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(54) **Title:** TOOL FOR MACHINING STONE OR CONCRETE FLOORS

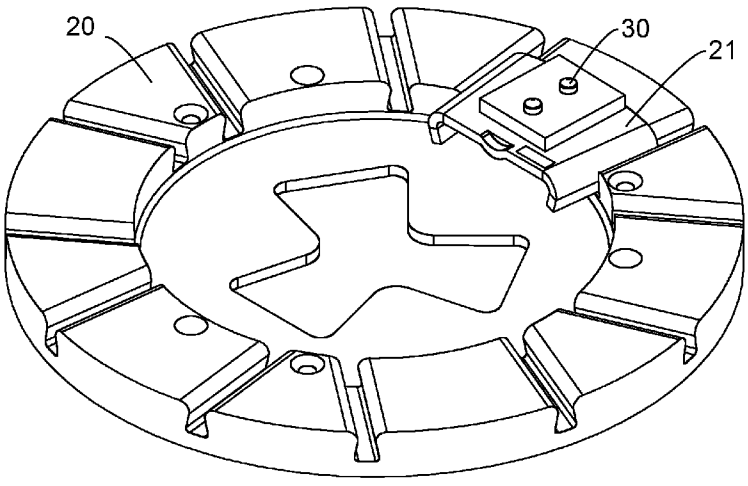


Fig 2

(57) **Abstract:** The invention relates to a machine and at least one tool (10) for machining floor and road surfaces. The tool comprises at least one rotatably mounted disc (20) driven during use, which disc (20) comprises at least one machining element (30) being attached at one end (30a) to the disc.The machining element has a free end (30b) with a symmetrically blunt shape, so that the disc can be driven in different directions with the same machining element in a plane essentially in parallel with the plane of the disc.

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TOOL FOR MACHINING STONE OR CONCRETE FLOORS

Technical field of the invention

The present invention relates to a tool for machining stone or concrete floors, comprising at least one rotatably mounted disc driven during use, which disc carries at least one machining element.

Description of related art

Today, tools for machining stone or concrete floors, i.e. primarily grinding and polishing but also cutting, milling or crushing floor surfaces and/or cleaning these surfaces by removing coatings on them with the object of producing plane, clean and/or smooth floor surfaces commonly use a machining appliance which carries one or more rotatably mounted discs that in turn carries one or more machining elements. This machining element or cutter/bit contacts the floor surface while performing a movement in a plane in parallel to the rotating disc, so that a machining of the floor surface is produced.

An exemplary tool for such machining of floor surfaces is disclosed in SE-C2-525 802.

A disadvantage of known tools for machining of floor surfaces is that one and the same tool can not be used for carrier discs rotating in different directions when driven, whereby left hand and right hand versions of the tools have to be manufactured. These left hand and right hand tool versions also have a disadvantage in that a left hand tool may not be mounted instead of a right hand tool or vice versa, whereby the risk of mistakes when mounting the tools increases. Moreover, another disadvantage is that prior art tools commonly only have one machining element and one supporting stud that restricts the cutting depth and which stud does not have any machining function, whereby the removal rate of these tools are relatively low. Furthermore, still another disadvantage is that prior art machining tools have a low resistance against shocks/strikes.

Summary

An object of the invention is therefore to provide an improved machining tool, which eliminates or at least reduces the disadvantages for prior art machining tools.

The invention is defined by the enclosed independent claim. Embodiments are set forth by the dependent claims attached and by the following description and the drawings.

According to the invention a tool for machining floor and road surfaces, comprises at least one rotatably mounted disc driven during use, which disc comprises at least one machining element being attached at one end to the disc. The machining element has a free end with a symmetrically blunt shape, so that the disc can be driven in different directions with the same machining element in a plane essentially in parallel with the plane of the disc.

In one embodiment of the invention, the machining element protrudes out of the disc with its longitudinal axis perpendicular to the plane of the disc.

In another embodiment of the invention, the machining element protrudes out of the disc with its longitudinal axis oblique in relation to the plane of the disc.

In yet another embodiment the disc which comprises at least one machining element protruding out of the disc with its longitudinal axis perpendicular to the plane of the disc and at least one machining element protruding out of the disc with its longitudinal axis inclined in relation to the plane of the disc.

In still another embodiment the machining element protrudes out of the disc with its longitudinal axis having an inclination angle of up to 45° in relation to an axis being perpendicular to the plane of the disc.

In other embodiments, the free end of the machining element has a rounded shape, a spherical shape, is chamfered, or has a frustoconical shape.

