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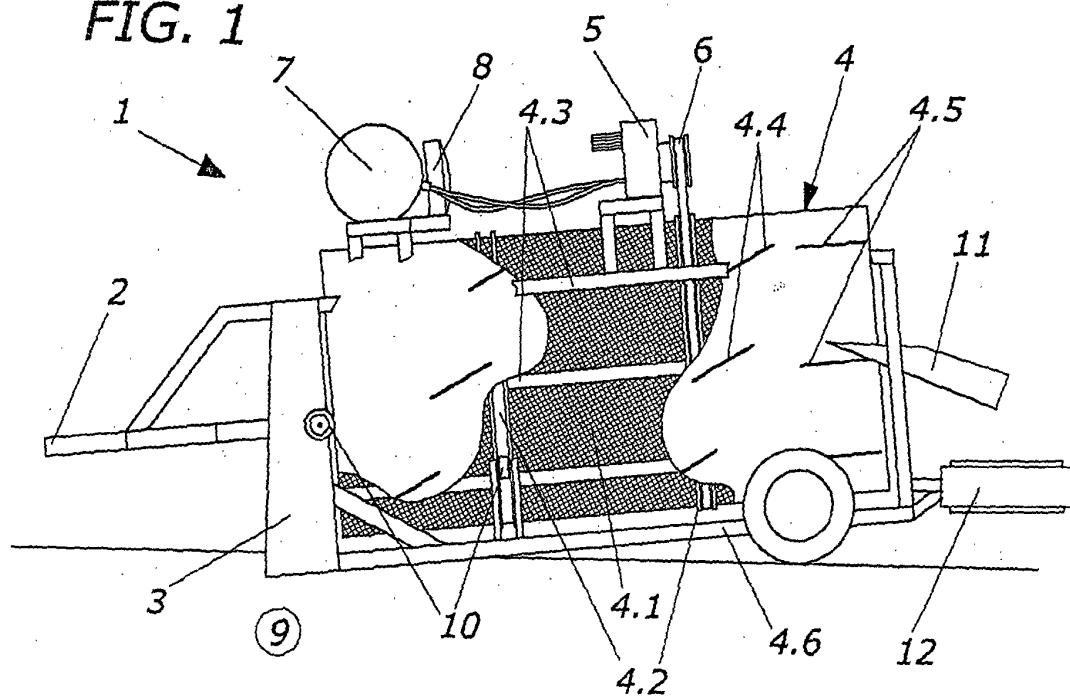
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**(54) STONE-RAKING AND BEACH-CLEANING MACHINE**

(57) A tractor connected (2) to a trailer (1) controls the depth of insertion in the soil (9) of the forward front frame (3) of a large drag sieve (4) built in the form of a longitudinal cylindrical drum with a mesh (4.1) supported by metal rings (4.2) and bars (4.3) and provided with

deflecting blades (4.4) to separate and sieve the soil by a combined action of the trailer motion, dragged by the tractor, and the rotation of the sieve (4) about lower lateral bearings (10) and additional lateral forward bearings, the soil being sifted and the rocks and larger objects being evacuated at the top rear area.

**FIG. 1**



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

**[0001]** The invention here disclosed relates to a machine for removing rocks, from among the different machines used in agriculture and beach machinery used for sorting and removing rocks and garbage.

**[0002]** This invention is characterised by a special construction of the machine, which includes a trailer with a large drag sieve with its front frame partially sunken in the land and having a longitudinal cylindrical drum shape, with an internal rock transporting spiral or equivalently blades to perform this separation function.

**[0003]** The sieve is exchangeable and can be driven hydraulically, with a hydraulic engine and a transmission belt, or directly from the tractor; it revolves about lower lateral support bearings and is centred by other lateral bearings, on which it also rests due to the forward inclination of the frame; the assembly is completed by a rock evacuation hopper and a transverse conveyor belt that discharges on a vehicle running in parallel or into a storage container.

**BACKGROUND OF THE INVENTION**

**[0004]** Rock removing machines are well known and have been used for decades. More recent are rock removers for agricultural land in general, as well as for beaches. Among these stands out P0464340 relating to a "Soil Rock Removal Machine" consisting of a pivoting frame with a fork and a sieve, with variable gauge and lateral chains with jointed links and telescoping rods, as well as hydraulic hammers.

**[0005]** Another patent is titled "Rock Removing Machine", N1 8607677, and has a similar pivoting construction, with forks and chains pulled from the power take off of the tractor.

**[0006]** Finally, another patent is N1 8103233, for a "Beach-Cleaning Rock Removing Machine", having a chassis with a sifting conveyor belt vibrated between rollers and made of steel rods welded to a chain, plus a blade and a fork feeding large waste to a waste container.

