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(54) **Brush for cleaning concave walls**

(57) Brush for cleaning walls having concave surface, comprising a central core (1), prevalently longitudinally developed, which is driven by corresponding motor means (6) moving it about the respective longitudinal axis (x-x) at a preset angular speed, said core (1) being associated to a motion device (3) by means of which it is moved in respect to the surface (SV) to be cleaned while the same core rotates about the said longitudinal axis (x-x), said core (1) being provided with a plurality of radial bristles (4) the distal ends of which define, in their whole, a rotational solid having a substantially convex barrel-shaped surface (SC), that is, a surface with a diameter decreasing form the middle of the core towards the two ends of the same.

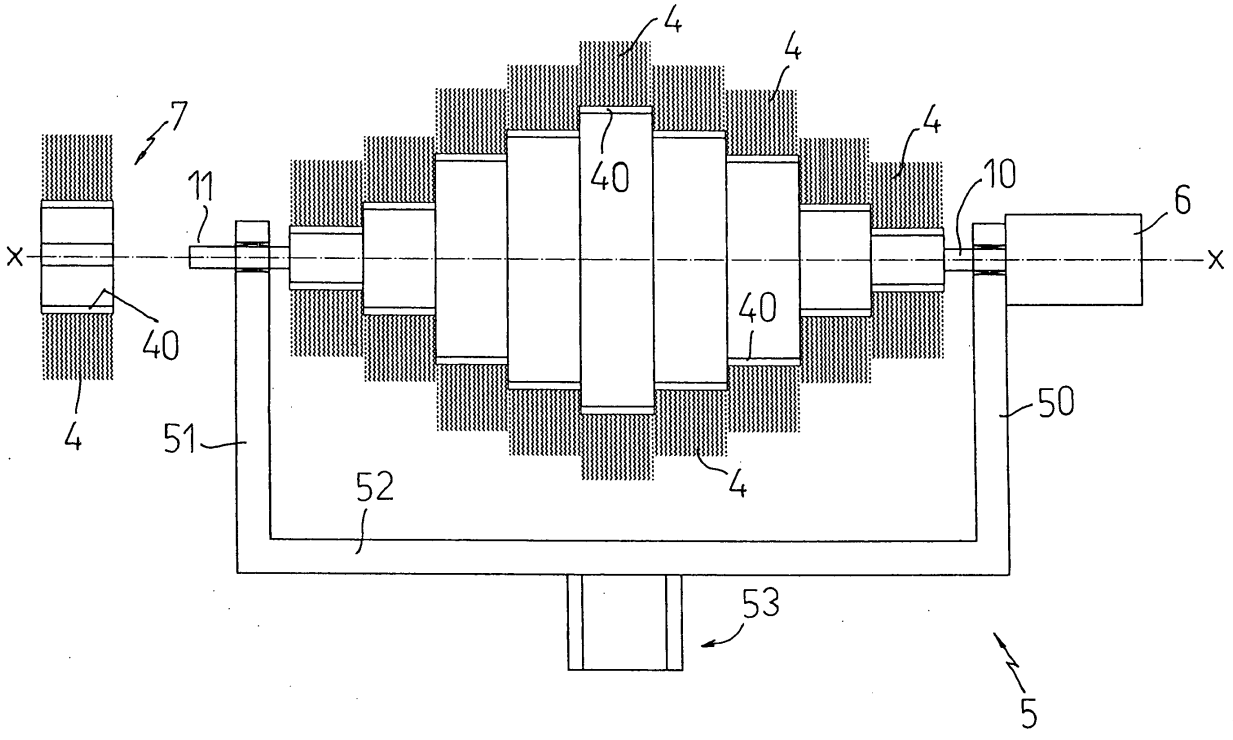

FIG.2

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Description

[0001] The present invention relates to a brush for cleaning walls having concave surface, like, for example, the vaults of road tunnels, motorway tunnels and the like.

[0002] It is known that the tunnel vaults are progressively blackened by the accumulation of soot and other materials produced by vehicular traffic, in particular, although not exclusively, by trucks.

