(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 705 651 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
10.04.1996 Bulletin 1996/15

(51) Int. Cl.[6]: **B21C 37/30**, B24B 9/00

(21) Application number: **95202607.8**

(22) Date of filing: **28.09.1995**

(84) Designated Contracting States:
DE GB IT

(30) Priority: **04.10.1994 SE 9403350**

(71) Applicant: **CAPEX AB**
S-330 10 Bredaryd (SE)

(72) Inventor: **Carlsson, Kenth**
S-330 10 Bredaryd (SE)

(74) Representative: **Wallengren, Yngvar**
Patentbyran Y Wallengren AB
Box 116
S-331 21 Värnamo (SE)

(54) A method and an apparatus for deburring

(57) A method of deburring cut surfaces of tubes or profiles (23) in that the cut surface (21) comes into contact with the periphery of a substantially circular brush (5) which rotates about a first axis (6). The cut surface (21) and the brush (5) are brought together in a position where the cut surface (21) is approximately encompassed in or is approximately parallel with a tangential plane (22) to the brush. Further, the brush (5) is rotated about a second axis (7) which is approximately at right angles or at least transversely directed in relation to the cut surface (21).

An apparatus for deburring cut surfaces of tubes comprises a preferably cylindrical brush (5) which rotates about a first axis (6), a guide for aligning the tube or the profile (23) and a drive unit for driving the brush (5). The guide means is to be capable of aligning the tube or profile (23) so that its cut surface (21) is approximately parallel with the tangential plane (22) of the brush (5). The drive unit further includes means for the movement of the brush (5) about a second axis (7) which is transversely directed in relation to, but is preferably approximately at right angles to the cut surface (21).

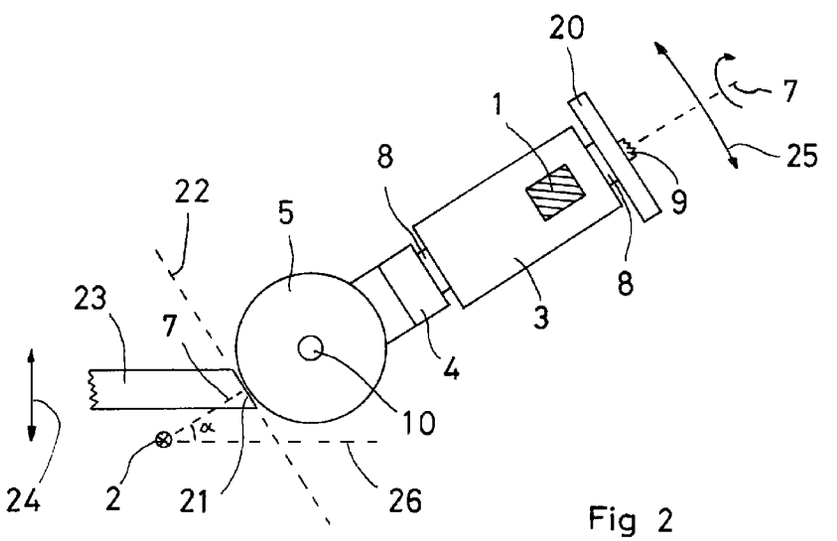


Fig 2

EP 0 705 651 A1

Description

TECHNICAL FIELD

The present invention relates to a method of deburring cut surfaces on tubes or profiles comprising the step that the cut surface is brought into contact with the periphery of a substantially circular brush rotating about a first axis.

The present invention also relates to an apparatus for deburring cut surfaces on tubes or profiles comprising a preferably circular brush rotary about a first axis, a guide for aligning the tube or profile, and drive means for driving the brush.

BACKGROUND ART

The use of a rotary steel brush for deburring cut surfaces on tubes and profiles is previously known in the art.

In such cases where the cut surface does not make approximately a right angle with the longitudinal axis of the tube or profile, such deburring has previously taken place fully manually in an operation in which the tube or profile must be moved a number of times before it is possible to debur the entire cut surface.

In such cases where the cut surface is approximately at right angles to the longitudinal axis of the tube or profile, it has been possible to employ deburring by machine, in which event the cut surface is brought into contact with a rotary brush roller.