**[0007]** The applicant is not aware of rock removing and beach cleaning machines with the characteristics described hereunder.

**DESCRIPTION OF THE INVENTION**

**[0008]** The invention object of the present memory relates to a rock-removing machine, from among the different machines for general agricultural use and beach cleaning machines with moving vehicles, intended for separating and removing rocks or garbage directly to large containers or to auxiliary vehicles, the rocks being evacuated by different means.

**[0009]** This invention is characterised by a special

construction of the machine that includes a tractor trailer connected to the tractor's third traction point that graduates the approximation and insertion of the machine into the ground, preferably with soil collection up to a depth of 50 cm.

**[0010]** The trailer can be connected to the tractor's hydraulic connection or not. It is provided with a large drag sieve with its front frame partially sunken in the soil.

**[0011]** The sieve is built in the form of a cylindrical drum, provided either with an internal rock-transportation spiral for when the rocks are not appreciably adhered to soil that cannot be shaken off by dragging, or alternatively, with deflecting blades that rotate with the sieve and which according to their positioning may or

15 may not determine an inner spiral.

**[0012]** The purpose of the blades is to separate soil and mud, as the rocks with adhered soil will fall from one blade to another as the sieve turns, with lumps of soil falling off and being disaggregated so that granulated

20 soil will leave through the sieve orifices.

**[0013]** The sieve is interchangeable, allowing to choose different gauges and, as mentioned above, it is driven hydraulically by a hydraulic engine and a transmission belt or directly from the tractor by its hydraulic

25 means or its power take off.

**[0014]** The combination of the trailer's motion generated by the pulling action of the tractor with the frame inserted in the soil and the rotation of the sieve about the lower lateral support bearings allows the soil to be sifted. The soil returns to the ground separated from rocks and objects larger than the sieve gauge; due to the inclination of the frame it is ejected on the upper rear area, at the end of the sieve, from where it is evacuated by the means selected.

**[0015]** The sieve is centred by other lateral bearings on which it also rests as a result of the above-mentioned forward inclination of the frame; the assembly is completed by a wheel-like hopper for evacuating rocks and other large objects to a transverse conveyor belt that

40 discharges onto a vehicle travelling in parallel, so that the rock removing machine can operate continuously.

**[0016]** Alternatively, if the machine is used for removing rocks from beaches, with a smaller machine and materials adapted for this use, the large objects and rocks

45 fall into a suitable container, which is periodically emptied at a convenient place.

**[0017]** Finally, provided at the end of the sieve of this second machine are short radial blades placed after the last deflecting blades in order to act as an exit carrousel for shells, glass, rocks, paper, etc., while an electromagnetic grid placed on the bottom of the sieve retains small ferromagnetic objects, which remain attached to it and are released after the removal task has finished.

**[0018]** When changing from one type of ground to another or from one type of beach to a different type, to separate soil or beach sand with different particle size requiring a different sieve orifice size, in order to avoid a nearly complete disassembly of the machine to re-

place the sieve, the sieve drum can be segmented by a regular rigid structure consisting of a number of frames with the corresponding mesh sectors that are bolted onto the structure, so that these frames can be easily replaced by others with a different orifice size, as is best in each case.

**[0019]** The sieve drive mechanism can also have the hydraulic engine disposed so that it turns a pneumatic wheel that will press firmly against the belt transmitting the motion to the sieve.

**[0020]** The sieve outlet blades, which turn together with it, can alternatively dump the rocks and residues onto an inclined metal sheet that directs them towards an external container that is unloaded by a simultaneous elevation and pivoting motion with the aid of lateral vertical pistons to the rear area of the trailer carrying the sieve.

**[0021]** It is also possible to modify the rear end of the sieve to determine a circular tubular housing for the outermost blades, placed immediately next to the sieve and in front of the exit for rocks and residues to the container. This housing can vary in size depending on the characteristics of the ground on which the machine will be used.

**[0022]** Instead of the blades that may or may not determine an inner spiral, the sieve can include a worm gear to feed and circulate inside the drum the products collected from the front frame.

**[0023]** This worm gear is made of steel plate that is thicker in its front end so that it can withstand impacts from rocks without deformation, gradually tapering down towards its opposite end, and can be perforated to facilitate exit of the earth or sand.

**[0024]** If the machine is used exclusively in beaches, or as an adaptation for this case of a machine to be used in different terrains, added on the rear are rollers that may or may not revolve, meant to level the ground and eliminate the tread marks made by the tractor wheels and those made by the forward frontal.

## **DESCRIPTION OF THE DRAWINGS**

**[0025]** The present descriptive memory is complemented with a set of drawings of the preferred embodiment, for purposes of illustration only and not limiting the invention.

