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(54) **ROTARY SNOW TILLER FOR GROOMING SKI SLOPES**

ROTIERENDE SCHNEEFRÄSE ZUM PFLEGEN VON SKIPISTEN

FRAISE À NEIGE POUR DAMAGE DE PISTES DE SKI

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## Description

### TECHNICAL FIELD

**[0001]** The present invention relates to a rotary snow tiller for grooming ski slopes.

### BACKGROUND ART

**[0002]** A rotary snow tiller for grooming ski slopes normally advances in a travelling direction, and comprises a frame; a shaft rotating about a first axis transverse to the travelling direction, and having teeth for breaking up the snow surface; and a protective casing surrounding the shaft.

**[0003]** Known rotary snow tillers of the above type have proved particularly effective in grooming ski slopes, but have several drawbacks, one of which is that the position of the shaft with respect to the snow surface (tilling depth) can only be adjusted by moving the entire frame. Because the frame often supports other snow-working devices, movement of the frame also alters - in most cases, involuntarily - the position of the other devices, such as the finish mat.

**[0004]** In order to overcome the above-identified drawback there are provided rotary tillers, wherein the shaft can be adjusted with respect to the frame in a direction transversal to the travelling direction and to the axis of the shaft. Some example of rotary tiller provided with such an adjustment device are disclosed in US 5,632,106; FR 2,740,194; US 5,659,984; US 3,746,101; US 4,786,111; and US 5,354,147. However, such an adjustment device modifies not only the tilling depth but also the space between the shaft and the surrounding casing and, thus, modifies the structure of the worked snow coat, because part of the working action on the snow is achieved by circulating the snow between the shaft and the casing.

### DISCLOSURE OF INVENTION

**[0005]** It is an object of the present invention to provide a rotary snow tiller for grooming ski slopes, designed to eliminate the drawbacks of the known art in a straightforward, low-cost manner.

**[0006]** According to the present invention, there is provided a rotary snow tiller for grooming the snow surface of ski slopes and designed to advance in a travelling direction, the rotary snow tiller comprising a frame; a shaft rotating about a first axis transverse to the travelling direction, and having teeth for breaking up the snow surface; a protective casing surrounding the shaft; and an adjusting device for selectively adjusting the position of the shaft with respect to the frame and the casing; wherein the adjusting device comprises first actuators to adjust the position of the shaft in a first direction transverse to the first axis and to the travelling direction; the rotary snow tiller being characterized in that the adjusting device comprises second actuators to adjust the position of the

shaft in a further direction substantially parallel to the travelling direction with respect to the casing.

**[0007]** In accordance with the invention it is possible to adjust, in a direction parallel to the travelling direction, the relative position of the shaft with respect to the casing, in particular at entrance and at the exit independently of the working depth.

### BRIEF DESCRIPTION OF THE DRAWINGS

**[0008]** A number of non-limiting embodiments of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a partly schematic side view, with parts removed for clarity, of a rotary snow tiller, for grooming ski slopes, in accordance with the present invention;

Figure 2 shows a perspective view, with parts removed for clarity, of a variation of the Figure 1 rotary snow tiller.

### BEST MODE FOR CARRYING OUT THE INVENTION

**[0009]** Number 1 in Figure 1 indicates as a whole a rotary snow tiller for grooming the snow surface M of ski slopes, and which is towed in direction D by a snow groomer vehicle not shown in the drawings.

**[0010]** In the example shown in the attached drawings, rotary snow tiller 1 provides for tilling a surface layer of snow surface M of ski slopes, and comprises a frame 2; a shaft 3 mounted to rotate with respect to frame 2 about an axis A1, and extending transverse to travelling direction D; a protective casing 4 surrounding shaft 3; a normally flexible finish mat 5 which is connected to casing 4, extends behind shaft 3, and is drawn over the surface of the tilled snow surface M; and an adjusting device 6 for adjusting the position of shaft 3 with respect to frame 2 and casing 4.

