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(71) Applicant (*for all designated States except US*): **NED-ERLANDSE ORGANISATIE VOOR TOEGEPAST-NATUURWETENSCHAPPELIJK ONDERZOEK TNO** [NL/NL]; Schoemakerstraat 97, NL-2628 VK Delft (NL).

(72) Inventors; and

(75) Inventors/Applicants (*for US only*): **MOONS, Andreas, Mattheus, Maria** [NL/NL]; De Akker 108, NL-2743 DP Waddinxveen (NL). **VAN DAALEN, Armand, Leendert, Leonard** [NL/NL]; Baarsveen 527, NL-3205 BJ Spijkenisse (NL).

(74) Agent: **PRINS, A., W.**; Nieuwe Parklaan 97, NL-2587 BN Den Haag (NL).

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(54) Title: POWER TOOL WITH DUST EXTRACTION

(57) Abstract: An apparatus for processing material, comprising: a processing element with a processing face and circumferential walls contiguous therewith; driving means for driving the processing element; at least one air inlet provided in or near the processing face for providing an air flow which carries along particles coming from a workpiece; a housing providing an air passage, in which housing the processing element is at least partly received; and an air outlet which is in air conducting communication with the at least one air inlet, to which an air extracting device can be connected. The flow area of the air passage in the housing is, always, greater than the flow area of the air inlet.



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POWER TOOL WITH DUST EXTRACTION

The invention relates to an apparatus for processing material, comprising: a processing element with a processing face and circumferential walls contiguous therewith; driving means for driving the processing element; at least one air inlet arranged in or adjacent the processing face for providing an air flow carrying along particles coming from a workpiece; a housing providing an air feed-through, in which housing the processing element is at least partly received; and an air outlet which is in air conducting communication with the at least one air inlet, to which an air extraction device can be connected.

Such an apparatus is known from German patent 42 38 564. The apparatus known in the state of the art has as a drawback that the extraction of dust particles is not optimal. This is because adjacent the air inlet a relatively high flow speed has to be effected for overcoming the impulse of the particles and for capturing the particles. In the state of the art, it is conventional to achieve an increase in speed by making the air inlet relatively small. However, this has as a consequence that the flow-through rate decreases and an important part of the particles coming from the workpiece can still not be captured.

The object of the invention is to obviate the referred-to drawback and to provide for an apparatus wherein an improved extraction is provided.

This object is achieved with an apparatus of the type mentioned in the opening paragraph, in which the flow area of the air feed-through in the housing is always greater than the flow area of the air inlets.

As the flow area of the air feed-through in the housing is, each time, greater than the flow area of the air inlets, no effective obstructions occur in the housing and the speed of the air flow adjacent the edges of the processing element remains maximal. Therefore, it is not necessary to strongly reduce the inlets; consequently, a flow volume remains relatively large. Herein, the term

flow area is understood to mean a net available surface, which is orientated perpendicularly to the flow-through direction.

In a preferred embodiment, the processing element comprises an endless belt provided with an abrasive material, the apparatus comprising an air inlet arranged in or near the prolongation of a main direction of movement of a particle flow of particles released from the workpiece as a result of the operation of the processing element.

As referred to herein, main direction of movement is a direction in which the majority of the particles flies away. The invention utilizes the insight that in an apparatus provided with such a support surface, an important amount of particles, for instance more than 70%, is flung away in directions which only slightly deviate, for instance less than 10°, with respect to this main direction of movement. Consequently, by placing the extraction mouth in or near the prolongation of this main direction of movement, a large majority can be captured.

In a preferred embodiment, the air inlet defines a passage area inclining at a slight angle to the support surface.

When processing the workpiece, a particle flow will move substantially parallel to the support surface, so that a main direction of movement of the particle flow is determined. The air inlet can then be disposed at a slight angle relative to the rest of the surface, so that the particle flow can be guided into the air inlet more easily.

In a preferred embodiment, the air inlet and the support surface are substantially located in one plane. As a result, a substantially flat side is formed, preferably at the underside of the apparatus, so that the extraction mouth does not hinder the manipulation of the apparatus. Additionally, it is noted that, through the air inlet, particles which are lighter and relatively more damaging to the human health can be deflected more easily to the air inlet, so that a practical optimum can be found in a flat construction on the one hand and an optimal particle extraction on the other hand.

Preferably, the apparatus comprises an air inlet for providing an air flow along the circumferential walls of the processing element.

