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(54) **MAGNETIC SLEEVE**

(57) A magnetic sleeve includes a body and a magnetic unit disposed in a second section of the body where a locking socket and a mounting hole are formed and communicating with each other. The mounting hole is enclosed by a peripheral wall while taking a reference point as center. The peripheral wall includes at least one engagement surface and at least one curved wall surface. Each engagement surface has two transition points for meeting the wall surface. The formation of one engagement surface or more engagement surfaces not only attains a firm engagement between the magnetic unit and the mounting hole but also forms a space therebetween to discharge air from the mounting hole smoothly, thereby preventing the magnetic unit from being broken during the installation. The space is also minimized to avoid undue accumulation of metal chips and allow the magnetic unit to be held in position stably.

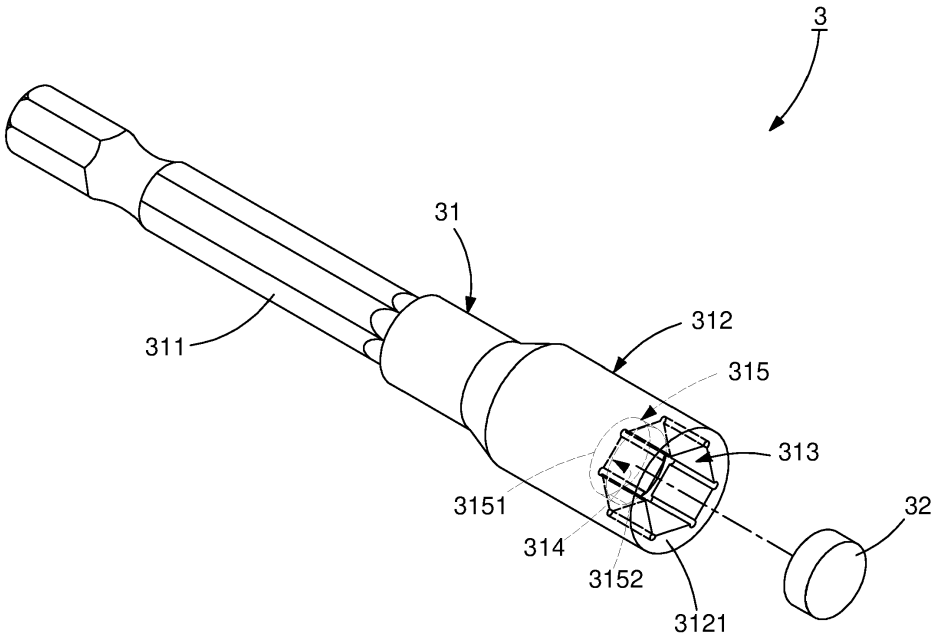

FIG. 3

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] This invention relates to a sleeve and relates particularly to a magnetic sleeve.

2. Description of the Related Art

[0002] Sleeves are commonly used in the assembly and disassembly of locking units such as bolts, nuts and screws in fields of construction, automobile service or furniture assembly. However, in order to accelerate a locking operation of the locking units while preventing the locking units from unduly trembling and solving the problem that the user should place a hand on the locking units for support when the locking units are formed with longer length, a conventional magnetic sleeve **1** is developed to help position the locking units by the magnetic force of the magnetic sleeve **1**.