**[0026]** Figure 1 shows a side elevation schematic representation of the trailer, partially sectioned, to reveal the location of the deflector blades in one of the examples of a preferred embodiment.

**[0027]** Figure 2 shows a rear elevation view of the same machine.

**[0028]** Figure 3 shows a rear perspective view of the trailer, showing the alternative where pistons raise the raised hopper, as well as the discharge sheet for rocks and residues.

**[0029]** Figure 4 shows an enlarged view of this area, with the hopper in a raised position, as well as the sheet

and the blades of the alternative solution.

**[0030]** Figure 5 is a partial perspective view of the side of the trailer, with the hopper disassembled and showing the segmented sieve as well as the blade housing.

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## **PREFERRED EMBODIMENT OF THE INVENTION**

**[0031]** In view of the above, the present invention relates to a rock removing machine for separating and removing rocks and other objects, as well as for collecting agricultural products on the surface or near it, using a moving vehicle, continuously or otherwise.

**[0032]** Example 1. The machine is essentially characterised by having a tractor trailer (1) connected (2) to its third traction point graduating the insertion depth of the forward front frame (3) in the ground, with the trailer connected or not to the hydraulic connection of the tractor in order to drive a large drag sieve (4), which is built in the form of a longitudinal cylindrical drum with a mesh (4.1) supported by metal rings (4.2) reinforced by external bars (4.3) and provided with either a rock-transporting spiral or, alternatively, with deflecting blades (4.4) that preferably determine an inner spiral, in order to separate and sieve the soil by a combined action of the trailer motion, dragged by the tractor, which controls the insertion of the frame (3) in the ground (9) and the rotation of the sieve (4) on lower lateral support bearings (10) and other lateral bearings (10) also supporting due to the inclination of the frame (3); or alternatively to this set 30 of bearings by a central shaft, the soil being sifted and the rocks and larger objects evacuated by the rear upper area of the sieve to a chute (11) from where they fall to a conveyor belt (12), in the case of the ground rock removing machine, for a continuous evacuation by means of an auxiliary vehicle or, in the case of the beach rock removing machine, which is shorter in length yet sturdier and made of suitable materials, to a container that can be replaced after it is filled or emptied by hydraulic bottles.

**[0033]** In the case of the blades (4.4), when the sieve turns the rocks will fall from one blade to another and the soil adhered to the rocks is shaken off and disaggregated as it is dragged until exiting through the orifices of the sieve (10).

**[0034]** The sieve (10) is such that it is possible to exchange meshes (4.1) with different orifice sizes and can be driven by a hydraulic engine (5) and a transmission belt (6), directly from the tractor or by hydraulic means of the trailer itself, being provided with a deposit (7) and a heat exchanger (8).

**[0035]** Attached to the top end of the sieve (4) of the beach rock removing machine are short radial blades (4.5) placed after the last deflecting blades (4.4) and on the bottom of the sieve (4) is attached an electromagnetic grid (4.6) that retains small ferromagnetic objects which remain adhered to it and are released at the end of the collection task.

**[0036]** Alternatively, the trailer connected to the trac-

tor can be replaced by a self-propelled rock removing machine.

**[0037]** Example 2. In this case, selected among various possible combinations, the drag sieve (4) is provided with a plurality of meshes (4.1.1) with different orifice sizes in order to segment the sieve drum with a rigid rectangular structure (4.7) formed by a number of frames (4.8) bolted on the sieve, with the sieve being driven by a hydraulic engine (5) that turns the pneumatic wheel (5.1), which in turn presses firmly against the transmission belt (6).

**[0038]** Blades (12.1) that turn together with the sieve and that are incorporated in a housing (12) with variable diameter collect and drop the rocks and residue on an inclined metallic discharge sheet (13), which directs them towards a hopper (14) that is unloaded by a simultaneous rising and pivoting with the aid of pistons (15), the collected products being moved and collected by a worm gear (16) that is attached to the chassis and is made of a steel plate thicker on its front end and tapering down backwards, as well as perforated.

**[0039]** In beach machines the machine incorporates on the rear rollers, able to turn or otherwise, which level the ground and eliminate tracks and marks.

**[0040]** The essence of this invention is not affected by variations in the shape, size and arrangement of its components, which are described in a non-limiting manner so that an expert in the field should be able to reproduce it.