[0003] Therefore, periodical cleaning operations are required.

[0004] The main aim of the present invention is to provide a cleaning system for walls having concave surface, particularly intended to allow a suitable cleaning of vaults of road tunnels, highway tunnels and the like.

[0005] This result has been achieved according to the invention thanks to the device having the features described in claim 1. Other features of the present invention are the object of the dependent claims.

[0006] Thanks to the present invention, it is possible to obtain the most effective cleaning of walls with concave surface, like the vaults of road and motorway tunnels, with a device which is structurally and mechanically simple, strong, economic and reliable.

[0007] These and other advantages and characteristics of the invention will be best understood by anyone skilled in the art from a reading of the following description in conjunction with the attached drawings given as a practical exemplification of the invention, but not to be considered in a limitative sense, wherein:

- Fig.1 shows a schematic frontal view of the central core of a brush according to the present invention;
- Fig.2 shows a schematic frontal view of a brush according to the invention;
- Fig.3 is a schematic exemplification concerning to the use of the brush shown in Fig.2;
- Fig.4 shows a schematic perspective view of a mechanical arm for the motion of the brush shown in Fig.2;
- Fig. 5 shows a schematic exploded perspective view of the arm shown in Fig.4.

[0008] Reduced to its essential structure and with reference to the enclosed drawings, a brush according to the invention comprises a central core (1) with prevalently longitudinal development; said core is connected to corresponding motor means (6) by means of which the same core (1) is driven into rotation about the respective longitudinal axis (x-x) with a preset angular speed. Said core (1) is also associated to a device (3) by means of which it is moved in respect to the surface (SV) to be cleaned while rotating about the said axis (x-x). On said core (1) a plurality of radial bristles (4) are applied. The distal ends of said bristles define, in their whole, a rotational solid having a substantially convex surface (SC) similar to the shape of a barrel, that is with a diameter decreasing form the middle of the core towards the two ends of the same.

[0009] According to the example shown in the figures of the enclosed drawings, said core (1) is formed by more toroidal elements (2) made of sheet-metal, whose external diameter is decreasing from the middle of the core (1) to the ends. Said toroidal elements (2) are placed side by side and welded each other along the axis (x-x), according to a symmetrical scheme in respect to the middle of the core (1). In such a way, a box-like structure is realized which is particularly light and balanced and requires a relatively limited power to be moved.

[0010] The bristles (4) emerge from correspondents bands (40), of the type available in commerce, applied on the external lateral surface of each toroidal element (2) of the core (1).

[0011] According to an advantageous embodiment of the present invention, the bristles applied on the toroidal element or elements (2) in correspondence of the middle of the core (1) are longer than the bristles applied on the other elements (2) of the same core.

[0012] The core (1) has two portions at its axial ends (10,11), each of which is inserted, free to rotate about the longitudinal axis (x-x) of the core (1), in a corresponding arm (50, 51) of a support cradle (5): an end (10) is connected to a hydraulic motor (6) which is supported by the same arm (50), while the other end (11) is free and can be used as a coupling element for an additional brush (7) as better described below.

[0013] The cradle (5) has an appendix (53), is disposed at the middle of a transverse bar (52) connecting the arms (50, 51), for connecting it to the aforesaid motion device (3). The device (3), according to the embodiment shown in Fig.3, Fig.4 and Fig.5, comprises an arm with two sections (30, 31) linked to each other. More particularly, the front section (30) is prevalently longitudinally developed and has a front end (32), to which the appendix (53) of the cradle (5) is intended to be fixed, and a rear cylindrical bush (33); the latter is orthogonal to the longitudinal axis of the said front section (30) and is linked to a rear box-shaped element (34), free to rotate about its own axis (b-b), being driven by a corresponding double-effect actuator (39). The rear section (31) is fork-shaped. The rear part (35) of the fork is connected to a motion device (8) of known type mounted, for example, on a truck (9). The front ends (36) of the fork are connected, by means of a hinge (37), to a bush (38) which is disposed on the rear side of the aforesaid box-shaped element (34) and whose axis (c-c) is orthogonal to the axis (b-b) of the bush (33). Moreover, said sections (30, 31) are linked to each other by means of a double-effect actuator (390) which is connected, on one side, to the rear part of the said fork and, on the opposite side, to the back side of the element (34) above the bush (38).