[0003] Referring to Figs. **1A** and **1B**, the magnetic sleeve **1** has a body **11** and a magnetic unit **12** disposed in the body **11**. The body **11** has a first section **111**, a second section **112** connected to the first section **111** and having an engagement end **1121**, a locking socket **113** recessed into the engagement end **1121**, and a mounting hole **114** formed inside the second section **112** and communicating with the locking socket **113**. The mounting hole **114** is formed to precisely fit the magnetic unit **12**. Because the magnetic unit **12** is formed by powder sintering and press molding, the magnetic unit **12** is hard and brittle. If the magnetic unit **12** is installed in the mounting hole **114** by a pressing action directly, the air cannot be discharged outward from the mounting hole **114** owing to the equal dimensions of the magnetic unit **12** and the mounting hole **114**. Meanwhile, the pressing action will exert a force on the air to further cause a reaction force to push the magnetic unit **12**, and that will break the magnetic unit **12**. Therefore, the magnetic unit **12** is usually clad in a protection unit **13** which is made of a soft material. Further, the protection unit **13** is formed with a plurality of grooves **131** on a periphery thereof for allowing the air to be discharged outward from the mounting hole **114**. Thus, during the installation of the magnetic unit **12**, the air can be discharged outward from the mounting hole **114** through the grooves **131** without pressing the magnetic unit **12**. However, the magnetic unit **12** should be clad with the protection unit **13** in advance before being mounted into the mounting hole **114**. The installation of the protection unit **13** not only causes extra costs, but also adds additional process, and that is not cost-effective.

[0004] Thus, a magnetic sleeve **2** is developed. Referring to Figs. **2A** and **2B**, the magnetic sleeve **2** has a body **21** and a magnetic unit **22** disposed in the body **21**. The body **21** has a first section **211**, a second section **212** connected to the first section **211** and having an engagement end **2121**, a locking socket **213** recessed into the engagement end **2121**, and a mounting hole **214** formed inside the second section **212** and communicating with the locking socket **213**. The mounting hole **214** is enclosed by six engagement surfaces **2141**. Each engagement surface **2141** meets a periphery of the magnetic unit **22** at one point and extends to connect with another abutting engagement surface **2141**. Therefore, the engagement surfaces **2141** attain an engagement between the magnetic unit **22** and the mounting hole **214** and a space is formed between the magnetic unit **22** and the mounting hole **214** for allowing the air to be discharged outward from the mounting hole **214** during the installation of the magnetic unit **22**.

[0005] Hence, the arrangement of the engagement surfaces **2141** of the mounting hole **214** must precisely fit the dimensions of the magnetic unit **22** in order to achieve the engagement of the mounting hole **214** and the magnetic unit **22**. However, the mounting hole **214** is formed by direct punching, and that may cause the dimensional variation of the mounting hole **214**. Meanwhile, the dimensions of the magnetic unit **22** is controlled within the dimensional tolerance. Thus, the dimensional variation of the mounting hole **214** and the dimensional tolerance of the magnetic unit **32** may cause the magnetic unit **22** cannot be mounted in the mounting hole **214** effectively. If the magnetic unit **22** is enlarged to be larger than the mounting hole **214** in order to fix the magnetic unit **22** by the engagement surfaces **2141**, the magnetic unit **22** will be worn excessively caused by the engagement surfaces **2141** during the installation of the magnetic unit **22**. Further, the space formed between the magnetic unit **22** and the mounting hole **214** are unduly large to expose the magnetic unit **22** to a large contact area with the outside air, and that accelerates the oxidation of the magnetic unit **22** after the magnetic unit **22** is mounted in the mounting hole **214**. Thus, the magnetic force of the magnetic unit **22** is reduced quickly and the service life of the magnetic unit **22** is decreased. Moreover, a great quantity of metal chips may accumulate in the overly large space, and that affects the magnetic force of the magnetic unit **22** indirectly. Although the magnetic sleeve **2** solves the problem of adding the protection unit **13** mentioned in the magnetic sleeve **1**, the engagement surfaces **2141** of the mounting hole **214** and the magnetic unit **22** must be precisely fit, and that causes increased processing difficulty and raised production costs. That requires to be improved.

SUMMARY OF THE INVENTION

[0006] The object of this invention is to provide a magnetic sleeve capable of preventing a magnet unit from being broken during the installation and providing a minimized space for discharging air and position the magnetic unit stably.