## Claims

1. Rock-removing machine for separating and removing rocks and other objects, as well as for collecting agricultural products on or near the surface, using a moving vehicle, whether continuously or otherwise, having a tractor trailer (1) connected (2) to its third traction point that controls the insertion depth of the forward front frame (3) in the ground, the trailer being connected or not to the hydraulic connection of the tractor in order to drive a large drag sieve (4), which is built in the form of a longitudinal cylindrical drum with a mesh (4.1) supported by metal rings (4.2) reinforced by external bars (4.3) and provided with either a rock-transporting spiral or, alternatively, with deflecting blades (4.4) that preferably determine an inner spiral, in order to separate and sieve the soil by a combined action of the trailer motion, dragged by the tractor, and the rotation of the sieve (4), the soil being sifted and the rocks and larger objects evacuated by the rear upper area of the sieve; in addition, the sieve (10) is made such that it is possible to exchange meshes (4.1) with different orifice sizes and it is driven by a hydraulic engine (5) and a transmission belt (6), either directly from the tractor or by hydraulic means of the trailer itself, having a deposit (7) and a heat exchanger (8),

this machine being **characterised in that** the rotation of the sieve takes place about lower lateral support bearings (10) and additional support bearings (10), where the machine is provided with blades (4.4) so that when sieve turns and the rocks fall from one blade to another the soil attached to them is shaken off and disaggregated as it is carried, leaving through the orifices of the sieve (4).

2. Rock-removing and beach-cleaning machine according to previous claims, **characterised in that** in the case of the soil rock removing machine, rocks and other large objects fall from the chute (11) to a conveyor belt (12) to be evacuated continuously by means of an auxiliary vehicle.
3. Rock-removing and beach-cleaning machine according to previous claims, **characterised in that** at on the top end of the sieve of the beach rock removal machine are attached short radial blades (4.5) placed after the last deflecting blades (4.4), and on the bottom of the sieve (4) is attached an electromagnetic grid (4.6) that retains small ferromagnetic objects which will remain adhered to it and are released at the end of the collection task.
4. Rock-removing and beach-cleaning machine according to claims 1 to 3, **characterised in that** in the case of the beach rock removing machine, which is shorter in length and made of suitable materials for its use, the rocks and other large objects fall from the chute (11) to an exchangeable container that can be replaced after it is full or that can be emptied by hydraulic bottles.
5. Rock-removing and beach-cleaning machine according to claim 1, **characterized in that** the single mesh (5.1) supported by metallic rings (4.2) reinforced with external bars (4.3) of the drag sieve is replaced by a plurality of meshes (4.1.1) with different orifice sizes in order to segment the sieve drum with a rigid rectangular structure (4.7) formed by a number of frames (4.8) bolted on the sieve, with hydraulic engine (5) that drives the sieve turning a pneumatic wheel (5.1), which in turn presses firmly against the transmission belt (6).
6. Rock-removing and beach-cleaning machine according to claims 3 and 5, **characterized in that** the short radial blades (4.5) housed in the drag sieve (4) are replaced by blades (12.1) that are slightly off the radial alignment and are incorporated in a housing (12) with a variable diameter that turns together with the sieve.
7. Rock-removing and beach-cleaning machine according to claims 1 and 3, **characterized in that** the spiral deflecting blades (4.4) are replaced by a

worm gear (16) attached to the chassis that feeds and removes the collected products, made of a steel plate that is thicker on its front end and tapers down backwards, as well as being perforated.

