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(54) **Magnet device**

(57) The present invention relates to a magnet device (1) for clearing rubble (35) containing rebars (37). Demolition of concrete structures results in a quantity of rubble which contains not only broken concrete but also rebars which have served as reinforcement in the concrete structure and have pieces of broken concrete thereon. A magnet device (1) according to the invention comprises a magnet (3) and at least one dislodging member (5, 7, 9, 11) positioned at the magnet (3).

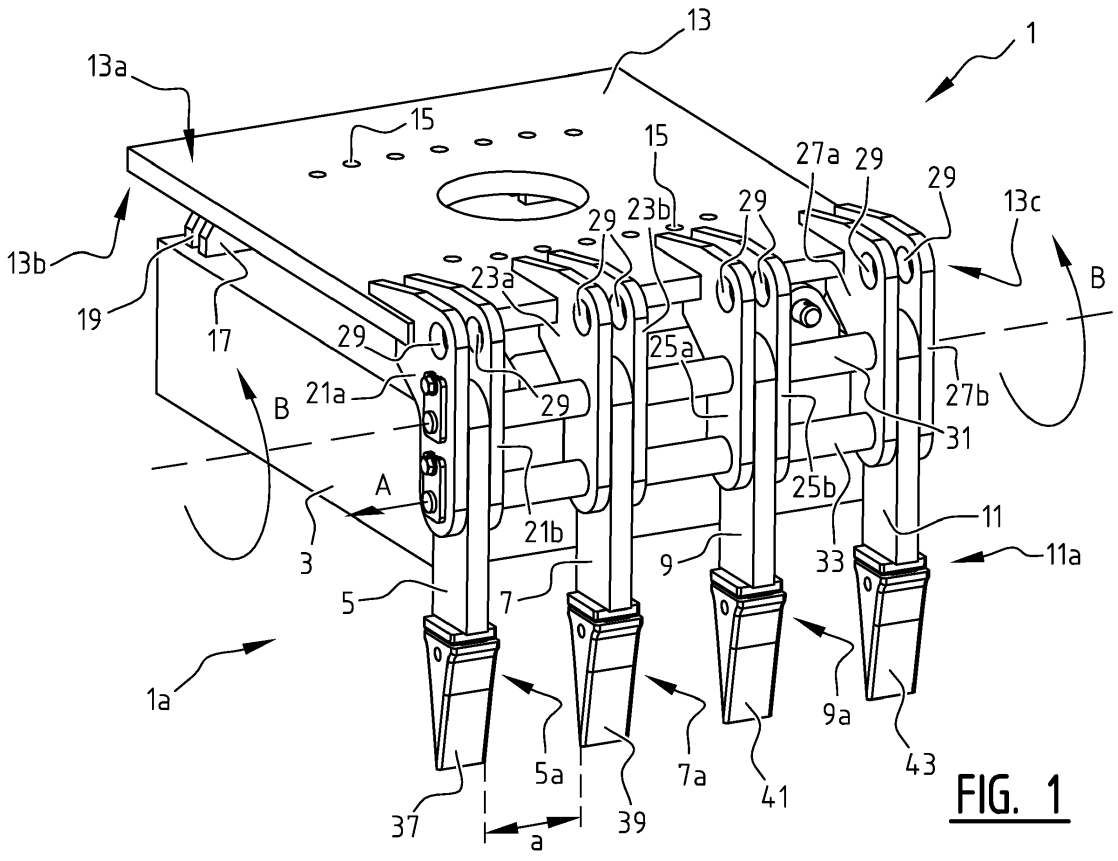

FIG. 1

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Description

[0001] The present invention relates to a magnet device for clearing rubble containing rebars.

[0002] Demolition of concrete structures results in a quantity of rubble which contains not only broken concrete but also rebars which have served as reinforcement in the concrete structure and have pieces of broken concrete thereon.

[0003] It is known to separate the rebars with pieces of broken concrete still connected thereto from the other rubble at the location where the concrete structure is being demolished. Employed here are machines with an operating arm, such as excavators, which are provided at the free end of the operating arm with a magnet device. By means of the magnet device, which is generally provided with an electromagnet, the rebars with pieces of concrete still connected thereto can be pulled out of the rubble and transferred to a container for removal of the rebars to a processing facility.

[0004] The present invention has for its object, among others, to improve the known magnet devices for clearing rubble containing rebars.

[0005] A magnet device according to the invention comprises for this purpose a magnet and at least one dislodging member positioned at the magnet, wherein the magnet device is provided on an attaching side with a frame configured for attaching to an operating arm of a machine, wherein the magnet is positioned on an active side of the magnet device lying opposite the attaching side and is attached rigidly to the frame such that during use the active side of the magnet device can be brought close to the surface of the rubble for clearing by means of the operating arm in order to attract rebars present in the rubble with the magnet, and wherein the dislodging member is mounted on at least one of the frame and the magnet.

[0006] The rubble can be dislodged using the dislodging member so that rebars can be pulled out of the rubble more easily by means of the magnet positioned at the dislodging member.