[0014] Thus, the activation of the cylinder (390) determines the rotation (RO) of section (30) about the axis (c-c), while the cylinder (39) determines the rotation (RV) of same section (30) about the axis (b-b). The movements thus given to the section (30) are correspondingly transmitted to the cradle (5) to which it is fixed and, conse-

quently, to the brush (1, 4).

[0015] Said additional side-brush (7) is engaged to the axis of the core (1) on opposite side in respect to the motor (6), so to project laterally outside from the cradle (5), i.e. from the arm (51) of the latter. Such additional element (7) is useful, in particular, for the cleaning of zones surrounding the road signs and/or the signalling panels normally placed along tunnels.

[0016] In operative conditions, as the truck (9) proceeds along a tunnel, the above described device provides the brushing of the surface (SV) in maintenance, thanks to the rotation of the core (1), which is driven by the motor (6), and thanks to the motion of the cradle (5) by means of the motion unit (3, 8) which is controlled by the driver of the truck or another worker. The particular barrel-shape of the brush ensures the most suitable brushing of the surface (SV) although the latter is concave.

[0017] In practice, the execution details may vary as regards the shape, the size, the arrangement of the elements, the kind of material used, but they are within the limits of the solution adopted and within the limits of the protection offered by the present patent.

Claims

1. Brush for cleaning walls having concave surface, **characterized in that** it comprises a central core (1), prevalently longitudinally developed, which is driven by corresponding motor means (6) moving it about the respective longitudinal axis (x-x) at a preset angular speed, said core (1) being associated to a motion device (3) by means of which it is moved in respect to the surface (SV) to be cleaned while the same core rotates about the said longitudinal axis (x-x), said core (1) being provided with a plurality of radial bristles (4) the distal ends of which define, in their whole, a rotational solid having a substantially convex barrel-shaped surface (SC), that is, a surface with a diameter decreasing form the middle of the core towards the two ends of the same.

2. Brush according to claim 1, **characterized in that** said core (1) is made of a plurality of sheet-metal toroidal elements (2), whose external diameter decreases from the middle of the core (1) towards the ends thereof.

3. Brush according to claim 2, **characterized in that** said toroidal elements (2) are placed side by side and welded to each other along the said longitudinal axis (x-x), according to a symmetrical disposition in respect to the middle of the core (1).

4. Brush according to claims 1 and 2, **characterized in that** said bristles (4) emerge from correspondents bands (40) applied onto the external lateral surface of each toroidal element (2) of the core (1).

5. Brush according to claim 1, **characterized in that** said core (1) has two portions at its axial ends (10, 11), each of which is inserted, free to rotate about the longitudinal axis (x-x) of the core (1), in a corresponding arm (50, 51) of a support cradle (5), an end (10) being connected to a hydraulic motor (6) supported by the same arm (50), the other end (11) being free and constituting a coupling element for an additional brush (7).

6. Brush according to claims 1 and 5, **characterized in that** said cradle (5) has an appendix (53) which is disposed at the middle of a transverse bar (52) connecting the arms (50, 51), for connecting it to the said motion device (3).

7. Brush according to claim 5, **characterized in that** said motion device (3) comprises an arm with two sections (30, 31) linked to each other: a front section (30) being prevalently longitudinally developed and having a front end (32), to which the appendix (53) of the cradle (5) is fixed, and a rear cylindrical bush (33), orthogonal to the axis of the same section (30) and which is connected at a rear box-shaped element (34), to rotate about its own axis (b-b) being driven by a correspondent double-effect actuator (39); a rear section (31) being fork-shaped, wherein a rear part (35) of the fork is connected to a motion device (8) mounted on a truck (9), the front ends (36) of the fork being linked, by means of a hinge (37), to a bush (38) which is disposed on the rear side of said element (34) and whose axis (c-c) is orthogonal to the axis (b-b) of the bush (33); said sections (30, 31) being connected to each other by means of a double-effect actuator (390) which is connected, on one side, to the rear part of the fork and, on the opposite side, to the back side of the box-shaped element (34), above the bush (38).