[0007] The magnetic sleeve comprises a body and a

magnetic unit disposed in the body. The body has a first section, a second section connected to the first section and having an engagement end, a locking socket recessedly formed in the engagement end, and a mounting hole formed inside the second section and communicating with the locking socket for accommodating the magnetic unit. The mounting hole is enclosed by a peripheral wall while taking a reference point as center. The peripheral wall has at least one engagement surface having two transition points for meeting at least one wall surface. Each wall surface is a curved surface. The formation of one or more engagement surfaces not only attains a stable engagement between the magnetic unit and the mounting hole, but also minimize a space therebetween for discharging air from the mounting hole smoothly and preventing metal chips from accumulating unduly to thereby prevent the magnetic unit from being broken during the installation and fix the magnetic unit in the mounting hole stably.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008]

Fig. **1A** is a perspective view showing a conventional magnetic sleeve;

Fig. **1B** is a bottom plan view showing the installation of the magnetic unit of the conventional magnetic sleeve shown in Fig. 1A;

Fig. **2A** is a perspective view showing another conventional magnetic sleeve;

Fig. **2B** is a bottom plan view showing the installation of the magnetic unit of the conventional magnetic sleeve shown in Fig. 2A;

Fig. **3** is a perspective view showing a first preferred embodiment of this invention;

Fig. **4** is a bottom plan view showing the diameter of the magnetic unit and the length of the first reference line;

Fig. **5** is a bottom plan view showing the installation of the magnetic unit of the first preferred embodiment of this invention;

Fig. **5A** is an enlarged view of the encircled portion 5A indicated in Fig. 5;

Fig. **6** is a schematic view showing the operation of the magnetic sleeve;

Fig. **7** is a bottom plan view showing a second preferred embodiment of this invention characterized by two engagement surfaces;

Fig. **8** is a bottom plan view showing the installation of the magnetic unit of the second preferred embodiment of this invention;

Fig. **9** is a bottom plan view showing a third preferred embodiment of this invention characterized by three engagement surfaces;

Fig. **10** is a bottom plan view showing a fourth preferred embodiment of this invention characterized by four engagement surfaces; and

Fig. **11** is a bottom plan view showing a fifth preferred embodiment of this invention characterized by six engagement surfaces.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0009] Referring to Fig. **3**, a first preferred embodiment of a magnetic sleeve **3** is disclosed. The magnetic sleeve **3** in this preferred embodiment comprises a body **31** and a magnetic unit **32** mounted in the body **31**. The body **31** has a first section **311**, a second section **312** connected to the first section **311** and having an engagement end **3121**, a locking socket **313** recessed into the engagement end **3121** of the second section **312**, and a mounting hole **314** formed inside the second section **312** and communicating with the locking socket **313** for accommodating the magnetic unit **32**. Referring to Fig. **4**, a reference point **L** is defined inside the mounting hole **314**. The mounting hole **314** is surrounded by a peripheral wall **315** while taking the reference point **L** as center. The peripheral wall **315** has a wall surface **3151** and an engagement surface **3152** different from the wall surface **3151**. The engagement surface **3152** and the wall surface **3151** meet at two transition points **3153**. The wall surface **3151** is formed to be curved in shape and extends between the two transition points **3153**. The engagement surface **3152** is formed to be plane in shape. A diameter **32D** of the magnetic unit **32** equals a length **316D** of a first reference line **316** defined from the wall surface **3151** to the center of the engagement surface **3152** and passing through the reference point **L** to thereby restrict the magnetic unit **32** by the engagement surface **3152** tightly and form a space between the magnetic unit **32** and the mounting hole **314** when the magnetic unit **32** is mounted in the mounting hole **314** as shown in Fig. **5** and Fig. **5A**.

[0010] Referring to Fig. **5** and Fig. **5A**, in order to proceed with the installation of the magnetic unit **32**, a force is applied on the magnetic unit **32** to push the magnetic unit **32** to the mounting hole **314**. The formation of the peripheral wall **315** allows the magnetic unit **32** to be slightly smaller than the mounting hole **314**. Meanwhile, the slight difference between the magnetic unit **32** and the mounting hole **314** is extremely small so that the space formed between the magnetic unit **32** and the mounting hole **314** is narrowed down to the minimum. Thus, during the installation of the magnetic unit **32**, air in the mounting hole **314** can be discharged outward through the space smoothly to thereby reduce a reaction force generated when pushing the air, and that prevents the magnetic unit **32** from being broken caused by the reaction force. Moreover, the minimized space can prevent metal chips from unduly accumulating and reduce an area that the magnetic unit **32** contacts the outside air to thereby slow the oxidation of the magnetic unit **32**. Thus, the magnetic force of the magnetic unit **32** is greatly enhanced. Further, the plane engagement surface **3152** can effectively press and position the curved periphery

of the magnetic unit **32** to thereby stably fix the magnetic unit **32**.