**[0011]** Frame 2 comprises a bar 7 parallel to axis A1; a hitch device 8 fixed to bar 7 and for connecting rotary snow tiller 1 to the snow groomer vehicle (not shown in the drawings); two arc-shaped segments 9 fixed to and transverse to bar 7; and two supporting bars 10 (only one shown in Figure 1) for supporting shaft 3.

**[0012]** Rotary snow tiller 1 comprises two adjustable panels 11 which have the purpose to protect casing 4 and finish mat 5 from the snow thrown up by the groomer vehicle not shown in the drawings.

**[0013]** Shaft 3 comprises a number of teeth 12 equally spaced about and along axis A1, and each of which projects radially from shaft 3 to penetrate snow surface M.

**[0014]** The length of shaft 3 defines the work range and the width of rotary snow tiller 1 as a whole.

**[0015]** Adjusting device 6 comprises two slides 13 (only one shown in Figure 1), each connected in sliding manner to a respective supporting bar 10; two further supporting bars 14, each arranged transverse to supporting

bars 10 and engaging in sliding manner a respective slide 13; and two blocks 15, each fitted to the end of a respective supporting bar 14 and connected in rotary manner to a respective end of shaft 3. In the example shown, one of blocks 15 supports a hydraulic motor 16 for rotating shaft 3 about axis A1.

[0016] Each slide 13 is connected to respective supporting bar 10 by an actuator 17 - which, in the Figure 1 example, is a double-acting hydraulic cylinder - and is connected to the respective further supporting bar 14 by a further actuator 18 - which, in the Figure 1 example, is also a double-acting hydraulic cylinder.

[0017] In actual use, rotary snow tiller 1 tills a surface layer of snow surface M by hydraulic motor 16 rotating shaft 3.

[0018] The depth of the tilled surface layer of snow surface M depends on the position of teeth 12 and shaft 3 with respect to snow surface M.

[0019] Adjusting device 6 provides for adjusting the tilling depth, without altering the position of frame 2 and casing 4, by simply activating actuators 18.

[0020] When the tilling depth is adjusted, the position of finish mat 5 therefore also remains unchanged.

[0021] Operation of actuators 17 moves shaft 3 in a direction parallel to travelling direction D, and provides for increasing or reducing recirculation of the tilled snow between casing 4 and shaft 3 for a given tilling depth.

[0022] In the Figure 2 variation, adjusting device 6 is replaced by an adjusting device 19, and supporting bars 10 of frame 2 are eliminated. Adjusting device 19 comprises two supporting plates 20 movable with respect to frame 2; and two arms 21 mounted to rotate with respect to frame 2 about an axis A2 parallel to axis A1.

[0023] Each arm 21 supports a respective supporting plate 20, and is operated by an actuator 22 connected to frame 2 and to arm 20. In the Figure 2 example, actuator 22 is a double-acting hydraulic cylinder.

[0024] Supporting plate 20 is mounted to slide along arm 21. In other words, arm 21 engages a guide 23 formed in supporting plate 20, which is movable selectively with respect to arm 21 by an actuator 24 which, in the Figure 2 example, is a double-acting hydraulic cylinder connected to arm 21 and to supporting plate 20.

[0025] Figure 2 only shows one supporting plate 20, one arm 21, one actuator 22, one guide 23, and once actuator 24.

[0026] A hydraulic motor 25 is connected to shaft 3 and fixed to one of supporting plates 20 to rotate shaft 3 about respective axis A1.

[0027] In actual use, adjusting device 19 provides for adjusting the tilling depth, and for adjusting the position of shaft 3 in a direction parallel to travelling direction D, to reduce the distance between shaft 3 and casing 4 on the inlet side, depending on the rotation direction of shaft 3.

[0028] In other words, shaft 3 can be moved forward or back, for a given tilling depth of snow surface M, to adjust the distance between shaft 3 and casing 4 and so

adjust the amount of snow recirculated between casing 4 and shaft 3.

[0029] This adjustment by adjusting device 19 is made possible by the system of polar coordinates centered about axis A2.