[0007] A piece of rebar with a part lying on the surface of the rubble often extends partially into the rubble. Although in known magnet devices which are configured to be brought close to the surface of the rubble for clearing and to attract rebars present in the rubble with a magnet, and which are not provided with dislodging members, the magnet can engage the portion of rebar lying on the surface of the rubble, it is difficult in practice to pull the portion of the rebar extending into the rubble from the rubble. This is particularly the result of the pieces of concrete which are still attached to the rebar and act as anchor. The more compacted the layer of rubble in which the rebar lies, the more difficult pulling the rebar from the rubble becomes. A considerable compaction of the layer of rubble occurs frequently because, during demolition of the concrete structure, the demolition machines drive over the previously created rubble as the demolition work progresses. With use of the magnet device according to the invention the layer of rubble can be dislodged by means of the dislodging member so that more space is created in the rubble to pull loose a piece of rebar with pieces of concrete thereon out of the rubble by means of the magnet positioned at the dislodging member. Because in the magnet device according to the invention the magnet is rigidly attached to the frame with which the magnet device can be attached to an operating arm of a machine, and the dislodging member is mounted on at least one of the frame and the magnet, the magnet and the dislodging member are displaceable as a unit by means of the operating arm relative to the surface of the rubble for clearing while maintaining relative orientation between the magnet and the dislodging member. This makes it possible, irrespective of the orientation of the surface of the rubble for clearing, to orient the magnet by means of the operating arm such that it can be brought to the surface in order to attract rebars present in the rubble without bringing the magnet into contact with the surface or the dislodging member and, irrespective of the orientation of the surface of the rubble for clearing, to also orient the dislodging member by means of the operating arm such that it can be inserted into the surface in order to dislodge the rubble without bringing the magnet into contact with the surface or the dislodging member.

[0008] In a favourable embodiment of the magnet device according to the invention the dislodging member extends in an operative mode beyond the magnet on the active side of the magnet device. In use the active side of the magnet device is brought close to the rubble so that the magnet can attract rebars present in the rubble. Because the dislodging member extends in an operative mode beyond the magnet on the active side of the magnet device, the dislodging member can be inserted into the rubble in order to dislodge the rubble, and the magnet can simultaneously be brought to the surface of the rubble for clearing in order to attract rebars present in the rubble.

[0009] In a favourable embodiment hereof the dislodging member is selectively movable between the operative mode and an inoperative mode, wherein in the inoperative mode the dislodging member does not extend beyond the magnet on the active side of the magnet device. This measure makes it possible to use the magnet not only for pulling rebars out of the rubble but also for picking up and displacing iron road plates.

[0010] In a further favourable embodiment of the magnet device according to the invention the magnet and the dislodging member are each mounted individually on the frame. By attaching the frame to the operating arm of a machine and mounting each of the magnet and the dislodging member individually on the frame, the forces occurring in the dislodging member during dislodging of the rubble are transmitted directly via the frame to the operating arm, so avoiding the magnet being loaded by forces occurring during the dislodging. The dislodging member

is alternatively mounted on the magnet. The wall of the magnet on which the dislodging member is then mounted must in that case be strong enough to withstand the forces occurring during dislodging of rubble.

[0011] In a favourable embodiment thereof the frame is provided with coupling members configured to couple an operating arm of a machine to the upper side of the frame, the frame is provided with coupling members with which the magnet is coupled to the underside of the frame, and the dislodging member is mounted on a side of the frame. This enables a simple embodiment of the magnet device according to the invention. The frame can for instance take the simple form of a plate. In a favourable embodiment the coupling members configured to couple an operating arm of a machine to the upper side of the frame are coupling members which co-act with known rapid coupling systems for coupling work tools such as an excavator bucket to an operating arm.

[0012] In a favourable embodiment of the magnet device according to the invention, wherein the dislodging member is selectively movable between the operative mode and an inoperative mode, the dislodging member is mounted by means of a hinge, preferably on the frame, and is pivotable by means of the hinge between the operative mode and the inoperative mode. These measures enable an easily operated and robust realization of the operative mode and an inoperative mode of the dislodging member.

[0013] In a favourable embodiment hereof the magnet device comprises a locking member for locking the dislodging member in the operative mode and in the inoperative mode. With this measure it is possible to avoid the dislodging member moving unintentionally from the operative mode to the inoperative mode or vice versa.

[0014] In a favourable embodiment of the magnet device according to the invention the dislodging member comprises an elongate body. An elongate body can be inserted in the longitudinal direction thereof into the rubble with relatively little effort. After the elongate body has been inserted into the rubble, the rubble can be dislodged in effective manner by displacing the magnet device in a direction transversely of the longitudinal direction of the dislodging member.

[0015] In a favourable embodiment hereof the dislodging member is provided on a free outer end thereof with an exchangeable wear tooth. Wear occurs at the free end of the dislodging member when the dislodging member is inserted into the rubble and when the rubble is dislodged. The use of an exchangeable wear tooth on the free end of the dislodging member makes it possible to remedy damage to the outer end of the dislodging member after a period of use in simple manner by changing the wear tooth.

[0016] In a favourable embodiment of the magnet device according to the invention the magnet device comprises an actuator configured to cause the dislodging member to vibrate. The forces required to insert the dislodging member into the rubble and/or to dislodge the rubble can be decreased, particularly in the case of a high degree of compaction of the rubble, by having the dislodging member vibrate.

