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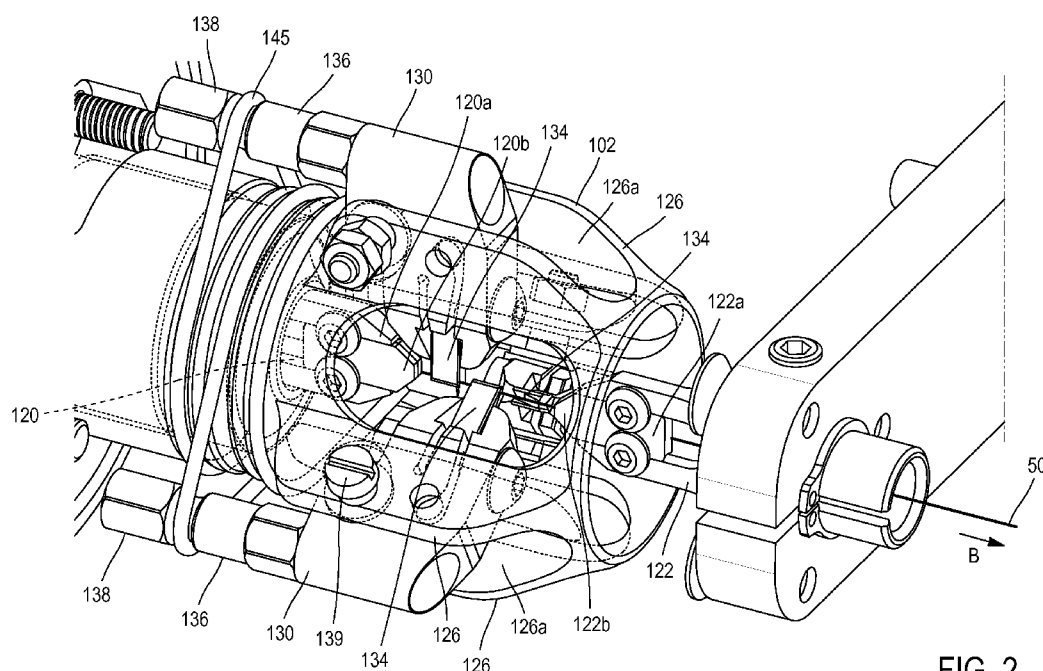


FIG. 2

(57) Abstract: In the field of the dry cleaning of metal wires intended for rubber articles, the invention relates to a centrifugal wire cleaner (100) that is used in a system that performs a cleaning cycle. The centrifugal wire cleaner (100) includes a rotary pod (102) with a bell housing (118) and a guide shuck and guide pin (120) that allow the wire (50) to pass along the axis of rotation of the rotary pod (102). At least one peripheral branch (126) allows attachment of a corresponding centrifugal tip (130), in which the centrifugal tip (130) includes a tip holder (132) that grips a cleaning tip (134) and a return attachment (136) terminating in a flyweight (138). Cleaning tips (134) are provided that correspond to the peripheral branches (126) and that are positioned radially so as to rotate about the wire (50) and so as to move radially under the effect of centrifugal force.



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CLEANING OF METAL WIRES
BY A CENTRIFUGAL SYSTEM WITH BLADES

TECHNICAL FIELD

5 The invention relates in general to a device for performing a dry cleaning cycle on metal wires that are intended particularly for use in rubber articles such as tyres.

CONTEXT

10 Metal/rubber composites are well known in the manufacture of various products, particularly tyres. As used here, the term "tyres" comprises, without limitation, tyres used for light vehicles, passenger cars, utility vehicles (including heavy duty vehicles), leisure vehicles (including, but without being restricted thereto, bicycles, motorbikes, mountain bikes, etc.), agricultural vehicles, military
15 vehicles, industrial vehicles, mining vehicles and construction vehicles.

 Metal/rubber composites are generally composed of a matrix made of unsaturated rubber, generally diene rubber, which can be crosslinked with sulphur, including metal reinforcing elements (or "reinforcements") such as wires, films or cords made of steel. As they are subjected to very high stresses during the running
20 of the tyres, especially to repeated actions of compression, bending or variation in curvature, these composites must, in a known way, satisfy a large number of sometimes contradictory technical criteria, such as uniformity, flexibility, flexural strength and compressive strength, tensile strength, wear resistance and corrosion resistance, and they must maintain this performance at a very high level for as long
25 as possible.

 During manufacture of metal/rubber composites, a cleaning process is often performed in order to remove dirt from the surface of the metal reinforcements. Such cleaning is beneficial to the properties of the metal/rubber composite regardless of the subsequent steps of manufacture, for example, during a cycle of
30 applying a predefined polymer to the surface of the metal reinforcement. For this reason, the manufacturers of metal/rubber composites, including tyre manufacturers, seek solutions for cleaning the metal reinforcements effectively while at the same time conserving the high quality of the metal/rubber composite.

SUMMARY

The invention is directed to a centrifugal wire cleaner that is used in a system that performs a dry cleaning cycle on a metal reinforcement comprising a wire intended for a rubber article. The centrifugal wire cleaner comprises a rotary
5 pod with a bell housing and a guide shuck that allow the wire to pass along the axis of rotation of the rotary pod. At least one peripheral branch allows attachment of a corresponding centrifugal tip, in which the centrifugal tip comprises a tip holder that grips a cleaning tip and a return attachment terminating in a flyweight.

In certain embodiments, three cleaning tips are provided that correspond to
10 three peripheral branches. The three cleaning tips are positioned radially so as to rotate about the wire and so as to move radially under the effect of centrifugal force.

According to one embodiment, a distance between two cleaning tips is set at 5.0 mm.