PROBLEM STRUCTURE

The present invention has for its object to devise the method intimated by way of introduction in such a manner that it may simply and rationally be applicable to tubes and profiles without the need of placing any restriction on the orientation of the cut surface in relation to the longitudinal axis of the tube or profile. In particular, the present invention thus has for its object to realise a method of deburring mitred or obliquely cut tubes or profiles. The present invention further relates to realising a method which is rapid and effective and may readily be automated.

The present invention further has for its object to devise the apparatus intimated by way of introduction such that this permits deburring of tubes or profiles irrespective of the orientation of the cut surface in relation to the longitudinal axis of the tube or profile. In particular, the present invention has for its object to realise an apparatus which is well-suited for deburring obliquely cut or mitred tubes or profiles. The present invention yet further has for its object to realise an apparatus which is economical to manufacture, simple to manage and efficient in operation.

SOLUTION

The objects forming the basis of the present invention will be attained in respect of the method if this is characterized in that the cut surface and the brush are brought to such a mutual position that the cut surface is approximately encompassed in or is approximately parallel with a tangential plane to the brush; and that a movement is imparted to the brush about a second axis which is approximately at right angles to, or at least transversely directed to the cut surface.

The objects forming the basis of the present invention will be attained in respect of the apparatus if this is characterized in that the guide is arranged to align the tube or profile such that its cut surface is approximately encompassed in or is approximately parallel with a tangential plane to the brush; and that the power unit includes means for the movement of the brush about a second axis which is transversely directed, but preferably approximately at right angles to the cut surface.

According to one preferred embodiment of both the method and the apparatus, the second axis extends through the cut surface, preferably through its central or middle region.

Further advantages will be attained according to the present invention if the method is given one or more of the characterizing features as set forth in appended Claims 2 to 8 and if the apparatus is given one or more of the characterizing features as set forth in appended Claims 12 to 16.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

The present invention will now be described in greater detail hereinbelow, with particular reference to the accompanying Drawings, in which:

Fig. 1 is a vertical front elevation of a frame included in the apparatus, with a journal arrangement for carrying a brush;

Fig. 2 is a partial section taken approximately along the section marking A-A in Fig. 1, the brush rotating about the second axis of rotation being located in the same position as in Fig. 1;

Fig. 3 is a partial section corresponding to the section of Fig. 2, in which the brush has, however, rotated approximately 90° about the second axis of rotation in relation to the position of Fig. 2; and

Fig. 4 is a partial section corresponding to that of Fig. 2, in which the apparatus is, however, set for deburring of straight cut tubes or profiles.

DESCRIPTION OF PREFERRED EMBODIMENT

Referring to the Drawings, in Fig. 1, reference numeral 1 relates to a frame arrangement which is mounted in a machine frame such that it is pivotal about the preferably horizontal pivot axis 2 shown by broken lines. In such an instance (with a horizontal pivot axis 2), the frame arrangement 1 is pivotal between a recumbent, approximately horizontal position for deburring straight cut tubes or profiles (Fig. 4), and an upwardly angled (or in an alternative embodiment downwardly angled) position for deburring obliquely cut tubes or profiles (Fig. 2).

The frame arrangement 1 carries a journal device 3 which, in turn, carries a retainer device 4 for a substantially cylindrical, rotary brush 5. The brush 5, which preferably has bristles of steel or other metal, is rotary in relation to the retainer device 4 about a first axis of rotation 6. Further, the retainer device 4 is rotatably journalled about a second axis of rotation 7 in the journal device 3. The housing of the retainer device 4 is rigidly connected to an outer drive shaft 8 which is tubular and is journalled in the journal device 3. Interiorly in the outer drive shaft 8, there is disposed an inner drive shaft 9 which is rotatably journalled in relation to the journal device 3, preferably by being interiorly journalled in the drive shaft 8. Both the inner and outer drive shafts extend through the journal device 3.

While not being apparent from Fig. 1, the inner drive shaft 9 extends into the retainer device 4 where there is disposed a gear arrangement by the intermediary of which the rotational movement of the inner drive shaft 9 is transmitted to the spindle 10 of the brush 5 so that rotation may thereby be imparted to the brush 5 about the first axis of rotation 6. The upper end 15 on the Drawing of the inner drive shaft 9 is connected to one or more pulleys 11. The pulleys 11 are, by the intermediary of belts 12, in communication with corresponding pulleys 13 on a drive motor 14 which is secured in and carried by the frame arrangement 1. The drive motor 14 will hereby be drivingly connected to the brush 5 so that this may be driven in the above-intimated rotational direction about the first axis of rotation 6.