[0011] Referring to Fig. **6**, after the magnetic unit **32** is stably mounted in the mounting hole **314**, the user can sleeve a drive tool (not shown) on the first section **311** and position a locking unit **4** in the locking socket **313** to proceed the assembly and disassembly of the locking unit **4** through the magnetic sleeve **3**. The magnetic force of the magnetic unit **32** allows the magnetic sleeve **3** to attract and position the locking unit **4** effectively to thereby prevent the locking unit **4** from unduly trembling during the operation and solve the problem that the user should place a hand on the locking unit **4** for support. Thus, the assembly and disassembly of the locking unit **4** can be executed quickly.

[0012] Referring to Fig. **7** and Fig. **8** show a second preferred embodiment of the magnetic sleeve **3** of this invention. The correlated elements and the concatenation of elements, the operation and objectives of the second preferred embodiment are the same as those of the first preferred embodiment. This embodiment is characterized in that the peripheral wall **315** has two wall surfaces **3151** and two engagement surfaces **3152**. The two wall surfaces **3151** and each engagement surface **3152** meet at two transition points **3153**. Each wall surface **3151** is formed to be curved in shape and each engagement surface **3152** is formed to be plane in shape. A radius **32R** of the magnetic unit **32** equals a length **317D** of a second reference line **317** defined from the reference point **L** to the center of any one of the engagement surfaces **3252**. Thus, the air in the mounting hole **314** can be discharged outward through the spaces formed between the magnetic unit **32** and the mounting hole **314** to thereby avoid breaking the magnetic unit **32** during the installation of the magnetic unit **32**. Meanwhile, the magnetic unit **32** and the mounting hole **314** are engaged tightly because the engagement surfaces **3152** effectively hold the magnetic unit **32** to thereby fix the magnetic unit **32** steadily. Moreover, the formation of the peripheral wall **315** can vary according to needs. For example, referring to Fig. **9** showing a third preferred embodiment of the magnetic sleeve **3** of this invention, three engagement surfaces **3152** and three wall surfaces **3151** are provided, or four engagement surfaces **3152** and four wall surface **3151** are provided as shown in Fig. **10** showing a fourth preferred embodiment of the magnetic sleeve **3** of this invention. Referring to Fig. **11** showing a fifth preferred embodiment of the magnetic sleeve **3** of this invention which is characterized in that the peripheral wall **315** has six engagement surfaces **3152** and six wall surfaces **3151**. Hence, the magnetic unit **32** can be fastened stably by increasing the number of the engagement surfaces **3152**.

[0013] To sum up, the magnetic sleeve of this invention takes advantages that the peripheral wall has at least one wall surface and at least one engagement surface meeting the wall surface at two transition points to attain a stable engagement between the magnetic unit and the mounting hole and minimize the space therebetween for discharging air from the mounting hole smoothly to thereby prevent the magnetic unit from being broken during the installation. Meanwhile, the minimized space avoids undue accumulation of the metal chips and reduces the area that the magnetic unit contacts the outside air to thereby avoid affecting the magnetic force of the magnetic unit and slow the oxidation of the magnetic unit. Further, the engagement surface can tightly press the magnetic unit to thereby hold the magnetic unit in the mounting hole stably.

[0014] While the embodiments of this invention are shown and described, it is understood that further variations and modifications may be made without departing from the scope of this invention.