15 According to one embodiment, the cleaning tips are arranged, with the aid of the rotary pod, in a pivoting cascade arrangement.

According to another embodiment, the cleaning tips are arranged, with the aid of the rotary pod, in a parallel cascade arrangement.

20 According to another embodiment, the cleaning tips are arranged, with the aid of the rotary pod, in a concentric arrangement.

In certain embodiments, the rotary pod is held in position by a guide spindle and is driven by an electric motor. A contact pressure with which the cleaning tips press against the wire varies according to the square of the rotational speed of the rotary pod.

25 According to one embodiment, the centrifugal wire cleaner further comprises annular return springs that keep the cleaning tips away from the axis of rotation of the rotary pod outside of the dry cleaning cycle.

According to one embodiment, the centrifugal wire cleaner further comprises a gravity-return of the cleaning tips that ensures that the cleaning tips
30 are kept away from the axis of rotation of the rotary pod outside of the dry cleaning cycle.

The invention is also directed to a system for performing a dry cleaning cycle on a metal reinforcement comprising a wire intended for a rubber article, the system comprising a centrifugal wire cleaner as described hereinabove.

According to one embodiment, the system further comprises a suction system for removing any dirt that is detached from the surface of the wire.

The invention also relates to a wire treated by a system as described hereinabove.

5

BRIEF DESCRIPTION OF THE DRAWINGS

The nature and various advantages of the present invention will be better understood from reading the detailed description which follows, and from studying the attached drawings, in which the same reference numerals denote identical elements throughout, and in which:

10

Figure 1 depicts a perspective view of a centrifugal wire cleaner that is performing a dry cleaning cycle.

Figure 2 depicts a detailed perspective view and Figure 3 depicts a view in cross section of a rotary pod of the centrifugal wire cleaner of Figure 1.

15

Figure 4 depicts a view in cross section of a centrifugal tip of the rotary pod of Figure 2.

20

Figures 5, 6 and 7 depict views in cross section of the cleaning tips of the centrifugal tip of Figure 4, which have been placed respectively in a “pivoting cascade” arrangement, in a “parallel cascade” arrangement and in a concentric arrangement.

DETAILED DESCRIPTION

Detailed reference will now be made to some embodiments of the invention, one or more examples of which are illustrated in the drawings. Each example is given for the purposes of explaining, rather than limiting, the invention described. A person skilled in the art will appreciate that various modifications and alternative forms may be made to the invention without departing either from the scope or from the spirit of the invention. For example, features or steps illustrated or described in the context of one embodiment may be used with one or more other embodiments to define at least one additional embodiment. Thus, provision is made for the invention to cover these modifications and alternative forms in so far as they fall within the scope of the attached claims and equivalents thereof.

30

With reference to Figures 1 to 7, in which the same numerals identify

identical elements, a centrifugal wire cleaner 100 includes a rotary pod 102 that is protected by a removable protection 104 (see Figures 1 and 2). The rotary pod 102 includes a rotary cage 106 and a wheel 108 (see Figure 3) that permit the rotary pod to be mounted on rolling bearings (not depicted). The rotary pod 102 is held in position by a guide spindle 112 and driven by an electric motor 114 via a toothed belt 116, as known.

The rotary pod 102 also includes a bell housing 118 having an interior space 118a that allows passage of a wire 50 along the axis of rotation of the rotary pod 102. The wire 50 enters the rotary pod 102 through a guide shuck 120 having a downstream split 120a that terminates in two half-barrels 120b. There is an opening in the half-barrels 120b that allows the wire 50 to be transferred towards a guide pin 122. The guide pin 122 includes a downstream split 122a and two half-barrels 122b with an opening that accepts the wire 50 as it passes. The openings of the guide shuck 120 and the guide pin 122 are aligned along the axis of rotation of the rotary pod 102 in order to ensure that the wire 50 follows a rectilinear path. The direction of the path is indicated in Figure 1 by the arrows A and in Figure 2 by the arrow B.

The rotary pod 102 includes at least one peripheral branch 126 in which a housing 126a allows the attachment of a corresponding centrifugal tip 130. The centrifugal tip 130 includes a tip holder 132 that grips a cleaning tip or blade 134 (described hereinbelow with reference to Figures 2 to 7). The centrifugal tip 130 also includes a return attachment 136 that terminates in a flyweight 138. Each pivoting centrifugal tip 130 is attached to a corresponding peripheral branch 126 via a bearing (not shown). This is all secured by a known fastener, such as a screw 139.

With reference to Figures 2 to 7, three cleaning tips 134 are positioned radially and arranged, with the aid of the rotary pod 102, in a cascade formation (see Figures 5 and 6) or concentrically (see Figure 7) along the wire 50. In the illustrated embodiments of the invention, three centrifugal tips 130 are provided that correspond to the three peripheral branches 126, although it is understood that the number of branches and centrifugal tips could be modified. In one embodiment, a distance between two cleaning tips is set at 5.0 mm.

The cleaning tips or blades 134 are made of hard metal, and, for their geometry, various configurations may be chosen. For example, overlapping tips

with a transverse (oblique) leading-edge or overlapping tips with a symmetrical or asymmetric longitudinal leading-edge may be chosen. It is obvious that the geometry of the cleaning tips 134 is non-limiting and that other geometries may be used, without departing from the scope of the invention.

5 There are various cleaning-system embodiments available according to the rigidity of the wire 50. In the case of rigid wires, upwards of a given wire diameter or of a given stiffness, the cleaning tips 134 are placed in a layout that is either “pivoting cascade” or “parallel cascade” and guide the wire 50 upstream and downstream. In one embodiment, the wire 50 having a diameter of 0.32 mm is
10 envisaged, but it is possible to envisage a range of diameters in various reinforcing applications (for example in the manufacture of tyres).