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8. Rock-removing and beach-cleaning machine according to claims 1, 2 and 4, **characterized in that** the chute (11) and the conveyor belt (12) are replaced by an inclined metallic discharge sheet (13), which directs the rocks and residues towards a hopper (14) that is unloaded by a simultaneous rising and pivoting with the aid of pistons (15).  
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9. Beach-cleaning machine according to previous claims, **characterized in that** it incorporates on its rear rollers able to turn or otherwise to level the ground and eliminate tracks and marks.  
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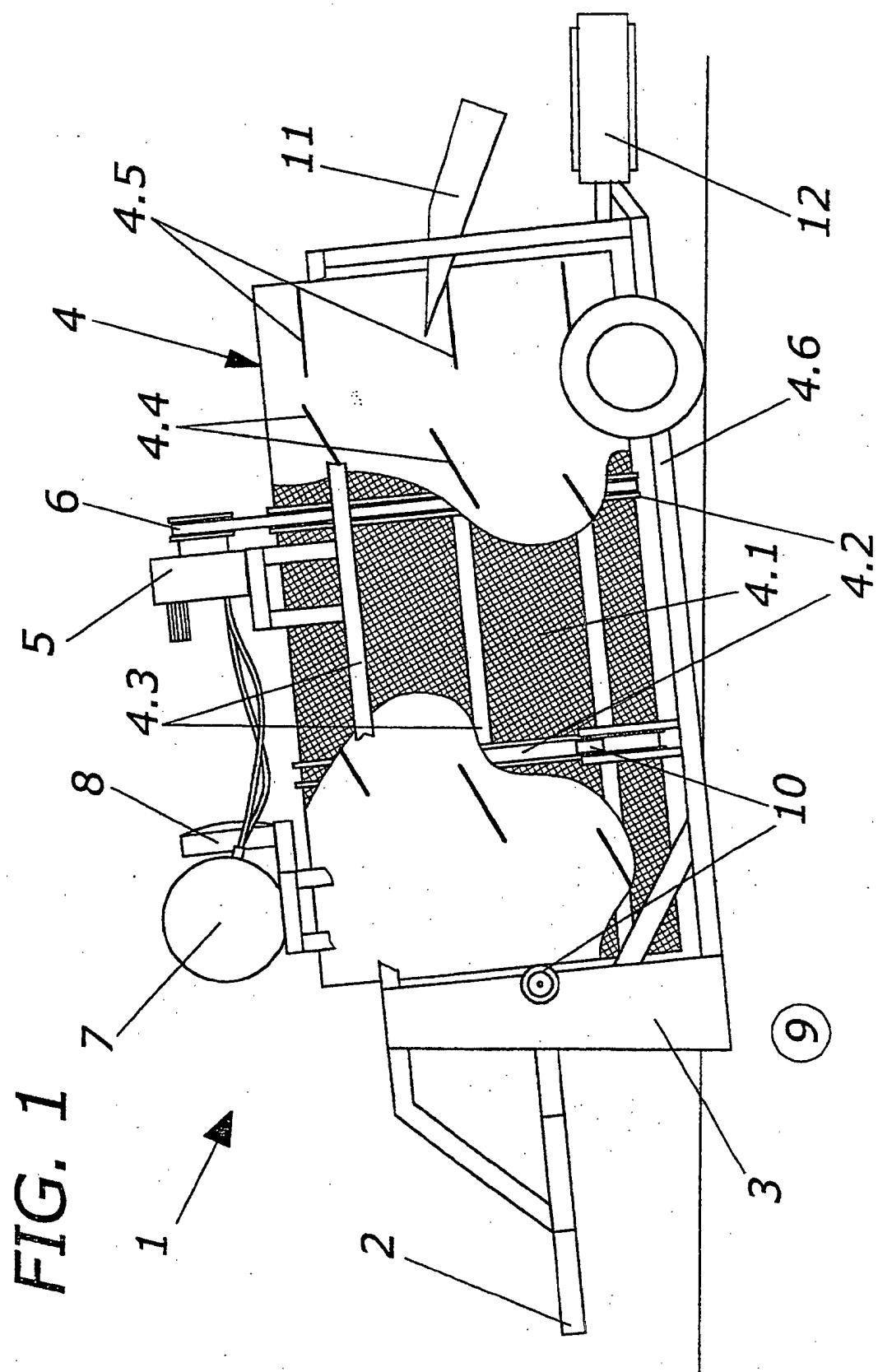
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*FIG. 2*