## Claims

1. A rotary snow tiller for grooming the snow surface (M) of ski slopes and designed second actuators to advance in a travelling direction (D), the rotary snow tiller (1) comprising a frame (2); a shaft (3) rotating about a first axis (A1) transverse to the travelling direction (D), and having teeth (12) for breaking up the snow surface (M) of ski slopes; and a protective casing (4) surrounding the shaft (3); an adjusting device (6; 19) for selectively adjusting the position of the shaft (3) with respect second actuators to the frame (2) and the casing (4); wherein the adjusting device (6; 19) comprises first actuators (18; 22) to adjust the position of the shaft (3) in a first direction transverse second actuators to the first axis (A1) and to the travelling direction (D); the rotary snow tiller (1) being **characterized in that** the adjusting device (6; 18) comprises second actuators (17; 24) to adjust the position of the shaft (3) with respect to the casing (4) in a further direction substantially parallel second actuators to the travelling direction, (D).
2. A rotary snow tiller as claimed in Claim 1, **characterized by** comprising a protective casing (4) integral with the frame (2).
3. A rotary snow tiller as claimed in Claim 2, **characterized by** comprising a finish mat (5) connected to the protective casing (4) and located downstream from the shaft (3) with reference to the travelling direction (D).
4. A rotary snow tiller as claimed in any one of the foregoing Claims, **characterized in that** the frame (2) comprises two supporting bars (10) for supporting the shaft (3); the adjusting device (6) comprising two slides (13), each of which is connected in sliding manner to a respective supporting bar (10) and is connected to the shaft (3).
5. A rotary snow tiller as claimed in Claim 4, **characterized in that** each second actuator (17) is connected to a respective slide (13) and to the frame (2) to move the respective slide (13) with respect to the respective supporting bar (10).
6. A rotary snow tiller as claimed in Claim 4 or 5, **characterized in that** the adjusting device (6) comprises two further supporting bars (14), each of which extends transverse to a respective supporting bar (10),

engages in sliding manner a respective slide (13), and is connected in rotary manner to a respective end of the shaft (3).

7. A rotary snow tiller as claimed in Claim 6, **characterized in that** each first actuator (18) is connected to a respective further supporting bar (14) and to a respective slide (13) to adjust the position of the further supporting bar (14) with respect to the slide (13). 5
8. A rotary snow tiller as claimed in any one of Claims 1 to 3, **characterized in that** the adjusting device (19) comprises two movable supporting members (20) fitted in rotary manner to said shaft (3); the supporting members (20) being adjustable with respect to the frame (2). 10
9. A rotary snow tiller as claimed in Claim 8, **characterized in that** the adjusting device (19) comprises two arms (21) connected to the frame (2); each supporting member (20) being connected in sliding manner to a respective arm (21). 15
10. A rotary snow tiller as claimed in Claim 9, **characterized in that** each of said arms (21) is mounted to rotate with respect to the frame (2) about a second axis (A2) parallel to the first axis (A1). 20
11. A rotary snow tiller as claimed in Claim 10, **characterized in that** each first actuator (22) is connected to a respective arm (21) and to the frame (2) to rotate the respective arm (21) about the second axis (A2). 25
12. A rotary snow tiller as claimed in any one of Claims 9 to 11, **characterized in that** each second actuator (24) is connected to a respective arm (21) and to a respective supporting member (20) to move the respective supporting member (20) with respect to the arm (21). 30

#### Patentansprüche

1. Dreh-Schneefräse zum Präparieren der Schneeoberfläche (M) von Skipisten und ausgelegt, um sich in einer Fahrtrichtung (D) vorwärtszubewegen, wobei die Dreh-Schneefräse (1) umfasst: einen Rahmen (2); eine Welle (3), die sich um eine erste Achse (A1) querverlaufend zur Fahrtrichtung (D) dreht und Zähne (12) zum Aufbrechen der Schneeoberfläche (M) von Skipisten aufweist; und ein Schutzgehäuse (4), das die Welle (3) umgibt; eine Einstellvorrichtung (6; 19) zum selektiven Einstellen der Position der Welle (3) in Bezug auf den Rahmen (2) und das Gehäuse (4); wobei die Einstellvorrichtung (6; 19) erste Stellglieder (18; 22) zum Einstellen der Position der Welle (3) in einer ersten zur ersten Achse (A1) und zur Fahrtrichtung (D) querverlaufenden Richtung 45

umfasst; wobei die Dreh-Schneefräse (1) **dadurch gekennzeichnet ist, dass** die Einstellvorrichtung (6; 19) zweite Stellglieder (17; 24) zum Einstellen der Position der Welle (3) in Bezug auf das Gehäuse (4) in einer weiteren Richtung im Wesentlichen parallel zur Fahrtrichtung (D) umfasst.