 In the “pivoting cascade” arrangement (see Figure 5), the three cleaning tips 134 are separated and fixed to corresponding tip holders 132. Each tip holder 132 pivots with its cleaning tip 134 on its pivot axis positioned transversely to the
15 axis of rotation of the rotary pod 102. The three zones of contact between the three cleaning tips or blades 134 are offset axially along the axis of rotation of the rotary pod 102.

 In the “parallel cascade” arrangement (see Figure 6), each cleaning tip 134 is mounted independently on a corresponding tip holder 132. The tip holders move
20 at right angles to the wire 50 with the aid of a pantograph system (not depicted) having two transverse pivot points. This embodiment also applies to the cleaning of wires that are not as rigid as those of the preceding embodiment.

 For wires that are more flexible, the cleaning tips 134 are placed in a more compact concentric arrangement. In the “concentric” arrangement (see Figure 7),
25 the three cleaning tips 134 are placed axially at the same level. The cleaning tips 134 slide radially in housings installed directly in the rotary pod 102 and are actuated by centrifugal levers pivoting on transverse pivot pins (pivots a, b, c).

 In all three arrangements, the cleaning tips 134 rotate about the wire 50 and move radially under the effect of centrifugal force. At high speed, flyweights 138,
30 subjected to the centrifugal effect, cause the tip holders 132 to pivot, thus ensuring that the cleaning tips 134 press against the wire 50. The contact pressure varies according to the square of the rotational speed of the rotary pod 102 and can easily be adjusted by controlling the speed of the motor 114.

In a vertical configuration (rotation of the rotary pod 102), at low speed, disengagement of the cleaning tips 134 from the wire 50 is obtained naturally under the effect of the Earth's gravity on the flyweights 138. Gravity-return of the cleaning tips 134 ensures that the cleaning tips 134 are kept away from the axis of rotation of the rotary pod 102 outside of the dry cleaning cycles.

In a horizontal configuration, the cleaning tips 134 can be kept away from the axis of rotation of the rotary pod 102 by annular return springs 145. The annular return springs 145 keep the cleaning tips 134 away outside of the dry cleaning cycles.

The bell housing 118 is borne by the rotary pod 102 and acts as a mechanical end stop for the pivoting of the tip holders 132 at high speeds (for example a wire speed of 53 m/min for a motor speed of 6000 rpm). The bell housing 118 also confines the volume of air in rotation in order to reduce noise and at the same time protect the operator and the environment if a mechanical part should accidentally become detached.

The dirt on the surface of the wire 50 is detached by the cleaning tips 134, moved away through the centrifugal effect and finally removed by a known suction system (not depicted). The contact surface of each cleaning tip 134 and the arrangement of these tips, combined with the speed at which the wire 50 is travelling, develop cleaned zones in a helicoidal layer formed of three tracks that wind around the wire. In order to ensure good coverage of the cleaning tips 134 over the entire surface of the wire 50, it is desirable to adapt the speed at which the wire 50 is travelling according to the rotational speed of the rotary pod 102.

The centrifugal wire cleaner 100 can be used during a cleaning cycle according to a programmed sequence. For example, a central control centre may have been programmed with data established for a plurality of metal reinforcements including a plurality of wire sizes. The data may also include data established for a plurality of cleaning tips in pivoting cascade, parallel cascade, and concentric arrangements. The centrifugal wire cleaner 100 may form part of a more complete system that, by way of example, applies polymer around the cleaned wire.

One or more sensors and/or sensor types may potentially be used, including, without limitation, environmental sensors (for example, to detect atmospheric conditions such as temperature, pressure and/or humidity during the

cleaning cycle) and verification sensors (for example, to detect a deviation in relation to a proscribed sequence).

At least some of the various techniques may be implemented in relation to hardware or software or, if justifiable, a combination of the two. As used here, the
5 terms “method” or “process” may encompass one or more steps performed at least by an electronic or computer-based apparatus having a processor used to execute instructions which carry out the steps.

The dimensions expressed in imperial units are to be understood as encompassing equivalent dimensions in metric and other units (for example, a
10 dimension given as “1 inch” is intended to denote an equivalent dimension of “2.5 cm”).

The terms “at least one” and “one or more” are used interchangeably. Ranges given as lying “between a and b” encompass the values of “a” and “b”.

Although particular embodiments of the disclosed apparatus have been
15 illustrated and described, it will be appreciated that various changes, additions and modifications can be made without departing from either the spirit or scope of the present description. Thus, no limitation should be imposed on the scope of the invention described, except for the limitations set out in the attached claims.

CLAIMS

1. A centrifugal wire cleaner (100) for use in a system that performs a dry cleaning cycle on a metal reinforcement comprising a wire (50) intended for a rubber article, characterized in that the centrifugal wire cleaner (100) comprises a rotary pod (102) with a bell housing (118) and a guide shuck (120) that allow the wire (50) to pass along the axis of rotation of the rotary pod (102), and with at least one peripheral branch (126) that allows the attachment of a corresponding centrifugal tip (130), in which the centrifugal tip (130) comprises a tip holder (132) that grips a cleaning tip (134) and a return attachment (136) terminating in a flyweight (138).

2. A centrifugal wire cleaner (100) according to claim 1, in which three cleaning tips (134) are provided that correspond to three peripheral branches (126) and that are positioned radially so as to rotate about the wire (50) and so as to move radially under the effect of centrifugal force.

3. A centrifugal wire cleaner (100) according to claim 2, in which a distance between two cleaning tips is set at 5.0 mm.