[0017] A favourable embodiment of the magnet device according to the invention wherein the dislodging member is selectively movable between the operative mode and an inoperative mode comprises an actuator configured to move the dislodging member between the operative mode and the inoperative mode. This measure makes it possible to move the dislodging member between the operative mode and the inoperative mode from for instance the driver's cab of a work vehicle on which the magnet device is arranged. Alternatively, the movement of the dislodging member between the operative mode and the inoperative mode can be realized manually. A suitable actuator is for instance a hydraulic working cylinder.

[0018] In a favourable embodiment of the magnet device according to the invention wherein the dislodging member is arranged on a frame by means of a hinge and is movable by means of this hinge between the operative mode and the inoperative mode, the dislodging member can be moved by means of an actuator from the operative mode to the inoperative mode by rotating the dislodging member around a pivot axis by means of the actuator. It is possible by means of the same actuator to realize a vibration of the dislodging member by moving the dislodging member reciprocally through a small angle around the pivot axis by means of the actuator. A suitable actuator is for instance a hydraulic working cylinder.

[0019] A favourable embodiment of the magnet device according to the invention comprises a plurality of dislodging members positioned at a distance from each other in a row. The dislodging members thus form a comb which can be pulled through the rubble in order to dislodge the rubble.

[0020] In a favourable embodiment of the magnet device according to the invention the magnet is an electromagnet. By means of an electromagnet a piece of rebar attracted by means of the magnet can be easily released again from the magnet by deactivating the magnet. The magnet is alternatively a permanent magnet.

[0021] The present invention also relates to a machine for rubble clearing operations, comprising an operating arm having on the free end thereof a magnet device according to the invention as described above.

[0022] The present invention also relates to a method for clearing rubble containing rebars by means of a magnet device according to the invention as described above, comprising the steps of

- dislodging the rubble with at least one dislodging member, and
- removing rebars from the dislodged rubble with a magnet positioned at the dislodging member.

[0023] In a favourable embodiment of the method according to the invention, wherein the dislodging member

extends at least in operative mode beyond the magnet on the active side of the magnet device, the active side of the magnet device is brought close to the surface of the rubble for clearing and the dislodging member is inserted into the rubble so that the magnet can attract rebars present in the rubble and the dislodging member can dislodge the rubble.

[0024] In a further favourable embodiment hereof, the method comprises of displacing the magnet device along the surface of the rubble for clearing following insertion of the dislodging member into the rubble.

[0025] The present invention will be further elucidated hereinbelow on the basis of a number of exemplary embodiments, which are shown schematically in the accompanying figures. These are non-limitative exemplary embodiments. In the figures:

- Figure 1 is a perspective view of an embodiment of a magnet device according to the invention with dislodging members in the operative mode;
- Figure 2 is a perspective view of the magnet device of figure 1 on an operating arm of a machine during use of the magnet device for the purpose of dislodging rubble and removing rebars from the rubble;
- Figure 3 is a perspective view of the magnet device of figure 1 with dislodging members in the inoperative mode;
- Figure 4 is a perspective view of the magnet device of figure 3 on an operating arm of a machine during use of the magnet device for the purpose of picking up an iron road plate;
- Figure 5 is a side view of an alternative embodiment of the magnet device of figures 1-4.

[0026] Figure 1 shows a magnet device 1. Magnet device 1 has an electromagnet 3 and four dislodging members 5, 7, 9, 11 positioned at magnet 3. Dislodging members 5, 7, 9, 11 and magnet 3 are mounted on a frame in the form of a plate 13. Plate 13 is provided with holes 15 which serve as coupling members for coupling the plate 13 on the upper side 13a thereof to a free end of an operating arm 16, as shown in figures 2 and 4. Magnet 3 is coupled rigidly to the underside 13b of plate 13. Plate 13 and magnet 3 are provided for this purpose with coacting coupling members 17, 19. Dislodging members 5, 7, 9, 11 are mounted on a side 13c of plate 13 by means of hinges 21, 23, 25, 27. Each hinge has a pair of hinge plates 21a/b, 23a/b, 25a/b, 27a/b mounted on plate 13. A respective dislodging member 5, 7, 9, 11 is positioned between each pair of hinge plates. Each hinge plate is provided with three holes. Each dislodging member 5, 7, 9, 11 is provided with two holes. The two holes of each dislodging member 5, 7, 9, 11 are aligned with two of the three holes of each pair of hinge plates. Two pins are placed through the aligned holes, i.e. a hinge pin 31 and a locking pin 33. Figure 1 shows only the upper hole 29 of each hinge plate. This is because hinge pin 31 and locking pin 33 are inserted into respectively the middle hole and the lower hole.

[0027] Dislodging members 5, 7, 9, 11 are pivotable by means of hinges 21, 23, 25, 27 between an operative mode as shown in figure 1 and an inoperative mode as shown in figure 3.