Through this feature, also when the processing face completely abuts against the surface of the workpiece to be processed or even when it is sucked onto it, an air flow is maintained and thus an air obstruction is prevented. Also, disposing an air inlet outside and above the processing face has as a result that particles flying outwards too can be captured. Also, operating with much larger air capacities can take place without the apparatus being able to suck itself completely to the processing face.

10 In a preferred embodiment, the air inlet comprises an apron provided with air flow-through openings, which apron extends along the processing element to a point adjacent the processing face.

As the apron virtually reaches to the processing face of the processing element, particles that fly away can bump against the apron and be extracted. As a result, material particles shooting off at high speed can still be captured close to the source. Further, the flow-through openings in the apron can form a "bypass" if further air inlets are present in the apparatus, for instance for generating an air flow along the processing face. In that case, the air automatically flows at increased speed through the flow-through openings in the apron.

20 In a preferred embodiment, the openings in the apron reach beyond a deformable part of the circumferential wall. Thus, the air inlet is prevented from being reduced when the pressure applied to the processing face deforms the circumferential walls.

25 The apron can be manufactured from a robust, flexible material. This embodiment in particular is advantageous, because then, the apron can follow the movements of the processing element, without the effective flow through the air inlet varying considerably.

In a further preferred embodiment, the apron forms one whole with a holder element in which the processing element is provided. In this manner,

30

air inlet, holder element and apron can be manufactured relatively inexpensively and be assembled in a simple manner.

In a still further preferred embodiment, spacers are provided in the air inlet. The spacers prevent the air inlet from being pressed shut when the processing element moves outside due to a pressure applied to the processing element. The spacers can be provided on the apron. The spacers can have the shape of flanges extending inwardly, transversely to the apron. Through the presence of spacers, the air flow is effectively maintained, notably on the side where the largest amount of material to be sucked away is generated, and the apparatus maintains its favorable extracting properties.

In a further embodiment the air inlet comprises inflow openings which are orientated slightly sideways relative to the processing face of the processing element. Through this orientation, a longitudinal axis of the air inlet extending parallel to the flow direction of the sucked-in air extends at an acute angle relative to the processing face, so that the air flow along the circumferential walls remains maximal. As a result, particles flying away cannot escape but are sucked along in the flow.

Preferably, the air feed-through comprises a relatively large air collecting space to which the air outlet is connected. Such a central space forms a plenum, thus creating an optimal air flow all around the processing element.

A further preferred embodiment of the invention relates to an apparatus according to any one of the above-mentioned aspects, in which the air outlet comprises a pivot joint. By designing the air outlet to be rotational relative to the housing, the air discharge is prevented from being pinched off. Thus, the manageability of the apparatus too is improved in that the air discharge remains orientated in the proper direction and, during the manipulation of the apparatus, no impeding forces and moments occur. Preferably, the pivot joint enables a rotation on a longitudinal axis orientated perpendicular to the processing face.

The invention will be further elucidated on the basis of the description of an exemplary embodiment of a preferred embodiment of the invention, as it is represented in the drawing. In the drawing:

Fig. 1 shows a schematic side view of an apparatus according to the invention;

Fig. 2 shows a detail of an edge of the apparatus according to the invention;

Fig. 3 shows a schematic side view of a different embodiment of an apparatus according to the invention;

Fig. 4 shows a schematic side view of an apparatus according to the invention;

Fig. 5 shows a schematic bottom view of an apparatus according to the invention; and

Fig. 6 shows a schematic bottom view of the apparatus according to Fig. 5 with an abrasive belt provided thereon.

In the Figures, identical or corresponding parts are indicated with the same reference numerals.

In Fig. 1, a hand sanding machine 1 is represented. The hand sanding machine 1 comprises a housing 2 with an abrasive disc 3 which is brought, with a processing face 4, onto a surface 5 to be processed of a workpiece. The abrasive disc 3 is brought into oscillation by an electric or pneumatic motor 6, which is connected to the abrasive disc 3 by a transmission 7. In the abrasive disc 3, air inlets 8 are provided which are disposed at regular distances relative to each other in the processing face 4 through the abrasive disc 3. The air inlets 8 generate an air flow along the processing face, schematically indicated with the arrows. The hand sanding machine is further provided with an air outlet 9 to which an air extraction device (not represented) can be connected. The air extraction device generates an air flow for discharging sanding dust coming from the abrasive disc 3. Air inlet 10 provides an air flow along the circumferential walls 11 of the abrasive disc 3.

