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(71) Applicant: **OMD OFFICINA MECCANICA DOMASO S.p.A.**
22013 Domaso (Como) (IT)

(72) Inventor: **Bassi, Albino,**
c/o OMD-OFFICINA MECC. DOM. S.P.A.
22013 Domaso (Como) (IT)

(74) Representative: **Cicogna, Franco**
Ufficio Internazionale Brevetti
Dott.Prof. Franco Cicogna
Via Visconti di Modrone, 14/A
20122 Milano (IT)

(54) All-purpose cutting device for coil spring winding machine

(57) The present invention relates to an all-purpose cutting device (1) specifically designed for coil-spring winding machines. The device comprises a framework (2) swingably supporting a guide (4) suitable to swing about a swinging axis (3a).

The guide (4) slidably supports a cutting tool bearing slide (5), which can be driven along a driving direction substantially transversal of the swinging axis (3a). The device comprises moreover a first cam member (8) affecting the slide (5), for causing the slide (5) to reciprocate along a driving direction, as well as a second cam member (9), affecting the guide (4) in order to cause the latter to swing about the swinging axis (3a) thereof. The second cam member (9) can be actuated simultaneously with the first cam member (8) to drive the cutting tool (6) along a "drop"-shape path, or it can be deactuated to cause said cutting tool (6) to be driven along a rectilinear path.

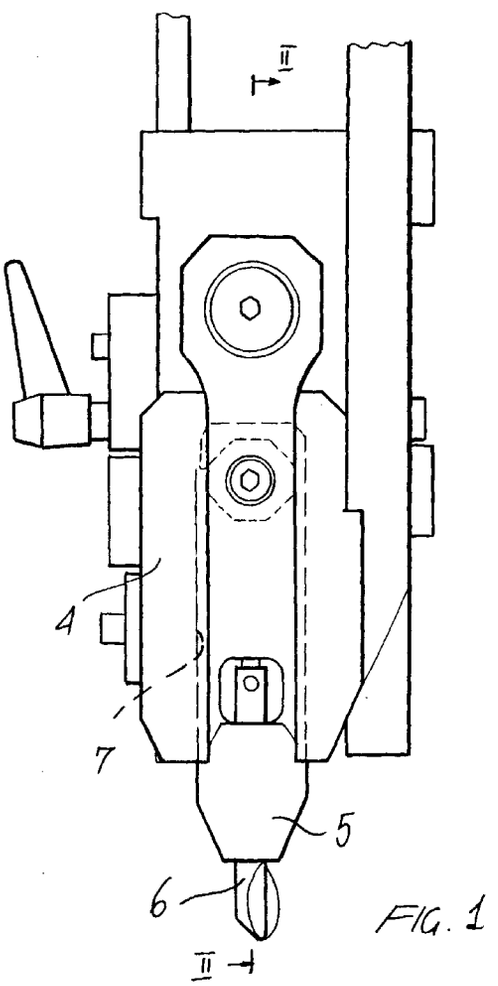

FIG. 1

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Description

BACKGROUND OF THE INVENTION

The present invention relates to an all-purpose cutting device, which has been specifically designed for coil or helical spring winding machines.

In the coil spring winding apparatus field are at present used linear cutting devices, or shear devices, circular rotary cutting devices as well elliptical rotary cutting devices.

The linear type of cutting devices, or the shear-like cutting devices, usually comprise a slide on which is assembled a movable knife element, operating against a fixed central knife element. During the cutting operation, the wire being processed is caused to stop.

The main drawback of these cutting devices is that inside the spring a so-called "flash" is formed.

Moreover, the changing feeding speed of the wire material can generate further problems.

The circular rotary cutting devices, on the other hand, comprise a cutting knife element which is mounted on a supporting member, in turn mounted on two parallel rotary cams, thereby jointly forming a mechanism which can be considered analogous to an articulated parallelogram.