[0028] In the operative mode as shown in figure 1 dislodging members 5, 7, 9 and 11 extend beyond magnet 3 on the active side 1a of magnet device 1. As shown in figure 2, the attaching side 1b of magnet device 1 lying opposite the active side 1a is attached during use to the free end of an operating arm 16 and the active side 1a of magnet device 1 is brought close to rubble 35 by means of the operating arm so that magnet 3 can attract rebars 37 present in the rubble. Because the dislodging members extend in the operative mode beyond magnet 3 on the active side 1a of magnet device 1, dislodging members 5, 7, 9, 11 can be inserted into the rubble 35 in order to dislodge rubble 35 without bringing magnet 3 into contact with the rubble to be dislodged. During dislodging the free ends 5a, 7a, 9a, 11a of the dislodging members embodied as elongate bodies are inserted into the rubble. On these free ends the dislodging members are each provided with an exchangeable wear tooth 37, 39, 41, 43. Dislodging members 5, 7, 9, 11 are positioned at a distance a from each other in a row. The dislodging members hereby form a comb which can be moved through the rubble.

[0029] By pulling locking pin 33 in the direction of arrow A out of the holes in hinge plates 21a/b, 23a/b, 25a/b, 27a/b and the holes in dislodging members 5, 7, 9, 11 the dislodging members 5, 7, 9, 11 are only still coupled to hinge plates 21a/b, 23a/b, 25a/b, 27a/b by means of hinge pin 31. Hinge pin 31 then serves as pivot shaft about which dislodging members 5, 7, 9, 11 can be rotated in the direction of arrow B in order to move the dislodging members into the inoperative mode shown in figure 3.

[0030] Figure 3 shows that dislodging members 5, 7, 9, 11 no longer point downward but point upward. In this inoperative mode the dislodging members 5, 7, 9, 11 no longer extend beyond magnet 3 on the active side 1a of the magnet device. As shown in figure 4, it is possible during use with the dislodging members in the inoperative mode to bring the active side 1a of magnet device 1 close to an iron road plate 45 and to pick up the iron road plate 45 by means of magnet 3.

[0031] As shown in figures 3 and 4, locking pin 33 has been inserted into upper holes 29 of hinge plates 21a/b, 23a/b, 25a/b, 27a/b which were still free in the operative mode of the dislodging members. Lower holes 47 are free in the inoperative mode of the dislodging members. In the inoperative mode of the dislodging members the locking pin 33 is inserted through upper holes 29 of the hinge plates and through the hole in the dislodging members which was aligned with lower holes 47 in the operative mode and is aligned with the upper holes 29 of the hinge plates in the inoperative mode of the dislodging members.

[0032] Figure 5 shows an alternative embodiment of magnet device 1 of figures 1-4. In this embodiment dislodging members 5, 7, 9, 11 are mounted on plate 13 for pivoting around pivot shaft 49. An actuator embodied as hydraulic working cylinder 51 is in engagement with an end 5b of the shown dislodging member 5. By lengthening or shortening working cylinder 51 the opposite end 5a of the dislodging member with wear tooth 37 thereon can be rotated around pivot shaft 49 in respectively the direction of arrow C and the direction of arrow D. By moving the dislodging members in the direction of arrow D the dislodging members can be brought into an inoperative mode in which the dislodging members no longer extend beyond magnet 3 on the active side 1 of the magnet device. An oscillating movement can be generated by alternately moving the dislodging members a short distance in the direction of arrow C and the direction of arrow D. The dislodging members thus vibrate.

[0033] In the shown embodiments the magnet and the dislodging members are each mounted individually on the frame. It is however also possible for the dislodging members to be mounted on the magnet. The walls of the magnet on which the dislodging members are then mounted must in that case be strong enough to withstand the forces occurring during dislodging of rubble.

[0034] In the shown embodiments four dislodging members are arranged in a row on one side of the frame. It is also possible for more or fewer dislodging members to be provided, for instance 1 dislodging member, or 2, 3, 5, 6, 7, 8, 9 or 10 dislodging members. Dislodging members can also be provided on more than one side of the frame.

[0035] In the shown embodiments the dislodging members are pivotable between an operative mode and an inoperative mode. Alternatively, the dislodging members are movable in other manner between the operative mode and inoperative mode, for instance by means of a sliding movement. It is also possible that in a magnet device according to the invention the dislodging members are not movable at all and can only be in the operative mode.

[0036] Although the principles of the invention have been set forth above with reference to specific embodiments, it must be understood that this description is given solely by way of example and not as limitation to the scope of protection, which is defined by the appended claims.

Claims

1. Magnet device (1) for clearing rubble (35) containing rebars (37), comprising:

- a magnet (3); and
- at least one dislodging member (5, 7, 9, 11) positioned at the magnet;

wherein

- the magnet device (1) is provided on an attaching side (1b) with a frame (13) configured for attaching to an operating arm (16) of a machine;
- the magnet (3) is positioned on an active side (1a) of the magnet device (1) lying opposite the attaching side (1b) and is attached rigidly to the frame (13) such that during use the active side (1a) of the magnet device (1) can be brought close to the surface of the rubble (35) for clearing by means of the operating arm (16) in order to attract rebars (37) present in the rubble (35) with the magnet (3); and
- the dislodging member (5, 7, 9, 11) is mounted on at least one of the frame (13) and the magnet (3).

2. Magnet device as claimed in claim 1, wherein

- the dislodging member extends at least in an operative mode beyond the magnet on the active side (1a) of the magnet device.

