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(54) Title: AN AIRBAG MECHANISM

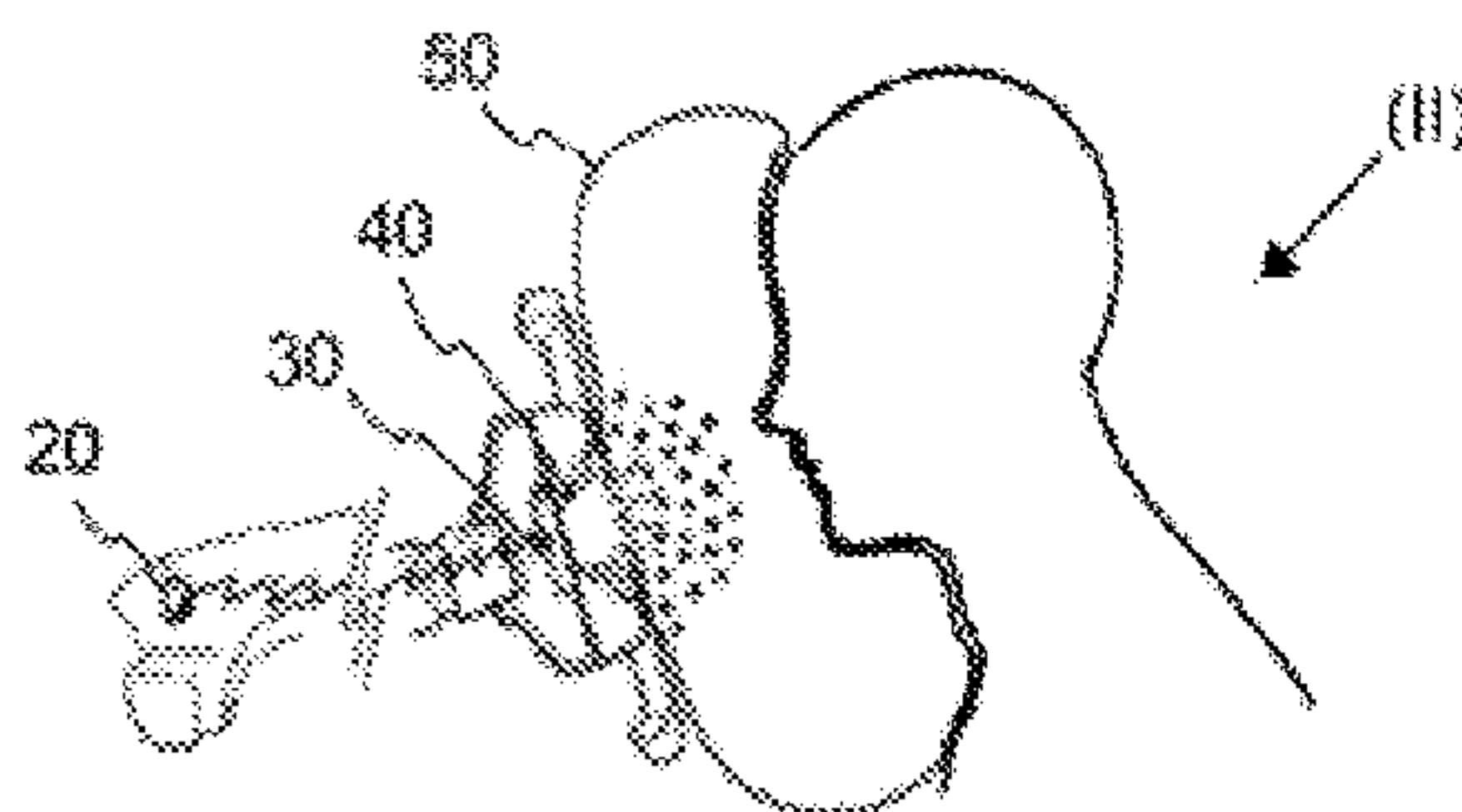


FIGURE 3

(57) Abstract: The invention relates to at least one airbag mechanism (10) having at least one inflatable cushion (50) to provide mainly in-vehicle safety, especially in the event of an accident. Thus the novelty of the invention is that said bag (50) is produced from a material with a partially negative Poisson ratio.

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AN AIRBAG MECHANISM

5 TECHNICAL FIELD

The invention relates to at least one airbag mechanism having at least one inflatable cushion to provide safety in vehicle, especially in the event of an accident.

10

PRIOR ART

The system is called an airbag that is inflated by means of filling air or gas into it during a clash of automobiles and ensures the safety of the driver and passengers together with the seat belt. The airbags open within a very short duration less than 15 1/10 of a second and prevent serious injuries.