The rotary or turning speed of the two cams is equal to the wire material feeding speed.

These prior devices do not perform a cutting like that of the linear cutting devices, since the wire material being wound is merely notched by the cutting knife, which will enter the wire material for about 1/3 of the thickness thereof.

The tension in the pre-tempered wire material will cause, during the winding up operation of said wire material, a breaking thereof without any flash, at the notch location.

The main drawback of these prior circular rotary cutting devices is that a comparatively large space is required for allowing the cutting knife to perform its rotary movement.

Moreover, in devices of this type, it is necessary to use modified wire winding foot elements, or it is necessary to modify the working positions thereof as well as of the outlet wire guiding element.

In order to overcome these drawbacks, elliptical rotary cutting devices have been provided, requiring a less space to allow the cutting knife to move, but, on the other hand, are very complex construction-wise and have a comparatively low operation flexibility.

SUMMARY OF THE INVENTION

Thus, the aim of the present invention is to overcome the above mentioned drawbacks, by providing an all-purpose cutting device, specifically designed for coil spring winding machines, which, depending on requirements, is suitable to perform a cutting operation by driving the cutting tool according to a drop-like path or according to a rectilinear path.

Within the scope of the above mentioned aim, a main object of the present invention is to provide such a cutting device which is very simple construction-wise and can be made at a competitive cost.

Another object of the present invention is to provide such a cutting device which is very reliable and safe in operation.

Yet another object of the present invention is to provide such a cutting device which, owing to its capability of performing a cutting operation by the cutting tool being driven on a closed path, or on a rectilinear path, will allow to meet all of the use requirements.

According to one aspect of the present invention, the above mentioned aim and objects, as well as yet other objects, which will become more apparent hereinafter, are achieved by an all-purpose cutting device, specifically designed for coil spring winding machines, characterized in that said device comprises a framework swingably supporting, about a swinging axis, a guide element, said guide element slidably bearing a cutting tool holding slide, which can be driven along a driving direction which is substantially transversal of said swinging axis, being moreover provided a first cam element affecting said slide for reciprocating said slide along the driving direction as well as second cam element, affecting said guide element, for causing said guide element to swing about the swinging axis thereof, said second cam element being suitable to be actuated simultaneously with said first cam element in order to cause said cutting tool to be driven along a drop path or being adapted to be deactuated in order to cause said cutting tool to be driven exclusively by said first cam element, according to a rectilinear path.

BRIEF DESCRIPTION OF THE DRAWINGS

Further characteristics and advantages of the cutting device according to the present invention will become more apparent hereinafter from the following detailed disclosure, of a preferred, though not exclusive, embodiment of said cutting device, which is illustrated, by way of a merely indicative, but not limitative example, in the figures of the accompanying drawings, where:

Figure 1 is an elevation view illustrating the cutting device according to the invention;

Figure 2 is a schematic cross-sectional view substantially taken along the section line II-II of figure 1;

Figure 3 is a front elevation view illustrating a portion of the cutting device according to the invention and clearly showing the movement path of the cutting tool, as the latter carries out a cutting operation along a drop-like path or trajectory;

Figure 4 is an enlarged view illustrating the cutting operation of the cutting tool included in the device according to the present invention, on the end por-

tion of a spring;
and
Figures 5 to 8 illustrate, in sequence, several positions of the cutting tool in performing a cutting operation according to a drop-like path, by the device according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to the number references of the above mentioned figures, the cutting device according to the present invention, which has been generally indicated by the reference number 1, comprises a framework or casing 2 swingably supporting, about a swinging axis 3a, a guide element 4 which. in turn, slidably supports a slide element 5 bearing a cutting tool 6.

More specifically, the swinging axis 3a of the guide element 4 is defined by a pin 3 which is coupled to said framework 2 and rotatably supports, about the axis 3a thereof, the guide element 4.