8. Brush according to claim 5, **characterized in that** said additional brush (7) is engaged on the axis of the core (1) on opposite side in respect to the said motor (6), so as to project laterally outside from the cradle (5), i.e. from the arm (51) of the latter.

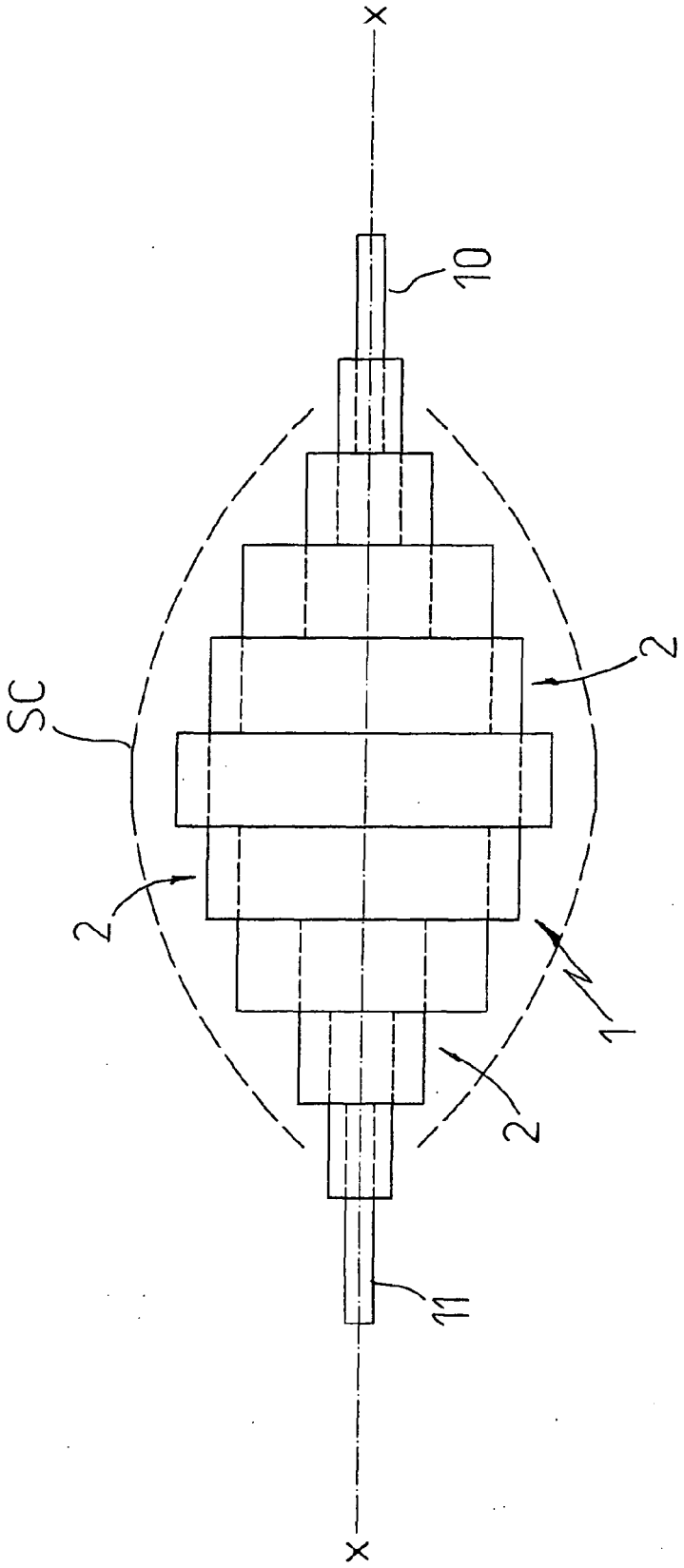


FIG.1

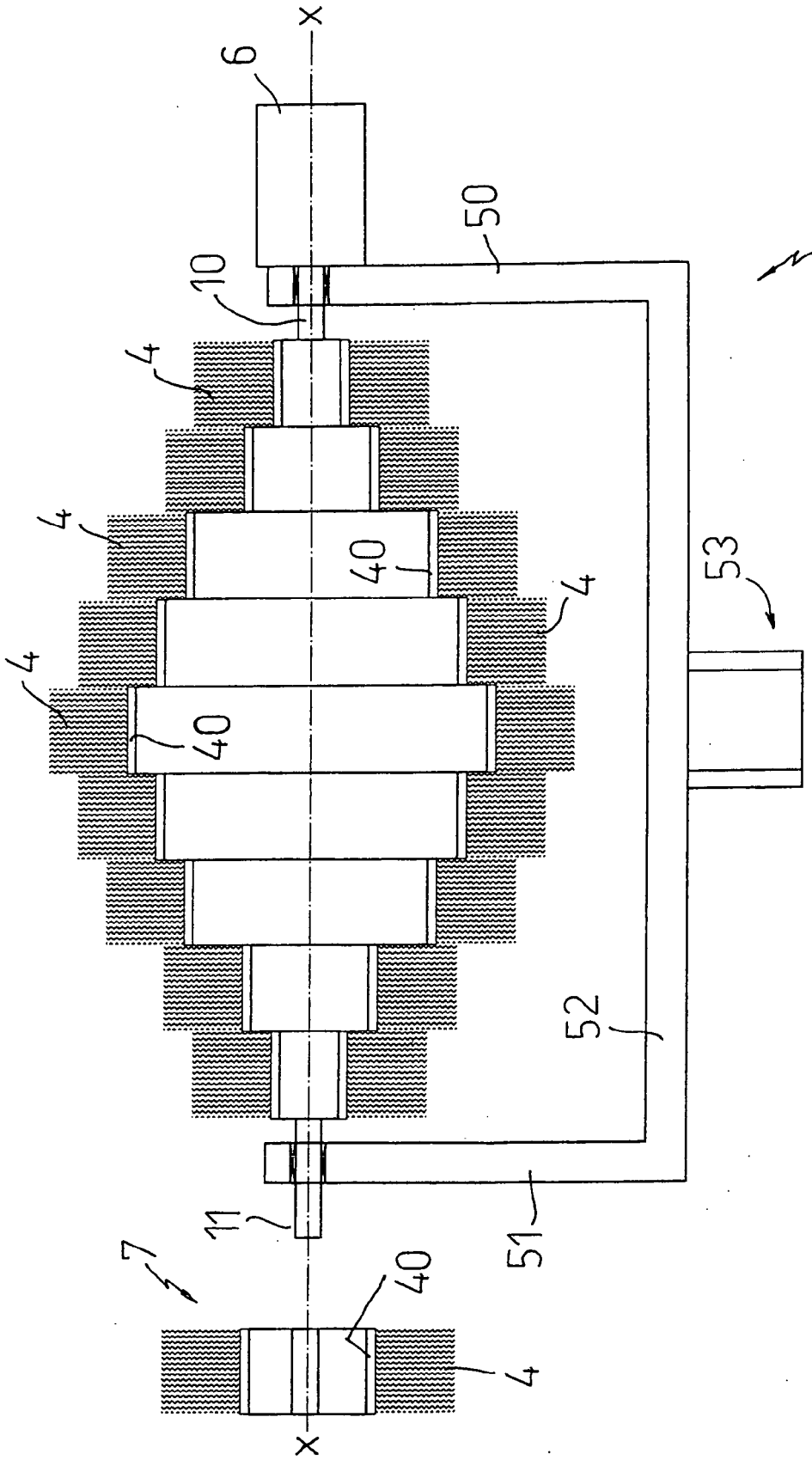
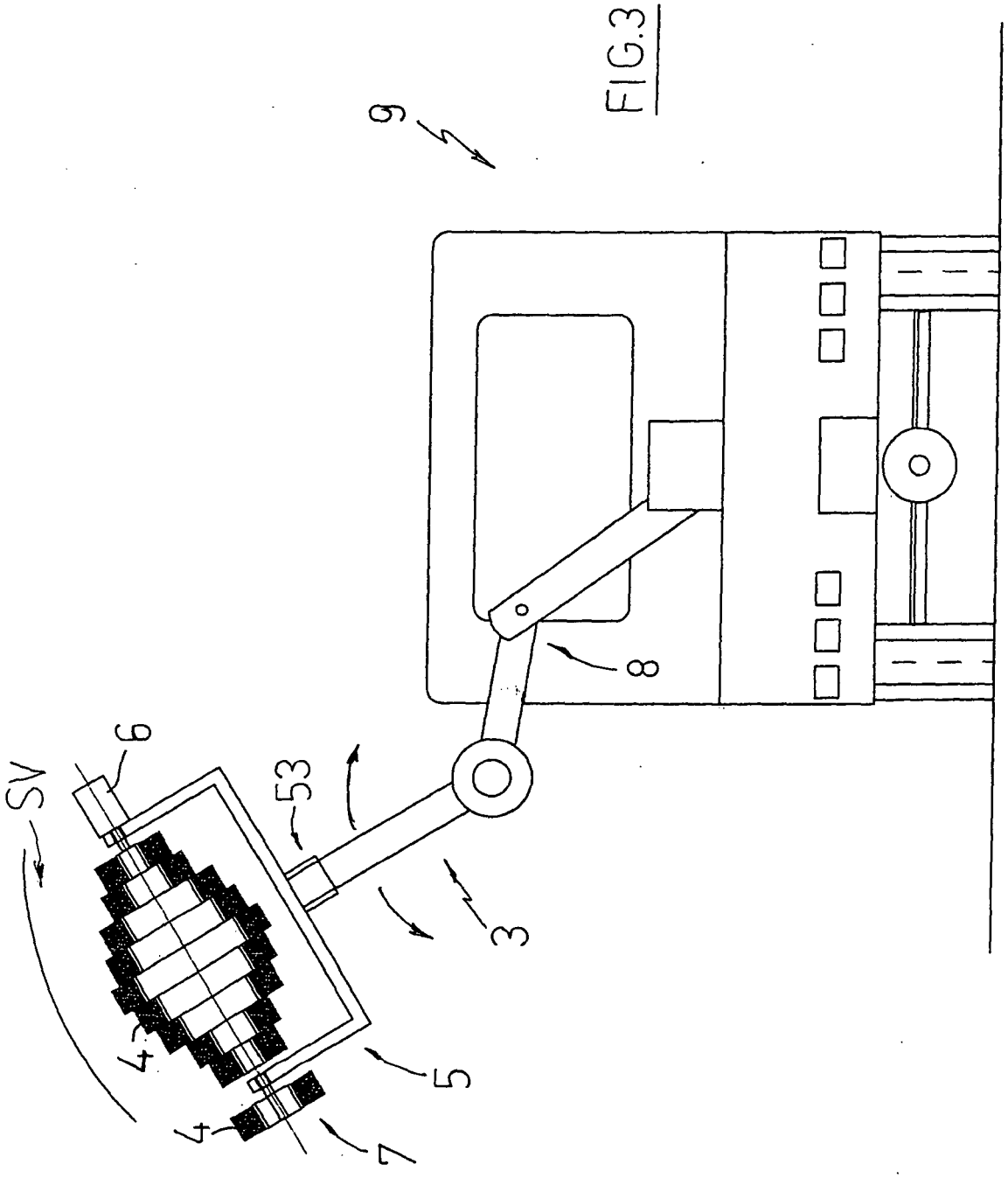