Moreover, in another embodiment, the tool comprises a supporting stud with a support surface in parallel with the plane of the disc for contacting the floor surface, whereby the supporting stud in yet another embodiment is a machining element in that its support surface comprises machining abrasives. Furthermore, in another embodiment, the tool comprises a cutting element, which, in still another embodiment, has a back-rake angle of between 5°-20°.

In one embodiment, the free end of the machining element is made of poly crystalline or poly compact diamond (PCD), or is made of mono crystalline diamond (MCD) in another embodiment,.

The invention also concerns a machine for machining floor and road surfaces, comprising at least one tool with at least one rotating disc, which disc comprises at least one machining element in accordance with any of the embodiments defined above.

Providing the machining element in a tool for machining floors and road surfaces with a free machining end having a symmetrically blunt shape, i.e. with no sharp edge/-s in any direction, means that the machining element machines the floor and/or road surface similar to a mill or a crusher, and that the machining of the floor/road surface is performed independently of the direction of rotation of the tool. Furthermore, a blunt shape is less sensible for strikes against projections, irregularities, edges etc in the floor/road surface. This strike/shock resistance of the tool is further enhanced by making the tool end in poly crystalline or poly compact diamond. Moreover, if such an inventive machining element is combined with cutting elements on the same tool, the inventive machining element enhances the engagement for the cutting element in the floor/road surface by milling/scratching the floor/road surface "opening" it up for the cutting edge on the cutting element, which increases the removal rate.

Brief Description of the Drawings

The tool will now be described in more detail with reference to the schematic drawings enclosed, in which

Fig. 1 shows a view of an exemplary machine with a tool having at least one machining disc with at least one machining element according to the invention,

Figs. 2-4 show different embodiments in perspective views of a machining disc for the tool according to Fig. 1,

Figs. 5-23 show different embodiments of the machining element according to Figs. 1-4 in different views, and

Figs. 24-29 show different shapes of a free machining end of the machining element according to Figs. 1-23.

Detailed Description of Embodiments

Fig. 1 indicates a machine for machining surfaces on floors and roads with an abrading or machining tool 10 with at least one rotating disc 20, which is mounted rotatably and for abrasion/machining of surfaces is driven by a motor as is explained in more detail in for example the patent publication WO 94/08752. The floor and/or road surfaces may be stone, concrete, different types of asphalt, or different types of coatings on these surfaces, e.g. epoxy lacquers/resins/adhesives, plastic materials (e.g. plastic mats), paint, lacquer, or any other type of coating. On the rotatable machining disc 20 a suitable number of carrier plates 21 may be detachably attached (only one plate is mounted in Figs. 2-4) and positioned according to a predetermined pattern, i.e. a pattern suitable for the desired machining, at the periphery of the disc 20. The machining disc 20 is rotated substantially in a plane parallel to the surface in a known way and by means of known driver means. There may be more than one disc 20 forming the tool 10 and these discs 20 may all be rotated in the same direction or one or more discs may be rotated in opposite directions in relation to the other disc or discs, i.e. in a contra-rotating manner, and/or in pairs (not shown), or only a single disc 20 may be used. If two contra-rotating discs 20 are used the forces during machining are balanced. Moreover, discs 20 without carrier plates 21 may also be used.

Each carrier plate 21, as shown in Figs. 2-13, and/or each disc 20, as shown in Figs. 14-29, supports at least one machining element 30 arranged in a predetermined manner. The machining disc 20 is described for clarifying the invention, whereby the machining disc may be of any kind, e.g. as disclosed in EP-1 321 233 and/or WO 2004/108352.

In a preferred embodiment of the machining disc 20 (shown in Figs 2-21 and 24-29) only one or up to three machining elements are arranged for machining. In other embodiments more than three machining elements 30, e.g. four or more as shown in Figs. 22 and 23, may be used, the number of elements being limited by costs associated therewith.

The machining element 30 shown in Figs. 2-29 is made of synthetic diamond, i.e. poly crystalline or poly compact diamond (PCD) or mono crystalline diamond (MCD). The machining element 30 is securely attached directly to the disc 20 and/or the carrier plate 21 by means of press fitting, adhesion, or brazing in a recess, e.g. in the form of a bottom or through hole on the carrier plate or the disc. The machining element 30 is shown with an elongated shape, i.e. a cylindrical shape with a circular cross-section but may of course have any other suitable cross-section shape, e.g. elliptical, square, rhomboid, rectangular etc.