4. A centrifugal wire cleaner (100) according to claim 2 or claim 3, in which the cleaning tips (134) are arranged, with the aid of the rotary pod (102), in a pivoting cascade arrangement.

5. A centrifugal wire cleaner (100) according to claim 2 or claim 3, in which the cleaning tips (134) are arranged, with the aid of the rotary pod (102), in a parallel cascade arrangement.

6. A centrifugal wire cleaner (100) according to claim 2 or claim 3, in which the cleaning tips (134) are arranged, with the aid of the rotary pod (102), in a concentric arrangement.

7. A centrifugal wire cleaner (100) according to any one of claims 2 to 6, in which the rotary pod (102) is held in position by a guide spindle (112) and

driven by an electric motor (114), and a contact pressure with which the cleaning tips (134) press against the wire (50) varies according to the square of the rotational speed of the rotary pod (102).

5 8. A centrifugal wire cleaner (100) according to any one of claims 2 to 7, further comprising annular return springs (145) that keep the cleaning tips (134) away from the axis of rotation of the rotary pod (102) outside of the dry cleaning cycle.

10 9. A centrifugal wire cleaner (100) according to any one of claims 2 to 7, further comprising a gravity-return of the cleaning tips (134) that keeps the cleaning tips (134) away from the axis of rotation of the rotary pod (102) outside of the dry cleaning cycle.

15 10. A system for performing a dry cleaning cycle on a metal reinforcement comprising a wire (50) intended for a rubber article, the system comprising a centrifugal wire cleaner (100) according to any one of claims 1 to 9.

 11. A system according to claim 10, further comprising a suction
20 system for removing any dirt detached from the surface of the wire (50).

 12. A wire (50) treated by a system according to claim 10 or claim 11.

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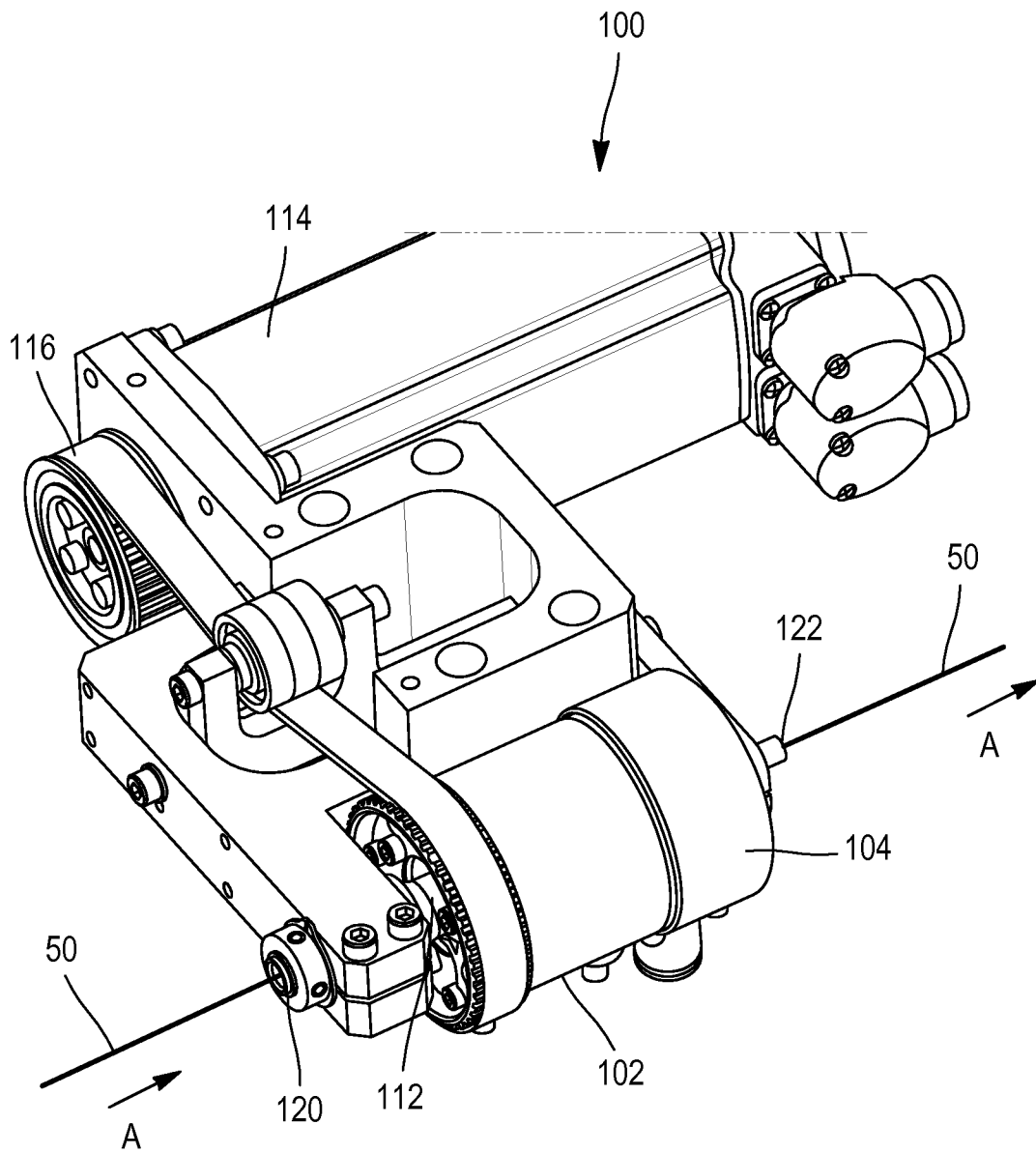