The field of airbag gains a place in the related literature or relevant market as a sub branch of the automotive textiles sometimes included in the technical textiles. The 20 airbag fabrics are fabrics which have certain air permeability (generally 10 LT in dm^2 per second) and are generally manufactured from polyamide 6.6 yarn. The airbags are supposed to inflate fully within 45 to 55 milliseconds at the time of the accident. The airbag deflates within 75 to 80 milliseconds and the incident ends. The airbags can rescue lives and in case they are designed appropriately, they can 25 ensure protection against serious injury in high speed clashes. In addition to this, the inflation rate of airbags creates enormous forces.

The airbag usage reduces the risk of head injuries that happen during journeys in a ratio of 81%. The airbags continue to rescue lives undoubtedly. However, airbags 30 are opened suddenly in the vehicle in some accident situations and causes serious injury or death of children and even adults by hitting the individuals in the vehicle.

As a result, all abovementioned problems have made it necessary to make an improvement in the relevant technical field.

BRIEF DESCRIPTION OF THE INVENTION

The present invention is related to an airbag mechanism in order to eliminate the
5 abovementioned disadvantages and to bring new advantages to the relevant technical field.

An aim of the invention is to provide an ergonomic airbag.

10 The invention relates to at least one airbag mechanism having at least one inflatable cushion to provide safety in vehicle, especially in the event of an accident so as to fulfill the aims mentioned above and obtained from the following description. Accordingly, the novelty is that said cushion is produced from a material with a partially negative Poisson ratio. Thus, in case the vehicle has an
15 accident, the airbag is opened and contacts with the body of the person and an ergonomic airbag mechanism is achieved by taking the shape of the place to which it contacts.

A possible embodiment of the invention is characterized in that the cushion is made
20 of multi-axial fabric. Therefore, the cushion has different levels of absorbing the impact and copying the body is ensured.

Another possible embodiment of the invention is characterized in that; the multi-axial fabric is obtained by combining a polyamide yarn with a yarn showing auxetic
25 effect. Therefore, when the auxetic yarns on one axis on the cushion inflates the surface patterns on the other axis change and provides to absorb the impact and copy the shape of the body.

Another possible embodiment of the invention is characterized in that the cushion
30 is made of leno woven fabric. Thus, the cushion is provided with two different flexibility and elongation amounts.

Another possible embodiment of the invention is characterized in that; the multi-axial fabric is obtained by combining a Polyamide + Lycra yarn with a Polyamide +

Auxetic Polypropylene yarn. Thus, while the obtained cushion fabrics are used to absorb the impact with a yarn, the other elastic yarn with different elasticity/elongation amount surrounding this yarn is provided to copy the shape of the body simultaneously.

5

BRIEF DESCRIPTION OF DRAWINGS

10 In Figure 1, a representative side section view of the first state of the inventive airbag mechanism is given.

In Figure 2, a representative side section view of the second state of the inventive airbag mechanism is given.

15 In Figure 3, a representative side schematic view showing the contact of the inventive airbag mechanism with the body of the individual during the accident is given.

20 In Figure 4, a representative front view of the multi-axial fabric that is used as a cushion material in the inventive airbag mechanism is given.

In Figure 5, a representative front view of the leno woven fabric that is used as a cushion material in the inventive airbag mechanism is given.

25 DETAILED DESCRIPTION OF THE INVENTION

In this detailed description, the subject of the invention is described by means of examples only for clarifying the subject matter such that no limiting effect is created.

30

In Figure 1, a representative side section view of the inventive airbag mechanism (10) is given. Thus, said airbag mechanism (10) modifies from at least one first state (I) to at least one second state (II) so as to provide mainly safety in vehicle, especially in the event of an accident. Said airbag mechanism (10) is located within

the vehicle body (60) and it prevents the vehicle driver and the passengers from receiving a blow during the accident in the second case (II). In a possible embodiment of the invention, said vehicle body (60) can be a steering wheel, door, torpedo, seat belt, etc.

5

In Figure 2, a representative side section view of the second state (II) of inventive airbag mechanism (10) is given. Accordingly, at least one sensor (20) so as to detect the car accident, at least one trigger (30) so as to activate at least one inflating element (40) depending on the signal received from said sensor (20), are
10 positioned in the airbag mechanism (10). Said sensor (20) can be electromagnetic sensor, acceleration sensor, and load sensor in possible embodiments of the invention. The sensor (20) activates the trigger (30) by determining any accident time instantly. Said inflating element (40) is a chemical explosive in a possible embodiment of the invention. The inflation element (40) provides the inner section
15 of at least one cushion (50) located in the airbag mechanism (10) with gas in a short time by being activated by means of the trigger (30). At least one hole (not shown in the figures) positioned on said cushion (50) in the airbag mechanism (10) ensures to discharge the gas in the cushion (50) after the accident.