Claims

1. A magnetic sleeve comprising a body and a magnetic unit disposed in said body, said body including a first section, a second section connected to said first section and having an engagement end, a locking socket recessed into said engagement end of said second section, and a mounting hole formed inside said second section and communicating with said locking socket for accommodating said magnetic unit;
   characterised in that a reference point is defined inside said mounting hole, said mounting hole being enclosed by a peripheral wall while taking said reference point as center, said peripheral wall including at least one wall surface and at least one engagement surface different from said at least one wall surface, said at least one engagement surface having two transition points opposite to each other, said two transition points meeting said at least one wall surface, said at least one wall surface being curved in shape.

2. The magnetic sleeve according to claim 1, wherein said peripheral wall includes one engagement surface and one wall surface extending between said two transition points, a diameter of said magnetic unit being equal to a length of a first reference line defined from said wall surface to said engagement surface, said first reference line passing through said reference point.

3. The magnetic sleeve according to claim 1, wherein said peripheral wall includes at least two engagement surfaces spaced from each other and at least two wall surfaces alternating with said at least two engagement surfaces, said at least two wall surfaces and each of said at least two engagement surfaces meeting at said two transition points, a radius of said magnetic unit being equal to a length of a second reference line defined from said reference point to

any one of said at least two engagement surfaces.

4. The magnetic sleeve according to any one of claims 1 to 3, wherein said at least one engagement surface is a plane surface.

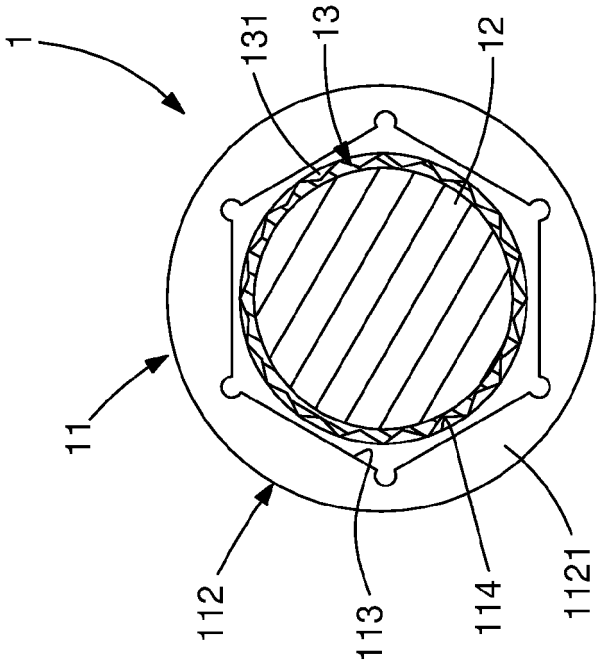

FIG. 1B (PRIOR ART)