The circumferential walls 11 are contiguous with the edges of the processing face 4 and can comprise a side orientated transversely to the processing face and a side extending parallel to the processing face. The air inlet 10 is then formed by the circumferential walls 11 and an apron 12 provided with air flow-
5 through openings 13. The openings 13 remotest from the processing face reach beyond a deformable circumferential wall of the abrasive disc 3. The apron 12 extends along the abrasive disc 3 to near the processing face 4 and is formed of flexible material. The arrows P indicate the air flow from the air inlet 8, 10 to the air outlet 9. In the Figure, the flow areas, i.e. a net available surface
10 perpendicularly orientated to the flow-through direction, is indicated with broken lines 14, 15, 16.

The air inlets 8, 10 then have a combined flow area 14 which is smaller than the flow area 15 of the air outlet 9 and the flow area 16 of the housing 2. The flow area 14 is then formed by the combination of the flow
15 areas of the orifices 8 and the air inlet 10. The housing comprises a central air collecting space 17, into which the air flow coming from the air inlet 8, 10 terminates.

In Fig. 1, with respect to the line I-I, two variants of the attachment of apron 12 are represented. In the left-hand part of the drawing, the apron
20 forms one whole with a holder element 18 in which the sanding disc 3 is disposed. The holder element 18 is connected to the housing 2, which allows the passage of air, by means of a sealing ring 19. In this variant, through channels 20 in the holder element, air is allowed to pass from the air inlet 10. In the right-hand part of the drawing, the apron 12 is connected to the
25 housing 2.

Further, in the Figure, arrows Q indicate that the air outlet 9 is connected by means of a pivot joint 21 so as to be pivotable relative to the housing 2, about a longitudinal axis oriented transversely to the processing face 4, parallel to the line I-I. The pivot joint 21 is annular and engages in the
30 walls of the housing 2. A compressed air hose 22 is connected to the housing 2

for supplying compressed air. Through the pivot joint 21, the compressed air hose and discharge hose are movable relative to each other, thus enhancing the manageability and preventing the air outlet 9 from becoming obstructed.

In Fig. 2, a detail of the apron 12 of the sanding machine 1 of Fig. 1 is represented. There, reference numeral 23 indicates spacers, which, in the shape of reinforced plastic projections, are provided on the inside of the apron 12. If pressure applied to the sanding machine 1 pushes the sanding disc outwards, the spacers 23 prevent the air inlet 10 from being pressed shut on that side. To that end, the spacers 23 can engage a circumferential wall (not represented) of the sanding disc 3. As a result, the distance between apron and circumferential wall remains intact and the air flow is maintained. In the apron, further air inlet openings 13 are provided, orientated sideways. The air inlet openings can be open or half open and are disposed at regular distances relative to each other. If the apron 12 is of flexible material, the shape of the opening can be such that under vertical pressure, the opening is enlarged (so as to form a vertical slit).

Finally, in Fig. 3, an alternative embodiment is given of an apparatus 24 according to the invention. Here, the processing element is formed by a flat polishing disc 25. In the polishing disc 25, openings 8 are provided as primary air inlet. The polishing disc 25 has a circumferential wall 26 contiguous with the processing face 46, which inclines strongly inwardly. Opposite the circumferential wall 26, spacers 23 are provided for preventing the air inlet 10 from being pressed shut along the circumferential wall. The collective flow area of the air inlet 10 and the openings 8 is smaller than the flow areas 15, 16 present in the housing 24.

In Fig. 4, a schematic side view of a sanding machine 27 is represented, also called "powerfile", modified according to the invention. The sanding machine 27 comprises an endless sanding belt 28, which can be of replaceable design. The sanding belt 28 is guided over at least two rollers 29, one of which is located closer to the heart of the machine 27 and one of which

closer to the extremity, thus forming an elongated part 30 over which the sanding belt can move and wherein the belt has an effective processing area 31 adjacent a support surface 32. Although it ought to be possible to bring the belt freely into contact with the workpiece (not shown) near the processing area 31, the rest of the belt periphery can be screened off.

In the example of the drawing, one of the rollers is driven by driving means (not shown), such as for instance a pneumatic drive or an electric drive. A handle 33 is provided for handling the apparatus 27.