In said gide element 4 a sliding recess 7 is provided, which extends substantially perpendicular to the axis 3a of the pin 3 and inside of which is slidably engaged the slide element 5.

The cutting device according to the invention comprises moreover a first cam element 8 and a second cam element 9, respectively affecting the slide 5 in order to cause the latter to be reciprocated along the driving direction 10, which is substantially perpendicular to the axis 3a, and in order to cause said guide element 4 to swing about said swinging axis 3a.

The simultaneous driving of the first cam element 8 and second cam element 9 will cause the cutting tool 6 to be driven along a "drop" path or trajectory, as is clearly shown in figures 3 to 8, whereas by driving only the first cam element 8, the slide 5 will be caused to be rectilinearly reciprocated along the driving direction 10.

More specifically, the first cam element 8 is constituted by a crank 11 connected to the end portion of a shaft 12, which has its axis 12a extending parallel to the swinging axis 3a.

The shaft 12 is rotatably supported about the axis 12a thereof, for example through bearings 13, by said frame 2.

The end portion of the shaft 12 opposite to the crank 11 supporting end portion, is coupled to a joint 14 connecting the shaft 12 to the outlet or output shaft 15a of a motor reducing unit 15, which can be driven so as to cause the shaft 12 and accordingly the crank 11 to turn.

As shown, on the shaft 12 is keyed a gear wheel 16 meshing with a gear wheel 17 keyed on an idle shaft 18, also supported by said framework 2, by means of which the gear wheel 16 is coupled to a gear wheel 19 keyed on a further shaft 20.

The second cam element 9 comprises a cam proper 21 and related pad 22, engaging in a seat 23 formed in the guide element 4. As shown, the cam element 21 is coupled to one end portion of the shaft 20 which is also rotatably supported by said framework 2, so as to turn about the rotary axis of said shaft 20.

In this connection it should be pointed out the shaft 12, the idle shaft 18 and shaft 20 are arranged with their axes parallel to the swinging axis 3a of the pivot pin 3.

Moreover, the first cam element 8 and second cam element 9 are spaced from one another on the same side with respect to the axis 9, i.e. the cam element causing the guide element 4 to swing about the swinging axis 3a is arranged between the first cam element 8 and the swinging axis 3a.

The crank 11, in turn, is coupled to the slide 5 through a connecting rod 25.

The idle shaft 18 can be driven, in a per-se known manner, in order to either actuate or deactuate the coupling of the shaft 12 to the shaft 20, or to actuate or deactuate the coupling of the first cam element 8 to the second cam element 9.

The rotary movement of the shaft 12 can be controlled by a sensor, for example an optical type of sensor, or an inductive or capacitive type of sensor 26 laterally facing the shaft 12 or the shaft 15a, or the joint 14, as is clearly shown.

The cutting device according to the present invention operates as follows.

As a drop path or trajectory cut is to be made, the shaft 12 and shaft 20 are simultaneously driven, i.e. the idle shaft 18 is so driven as to perform, by the gear wheel 17, the coupling of the gear wheel 16 to the gear wheel 19.

Under the simultaneous driving of the first cam element 8 and second cam element 9, the slide 5 will be driven by a reciprocating rectilinear movement along the direction 10, whereas the guide element 4 will be caused to swing, under the action of the second cam element 9, about the swinging axis 3a, as is shown in the operating sequence illustrated in figures 5 to 8, thereby causing the tip of the cutting tool 6 to be driven on a drop-like path or trajectory, as is clearly shown in figures 3 and 4.

As, on the other hand, the cutting tool 6 must be merely actuated or driven on a rectilinear path, then the coupling of the gear wheels 16 and 19 is disengaged, so as to prevent the driving to the shaft 12 from being transmitted to the shaft 20 and hence to the cam 21.

Thus, in this case, the slide 5 will be merely driven with a reciprocating movement along the driving direction 10.

From the above disclosure and from the figures of the accompanying drawings, it should be apparent that the invention fully achieves the intended aim and objects.

