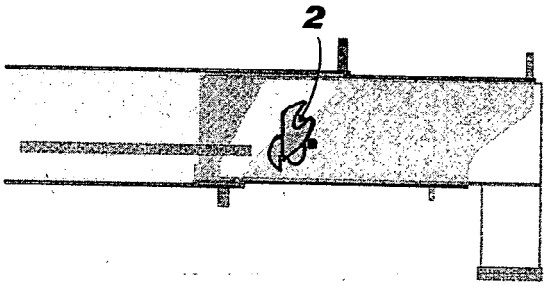

FIG.7C

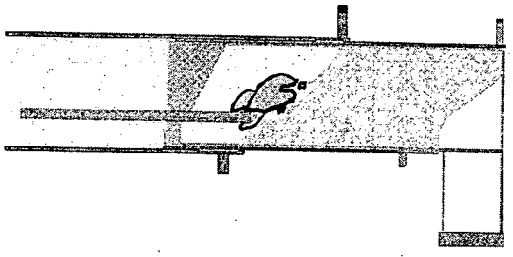

FIG.7D

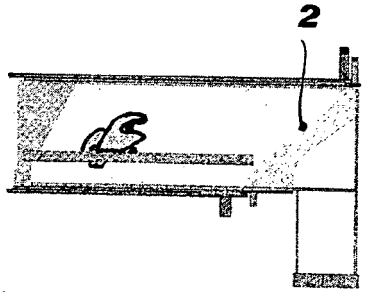

FIG.7E

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EUROPEAN SEARCH REPORT

Application Number
EP 05 42 5282

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	7 October 2005	Jazbec, S

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07-10-2005

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