According to the invention, the apparatus comprises an air inlet 34 in or near the prolongation of a substantial movement direction, defined by the support surface, of a particle flow of particles released from the workpiece. This movement direction is represented in the Figure by the arrow P. Further, in the apparatus, an air extraction 35 is provided for generating an air flow through the air inlet 34. The air extraction can be of external design, while, for instance, the apparatus can be connected to an industrial dust extractor etc. In that case, the particle flow is sucked away via the outlet 36. If in the apparatus itself a motor driven air extractor is present, the particles can, for instance, be captured in a collecting space (not shown) via outlet 36, such as a dust bag or the like.

In a preferred embodiment, the opening of the air inlet 34 has a small angle relative to the support surface 32 and is located in, or at a small distance under, the surface of the support surface, for obtaining a compact construction.

In Figs. 5 and 6, a schematic bottom view of a powerfile without and with sanding belt 28, respectively, are represented. In the drawing, the air inlet 34 is represented at the bottom side of the handle of the powerfile. The air inlet is located in the prolongation of the front roller 29 forming a support surface for the sanding belt represented in Fig. 2. An important part of the sanding particles generated by the belt will be flung away in the direction of the air inlet. The air inlet can be connected to an air extractor (not shown). As

represented in Fig. 5, additional air extracting openings 37 are included under the sanding belt, which, as in Fig. 6, is provided with holes 38.

Although the invention is described on the basis of a preferred embodiment, it is evident that the invention is not limited thereto, but can
5 comprise all sorts of variations and modifications. The guiding means need not all be of rotating design but can also comprise guiding faces. Further, the support surface can be formed by a rotating guide. Such variants are deemed to fall within the reach and scope of protection of the following claims.

Claims

1. An apparatus for processing material, comprising:
 - a processing element with a processing face and circumferential walls contiguous therewith;
 - driving means for driving the processing element;
 - 5 - at least one air inlet provided in or near the processing face for providing an air flow which carries along particles coming from a workpiece;
 - a housing providing an air passage, in which housing the processing element is at least partly received; and
 - an air outlet which is in air conducting communication with the at
 - 10 least one air inlet, to which an air extracting device can be connected; characterized in that
 - the flow area of the air passage in the housing is always greater than the flow area of the air inlets.
2. An apparatus according to claim 1, characterized in that the
- 15 processing element comprises an endless belt provided with an abrasive material, wherein the apparatus comprises an air inlet which is disposed in or near the prolongation of a substantial movement direction of a particle flow of particles released from the workpiece as a result of the operation of the processing element.
- 20 3. An apparatus according to claim 1 or 2, characterized in that the air inlet defines a passage surface extending at a reduced angle to the processing face.
4. An apparatus according to claim 3, characterized in that the air inlet and the processing face are substantially located in one plane.
- 25 5. An apparatus according to claim 3, or 4, characterized in that the air inlet is located below the processing face.

6. An apparatus according to at least one of the preceding claims, characterized in that the air inlet comprises an apron provided with air flow-through openings extending along the processing element to near the processing face.

5 7. An apparatus according to claim 6, characterized in that the openings in the apron extend beyond a deformable part of the circumferential wall.

8. An apparatus according to at least one of claims 6 – 7, characterized in that the apron is manufactured from a robust, flexible material.

10 9. An apparatus according to at least one of claims 6 – 8, characterized in that the apron forms one whole with a holder element in which the processing element is provided.

10. An apparatus according to at least one of the preceding claims, characterized in that in the air inlet, spacers have been provided.

15 11. An apparatus according to at least one of the preceding claims, characterized in that the air inlet comprises inflow openings orientated slightly sideways relative to the processing face of the processing element.

12. An apparatus according to at least any one of the preceding claims, characterized in that the air passage comprises a relatively large air collecting
20 space to which the air outlet is connected.

13. An apparatus according to at least any one of the preceding claims, characterized in that the air outlet comprises a pivot joint.

14. An apparatus according to claim 13, characterized in that the pivot joint enables a rotation about a longitudinal axis orientated transversely to the
25 processing face.