20 At the time of accident, when the airbag mechanism (10) passes to the second state (II), the cushion (50) inflates and reduces the damage to the person by absorbing the impact. The cushion (50) is produced from a material with a partially negative Poisson ratio so as to prevent the same from giving damage to the person after hitting the person as a result of sudden inflation.

25

The materials with a negative Poisson ratio are also called auxetic materials. The auxetic materials have an extraordinary property in contrast to materials with a positive Poisson ratio. While auxetic materials are stretched on an axis, they also expand on an axis perpendicular to the same axis and in the contrary case when
30 they are pressed on one axis; they are narrowed on axis perpendicular to the same axis. Materials exhibiting auxetic property absorb energy better compared to materials with positive Poisson ratio. The auxetic materials also exhibit synclastic curvature property that facilitates to take the form of the contact surface on the pillow (50). In Figure 3, a representative side schematic view showing the contact

of the inventive airbag mechanism (10) with the body of the individual during the accident is given. Thus, this curvature feature gives the cushion (50) the ability to copy the human body and in this manner, the damage to the human body during and after the accident is minimized. In other words, the geometrically adaptation of the cushion (50) to human body is ensured.

In Figure 4, a representative front view of the multi-axial fabric (50a) that is used as a cushion (50) material in the inventive airbag mechanism (10) is given. Thus, in a possible embodiment of the invention, cushion (50) fabric is manufactured by multi-axial weaving. Said multi-axial fabric (50a) combines a standard yarn (in a possible embodiment of the invention, Polyamide 6.6) and a yarn showing auxetic effect. Therefore, the produced cushion (50) can have the ability to absorb impact at different levels and copy the body, in other words, it is adapted to the required level of impact absorption and copy of the human body. When the auxetic yarns on one axis are swollen, the surface patterns on the other axis change and provide to absorb the impact and copy the shape of the body.

In Figure 5, a representative front view of the leno woven fabric (50b) that is used as a cushion (50) material in the inventive airbag mechanism (10) is given. Thus, in the production of cushion (50) with leno woven fabric (50b), fabric is obtained from a combination of yarns with two different flexibility and elongation amounts. In a possible embodiment of the invention, the yarns are a combination of Polyamide 6.6 + Lycra and Polyamide 6.6 + Auxetic Polypropylene. Thus, while the obtained cushion (50) fabrics are subject to impact, the impact is absorbed with linear yarn, the elastic spiral yarn with different elasticity/elongation amount surrounding the linear yarn copies the shape of the body simultaneously, it gradually absorbs the energy and distributes it to different sections. Moreover, in possible embodiments of the invention, the cushion (50) fabrics manufactured from these two fabric types are modified in a manner such that the NPO property of the Silicone Resin Coatings is not damaged.

In an exemplary embodiment of the present invention, the cushion (50) positioned in the airbag mechanism (10) contacts with the user's body by inflating during the accident. When the cushion (50) contacts with the body, it minimizes the load

applied to the body and absorbs the impact ideally by copying the body to which it contacts. Subsequently, when the effect of the accidents ends, the air is discharged through the holes on the cushion (50) and the cushion (50) is provided to be deflated.

5

Consequently, an airbag mechanism (10) which is manufactured in the light of the auxetic effect principle, can absorb the impact severity during the accident by copying the human body, is ergonomic, and with high added value is obtained. It both reduces the risk of injury and death during the accident permanent and/or

10 temporary damages to a minimum level after the accident.

The protection scope of the invention is specified in the appended claims and cannot be limited to the description made for illustrative purposes in this detailed description. Likewise, it is clear that a person skilled in the art can present similar

15 embodiments in the light of the above descriptions without departing from the main theme of the invention.

REFERENCE NUMBERS GIVEN IN THE FIGURE

- 10 Airbag mechanism
- 20 Sensor
- 5 30 Trigger
- 40 Inflating Element
- 50 Cushion
- 50a Multi-Axis Fabric
- 10 50b Leno Woven Fabric
- (I) First State
- (II) Second State
- 15 60 Vehicle Body

CLAIMS

1. The invention relates to at least one airbag mechanism (10) having at least one inflatable bag (50) to provide mainly in-vehicle safety, especially in the event of an accident, ***characterized in that***; said bag (50) is produced from a material with a partially negative Poisson ratio.
5
2. An airbag mechanism (10) according to claim 1, ***characterized in that***; the cushion (50) is produced from multi-axial fabric (50a).
10
3. An airbag mechanism (10) according to claim 2, ***characterized in that***; the multi-axial fabric (50a) is obtained by combining a polyamide yarn with a yarn showing auxetic effect.
- 15 4. An airbag mechanism (10) according to claim 1, ***characterized in that***; the cushion (50) is produced from leno woven fabric (50b).
- 20 5. An airbag mechanism (10) according to claim 4, ***characterized in that***; the leno woven fabric (50b) is obtained by combining a Polyamide + Lycra yarn with a Polyamide + Auxetic Polypropylene yarn.