2. Dreh-Schneefräse nach Anspruch 1, **dadurch gekennzeichnet, dass** diese ein mit dem Rahmen (2) einstückiges Schutzgehäuse (4) umfasst. 10
3. Dreh-Schneefräse nach Anspruch 2, **dadurch gekennzeichnet, dass** diese eine Abziehmatten (5) umfasst, die mit dem Schutzgehäuse (4) verbunden ist und nach der Welle (3) nachgelagert in Bezug auf die Fahrtrichtung (D) ist. 15
4. Dreh-Schneefräse nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** der Rahmen (2) zwei Tragstangen (10) zum Tragen der Welle (3) umfasst; wobei die Einstellvorrichtung (6) zwei Gleitstücke (13) umfasst, die beide mit einer entsprechenden Tragstange (10) gleitend verbunden sind, und verbunden mit der Welle (3). 20
5. Dreh-Schneefräse nach Anspruch 4, **dadurch gekennzeichnet, dass** jedes der zweiten Stellglieder (17) mit einem entsprechenden Gleitstück (13) und mit dem Rahmen (2) verbunden ist, um das entsprechende Gleitstück (13) in Bezug auf die entsprechende Tragstange (10) zu bewegen. 25
6. Dreh-Schneefräse nach Anspruch 4 oder 5, **dadurch gekennzeichnet, dass** die Einstellvorrichtung (6) zwei weitere Tragstangen (14) umfasst, die sich beide quer zu einer entsprechenden Tragstange (10) erstrecken, gleitend in ein entsprechendes Gleitstück (13) eingreift, und drehend mit einem entsprechenden Ende der Welle (3) verbunden ist. 30
7. Dreh-Schneefräse nach Anspruch 6, **dadurch gekennzeichnet, dass** jedes der ersten Stellglieder (18) mit einer entsprechenden weiteren Tragstange (14) und einem entsprechenden Gleitstück (13) verbunden ist, um die Position der weiteren Tragstange (14) in Bezug auf das Gleitstück (13) einzustellen. 35
8. Dreh-Schneefräse nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** die Einstellvorrichtung (19) zwei bewegliche Tragstangen (20) umfasst, die drehend an der Welle (3) angebracht sind; wobei die Tragstangen (20) in Bezug auf den Rahmen (2) verstellbar sind. 40
9. Dreh-Schneefräse nach Anspruch 8, **dadurch gekennzeichnet, dass** die Einstellvorrichtung (19) zwei Arme (21) umfasst, die mit dem Rahmen (2) verbunden sind; wobei jede Tragstange (20) gleitend 45

mit einem entsprechenden Arm (21) verbunden ist.

10. Dreh-Schneefräse nach Anspruch 9, **dadurch gekennzeichnet, dass** jeder der Arme (21) angeordnet ist, um sich in Bezug auf den Rahmen (2) um eine zweite Achse (A2) parallel zur ersten Achse (A1) zu drehen. 5
11. Dreh-Schneefräse nach Anspruch 10, **dadurch gekennzeichnet, dass** jedes der ersten Stellglieder (22) mit einem entsprechenden Arm (21) und dem Rahmen (2) verbunden ist, um den entsprechenden Arm (21) um die zweite Achse (A2) zu drehen. 10
12. Dreh-Schneefräse nach einem der Ansprüche 9 bis 11, **dadurch gekennzeichnet, dass** jedes der zweiten Stellglieder (24) mit einem entsprechenden Arm (21) und einer entsprechenden Tragstange (20) verbunden ist, um die entsprechende Tragstange (20) in Bezug auf den Arm (21) zu bewegen. 15 20