FIG. 1

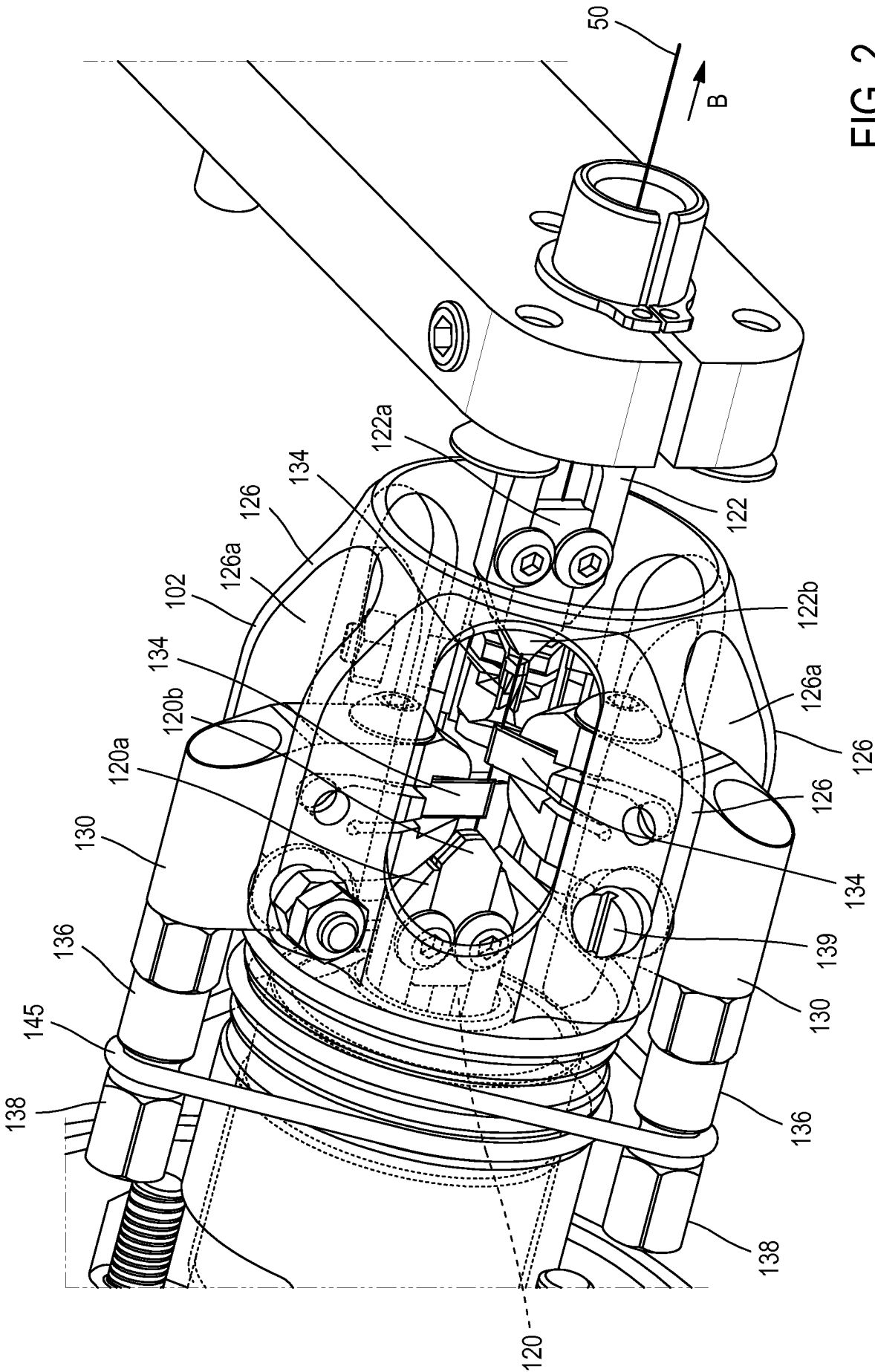


FIG. 2

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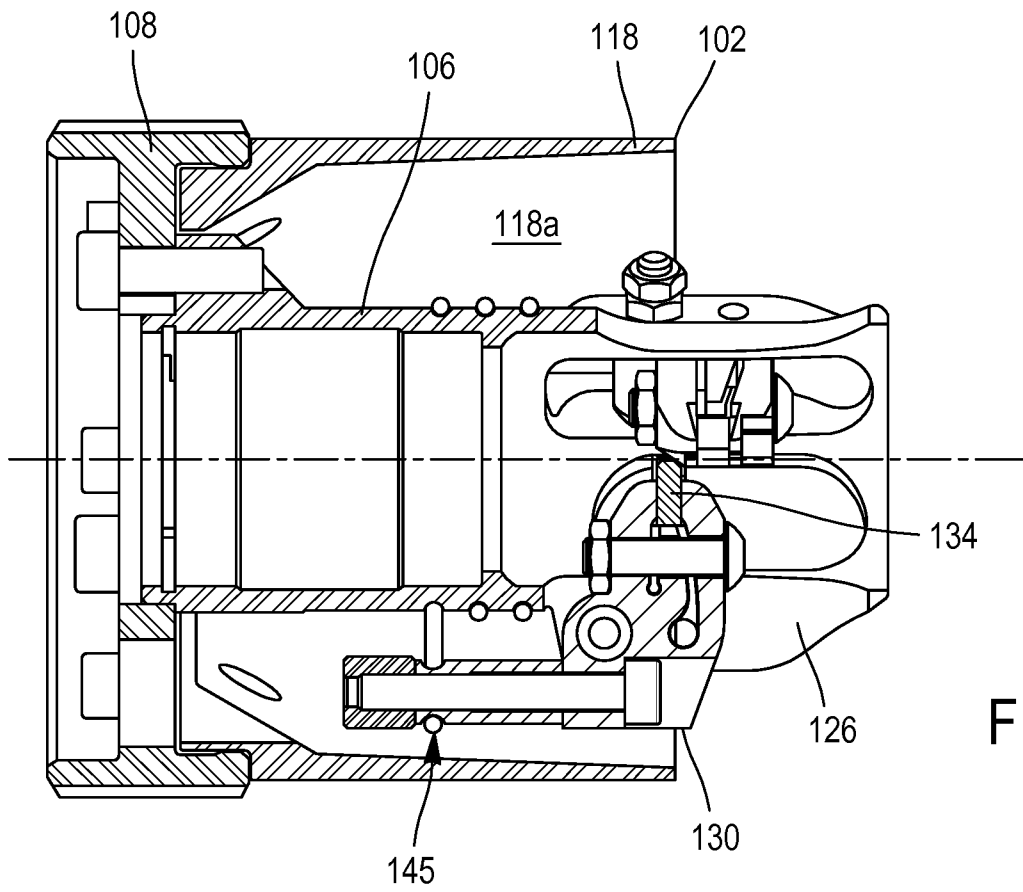