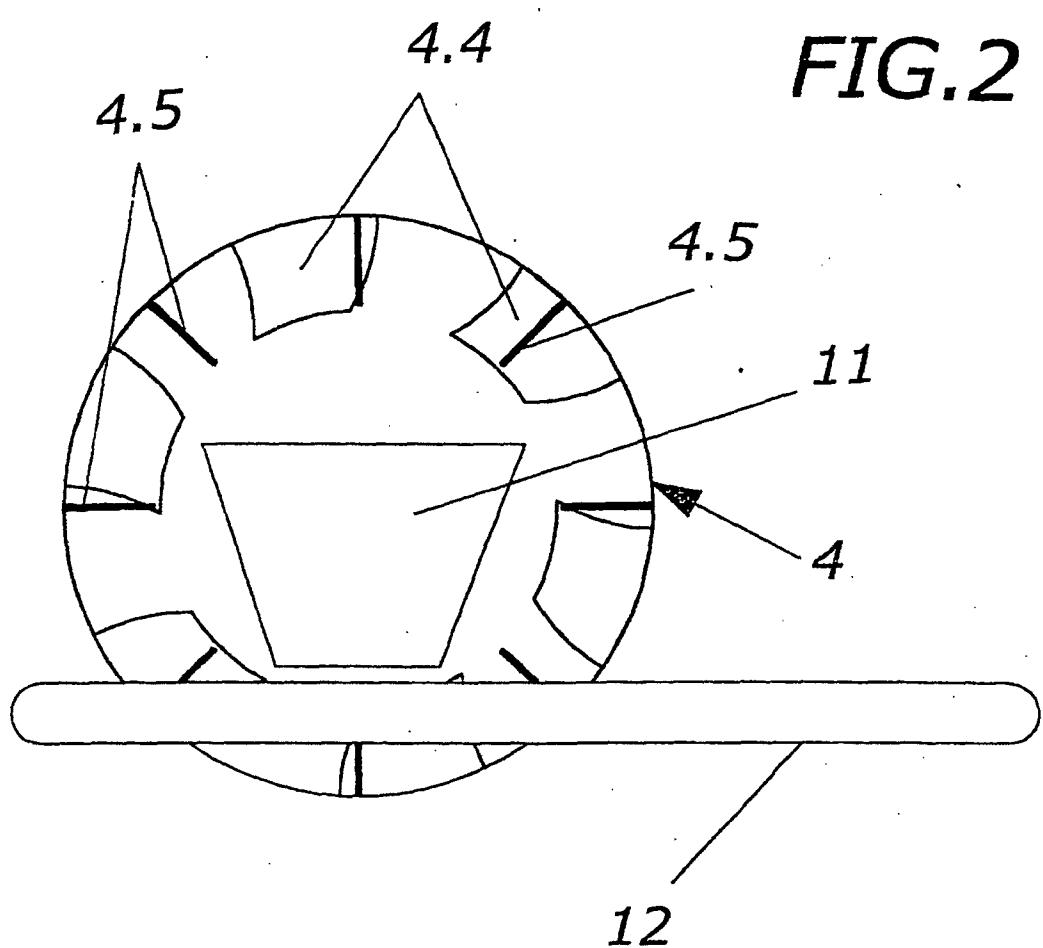


FIG. 3