The tool 10 for machining floor and road surfaces comprises the at least one rotatably mounted disc 20 driven during use, which disc carries the at least one machining element 30 being attached at one end 30a to the disc or the plate 21. The machining element 30 has a free end 30b with a symmetrically blunt shape, i.e. it has no sharp cutting edges in any direction, so that the disc 20 can be driven in different directions with the same machining element. This is possible due to the fact that the symmetrically blunt shape does not hinder the movement of the disc 20 to different extents in different directions, instead it gives an essentially equal resistance/friction in all directions of movement when the element 30 is in engagement with the surface, i.e. independently of linear and/or rotational direction of the disc 20. The directions could as mentioned be opposite rotational directions for the disc 20, e.g. clockwise and anti-clockwise, or linear movements of the disc 20 in different directions, e.g. back and forth, or combinations of these movements in varying patterns depending on the desired machining of the floor/road surface.

In one embodiment, the machining element 30 protrudes out of the disc 20 or the plate 21 with its longitudinal axis perpendicular to the plane of the plate (Figs. 2-15 and 16-29). In another embodiment, the machining element 30 protrudes out of the disc 20 or the plate 21 with its longitudinal axis oblique in relation to the plane of the disc or plate (Figs. 20 and 21). These different orientations or protrusions, i.e. both perpendicularly and inclined in relation to the plane of the disc/plate of the machining element 30 is possible in that its blunt end shape reduces the risk of jamming the free end 30b in the surface when the machining element is moved in different directions, and also when the direction is altered during a current machining of a surface.

One embodiment of the tool 10 comprises the at least one machining element 30 protruding out of the disc 20 or the plate 21 with its longitudinal axis perpendicular to the plane of the disc/plate and at least one machining element 30 protruding out of the disc or plate with its longitudinal axis inclined in relation to the plane of the disc/plate, as shown in Figs. 20 and 21. In another embodiment, the machining element 30 protrudes out of the disc 20 or the plate 21 with its longitudinal axis having an inclination angle α of up to 45° in relation to an axis V being perpendicular to the plane of the disc/plate, as shown in Figs. 20 and 21. More specifically, in yet another embodiment, at least one machining element

may extend perpendicularly and/or at least two machining elements 30 may extend inclined with different angles α and/or in different directions. Here, the left element is inclined with 30° and the right element is inclined with 45°. Any other angle between 0° and 45° for each element 30 and any combination of straight and/or oblique extending elements are possible for achieving the effect.

According to another embodiment, the free end 30b of the machining element 30 has a rounded shape, i.e. an all round shape, as shown in Figs. 2-29, and in more detail in Figs. 24-29. According to yet another embodiment, the free end 30b of the machining element 30 has a dome-shape, and in still another embodiment, the free end 30b of the machining element 30 has a spherical shape as shown in Fig. 28 and 29. In yet another embodiment, the free end 30b of the machining element 30 is bevelled/chamfered, i.e. chamfer round, as shown in Figs. 24-26. Moreover, in another embodiment, the free end of the machining element has a frustoconical shape as shown in Fig. 24, 26-27. Another embodiment is shown in Fig 25 where the free end 30b of the machining element has a conical shape transcending into a rounded tip. In Fig 27, one embodiment is shown where the free end 30 b has a frustoconical shape with a camber/cross slope shape. All of these shapes give a smoother surface of the free end 30b further reducing the friction with the machined surface and the risk of jamming the free end in the surface.

According to another embodiment, the tool 10 comprises a supporting stud 40 with a support surface 41 in parallel with the plane of the disc 20 or the plate 21 for contacting the surface, so that any surface is machined as plane as possible. This further reduces the risk of jamming the free end 30b of the machining element 30 in the surface during machining because it controls the depth of the engagement for the machining element with the surface, i.e. the milling/crushing effect of the machining element 30 is controlled.

In one embodiment, the supporting stud 40 also is a machining element in that its support surface 41 comprises machining abrasives, which may be of any known type, e.g. a diamond matrix. This improves the removal rate when machining the surface and enhances the control of the engagement depth for the machining element 30 with the surface, and also makes the surface of the floor/road smoother reducing the risk of jamming the free end 30b into a too coarse surface.

According to yet another embodiment, the supporting stud 40 has a underheight in relation to the free end 30b of the machining element 30. This further enhances the control of the engagement depth for the machining element with the surface, and further reduces the risk of jamming or machining the free end 30b too deep into the surface. In another embodiment, the tool 10 comprises a cutting element 50. This increases the removal rate for the tool when combined with the inventive machining element 30 when machining the surface due to the fact that at least two machining elements, i.e. the machining element 30 and the cutting element 50, cooperate in that the machining element 30 “opens up” the surface for the cutting element 50. The third machining element 50 has a back-rake angle

of between 5°-20°, preferably 15° as shown in Figs. 4, 10-13.