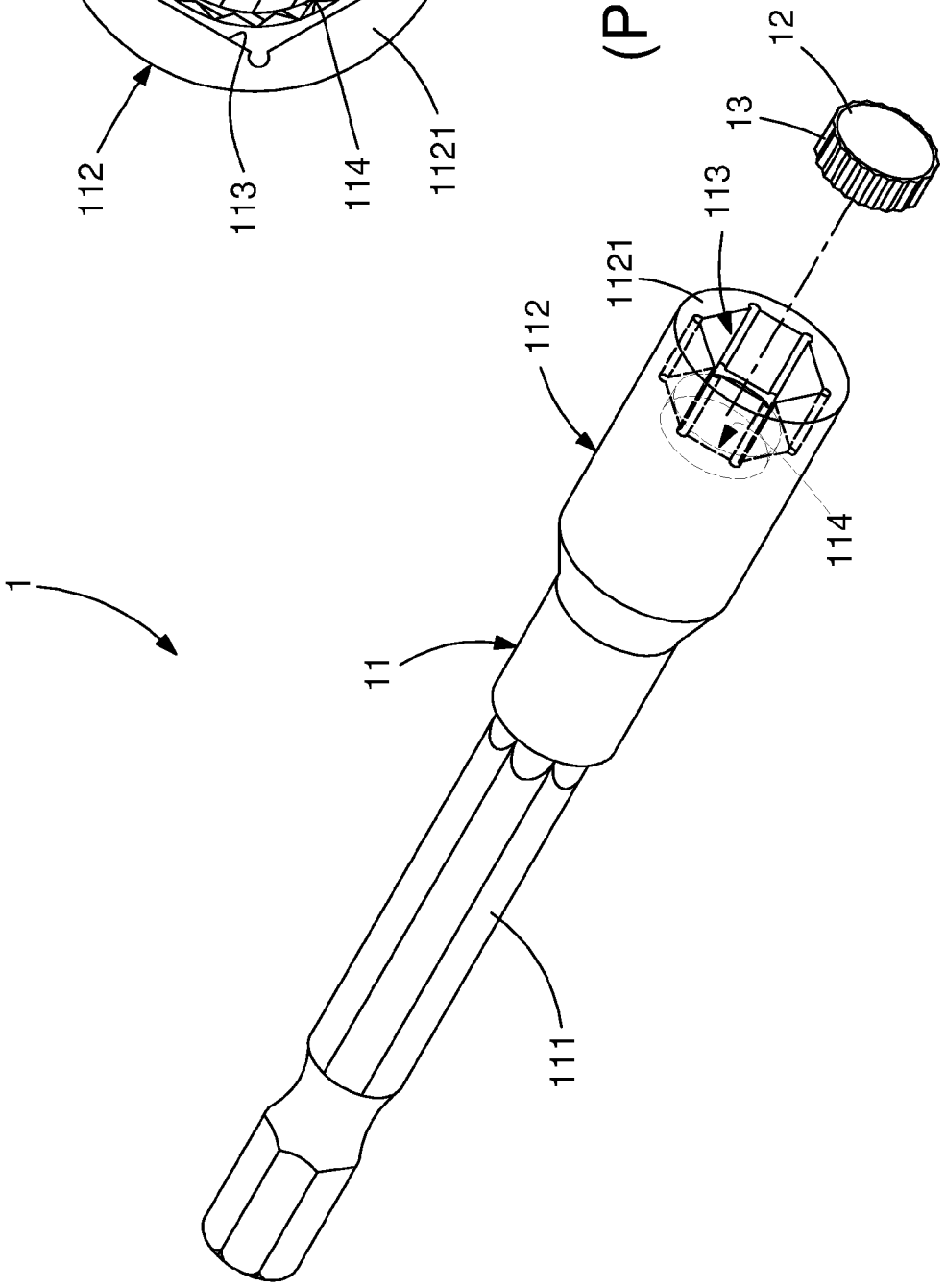

FIG. 1A (PRIOR ART)

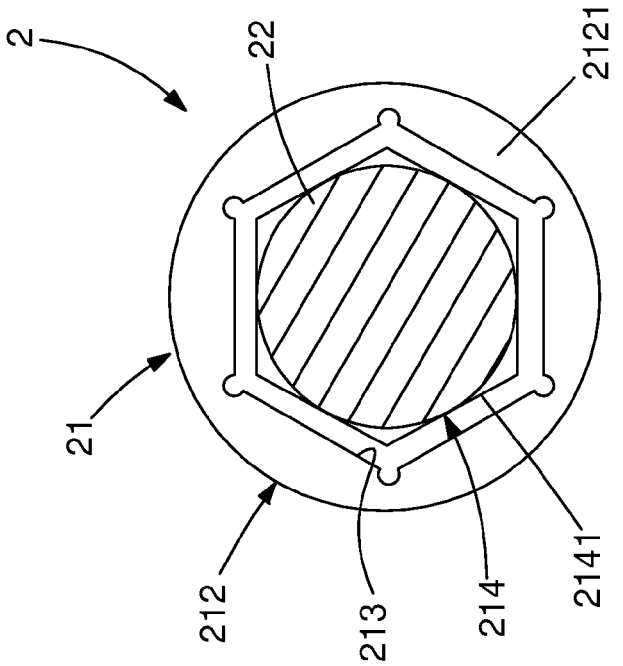

FIG. 2B
(PRIOR ART)