#### Revendications

1. Dameuse rotative pour damer la surface enneigée (M) des pistes de ski et destinée à avancer selon une direction de déplacement (D), la dameuse rotative (1) comprenant un cadre (2); un arbre (3) monté à rotation autour d'un premier axe (A1) transversal à la direction de déplacement (D), et pourvu de dents (12) pour casser la surface enneigée (M) des pistes de ski; et un boîtier de protection (4) entourant l'arbre (3); un dispositif de réglage (6; 19) pour régler la position de l'arbre (3) sélectivement par rapport au cadre (2) et au boîtier (4); dans lequel le dispositif de réglage (6; 19) comprend des premiers actionneurs (16; 22) pour régler la position de l'arbre (3) dans une première direction transversale à ce premier axe (A1) et à la direction de déplacement (D); la dameuse rotative (1) étant **caractérisée en ce que** le dispositif de réglage (6; 19) comprend des deuxièmes actionneurs (17; 24) pour régler la position de l'arbre (3) par rapport au boîtier (4) dans une direction supplémentaire sensiblement parallèle à la direction de déplacement (D). 25 30 35 40 45
2. Dameuse rotative selon la Revendication 1, **caractérisée en ce qu'il** comprend un boîtier de protection (4) solidaire du cadre (2). 50
3. Dameuse rotative selon la Revendication 2, **caractérisée en ce qu'il** comprend un tapis de finition (5) relié au boîtier de protection (4) et situé en aval de l'arbre (3) par rapport à la direction de déplacement (D). 55
4. Dameuse rotative selon l'une quelconque des Revendications précédentes, **caractérisée en ce que**

le cadre (2) comprend deux barres de soutien (10) pour supporter l'arbre (3); le dispositif de réglage (6) comprenant deux glissières (13), chacune desquelles étant reliée à glissement à une barre de soutien (10) respective ainsi qu'à l'arbre (3).

5. Dameuse rotative selon la Revendication 4, **caractérisée en ce que** chaque deuxième actionneur (17) est relié à une glissière (13) respective et au cadre (2) pour déplacer la glissière (13) respective par rapport à la barre de soutien (10) respective.
6. Dameuse rotative selon la Revendication 4 ou 5, **caractérisée en ce que** le dispositif de réglage (6) comprend deux barres de soutien (14) supplémentaires, chacune desquelles s'étendant de manière transversale à la barre de soutien (10) respective, s'engageant à glissement dans une glissière (13) respective, et étant reliée à rotation à une extrémité respective de l'arbre (3).
7. Dameuse rotative selon la Revendication 6, **caractérisée en ce que** chaque premier actionneur (18) est relié à une barre de soutien supplémentaire (14) respective ainsi qu'à une glissière (13) respective pour régler la position de la barre de soutien supplémentaire (14) par rapport à la glissière (13).
8. Dameuse rotative selon l'une quelconque des Revendications 1 à 3, **caractérisée en ce que** le dispositif de réglage (19) comprend deux éléments de support mobiles (20) montés à rotation sur ledit arbre (3); les éléments de support (20) étant réglables par rapport au cadre (2).
9. Dameuse rotative selon la Revendication 8, **caractérisée en ce que** le dispositif de réglage (19) comprend deux bras (21) reliés au cadre (2); chaque élément de support (20) étant relié à glissement à un bras (21) respectif.
10. Dameuse rotative selon la Revendication 9, **caractérisée en ce que** chacun desdits bras (21) est monté de manière à tourner par rapport au cadre (2) autour d'un deuxième axe (A2) parallèle au premier axe (A1).
11. Dameuse rotative selon la Revendication 10, **caractérisée en ce que** chacun des premiers actionneurs (22) est relié à un bras (21) respectif ainsi qu'au cadre (2) afin de faire tourner le bras (21) respectif autour du deuxième axe (A2).
12. Dameuse rotative selon l'une quelconque des Revendications 9 à 11, **caractérisée en ce que** chacun des deuxièmes actionneurs (24) est relié à un bras (21) respectif ainsi qu'à un élément de support (20) respectif afin de déplacer l'élément de support (20)

respectif par rapport au bras (21).