In Figs. 3, and 8-9, the first machining element 30 is shown together with the second machining and supporting element 40, i.e. the supporting stud 40. Figs. 4 and 10-13 show the first machining element 30 together with the second machining and supporting element 40, i.e. the supporting stud 40, and the third machining element, i.e. the cutting element 50, but any other combination of one or more of these elements 30, 40, 50 is possible. In a first embodiment shown in Fig. 2 and 5-7 only one machining element 30 is arranged on the carrier plate 21, and in Figs 14-15 and 24-29 only one machining element 30 is arranged directly on the disc 20 eliminating the use of the carrier plate. In another embodiment, as shown in Figs. 2 and 3, 12 and 13, and 16-23, two, three, four and twelve respectively, first machining elements 30 are arranged on the respective carrier plate 21 or directly on the disc 20. In Figs. 4 and 10-11 another embodiment is shown in which one first machining element 30 is arranged on the carrier plate 21 together with one supporting stud 40 and one cutting element 50. Finally, in Figs. 12-13, in another embodiment, three first machining elements 30 are arranged on the carrier plate together with one supporting stud 40 and one cutting element 50. All of these machining elements 30, 40, 50 may as described be attached directly onto the disc 20 eliminating the need of the intermediate carrier plate 21.

The size of the machining element 30 and its orientation together with its free length protruding out of the disc 20 or plate 21 may be chosen differently for different applications. The machining element is for example between 2 to 20 mm in diameter and protrudes out of the disc 20 or the plate 21 with a length of at least 3 mm when used for machining and cleaning stone and/or concrete floors while it may have a larger diameter and may protrude out with a different length when used for machining roads, wherein a diameter of more than 20 mm and a free protruding length of more than 3 mm are suitable.

Moreover, the machining element 30 may protrude out of the disc 20 or the plate 21 with its longitudinal axis having an inclination angle α of up to 45° in relation to the axis V being perpendicular to the plane of the disc/plate, i.e. the machining element 30 may extend in any direction out of the disc/plate in relation to the vertical axis V as long as the longitudinal axis is inclined not more than 45° from the vertical axis V. This means that the inclination of the longitudinal axis of the machining element is limited by a cone with a cone angle of 45° if the longitudinal axis of the machining element is swept 360° around the vertical axis V as seen in a plane being perpendicular to the vertical axis, i.e. a swept plane in parallel with the plane of the disc 20 or the plate 21, with the limiting inclination of 45°.

CLAIMS

1. A tool (10) for machining floor and road surfaces, comprising at least one rotatably mounted disc (20) driven during use, which disc (20) comprises at least one machining element (30) being attached at one end (30a) to the disc, **characterized in that** the machining element (30) has a free end (30b) with a symmetrically blunt shape, so that the disc (20) can be driven in different directions with the same machining element in a plane essentially in parallel with the plane of the disc.

2. A tool (10) according to claim 1, wherein the machining element (30) protrudes out of the disc (20) with its longitudinal axis perpendicular to the plane of the disc.

3. A tool (10) according to claim 1, wherein the machining element (30) protrudes out of the disc (20) with its longitudinal axis oblique in relation to the plane of the disc.

4. A tool (10) according to any of the preceding claims, wherein the disc (20) comprises at least one machining element (30) protruding out of the disc (20) with its longitudinal axis perpendicular to the plane of the disc and at least one machining element protruding out of the disc with its longitudinal axis inclined in relation to the plane of the disc.

5. A tool (10) according to claim 3, wherein the machining element (30) protrudes out of the disc (20) with its longitudinal axis having an inclination angle (α) of up to 45° in relation to an axis (V) being perpendicular to the plane of the disc.

6. A tool (10) according to any of the preceding claims, wherein the free end (30b) of the machining element (30) has a rounded shape.

7. A tool (10) according to any of the preceding claims, wherein the free end (30b) of the machining element (30) has a spherical shape.

8. A tool (10) according to any of the claims 1-5, wherein the free end (30b) of the machining element (30) is chamfered.

9. A tool (10) according to any of the claims 1-5 or 8, wherein the free end (30b) of the machining element (30) has a frustoconical shape.

10. A tool (10) according to any of the preceding claims, comprising a supporting stud (40) with a support surface (41) in parallel with the plane of the disc (20) for contacting the floor surface.

11. A tool (10) according to claim 10, wherein the supporting stud (40) is a machining element in that its support surface (41) comprises machining abrasives.

12. A tool (10) according to any of the preceding claims, comprising a cutting element (50).

13. A tool (10) according to claim 12, wherein the cutting element (50) has a back-rake angle of between 5°-20°.

14. A tool (10) according to any of the preceding claims, wherein the free end (30b) of the machining element (30) is made of poly crystalline or poly compact diamond (PCD).