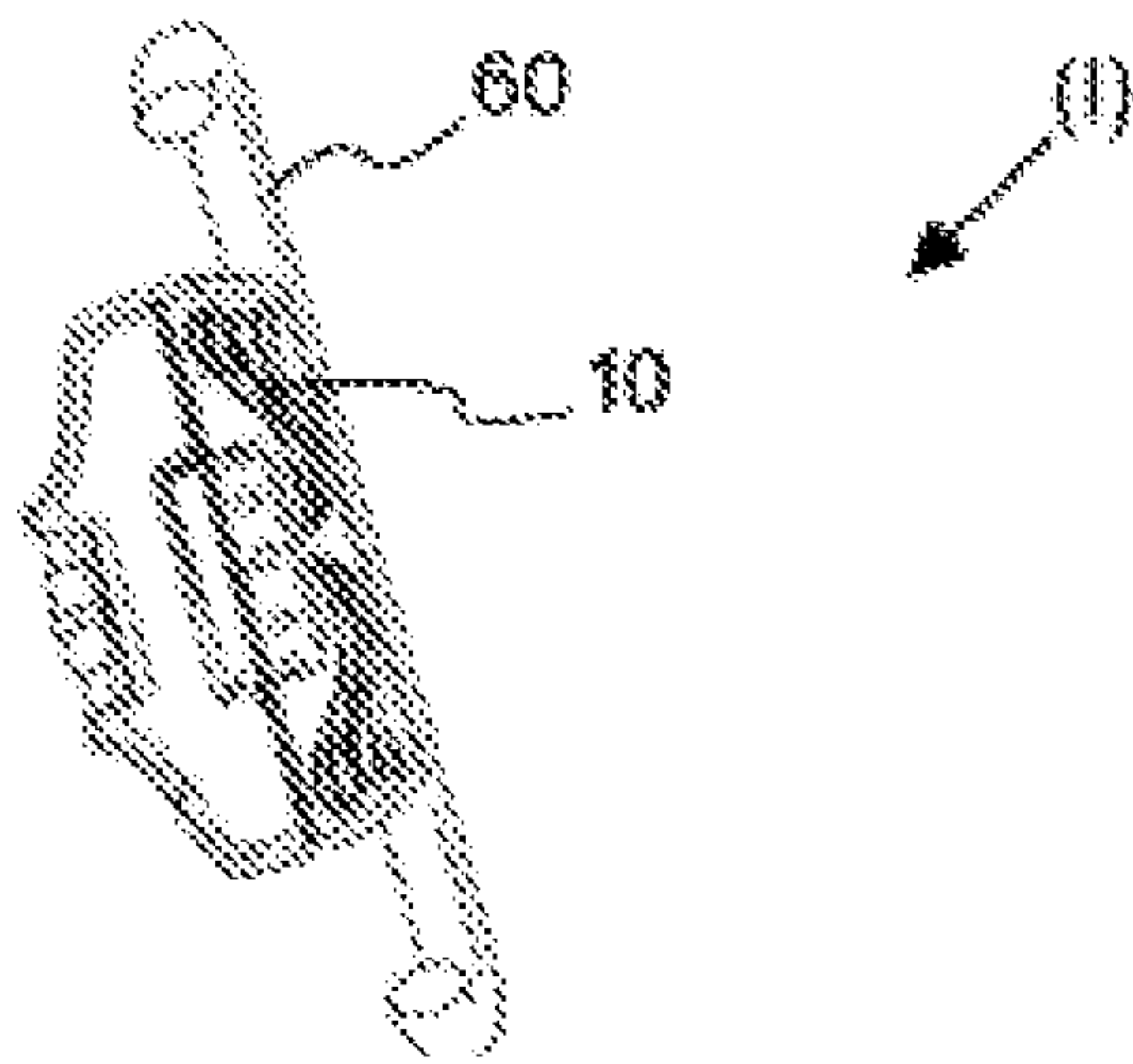


FIGURE 1

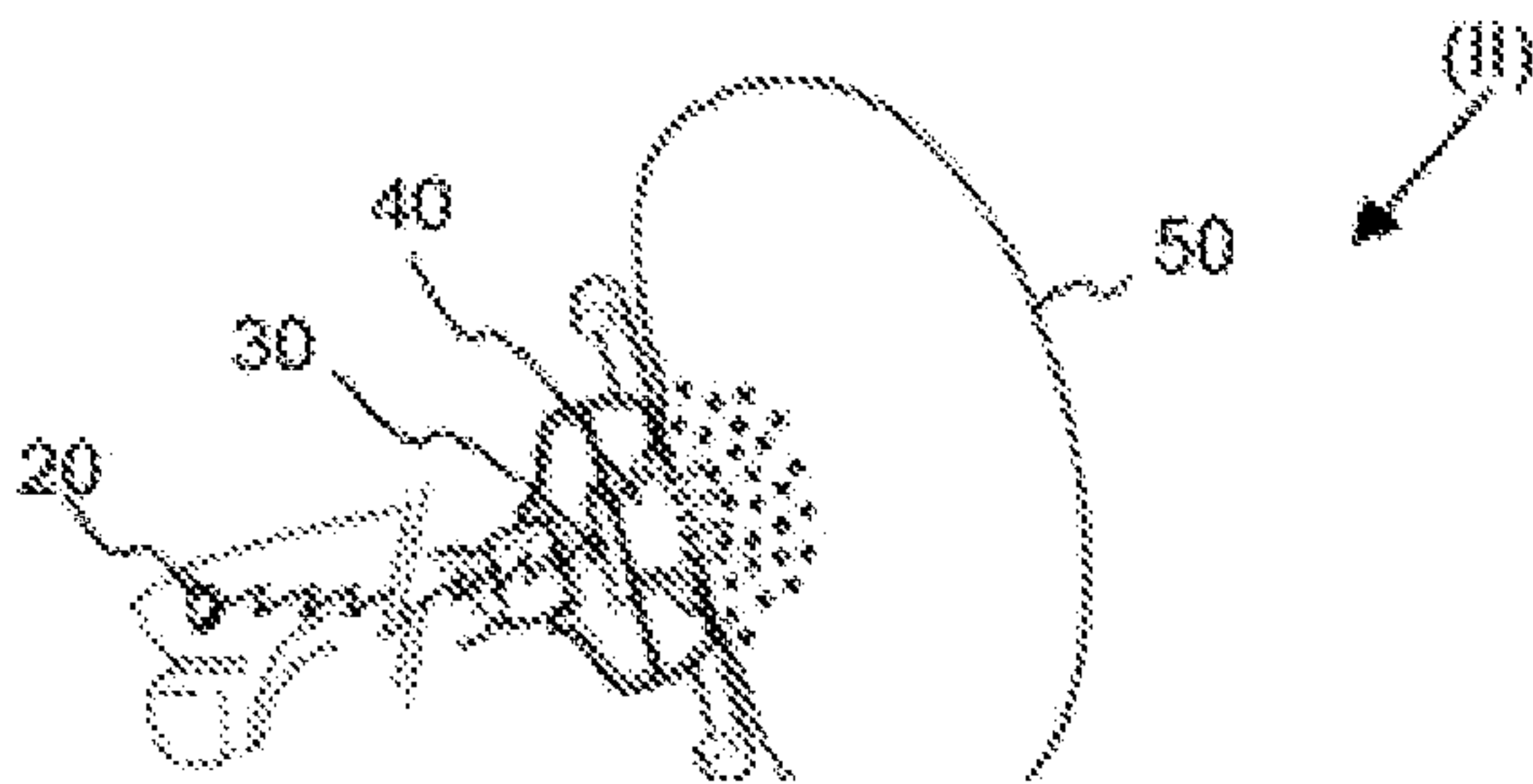