In particular, the fact is to be pointed out that an all-purpose cutting device has been provided which is very simple construction-wise, while providing a very high operating reliability and the capability of being used both for performing a rectilinear type of cut and for performing

a drop-like type of cut.

In this connection, it is to be moreover pointed out that the subject device has been above disclosed and illustrated merely by way of an indicative but not limitative example, and exclusively to demonstrate the practicing the invention and the main features thereof.

Thus, the disclosed device is susceptible to several variations and modifications, in the skillness capability of those skilled in the art, and coming within the above disclosed invention scope.

In practicing the invention, the used materials, as well as the contingent size, can be any, depending on requirements.

Claims

1. An all-purpose cutting device, specifically designed for coil spring winding machines, characterized in that said device comprises a framework swingably supporting, about a swinging axis, a guide element, said guide element slidably bearing a cutting tool holding slide, which can be driven along a driving direction which is substantially transversal of said swinging axis, being moreover provided a first cam element affecting said slide for reciprocating said slide along the driving direction as well as second cam element, affecting said guide element, for causing said guide element to swing about the swinging axis thereof, said second cam element being suitable to be actuated simultaneously with said first cam element in order to cause said cutting tool to be driven along a drop path or being adapted to be deactuated in order to cause said cutting tool to be driven exclusively by said first cam element, according to a rectilinear path.

2. A cutting device according to Claim 1, characterized in that said first and second cam elements are spaced on a same side with respect to said swinging axis.

3. A cutting device according to Claims 1 and 2, characterized in that said second cam element is arranged between said first cam element and said swinging axis.

4. A cutting device according to one or more of the preceding claims, characterized in that said first cam element comprises a crank coupled to an end portion of said slide on a side thereof opposite to said cutting tool, through a connecting rod.

5. A cutting device according to one or more of the preceding claims, characterized in that said first and second cam elements are adapted to be operatively coupled to one another for turning about the rotary axes thereof.

6. A cutting device according to one or more of the preceding claims, characterized in that said cutting device comprises moreover means for controlling the rotary movement of said first cam element.

7. An all-purpose cutting device, specifically designed for coil spring winding machines, characterized in that said cutting device comprises specifically designed structural elements substantially as broadly disclosed and illustrated and for the intended aim and objects.