15. A tool (10) according to any of the preceding claims, wherein the free end (30b) of the machining element (30) is made of mono crystalline diamond (MCD).

16. A machine for machining floor and road surfaces, comprising at least one tool (10) with at least one rotating disc (20),

characterized in that the disc (20) comprises at least one machining element (30) in accordance with any of the claims 1-15.

Fig 1

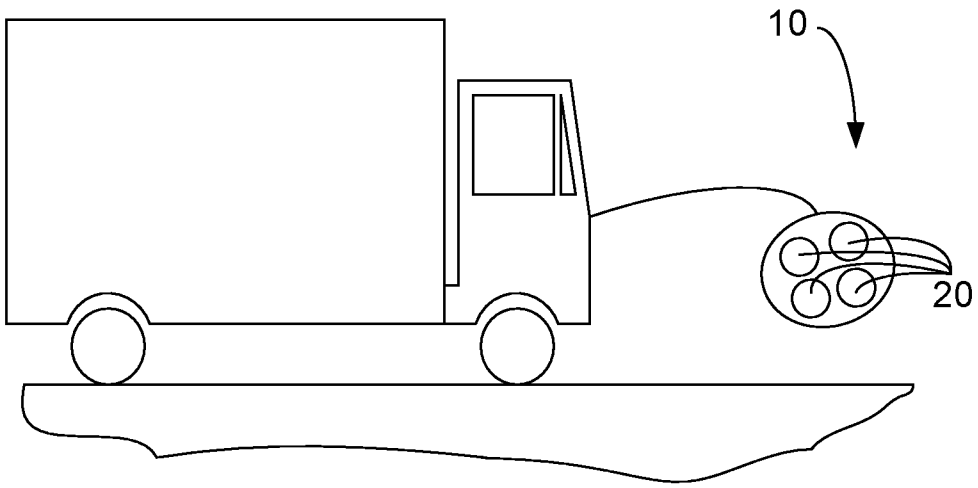


Fig 2

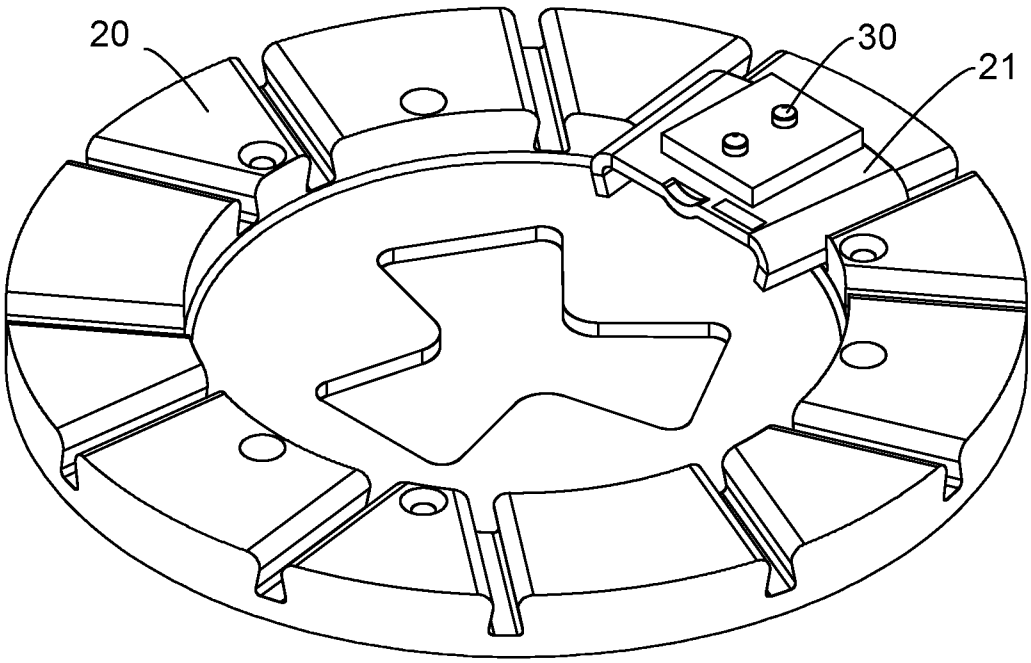


Fig 3

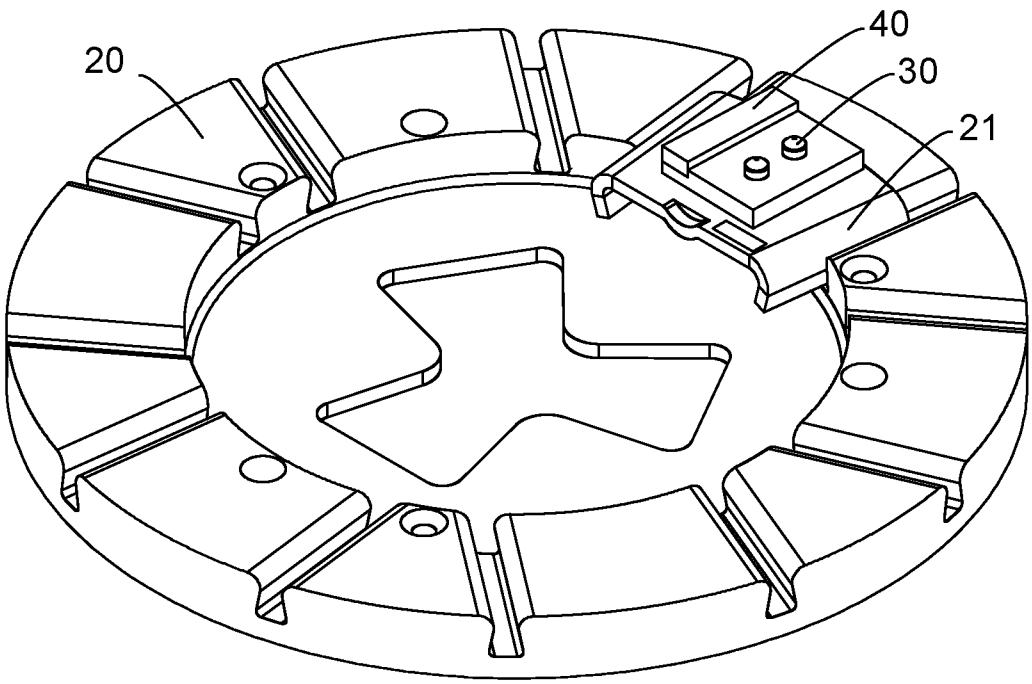


Fig 4

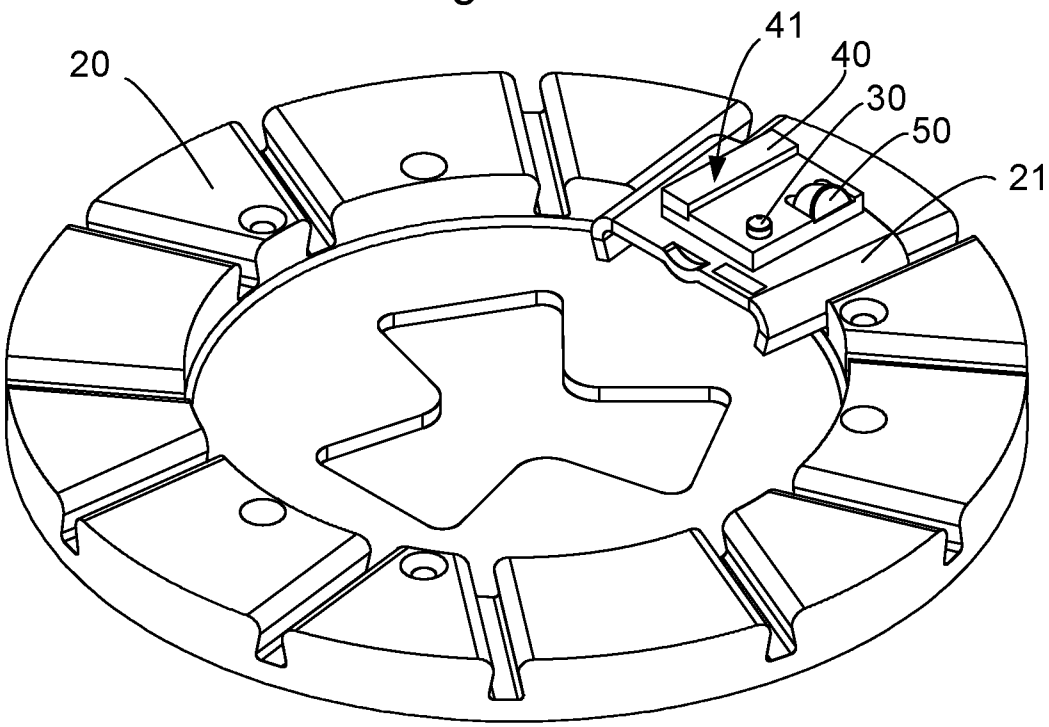


Fig 5

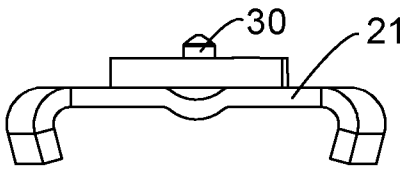


Fig 6

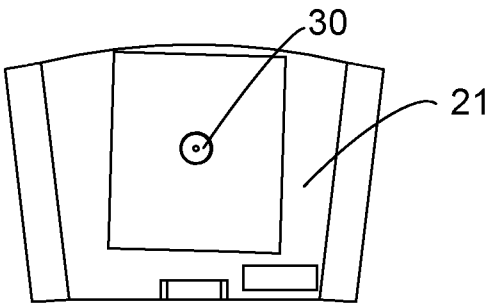


Fig 7

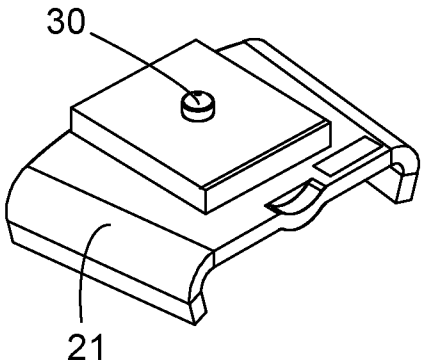


Fig 8

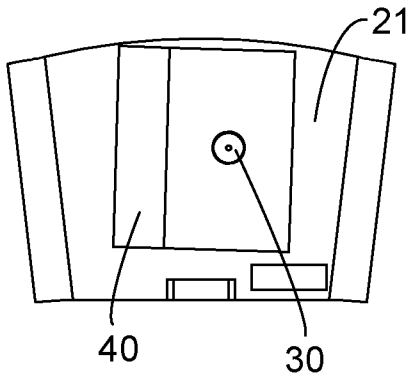