3. Magnet device as claimed in claim 2, wherein

- the dislodging member is selectively movable between the operative mode and an inoperative mode, wherein in the inoperative mode the dislodging member does not extend beyond the magnet on the active side of the magnet device.

4. Magnet device as claimed in claim 1, 2 or 3, wherein

- the magnet and the dislodging member are each mounted individually on the frame.

5. Magnet device as claimed in claim 4, wherein

- the frame is provided with coupling members configured to couple an operating arm of a machine to the upper side of the frame;
- the frame is provided with coupling members with which the magnet is coupled to the underside of the frame; and
- the dislodging member is mounted on a side of the frame.

6. Magnet device as claimed in any of the foregoing claims, wherein

- the dislodging member is mounted on the magnet.

7. Magnet device as claimed in claims 2 to 6,

wherein

- the dislodging member is mounted by means of a hinge, preferably on the frame, and is pivotable by means of the hinge between the operative mode and the inoperative mode, wherein the magnet device preferably further comprises a locking member for locking the dislodging member in the operative mode and in the inoperative mode.

8. Magnet device as claimed in any of the foregoing claims,
wherein

- the dislodging member comprises an elongate body, wherein the dislodging member is preferably provided on a free end thereof with an exchangeable wear tooth.

9. Magnet device as claimed in any of the foregoing claims,
comprising

- an actuator configured to cause the dislodging member to vibrate.

10. Magnet device as claimed in at least claim 2,
comprising

- an actuator configured to move the dislodging member between the operative mode and the inoperative mode.

11. Magnet device as claimed in any of the foregoing claims,
comprising

- a plurality of dislodging members positioned at a distance from each other in a row.

12. Magnet device as claimed in any of the foregoing claims,
wherein the magnet is an electromagnet.

13. Machine for rubble clearing operations, comprising an operating arm having on the free end thereof a magnet device as claimed in any of the claims 1 to 14.

14. Method for clearing rubble containing rebars by means of a magnet device as claimed in any of the claims 1 to 14,
comprising the steps of

- dislodging the rubble with at least one dislodging member, and
- removing rebars from the dislodged rubble with a magnet positioned at the dislodging member.

15. Method as claimed in claim 14,
wherein

- the dislodging member extends at least in an operative mode beyond the magnet on the active side of the magnet device, and

wherein

- the active side of the magnet device is brought close to the surface of the rubble for clearing and the dislodging member is inserted into the rubble so that the magnet can attract rebars present in the rubble and the dislodging member can dislodge the rubble;

wherein

- the magnet device is preferably displaced along the surface of the rubble for clearing following insertion of the dislodging member into the rubble.

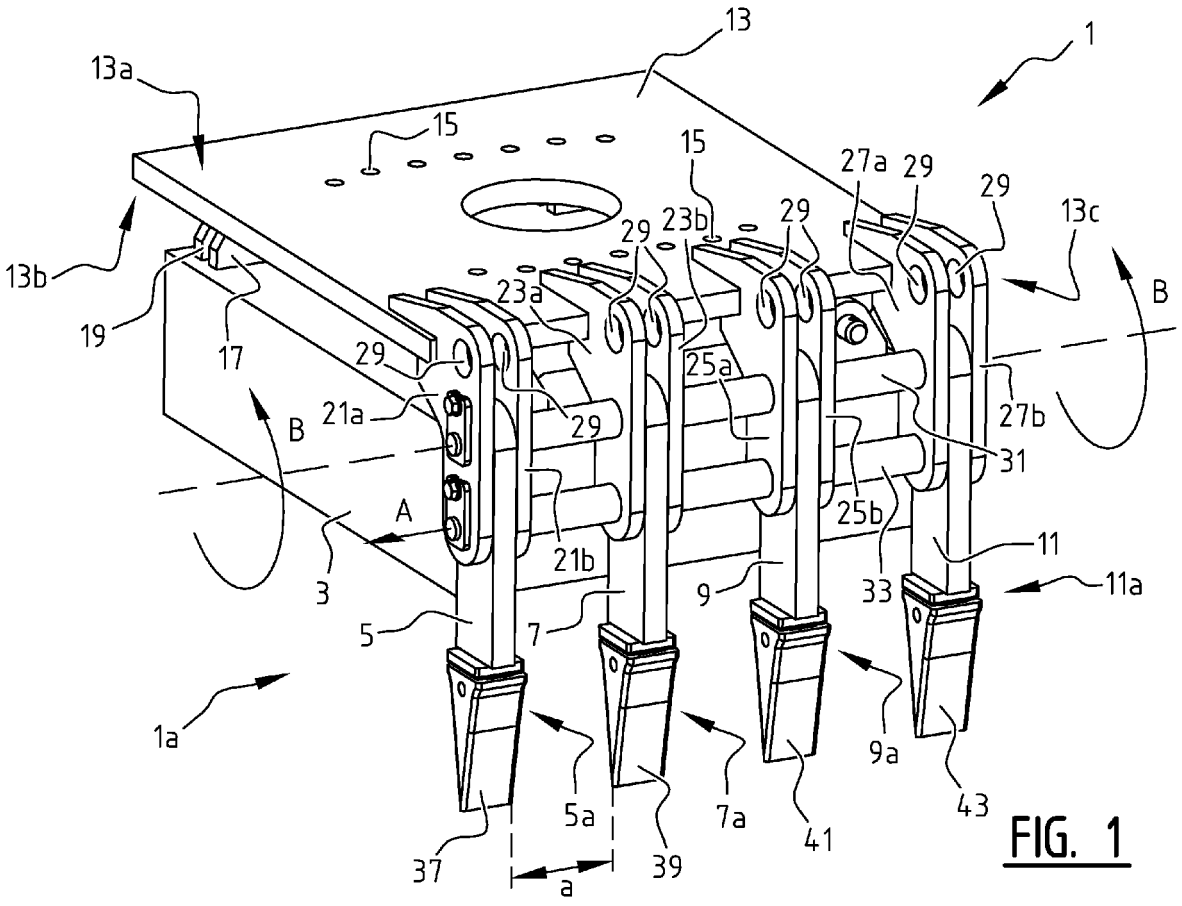
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FIG. 1