FIG. 3

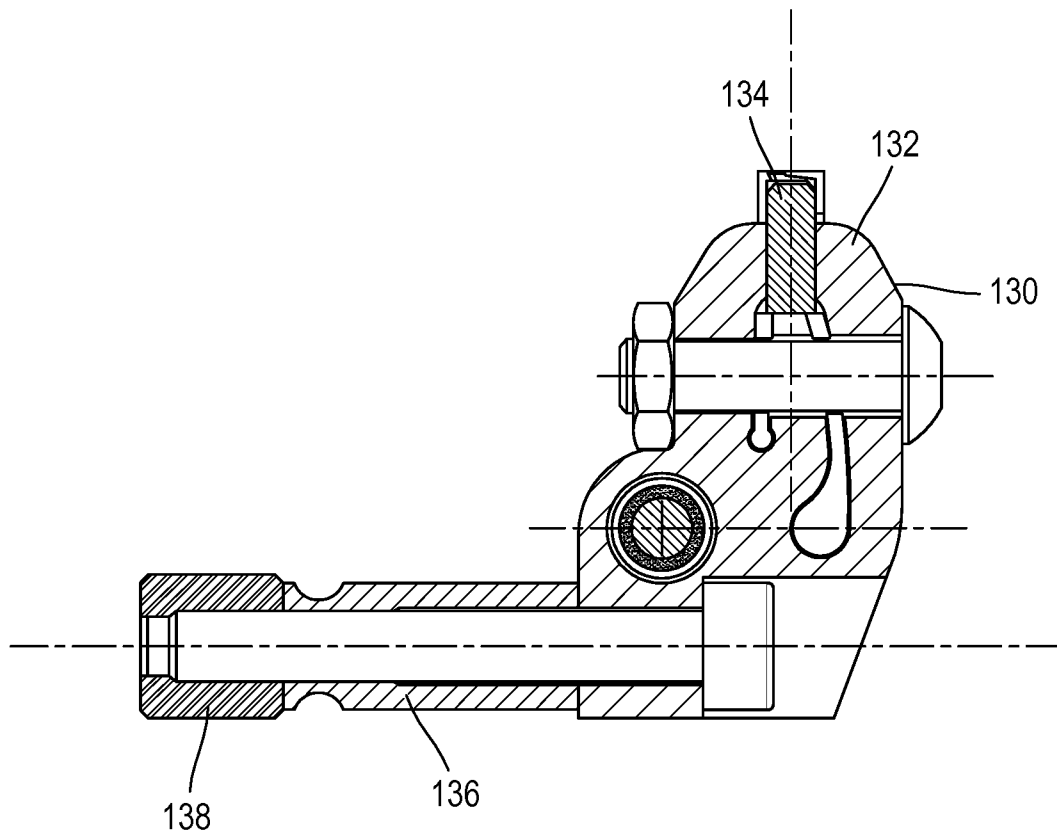


FIG. 4

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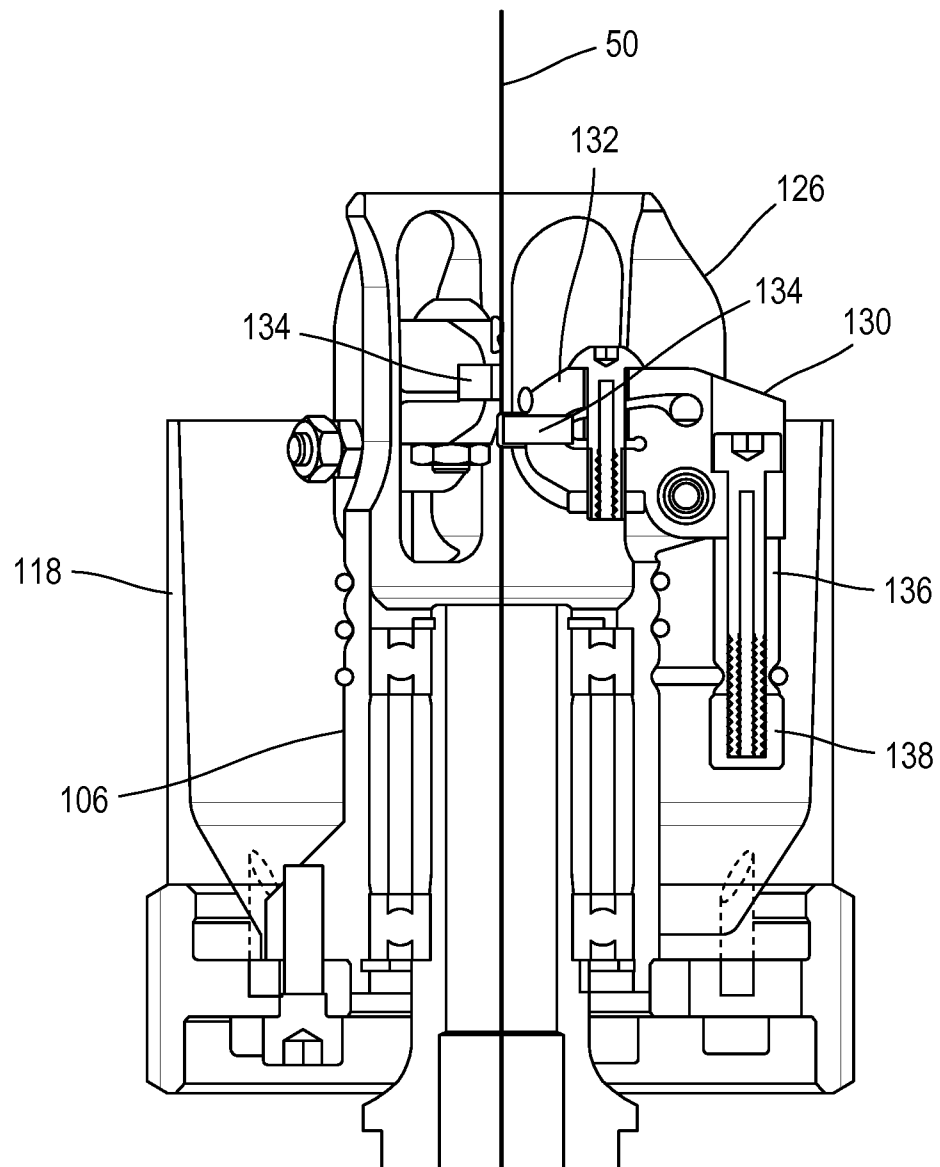