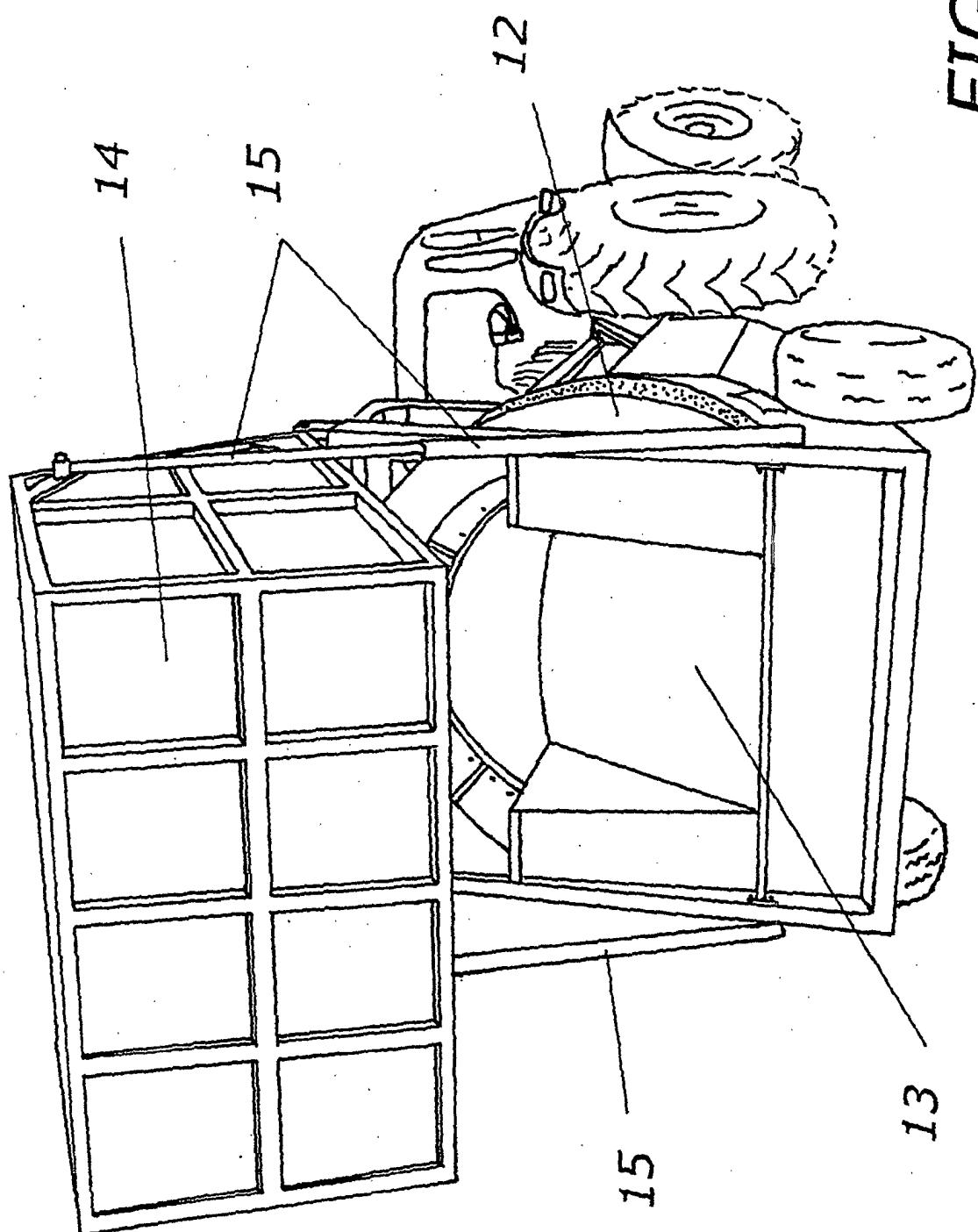
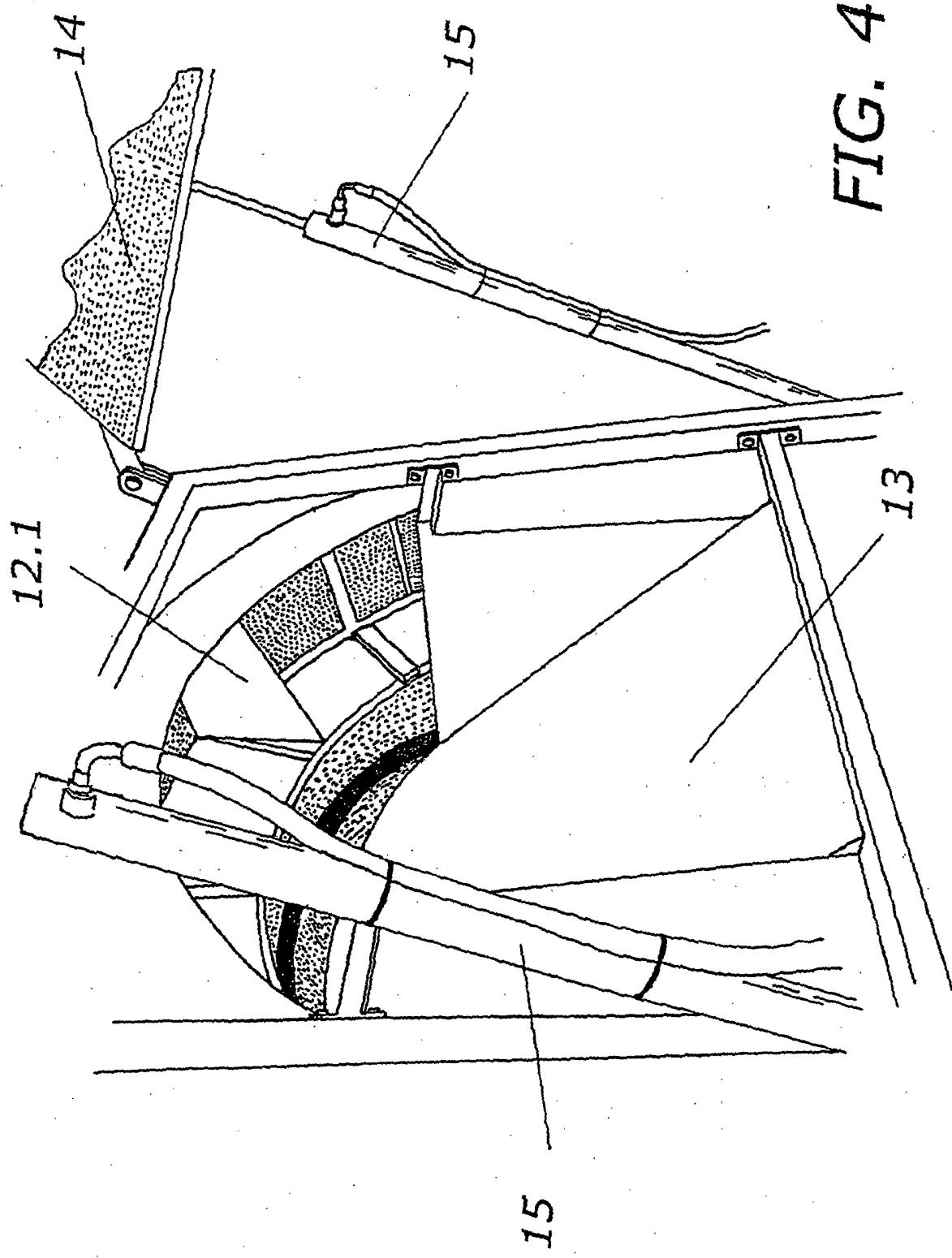