FIGURE 2

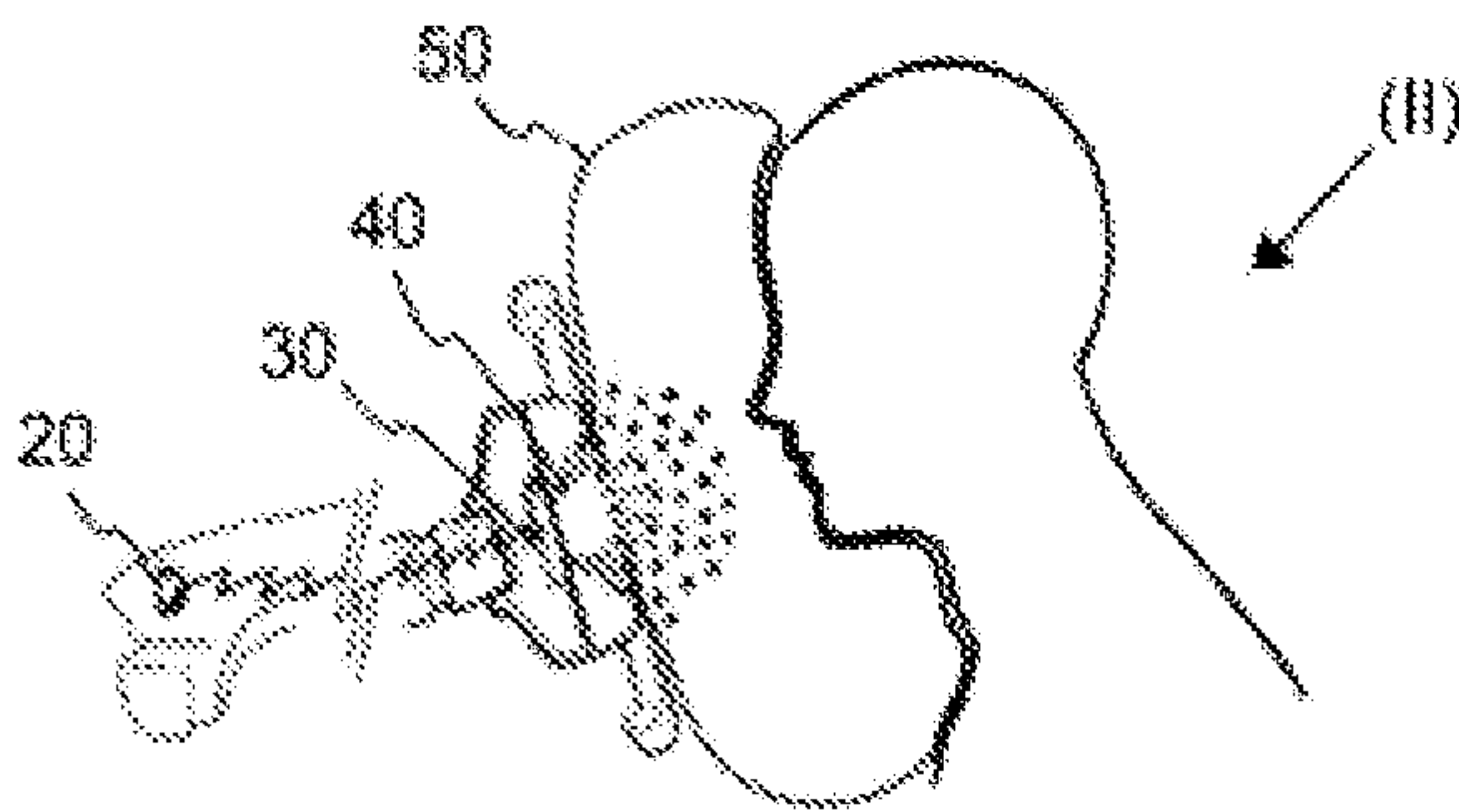


FIGURE 3