FIG. 5

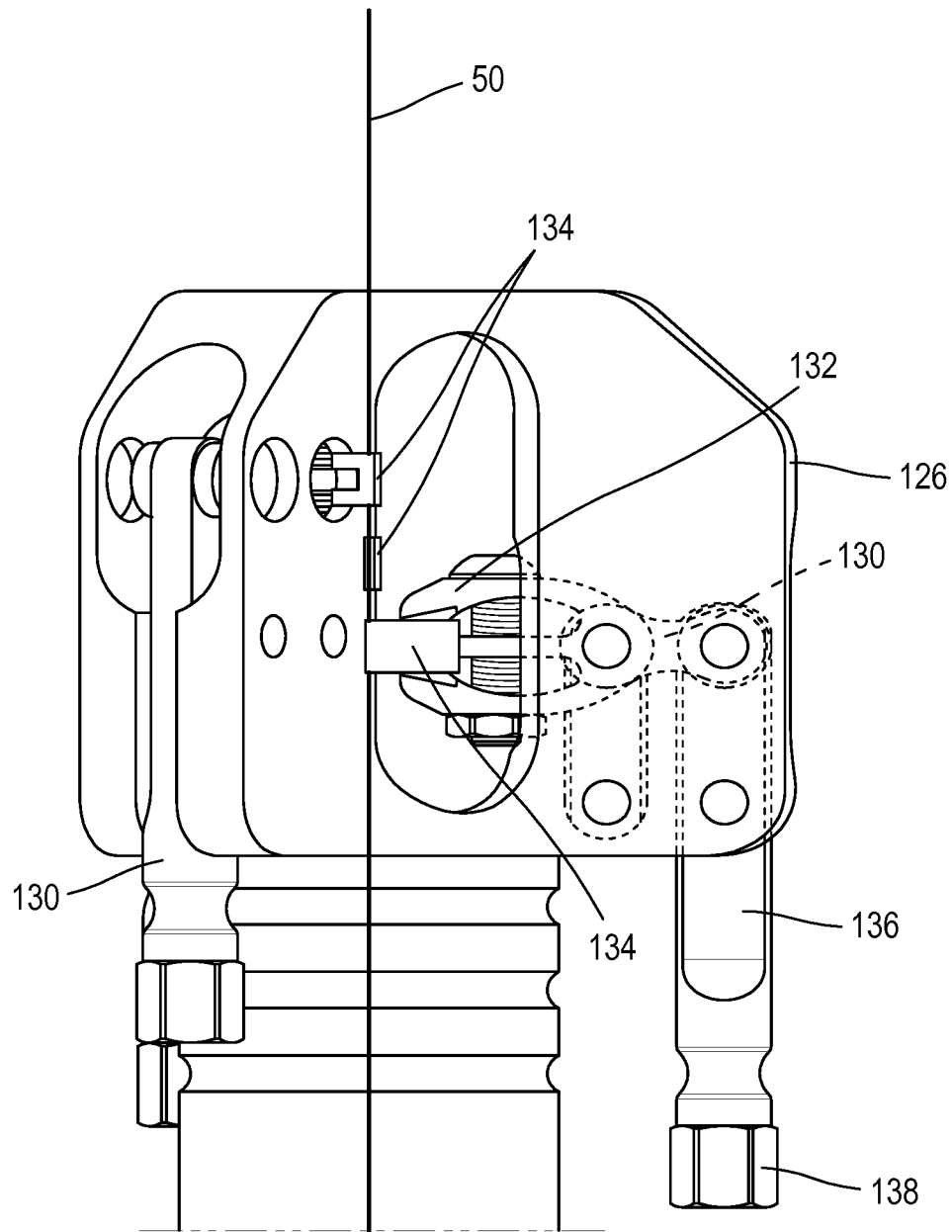


FIG. 6

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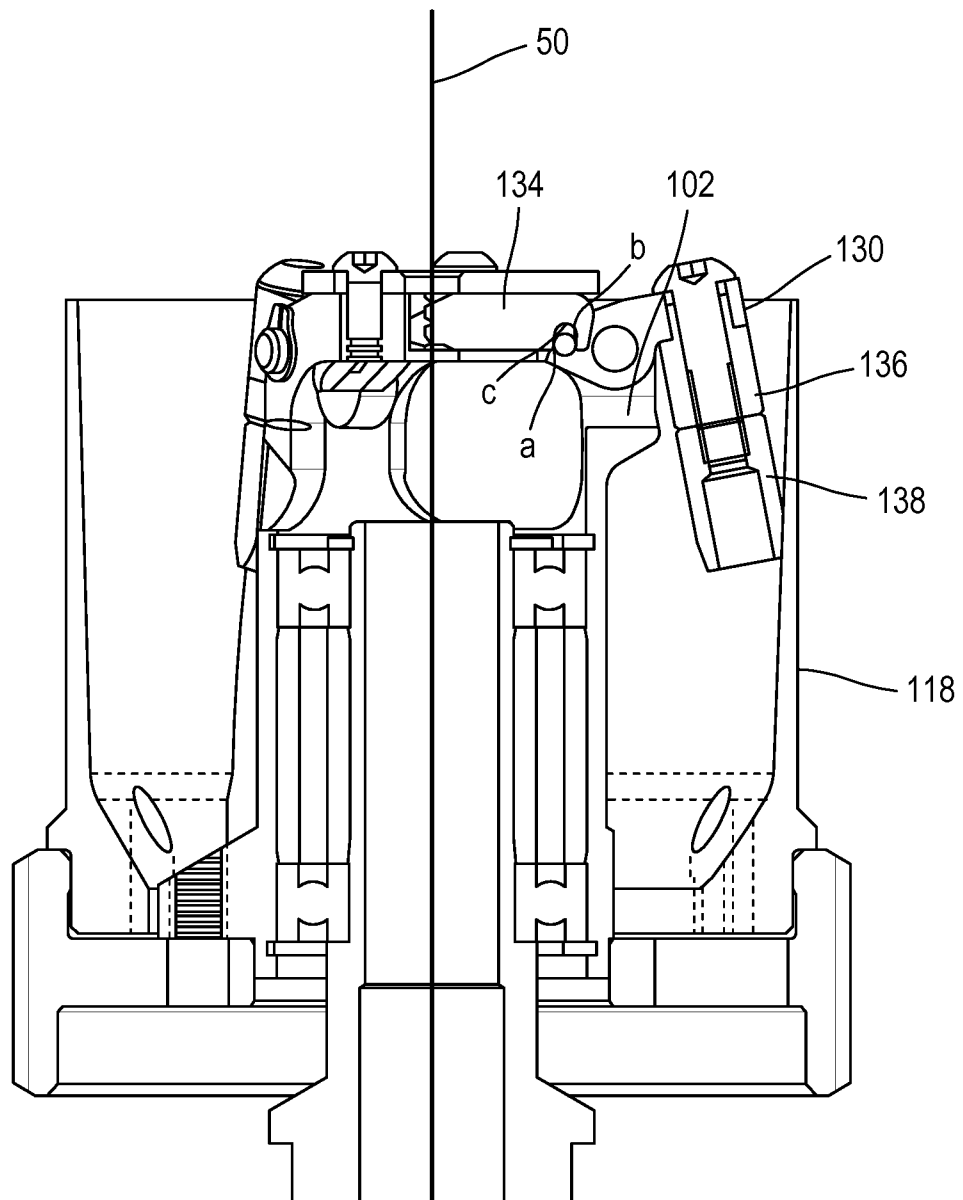


FIG. 7

INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER
INV. B08B1/02 B08B1/04 B21C43/04 B21B45/04
ADD.

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)

B66B B08B B21C B21B H02G

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 practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 931 601 A1 (LISCIANI TRAFILERIE S R L R [IT]) 28 July 1999 (1999-07-28)	1-10,12
Y	abstract; claims 1,8; figures paragraph [0016] - paragraph [0028]	11
X	US 997 167 A (WERTH FEDERICO [IT]) 4 July 1911 (1911-07-04)	1-10,12
A	the whole document	11
X	DE 38 21 362 C1 (KROLL) 3 May 1989 (1989-05-03)	1,10
A	the whole document	2-9,11, 12
X	US 2 452 423 A (BASS ARTHUR P) 26 October 1948 (1948-10-26)	1,10,12
A	column 1, line 52 - column 3, line 21	3-9,11
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Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

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03/01/2018

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INTERNATIONAL SEARCH REPORT

International application No

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 43 36 539 A1 (METEOR AG [CH]) 27 April 1995 (1995-04-27)	12
Y	abstract; figures column 2, line 19 - line 28 -----	11

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2017/075217

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0931601	A1	28-07-1999	AT 226489 T 15-11-2002
		DE 69808879 D1	28-11-2002
		DE 69808879 T2	05-06-2003
		DK 0931601 T3	17-02-2003
		EP 0931601 A1	28-07-1999
		ES 2185136 T3	16-04-2003
		PT 931601 E	31-03-2003
		SI 0931601 T1	30-04-2003

US 997167	A	04-07-1911	NONE

DE 3821362	C1	03-05-1989	NONE

US 2452423	A	26-10-1948	NONE

DE 4336539	A1	27-04-1995	NONE