Fig 9

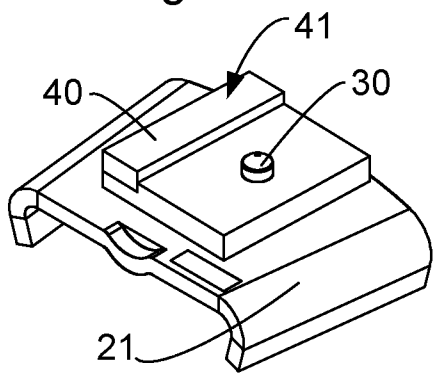


Fig 10

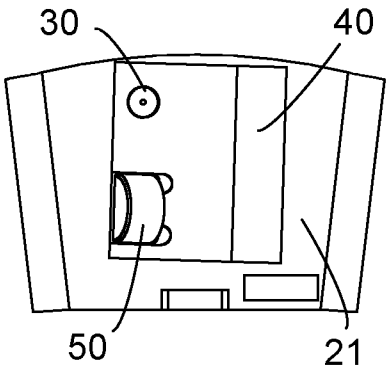


Fig 11

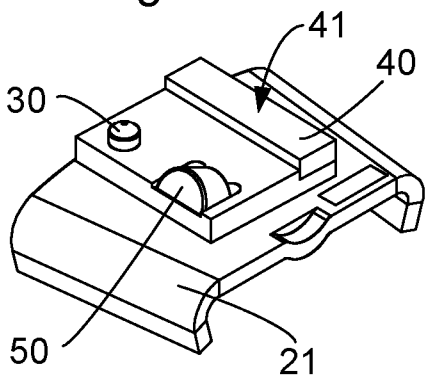


Fig 12

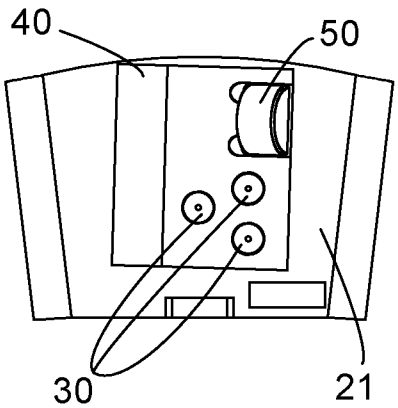


Fig 13

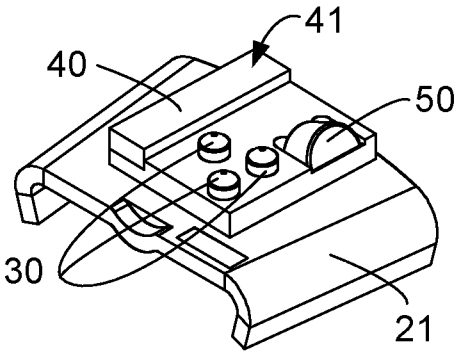


Fig 14

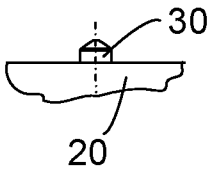


Fig 15

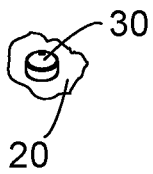


Fig 20

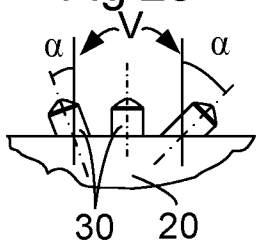


Fig 21

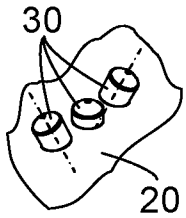


Fig 16

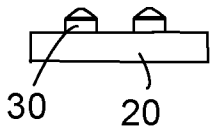


Fig 17

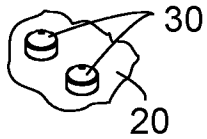


Fig 22

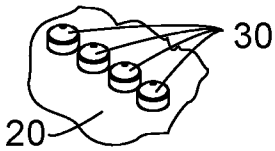


Fig 18

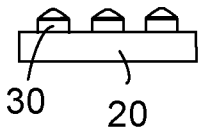


Fig 19

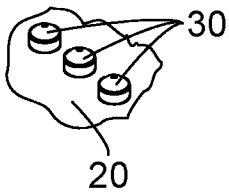


Fig 23

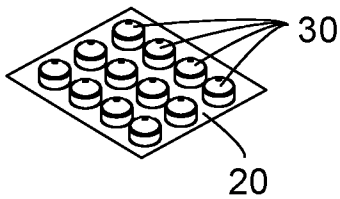


Fig 24