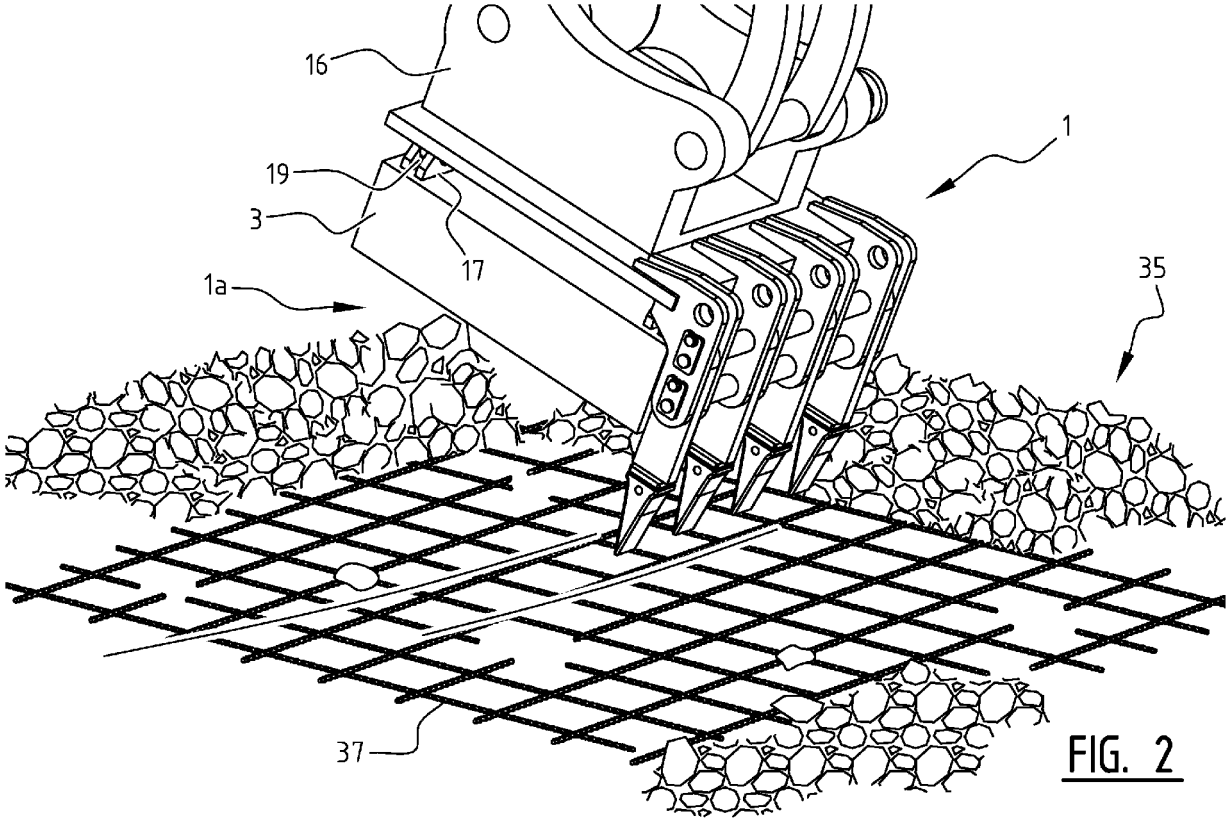

FIG. 2

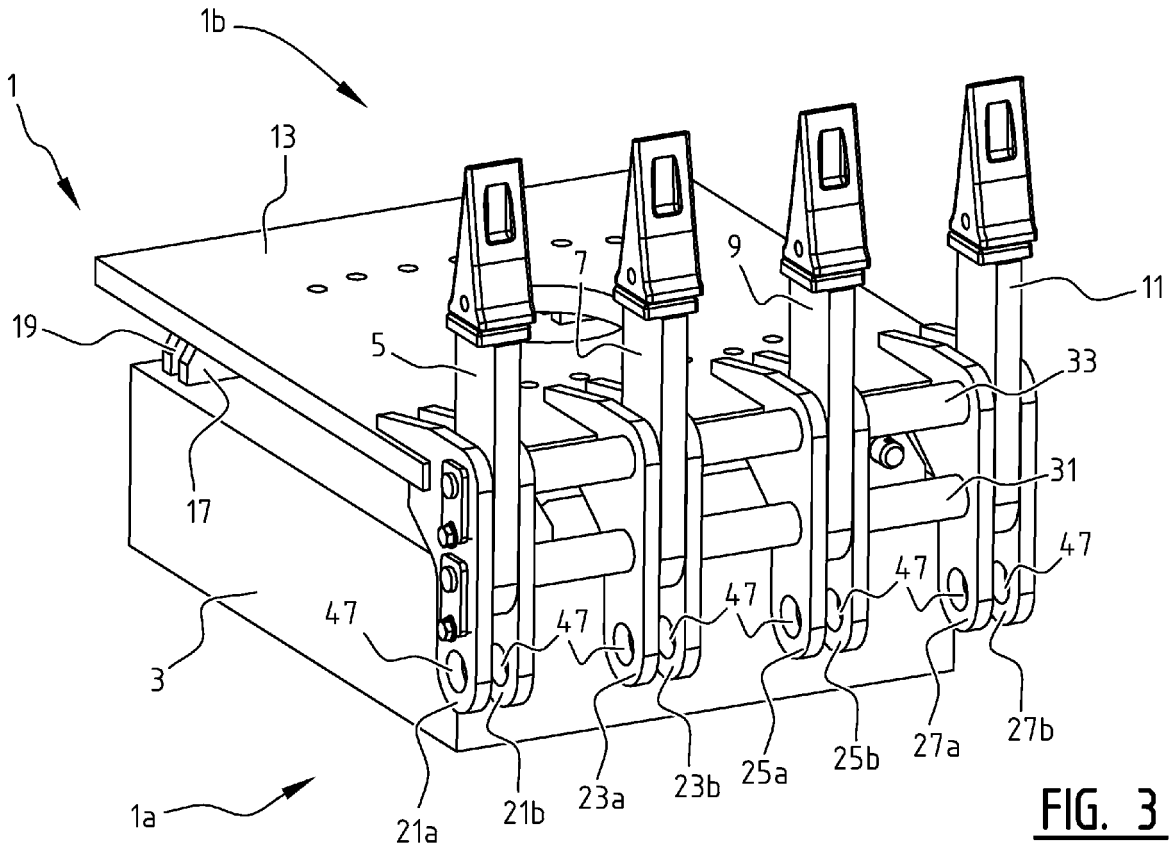
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FIG. 3