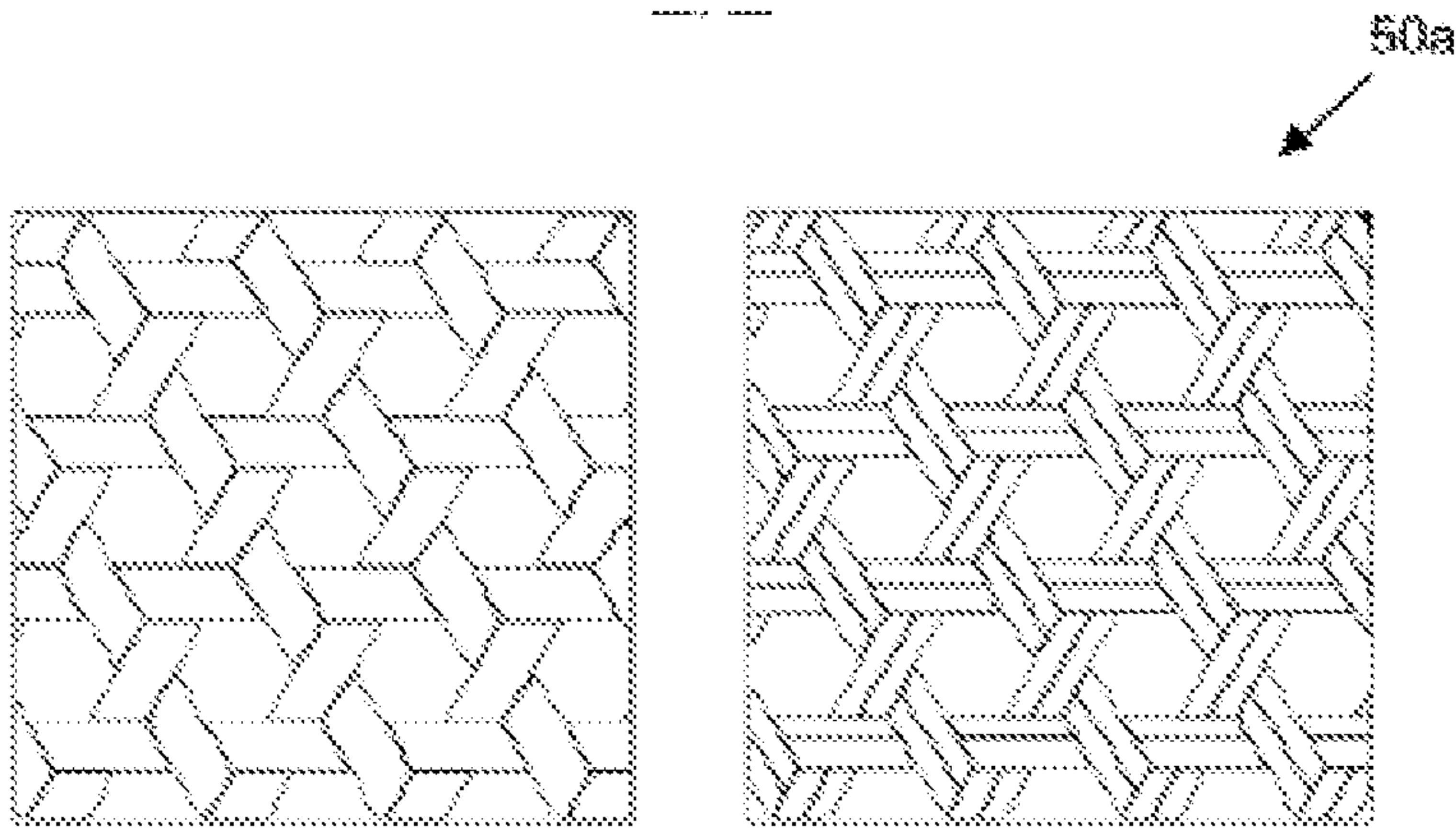


FIGURE 4

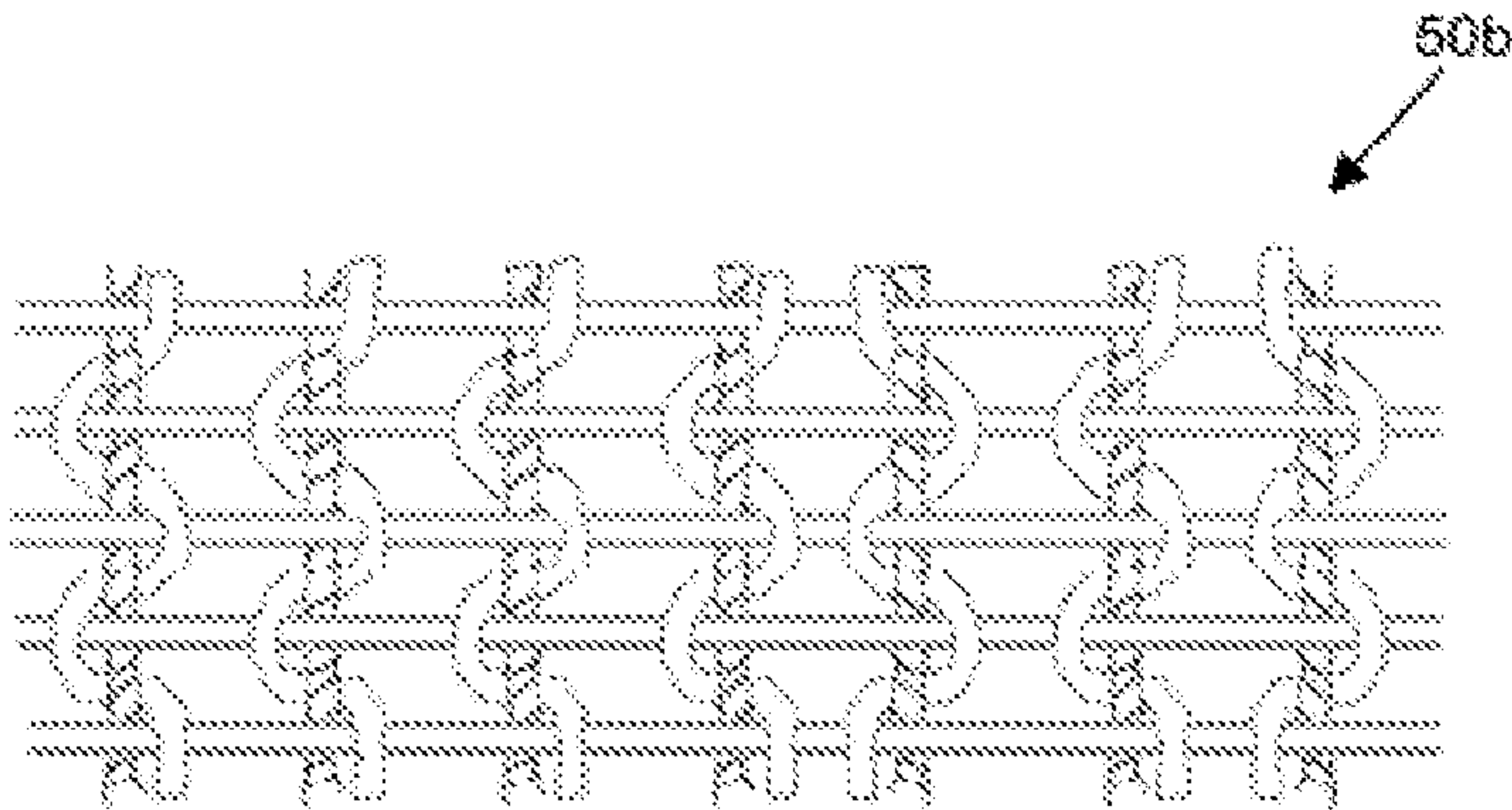


FIGURE 5

INTERNATIONAL SEARCH REPORT

International application No.