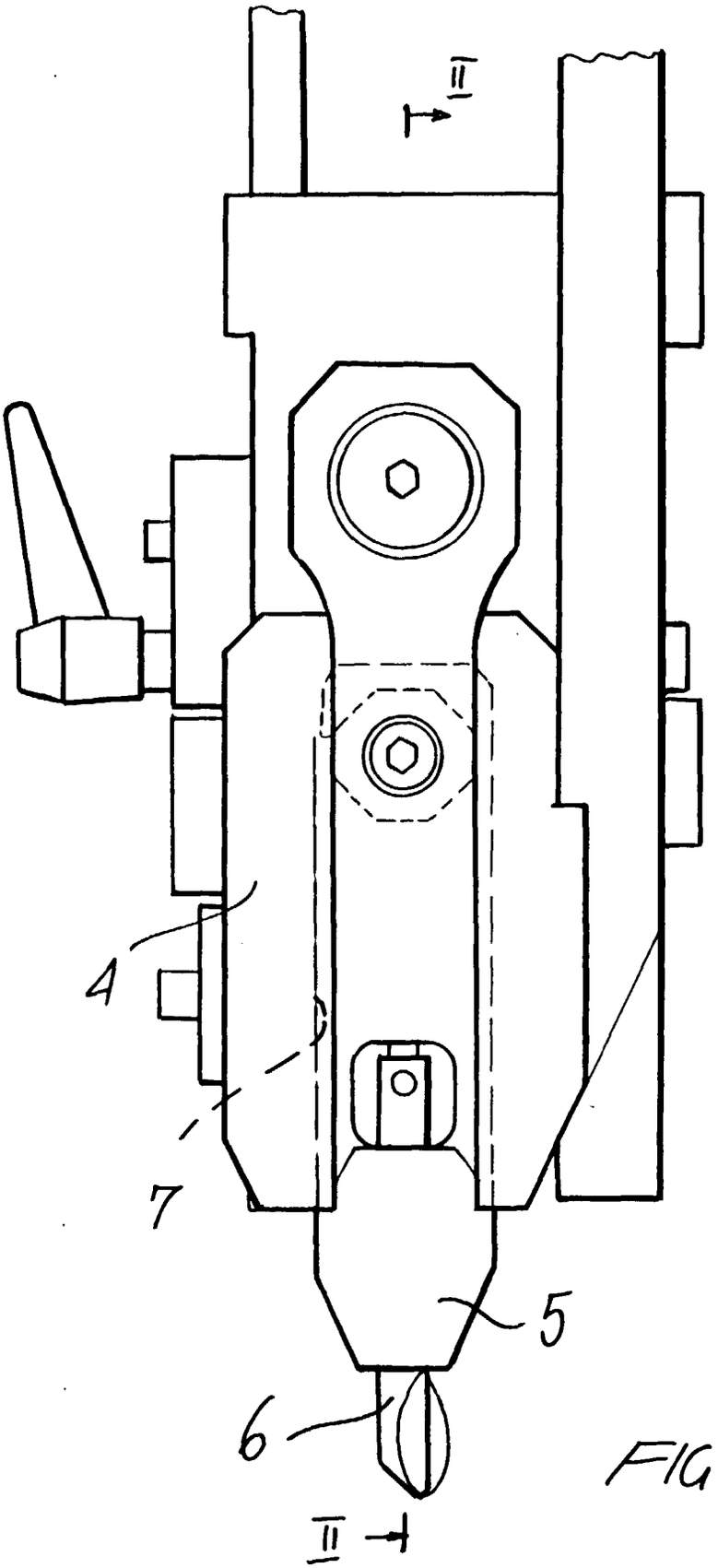

FIG. 1

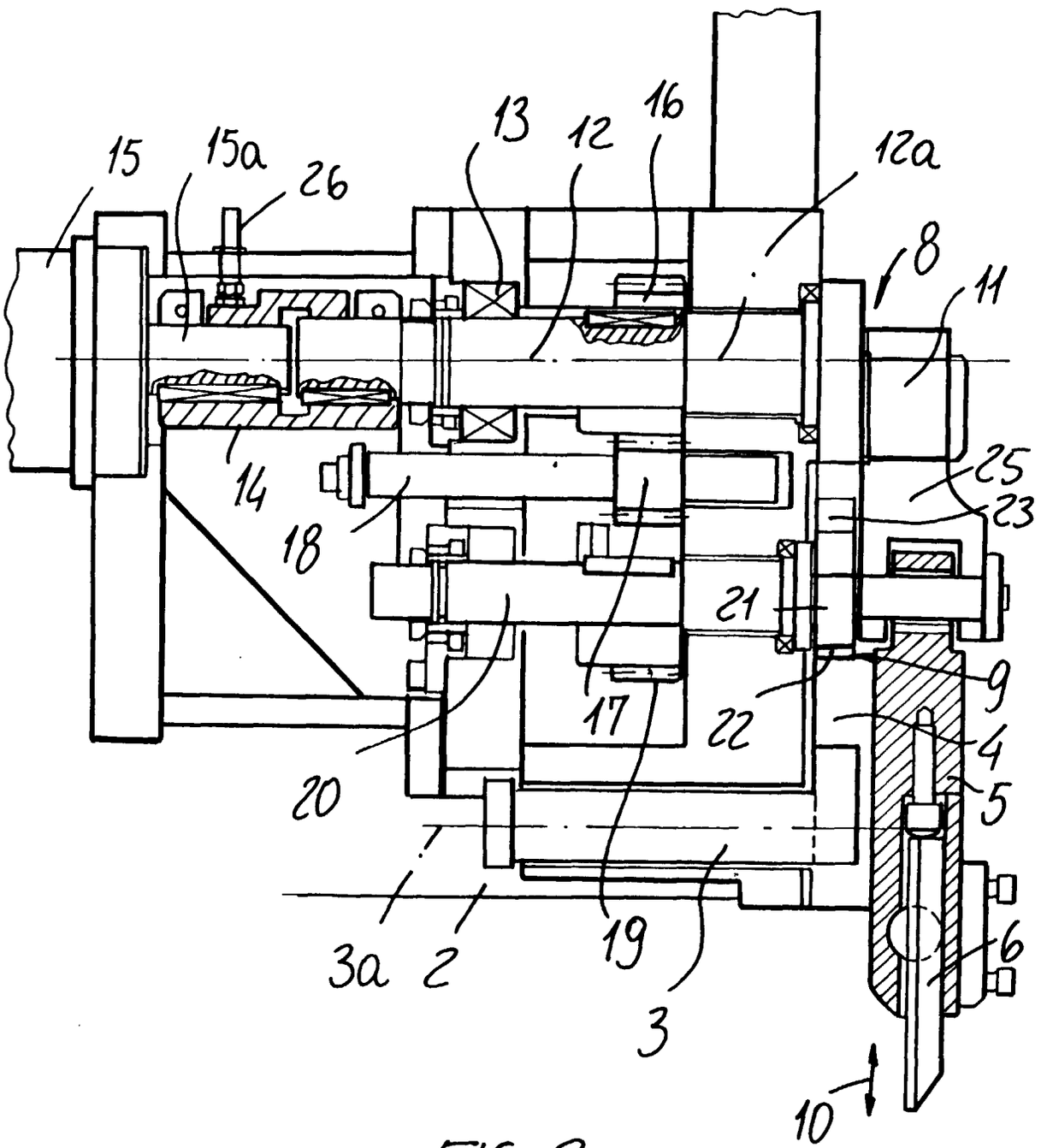

FIG. 2

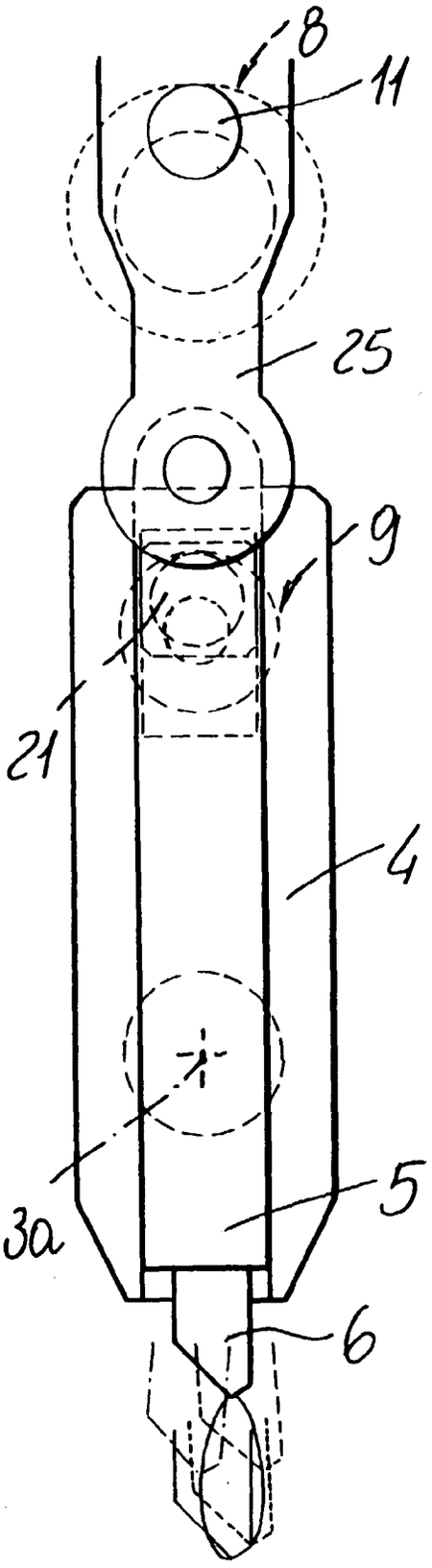

FIG. 3

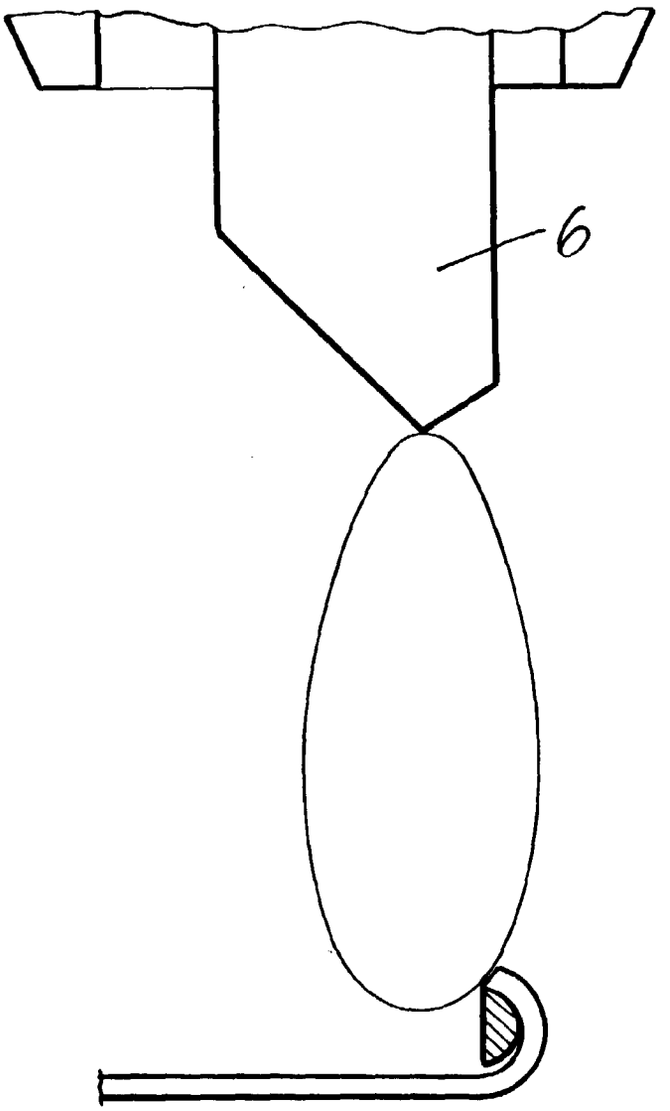

FIG. 4

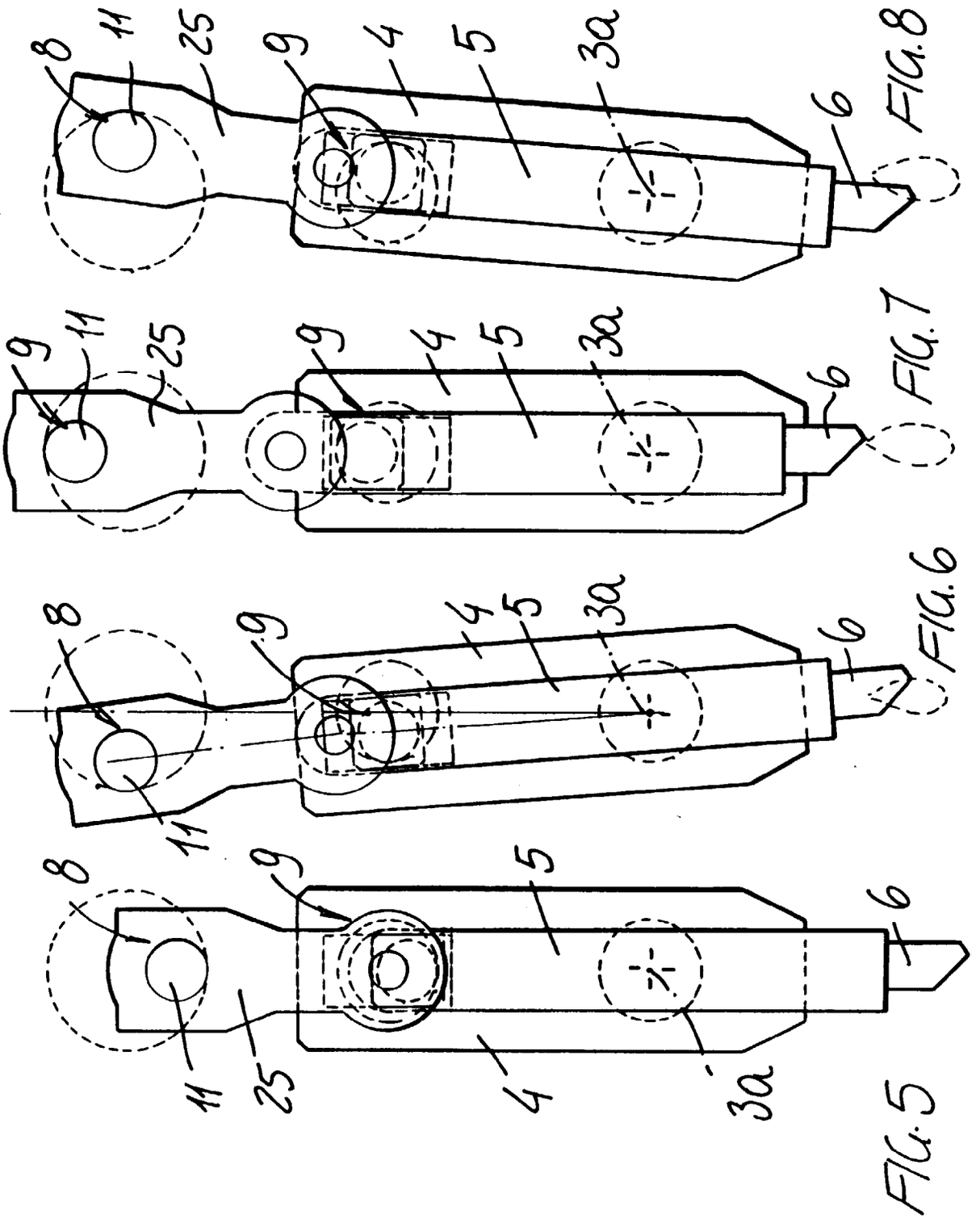

FIG.8

FIG.7

FIG.6

FIG.5

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EUROPEAN SEARCH REPORT

Application Number
EP 97 83 0184

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)
X	PATENT ABSTRACTS OF JAPAN vol. 095, no. 002, 31 March 1995 & JP 06 315732 A (ITAYA SEISAKUSHO:KK), 15 November 1994, * abstract *	1-7	B21F11/00
X	PATENT ABSTRACTS OF JAPAN vol. 096, no. 008, 30 August 1996 & JP 08 108238 A (ASAHI SEIKI KOGYO KK), 30 April 1996, * abstract *	1,2,5-7	
A	DE 40 40 659 C (WAFIOS MASCHINENFABRIK GMBH) 20 February 1992		

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

B21F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	27 August 1997	Barrow, J

CATEGORY OF CITED DOCUMENTS

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