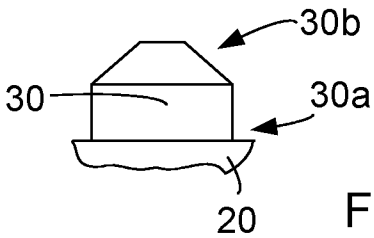


Fig 27

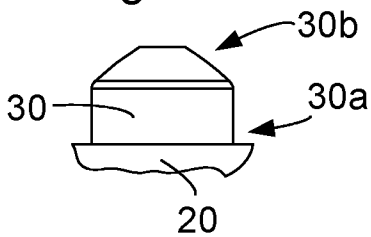


Fig 25

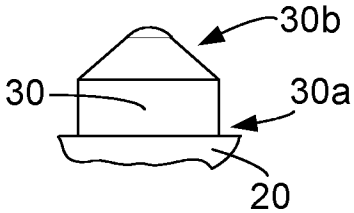


Fig 26

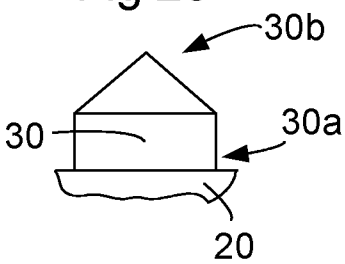


Fig 28

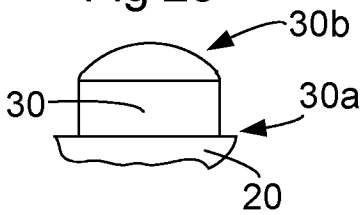
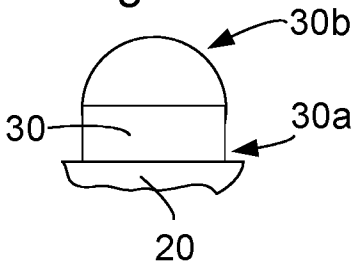


Fig 29



INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2008/050153

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet
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)

IPC: B24D, E01C, B24B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 10208988 A1 (RICHTER, B.), 18 Sept 2003 (18.09.2003), figures 1-5, abstract	1-4,6,16
Y		5,7-15
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X	DE 10235176 A1 (ELARGO ENGINEERING GMBH), 4 March 2004 (04.03.2004), figure 5, claim 5, abstract	1-4,6,7,16
Y		5,8-15
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A	WO 2004108352 A2 (HTC SWEDEN AB), 16 December 2004 (16.12.2004), figures 1-2, abstract	1-16
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Date of the actual completion of the international search	Date of mailing of the international search report
5 May 2008	05 -05- 2008
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Fredrik Strand / MRo Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2008/050153

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 20060172667 A1 (S. JEANSSON), 3 August 2006 (03.08.2006), figures 1-2, abstract -- --------	1-16

International patent classification (IPC)

B24D 5/06 (2006.01)
E01C 23/088 (2006.01)
B24B 7/00 (2006.01)

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