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FIG. 1

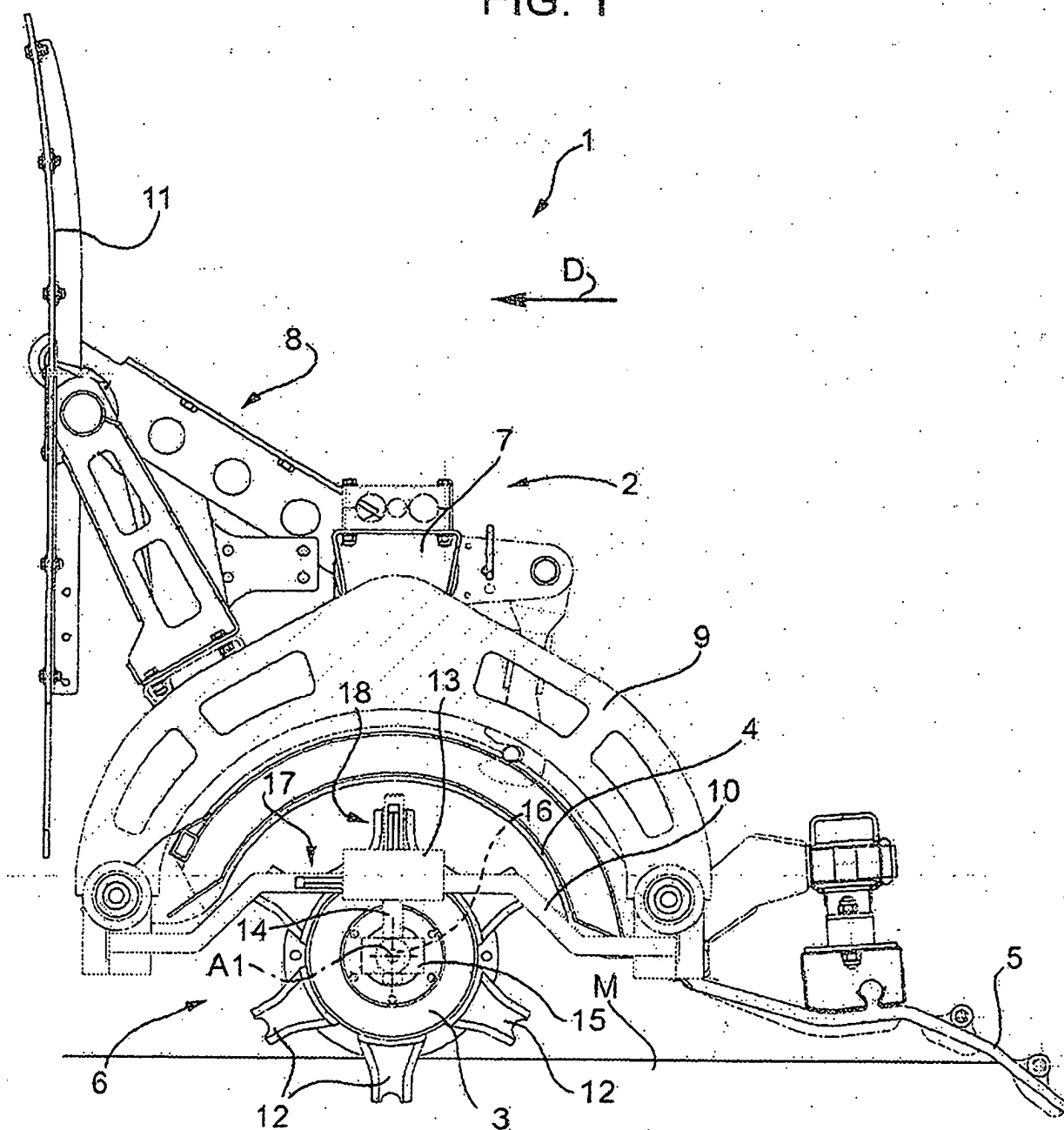
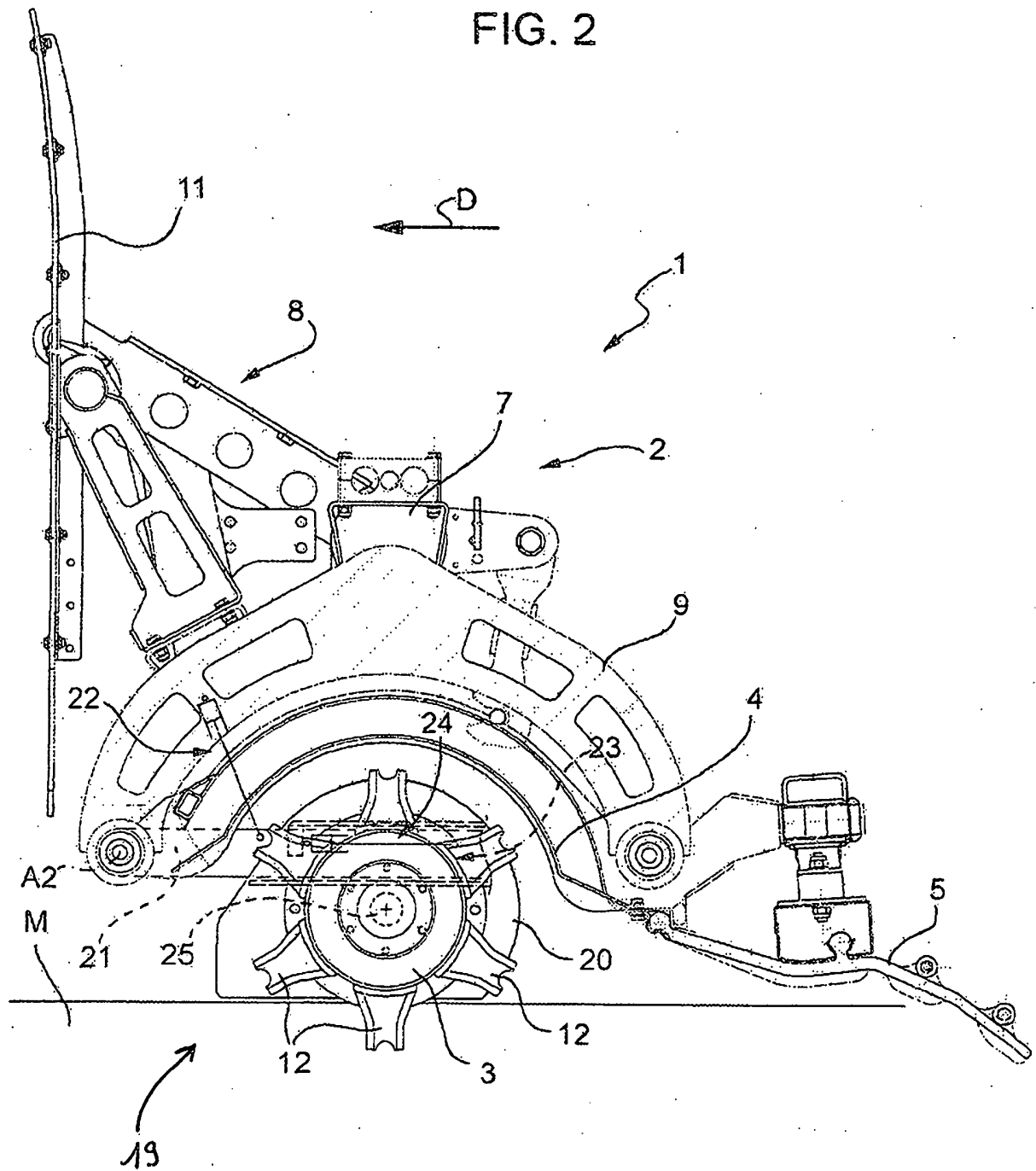


FIG. 2





**REFERENCES CITED IN THE DESCRIPTION**

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