The upper end portion 15 of the inner drive shaft 9 has a further pulley 16 for driving a reduction mechanism 18 by the intermediary of a drive belt 17. Via a drive belt 19, the reduction mechanism 18 drives a pulley 20 which is connected to the end portion of the outer drive shaft 8 located over the journal device 3. Hereby, the drive motor 14 will, in the above-described manner, be connected for driving the brush 5 about the first axis of rotation 6, but also via the reduction mechanism 18 for driving the outer drive shaft 8 and thereby for rotating the retainer device 4 and the brush 5 about the second axis of rotation 7.

In Fig. 1, the reduction mechanism 18 has been exemplified as a belt transmission, but may of course be designed in any other optional and appropriate manner. Naturally, the reduction mechanism 18 should be mounted on and supported by the frame arrangement 1.

As an alternative to the reduction mechanism 18 and the belt transmission 16 and 17, it is possible to place a second drive motor on the frame arrangement 1 which, in such an event, should suitably be of steplessly adjustable speed, for driving the outer drive shaft 8 and thereby for rotating the brush about the second axis of rotation 7.

That which was described in the foregoing as comprising pulleys and belts may, naturally, just as well consist of other types of transmission devices such as gear wheels, chain drive, cogged belts etc.

In Fig. 1, the end surface or cut surface of the tube or profile 23 which is to be deburred is intimated at 21 by broken lines.

In Fig. 2, which shows the brush 5 in the same position of rotation about the second axis of rotation 7 as in Fig. 1, reference numeral 22 relates to a tangential plane to the brush. This tangential plane should be approximately parallel with the first axis of rotation 6. In the same Figure, reference numeral 23 relates to an end portion of the tube or profile which is to be deburred. It will be apparent from the Figure that the end portion is not cut straight across but is mitred or obliquely cut so that the cut surface makes an angle deviating from 90° to the longitudinal direction of the tube or profile.

For positioning and aligning the tube or profile 23 which is to be deburred, use is made of a guide (not specified in great detail on the Drawings), through which the tube or profile may be inserted. This guide is adjustable in the vertical direction in relation to the pivot axis 2, i.e. is movable in accordance with the double headed arrow 24. In addition, the guide is laterally adjustable, i.e. parallel with the longitudinal direction of the pivot axis 2. Suitably, the guide may comprise a sleeve-shaped or tubular device which surrounds the tube or profile which is to be deburred so that the profile or the tube may be inserted therein. Suitably, this sleeve-shaped device may be replaceable so as to allow for adaptation to different dimensions of tubes or profiles.

In Fig. 4, the frame arrangement 1 has been pivoted about the pivot axis 2 in a clockwise direction so that the second axis of rotation 7 is parallel with or coincides with the longitudinal direction of the tube or profile 23. In this position, the apparatus is set for deburring a tube or profile which has been straight cut.

Both in the adjustment position according to Fig. 2 and in the adjustment position according to Fig. 4, the cut surface 21 of the tube or profile is located in or approximately parallel with the tangential plane 22 of the brush 5. Furthermore, the adjustment setting is such that the second axis of rotation 7 extends through the cut surface 21, preferably through its central or middle region.

It will be apparent from Figs. 1 and 2 taken together that the first and second axes of rotation 6 and 7, respectively, are transversely directed in relation to one another, however, preferably approximately at right angles. Moreover, the axes 6 and 7 suitably intersect one another at a common point.

In Fig. 3, the retainer device 4 and the brush 5 have been turned through approximately 90° about the sec-

ond axis of rotation 7 in relation to that illustrated in Fig. 2. Also in this position of rotation of the brush 5, the cut surface 21 of the tube or profile 23 lies in or parallel with the tangential plane 22 of the brush 5. Furthermore, the second axis of rotation 7 extends through the cut surface 21, preferably through its central region. It will also be clearly apparent that the axes 6 and 7 are transversely directed and are preferably at right angles in relation to one another.

The method of deburring using the above-described apparatus proceeds in the following manner:
The angle of inclination of the frame arrangement 1 in relation to the horizontal plane 26, and thereby also the angle of inclination of the second axis of rotation 7 (see Fig. 2) is set in response to a display device which shows the inclination of the frame arrangement 1 in relation to the horizontal plane 26 and the frame or foundation of the machine. It will here be assumed that the longitudinal direction of the tube or profile 23 also lies in a horizontal plane.