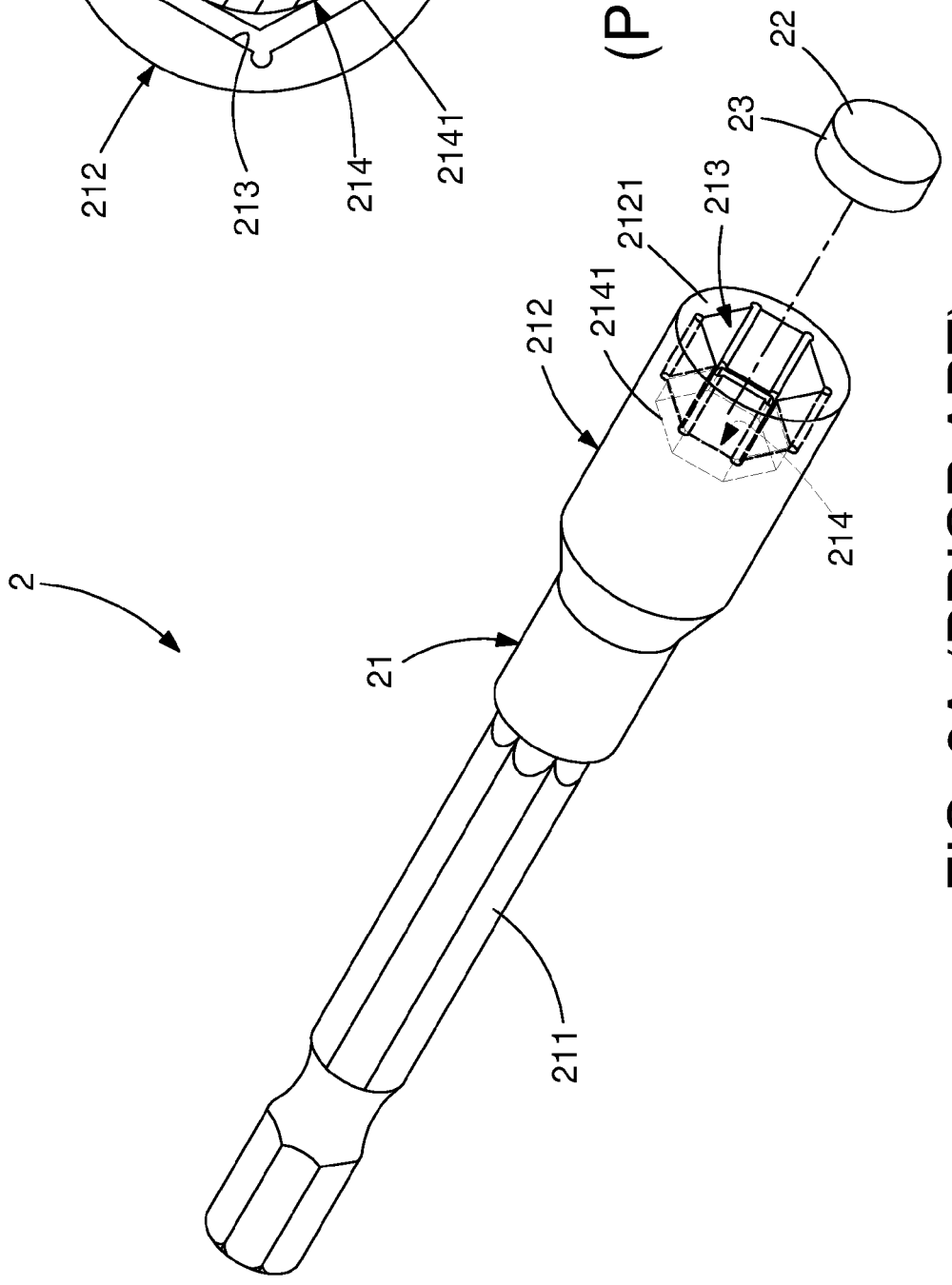

FIG. 2A (PRIOR ART)