PCT/TR2020/051160

A. CLASSIFICATION OF SUBJECT MATTER

B60R 21/235 (2006.01)i; D03D 1/02 (2006.01)i; D03D 19/00 (2006.01)i

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)

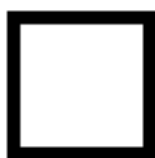
B60R 21/235; D03D 1/02; D03D 19/00; B60R; D03D

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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2017036626 A1 (FORD GLOBAL TECH LLC [US]) 09 February 2017 (2017-02-09)	1
Y	Paragraph 30	4
Y	US 2015246655 A1 (TORAY INDUSTRIES [JP]) 03 September 2015 (2015-09-03)	4
Y	Paragraph 21, 23, 37	
A	US 2015115574 A1 (ASAHI KASEI FIBERS CORP [JP]) 30 April 2015 (2015-04-30)	1-5
A	Paragraph 18	
A	US 2005287371 A1 (GEN ELECTRIC) 29 December 2005 (2005-12-29)	1-5
A	Paragraph 23	



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:	“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
“A” document defining the general state of the art which is not considered to be of particular relevance	“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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“O” document referring to an oral disclosure, use, exhibition or other means	
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INTERNATIONAL SEARCH REPORT
Information on patent family members

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Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
US	2015246655	A1	03 September 2015	WO	2014051049	A1	04 December 2013
				JP	5679076B	B2	03 December 2014
				KR	20150036832	A	04 December 2014
				EP	2883986	A1	06 December 2014
				CN	104641029	A	05 December 2014
				US	2015246655	A1	09 December 2014
				US	9211865	B2	02 November 2014
				KR	101569328B	B1	01 November 2014
				MX	2015003683	A1	06 December 2014
				VN	43017	A	07 December 2014
				CN	104641029B	B	03 December 2015
				EP	2883986	B1	07 December 2015
				JP	2013555494X	X	08 December 2015
				IN	2260CHENP2015	A	07 December 2015
				MX	346044	B	03 December 2016
				BR	112015006014	A2	07 December 2016
				EP	2883986	A4	07 December 2014
				TH	157485	A	01 November 2015
				TH	62923R	R0	06 December 2017
				VN	10020663	B	03 December 2018
				IN	317156	B	08 December 2018
US	2017036626	A1	09 February 2017	US	9561765	B1	02 December 2016
				DE	102016114302	A1	02 December 2016
				US	2017036626	A1	02 December 2016
				CN	106427541	A	02 December 2016
				MX	2016010125	A1	02 December 2016
				RU	2016131051	A	02 December 2017
US	2015115574	A1	30 April 2015	WO	2013133382	A1	09 December 2012
				JP	2014037229	A	02 December 2013
				TW	201348544	A	02 November 2012
				JP	5486741B	B2	05 December 2013
				KR	20140109471	A	09 December 2013
				CN	104160086	A	01 November 2013
				EP	2824236	A1	01 December 2014
				US	2015115574	A1	04 December 2014
				JP	5711803B	B2	05 December 2014
				JP	2013531597X	X	07 December 2014
				MX	2014010825	A1	02 November 2013
				IN	1789KOLNP2014	A	31 October 2014
				US	9352718	B2	05 December 2015
				TW	201610253	A	03 December 2015
				KR	101669347B	B1	01 November 2015
				CN	104160086B	B	02 November 2015
				TW	I557283B	B	01 November 2015
				TW	I564445B	B	01 December 2016
				EP	2824236	A4	08 December 2014
				EP	2824236	B1	01 November 2016
				MX	350484	B	09 December 2016
US	2005287371	A1	29 December 2005	US	2005287371	A1	02 November 2004
				EP	1612108	A1	01 December 2005

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/TR2020/051160

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
		JP 2006071093 A	03 December 2005
		CN 1715702 A	01 December 2005
		KR 20060048627 A	05 December 2005
		US 7160621 B2	01 December 2006
		IN 1525DEL2005 A	02 November 2005
		EP 1612108 B1	02 December 2007
		DE 602005004701E E	03 December 2007
		ES 2303195T T3	08 December 2007
		DE 602005004701T T2	02 December 2008
		MY 143426 A	05 December 2010