The angle of adjustment α (Fig. 2) of the frame arrangement 1 is, in this situation, adapted in response to the angle between the longitudinal direction of the tube or profile and the direction of the cut surface 21. In, for example, a tube mitred at 45°, the angle α will be 45°, while the angle α will be 0 in a straight cut tube.

One the frame arrangement 1 has been adjusted in response to the cutting angle of the tube or profile, the guide is placed in such a manner that the second axis of rotation 7 will pass through the cut surface 21, preferably as close to its centre as possible. The adjustment of the guide may, here, take place in both the vertical direction (according to the arrow 24) and in the horizontal direction (in the longitudinal direction of the pivot axis 2). This completed, the apparatus is set for use, whereafter the drive motor 14 may be started. Here, the brush 5 will rotate, not only about the first axis of rotation 6, but also, and preferably at lower speed, about the second axis of rotation 7. Once the machine has been started, the tubes or profiles 23 which are to be deburred, are moved in the longitudinal direction into the guide until the cut surface 21 comes into contact with the brush 5. Once the brush 5 has completed a number of rotations about the second axis 7, the deburring operation is completed.

Thanks to the rotation of the brush 5 about the second axis of rotation 7, all walls in, for example, a square tube will be touched and processed by the brush, both in a direction from inwards and out from the centre of the tube and in a direction from outwards and in towards the centre of the tube. Hereby, both the external and internal edges of the tube will be deburred in both directions.

DESCRIPTION OF ALTERNATIVE EMBODIMENTS

It has been presupposed in the foregoing that the movement of the brush 5 about the second axis of rotation 7 is to be a continuous rotational movement. According to the present invention however, this is not necessary, but instead the movement may be a stepwise rotational movement, an alternating movement and a movement in which each phase should extend reciprocally through at least 360°.

It has further been presupposed in the foregoing that the frame arrangement 1 is to be pivotally secured in the foundation or frame of the machine proper and be pivotal about the pivot axis 2. According to the present invention, it is essential that the angle between the second axis of rotation 7 and the longitudinal direction of the workpieces 23 which are to be deburred may be set in response to the angle of cut of the workpiece. However, such a setting or adjustment may also be made with a fixed mounting of the frame arrangement by pivotal adjustment of the guide.

It will be apparent from Fig. 1 that the extent of the brush 5 in the axial direction is greater than the width of the cut surface 21. This is not entirely necessary according to the present invention, but the guide may instead be reciprocally displaceable while deburring is in progress in a direction which is parallel with the pivot axis 2.

The present invention may be modified without departing from the spirit and scope of the appended Claims.

Claims

1. A method of deburring cut surfaces on tubes or profiles (23) comprising the step that the cut surface (21) is brought into contact with the periphery of a substantially circular brush (5) rotating about a first axis (6), **characterized in that** the cut surface (21) and the brush (5) are brought to such a mutual position that the cut surface is approximately encompassed in or is approximately parallel with a tangential plane (22) to the brush (5); **and that** a movement is imparted to the brush about a second axis (7) which is approximately at right angles to, or at least transversely directed to the cut surface (21).

2. The method as claimed in Claim 1, **characterized in that** the second axis (7) extends through the cut surface (21) preferably through its central or middle region.

3. The method as claimed in Claim 1 or 2, **characterized in that** the movement about the second axis (7) takes place continuously as a rotational movement.

4. The method as claimed in Claim 1 or 2, **characterized in that** the movement about the second axis (7) takes place stepwise.

5. The method as claimed in any of Claims 1 to 3, **characterized in that** the movement of the brush (5) about the second axis (7) takes place more slowly than about the first axis (6).

6. The method as claimed in any of Claims 1 to 5, **characterized in that** the tube or profile (23) is passed in its longitudinal direction into a guide and into contact with the brush (5).

7. The method as claimed in Claim 6, **characterized in that** the mutual position between the second axis (7) and the longitudinal direction of the guide is adjusted for alignment of the cut surface (21) approximately in or approximately parallel with the tangential plane (22) of the brush.

8. The method as claimed in any of Claims 1 to 7, **characterized in that** the first (6) and the second (7) axes intersect preferably at a right angle.