FIG. 4



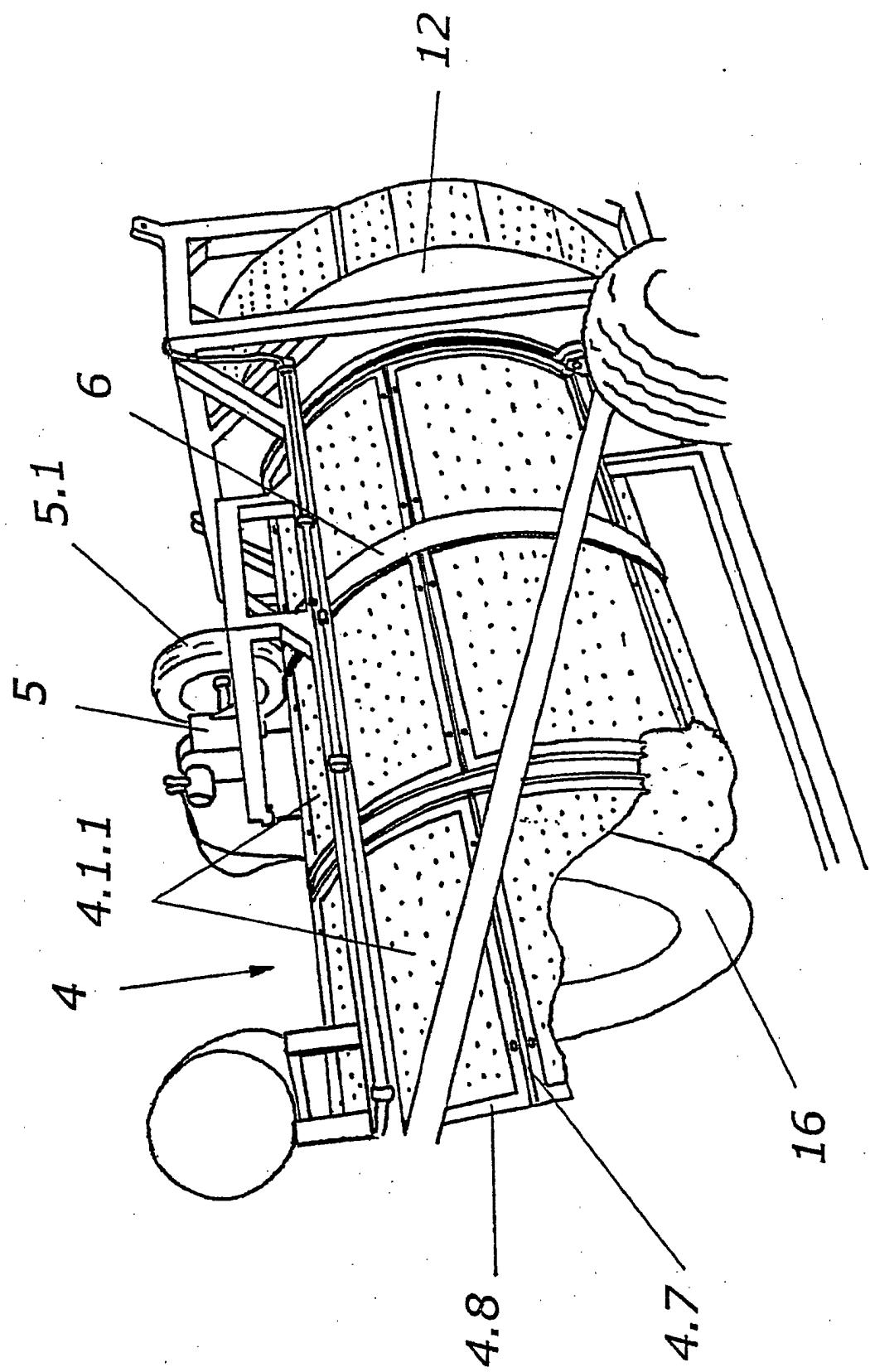


FIG. 5

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/ES 02/00338

## A. CLASSIFICATION OF SUBJECT MATTER

CIP<sup>7</sup> E01H 12/00

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)

CIP<sup>7</sup> E01H, A01D, A01B, B07B

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)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	FR 2651812 A1 (BUCHENAUD) 15.03.1991. <b>the whole document</b>	1, 2 9
Y A	JP 57058709 A (CATERPILLAR MITSUBISHI LTD.) 08.04.1982. <b>figures 1-7.</b>	1, 2 7, 9
Y A	DE 4134194 C1 (BERNHARD FARWICK G.M.B.H. & CO.) 19.05.1993. <b>abstract, figures.</b>	2 7

 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	"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
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"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family

Date of the actual completion of the international search  14 August 2002 (14.08.2002)	Date of mailing of the international search report  17 October 2002 (17.10.2002)
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Name and mailing address of the ISA/  S.P.T.O.  Facsimile No.	Authorized officer  Telephone No.
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Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT Information on patent family members		International Application No PCT/ES 02/00338	
Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR 2651812 A	15.03.1991	NONE	-----
JP 57058709 A	08.04.1982	NONE	-----
DE 4134194 C	19.05.1993	NONE	-----

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