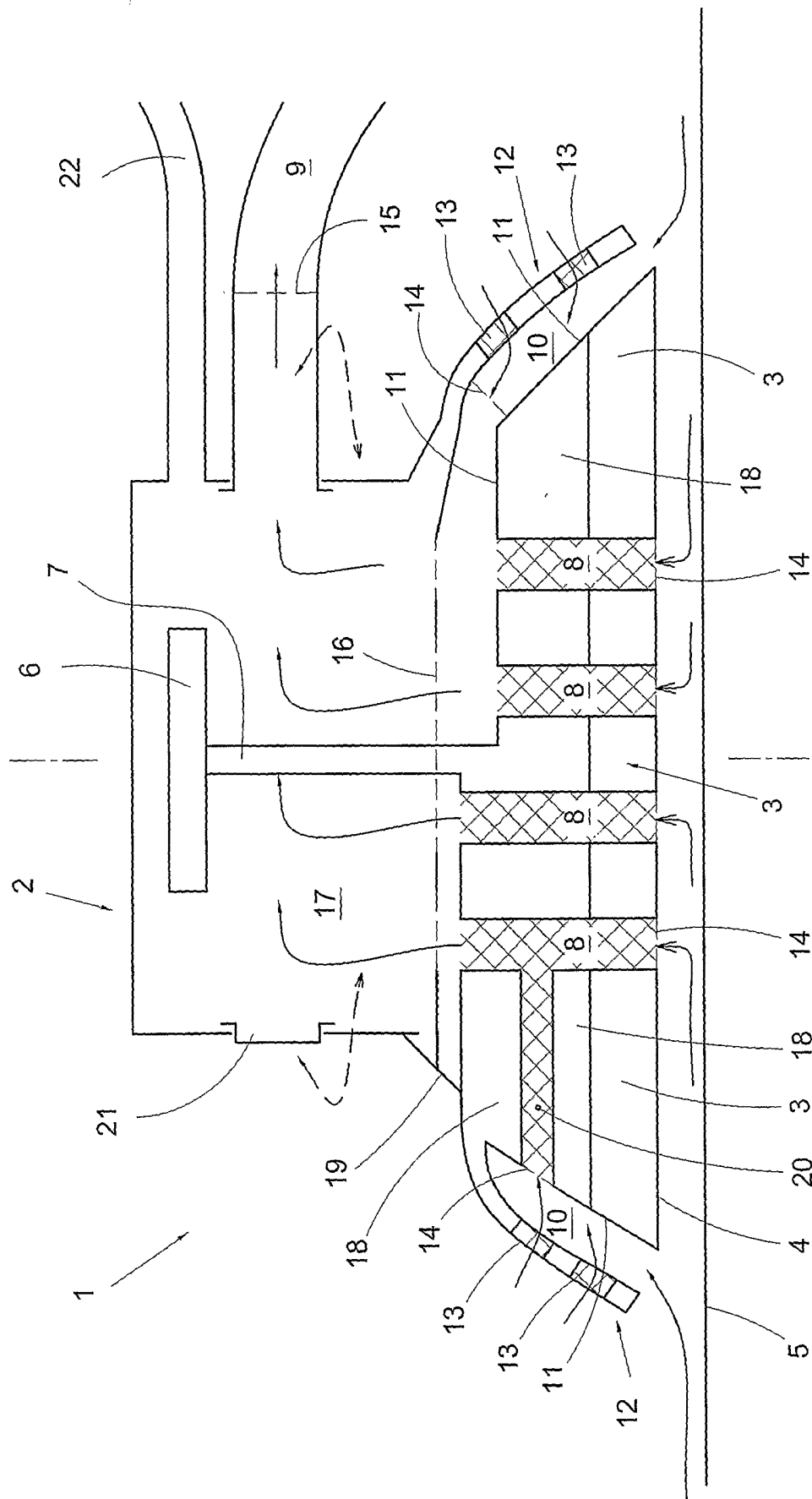


Fig. 1

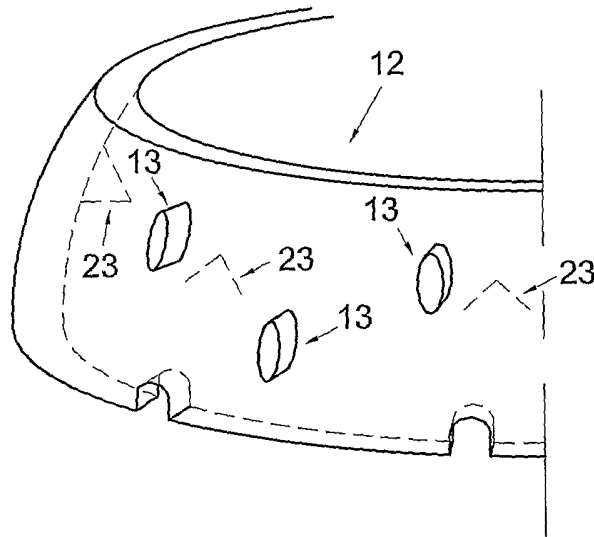


Fig. 2

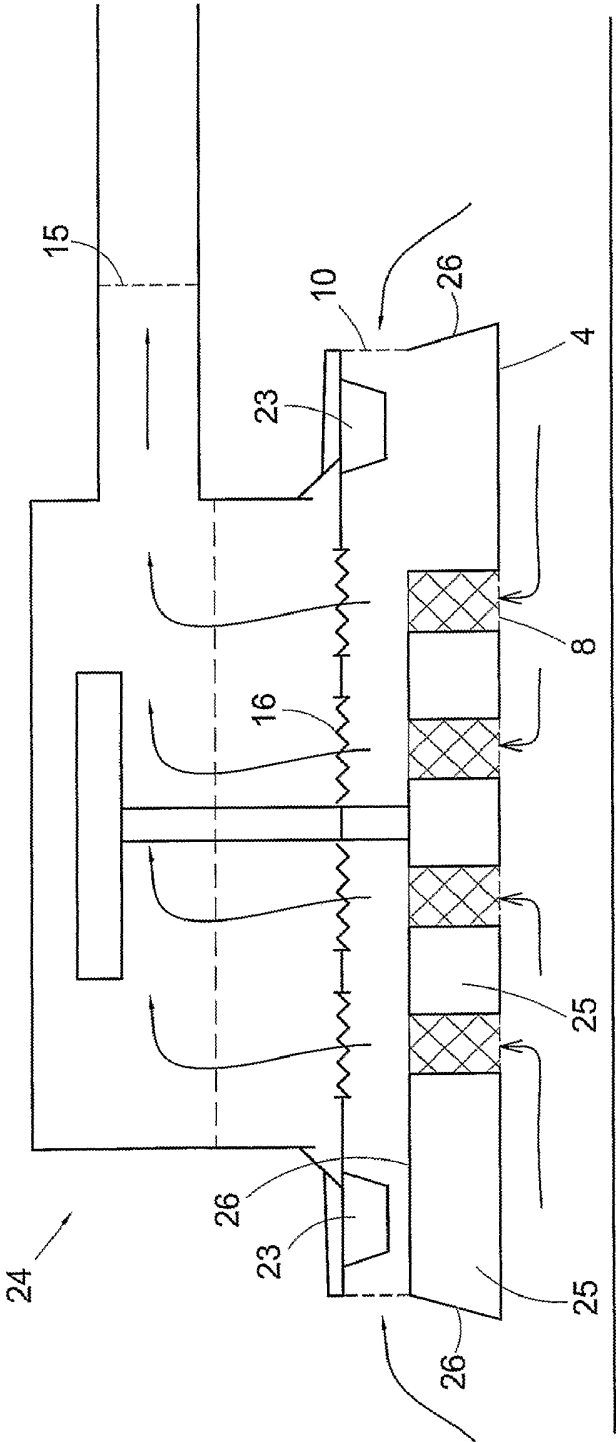


Fig. 3

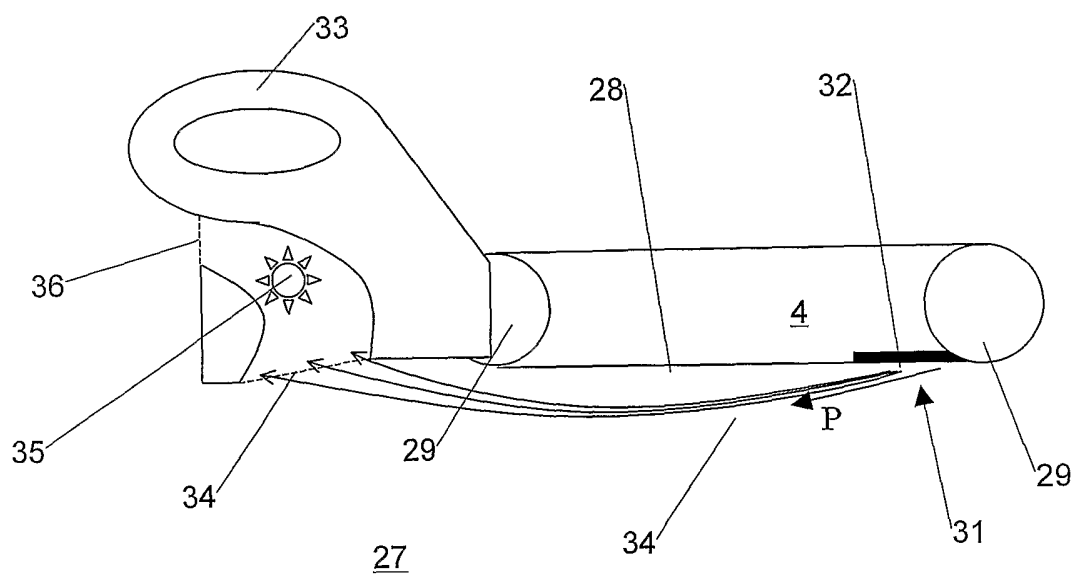


Fig. 4

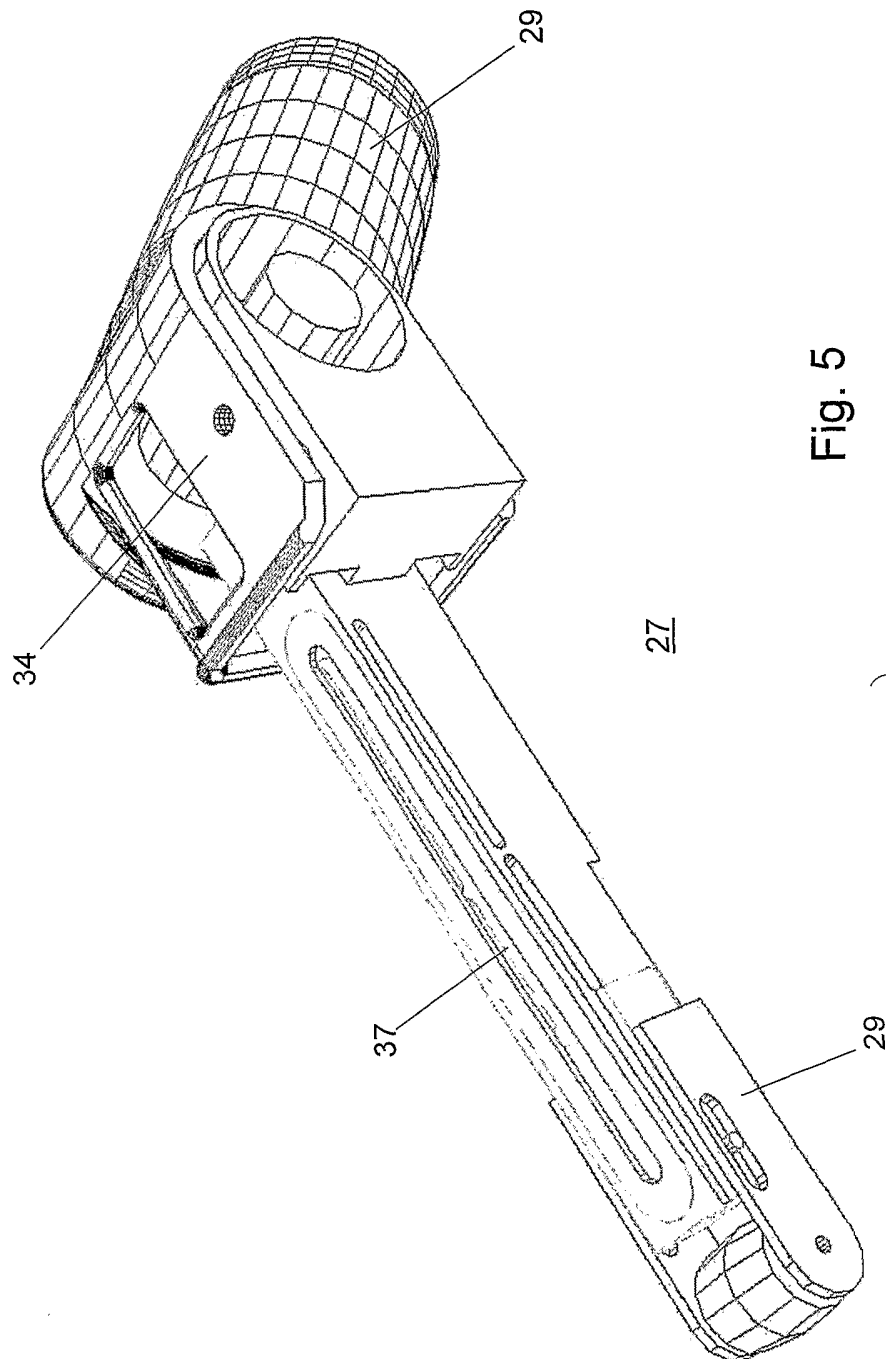


Fig. 5

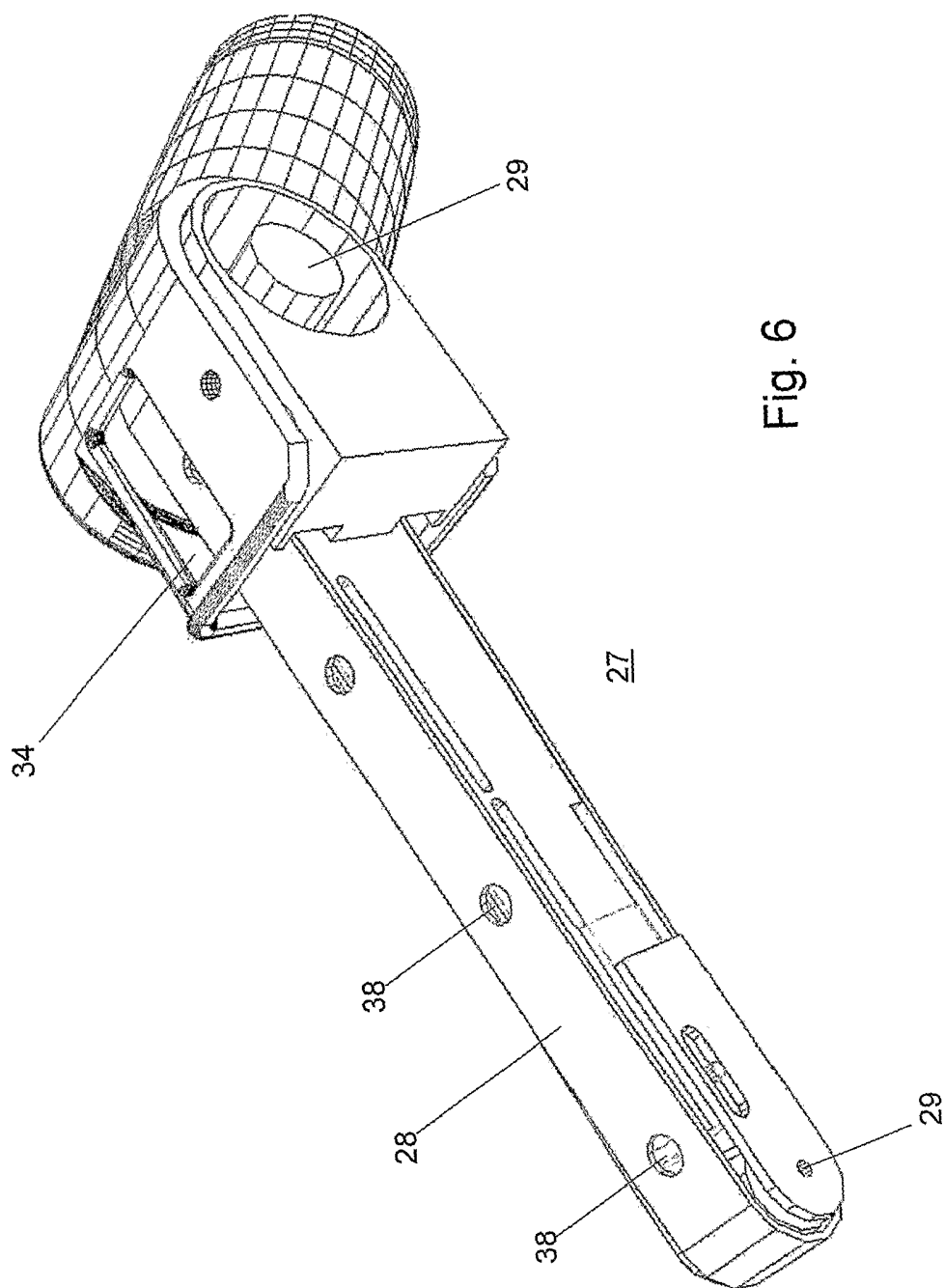


Fig. 6

INTERNATIONAL SEARCH REPORT

International Application No

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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B24B55/10

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 7 B24B

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

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

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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A	DE 42 38 564 A (FEIN C & E) 19 May 1994 (1994-05-19) cited in the application column 4, line 45 - line 48; figure 1 ---	1,9,12
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A	DE 703 323 C (SCHEER & CIE C F) 6 March 1941 (1941-03-06) the whole document ---	1-3
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Eschbach, D

INTERNATIONAL SEARCH REPORT

Int'l Application No
PC 1 / NL 02/00536

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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