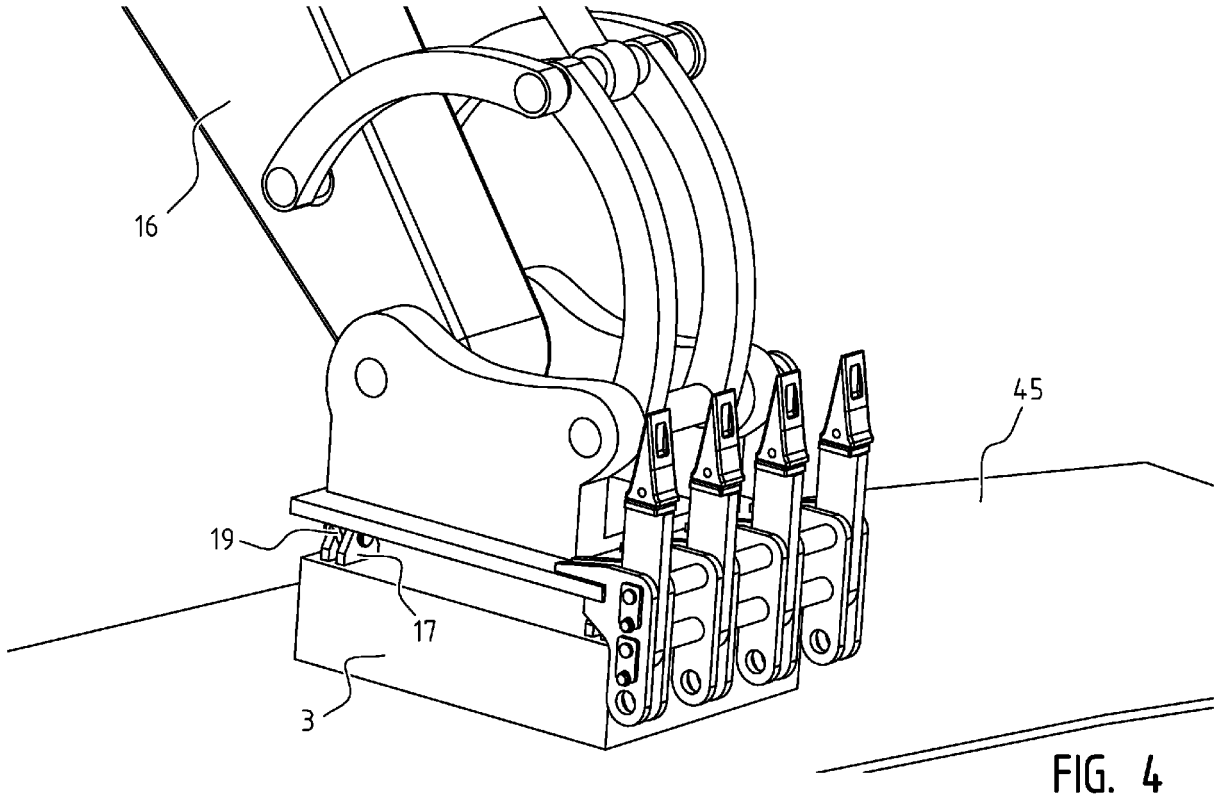

FIG. 4

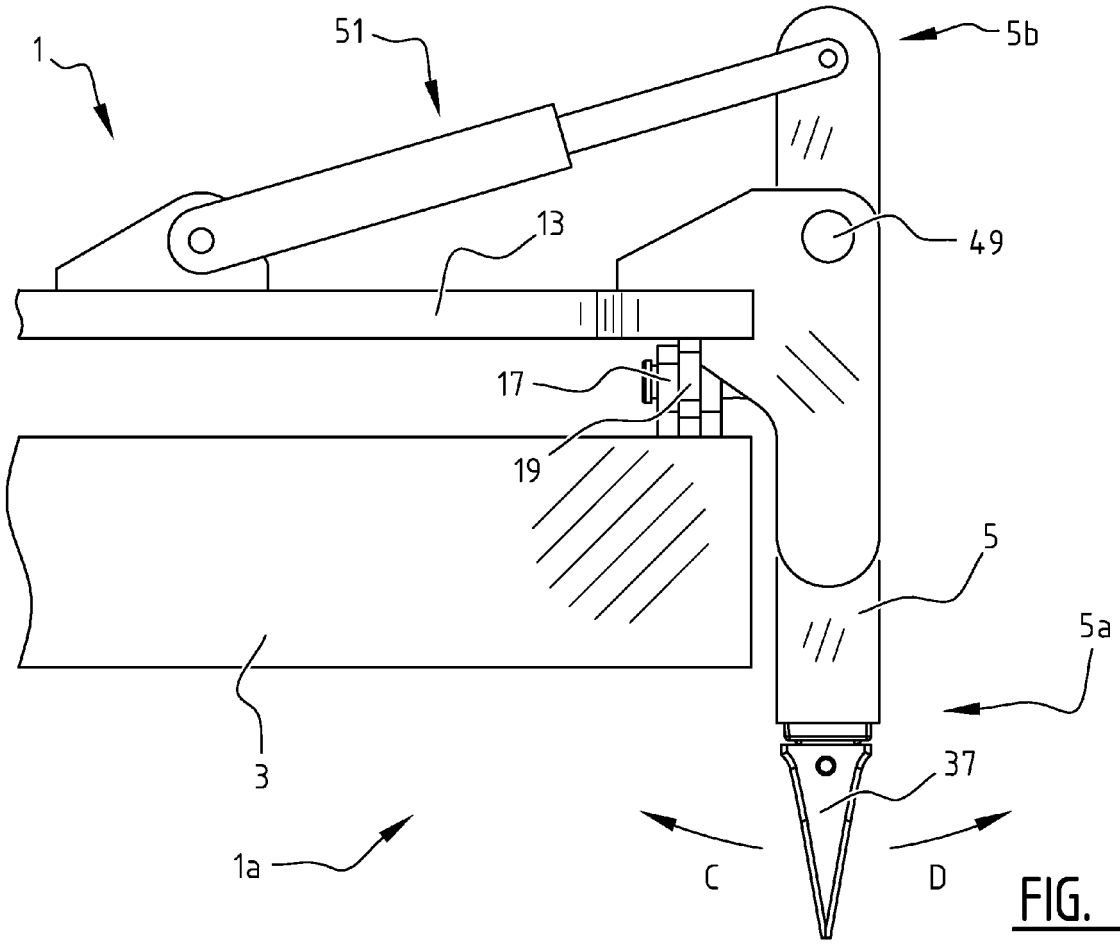

FIG. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 15 15 8688

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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X	JP H08 260505 A (NIIGATA KOBELCO KENKI KK) 8 October 1996 (1996-10-08) * figures 3,5 * * paragraph [0004] * -----	1-15	
X	JP H10 306464 A (OGURA RIICHI) 17 November 1998 (1998-11-17) * figures 1-3,5 * * paragraph [0008] - paragraph [0011] * -----	1-15	
A	US 2007/089328 A1 (GLATZ TOBIAS [DE]) 26 April 2007 (2007-04-26) * figure 1 * -----	1-15	TECHNICAL FIELDS SEARCHED (IPC) E02F B03C
A	WO 2007/017554 A1 (SAVONLINNAN PR URAKOINTI OY [FI]; RAESAENEN JANI [FI]; RAESAENEN PENTT) 15 February 2007 (2007-02-15) * figure 1 * * page 2, line 14 - line 27 * * page 3, line 1 - line 10 * * page 3, line 16 - line 19 * -----	1-15	
A	WO 01/73214 A1 (ROESSMANN MARKUS [DE]) 4 October 2001 (2001-10-04) * figure 4 * * page 7, second to last paragraph * -----	1-15	
	-/--		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	29 July 2015	Menck, Anja

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			TECHNICAL FIELDS SEARCHED (IPC)

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