FIG.2

FIG.3



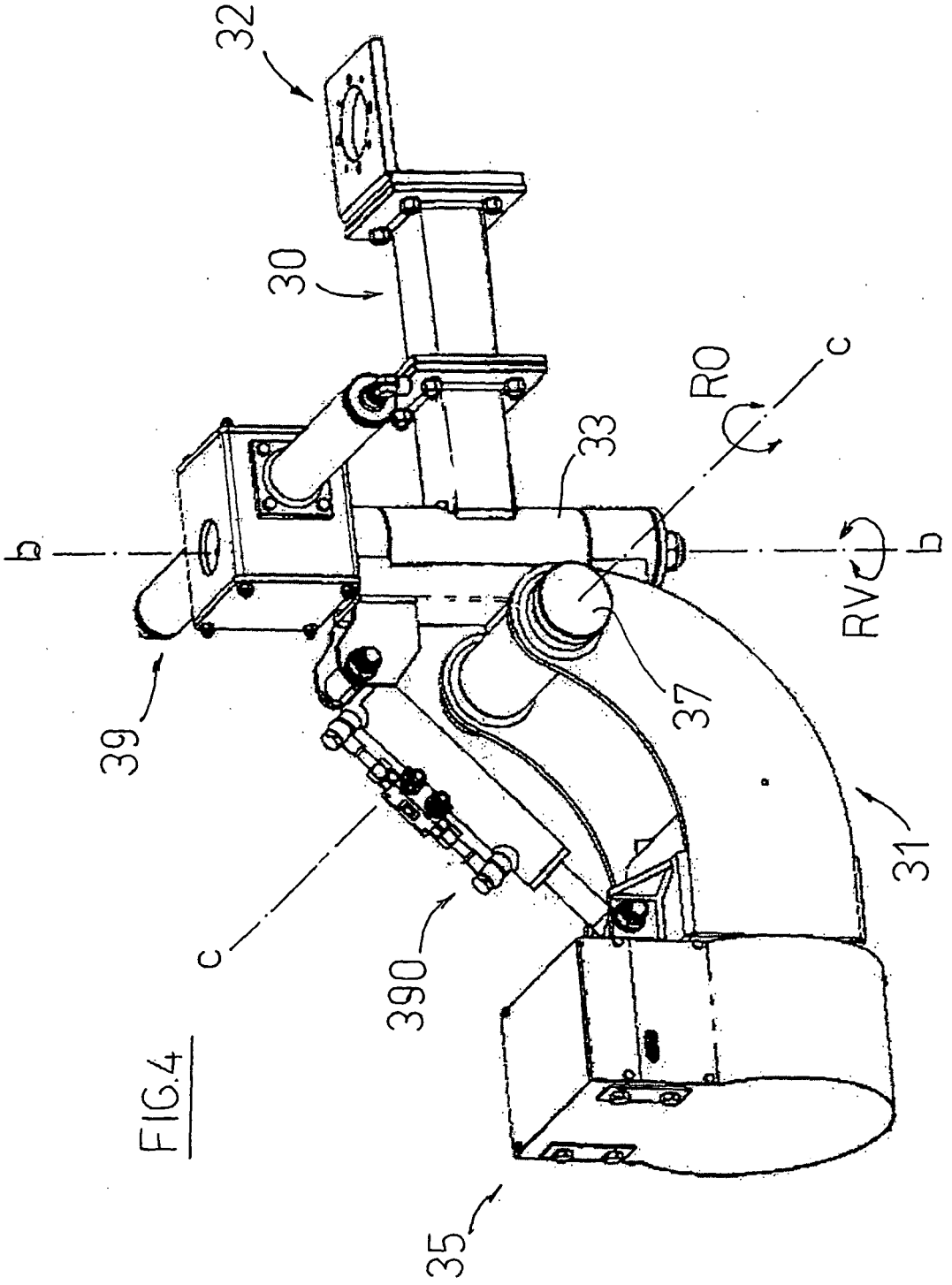


FIG.4

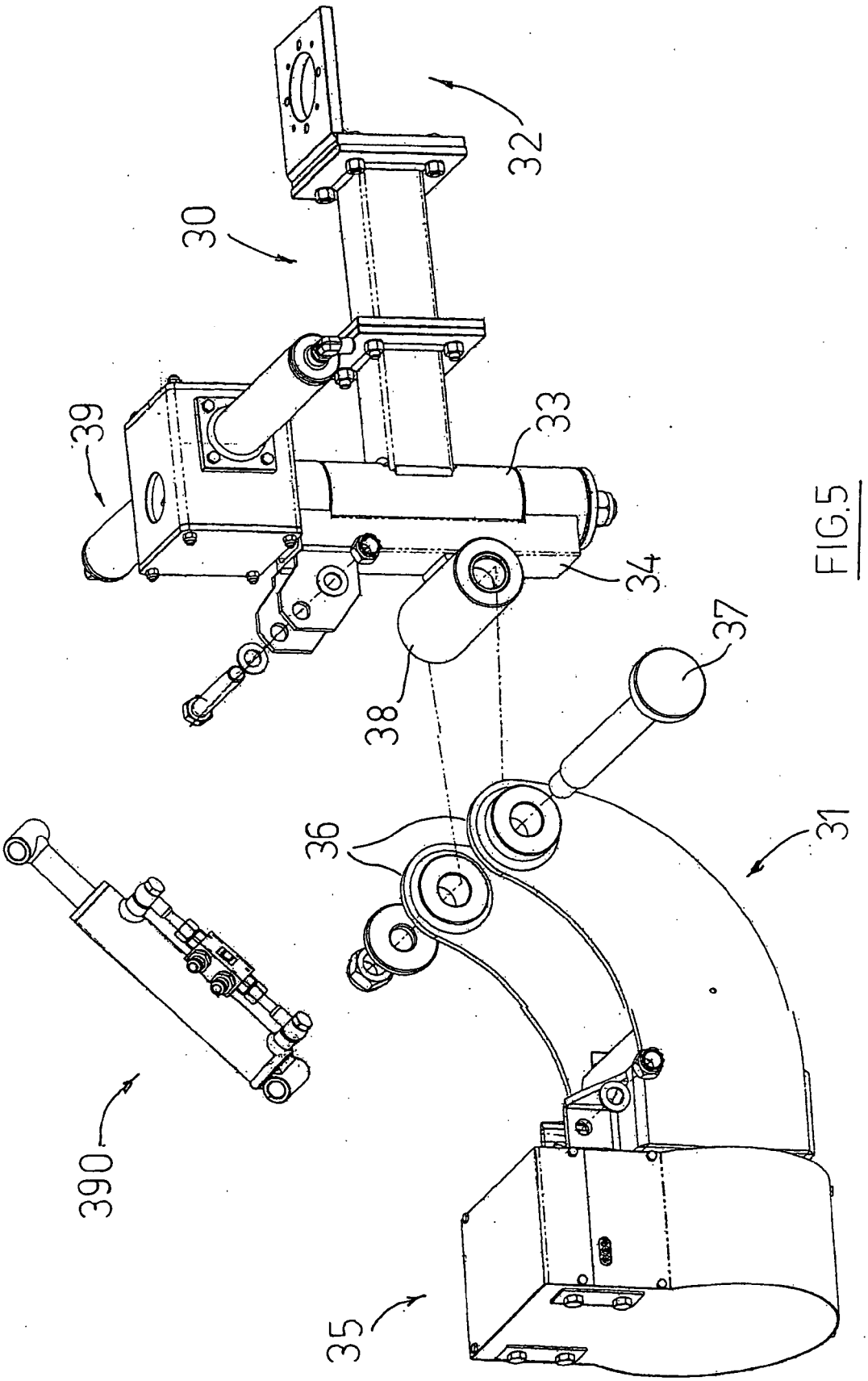


FIG.5

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EUROPEAN SEARCH REPORT

Application Number
EP 07 00 3068

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Y	DE 242 117 A (C.V. MOLITOR IN BRETTEN) 22 December 1911 (1911-12-22) * the whole document *	1	
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A	DE 197 34 289 C1 (MAYER GEORG [DE]) 26 November 1998 (1998-11-26) * abstract; figure 1 *	1	
A	DE 40 35 519 A1 (PUTZMEISTER MASCHF [DE]) 16 May 1991 (1991-05-16) * abstract; figures 1-5 *		TECHNICAL FIELDS SEARCHED (IPC) A46B E01H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	11 July 2007	Nicolás, Carlos

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