9. An apparatus for deburring cut surfaces (21) of tubes or profiles (23) comprising a preferably circular brush (5) rotary about a first axis (6), a guide for aligning the tube or profile (23), and a power unit for driving the brush (5), **characterized in that** the guide is arranged to align the tube or profile (23) such that its cut surface (21) is approximately encompassed in or is approximately parallel with a tangential plane (22) to the brush (5); **and that** the power unit includes means (8, 16-20) for the movement of the brush (5) about a second axis (7) which is transversely directed, but preferably approximately at right angles to the cut surface (21).

10. The apparatus as claimed in Claim 9, **characterized in that** the second axis (7) extends through the cut surface (21), preferably through its central or middle region.

11. The apparatus as claimed in Claim 9 or 10, **characterized in that** the first (6) and the second (7) axes intersect one another preferably at approximately a right angle.

12. The apparatus as claimed in any of Claims 9 to 11, **characterized in that** the second axis (7) extends through the central region of the brush (5) counting in the axial direction thereof.

13. The apparatus as claimed in any of Claims 9 to 12, **characterized in that** the drive unit is operative to rotate the brush (5) at a lower speed about the second (7) axis than about the first (6) axis.

14. The apparatus as claimed in any of Claims 9 to 13, **characterized in that** the drive unit includes a frame (1) with a journal device (3), a first drive shaft (9) which extends through and is journalled in the journal device for driving the brush (5) about the first axis (6), and a second, tubular drive shaft (8) which surrounds the first and which extends through and is journalled in the journal device (3) for driving the brush (5) about the second axis (7).

15. The apparatus as claimed in Claim 14, **characterized in that** the frame (1) carries a drive motor (14) which, by the intermediary of power transmission means (11-13), is drivingly connected to the first drive shaft (9); **and that** the first drive shaft is drivingly connected to the second drive shaft (8) by the intermediary of a reduction transmission (18) carried by the frame (1).

16. The apparatus as claimed in any of Claims 14 or 15, **characterized in that** the frame (1) is pivotal about an axis (2) which is approximately at right angles to the longitudinal direction of the guide.

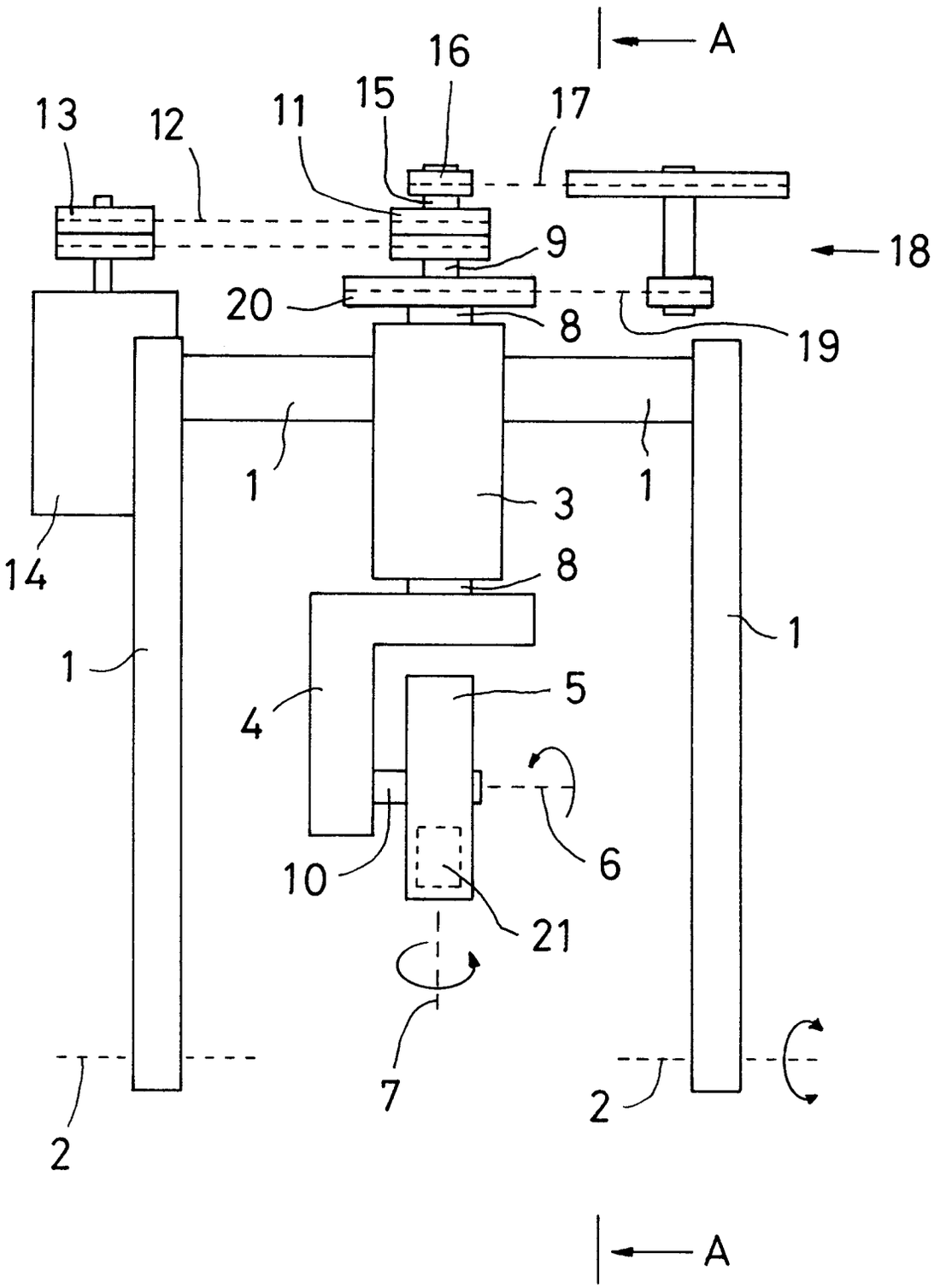


Fig 1

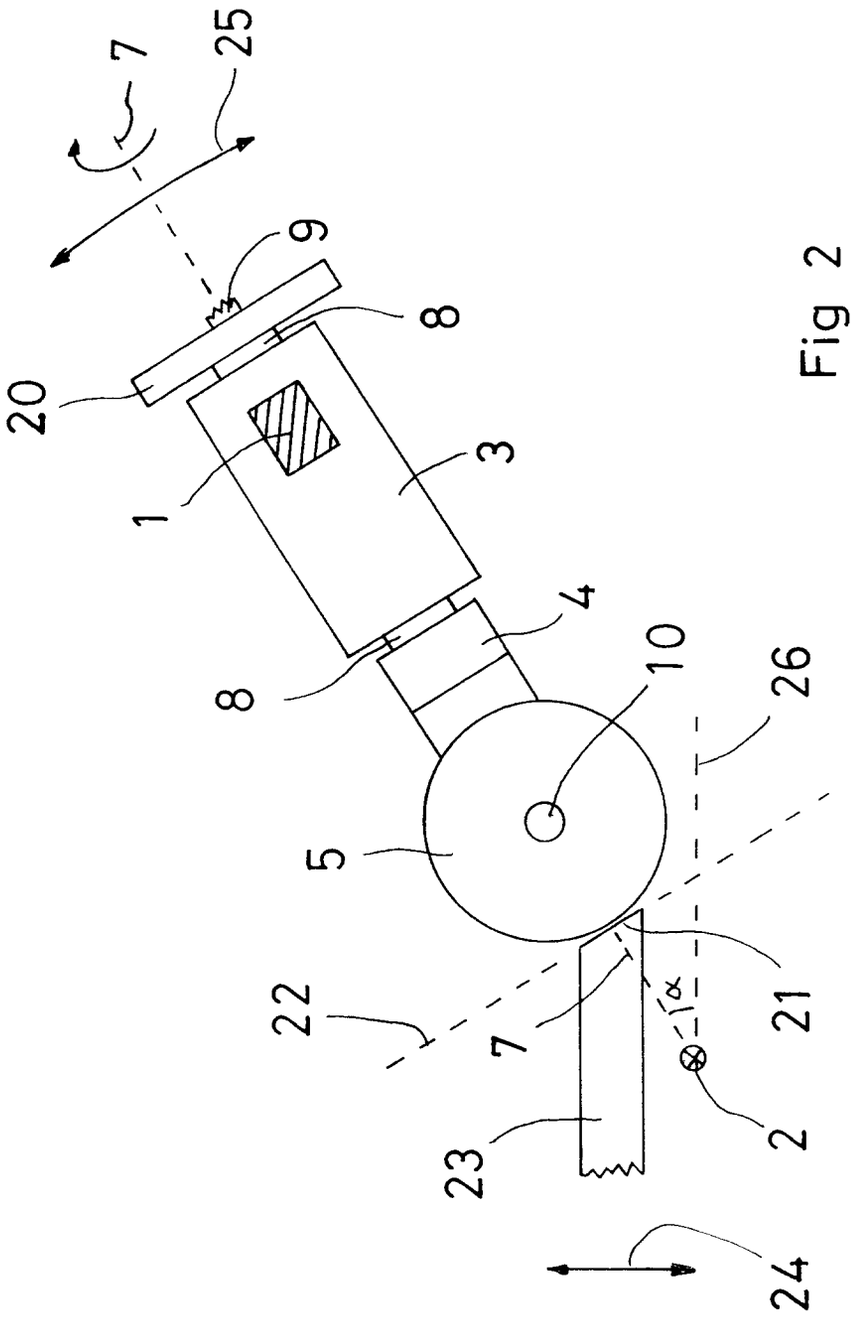


Fig 2

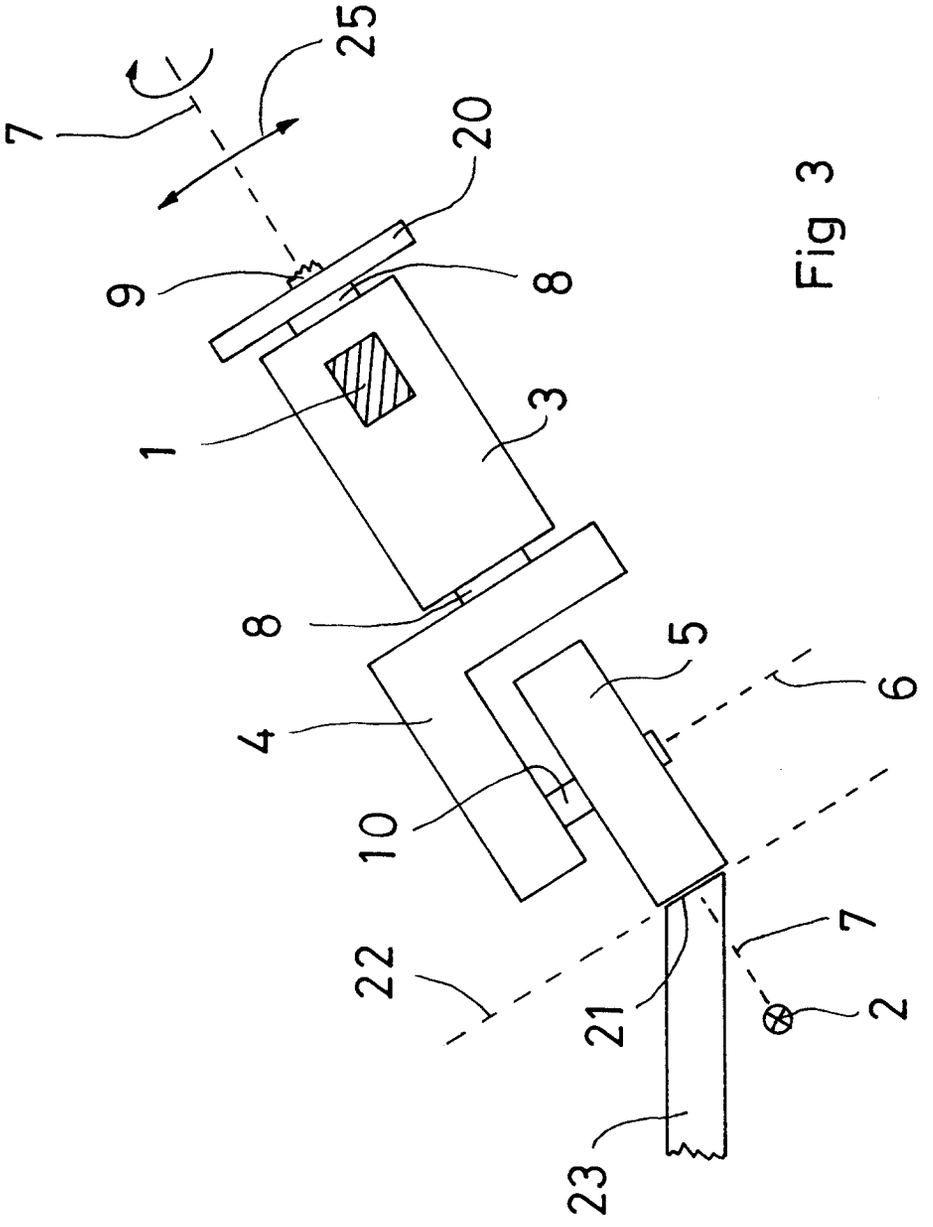


Fig 3

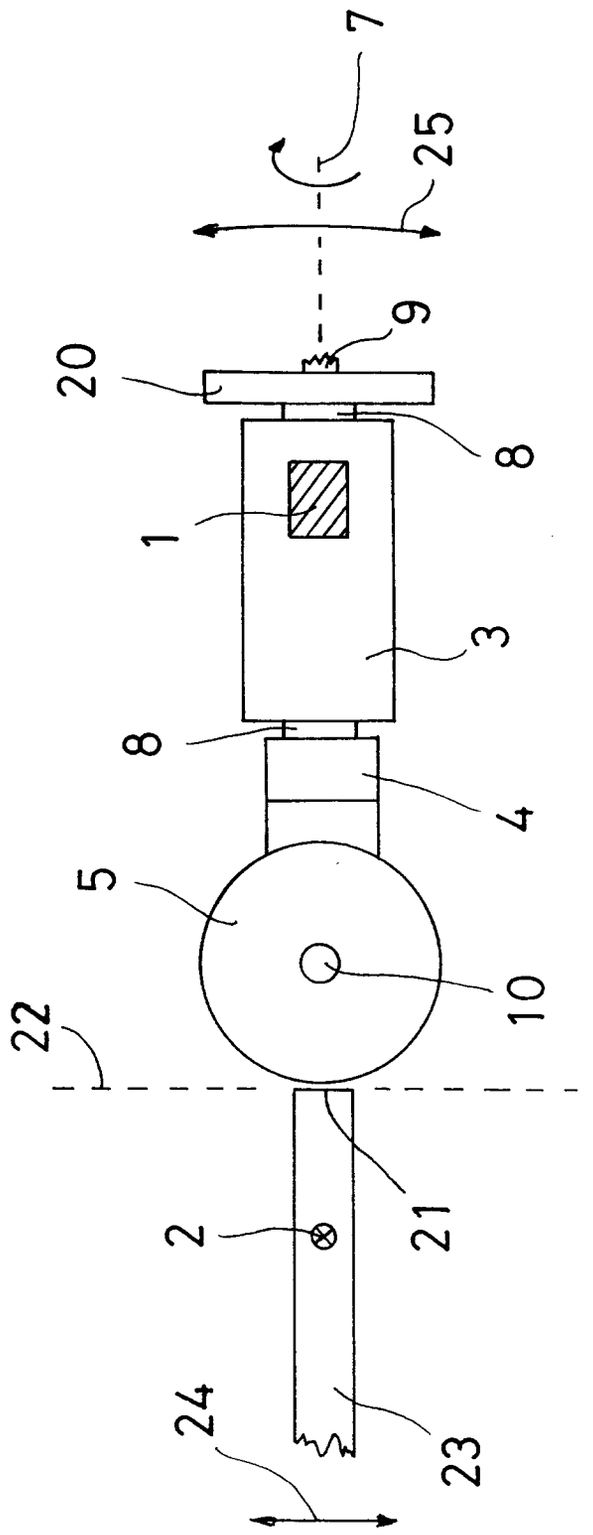


Fig 4

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 20 2607.8
Page 1

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.6)
A	US, A, 3045268 (R.L.COAN), 24 July 1962 (24.07.62) --	1-16	B21C 37/30 B24B 9/00
A	SE, B, 439260 (BENGT FJÄLLSTRÖM), 10 June 1985 (10.06.85) --	1-16	
A	DE, A1, 3124931 (WALLICH, ERICH), 20 January 1983 (20.01.83) --	1-16	
A	DE, A1, 2152229 (UEBELGÜNN, OTTO), 26 April 1973 (26.04.73) --	1-16	
A	DD, A5, 31342 (REINER UHLMANN; WERNER SCHULZE), 5 November 1968 (05.11.68) -----	1-16	TECHNICAL FIELDS SEARCHED (Int. Cl.6) B21C B24B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
STOCKHOLM	8 January 1996	THOMAS AVASALU

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermidiate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P0401)