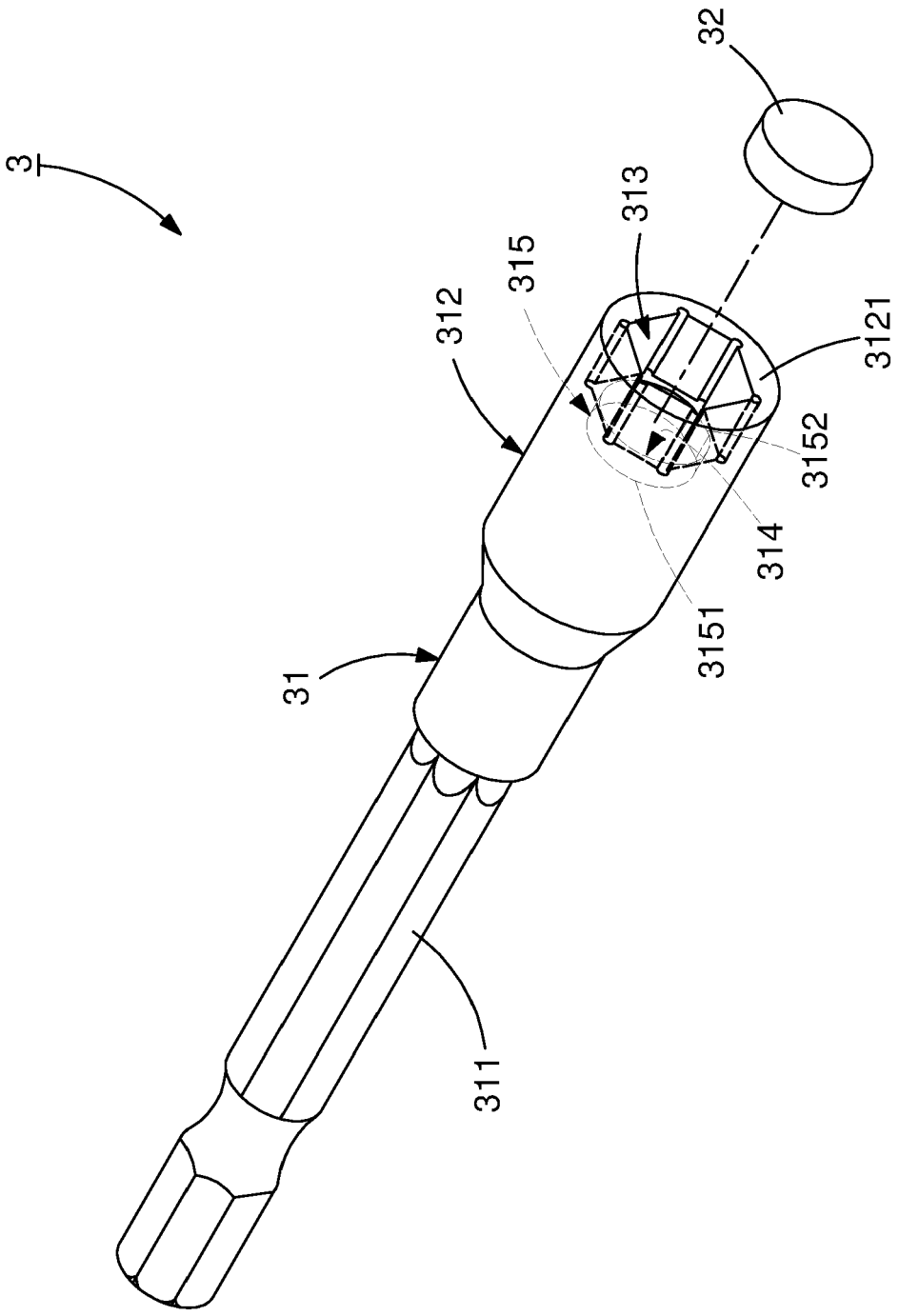

FIG. 3

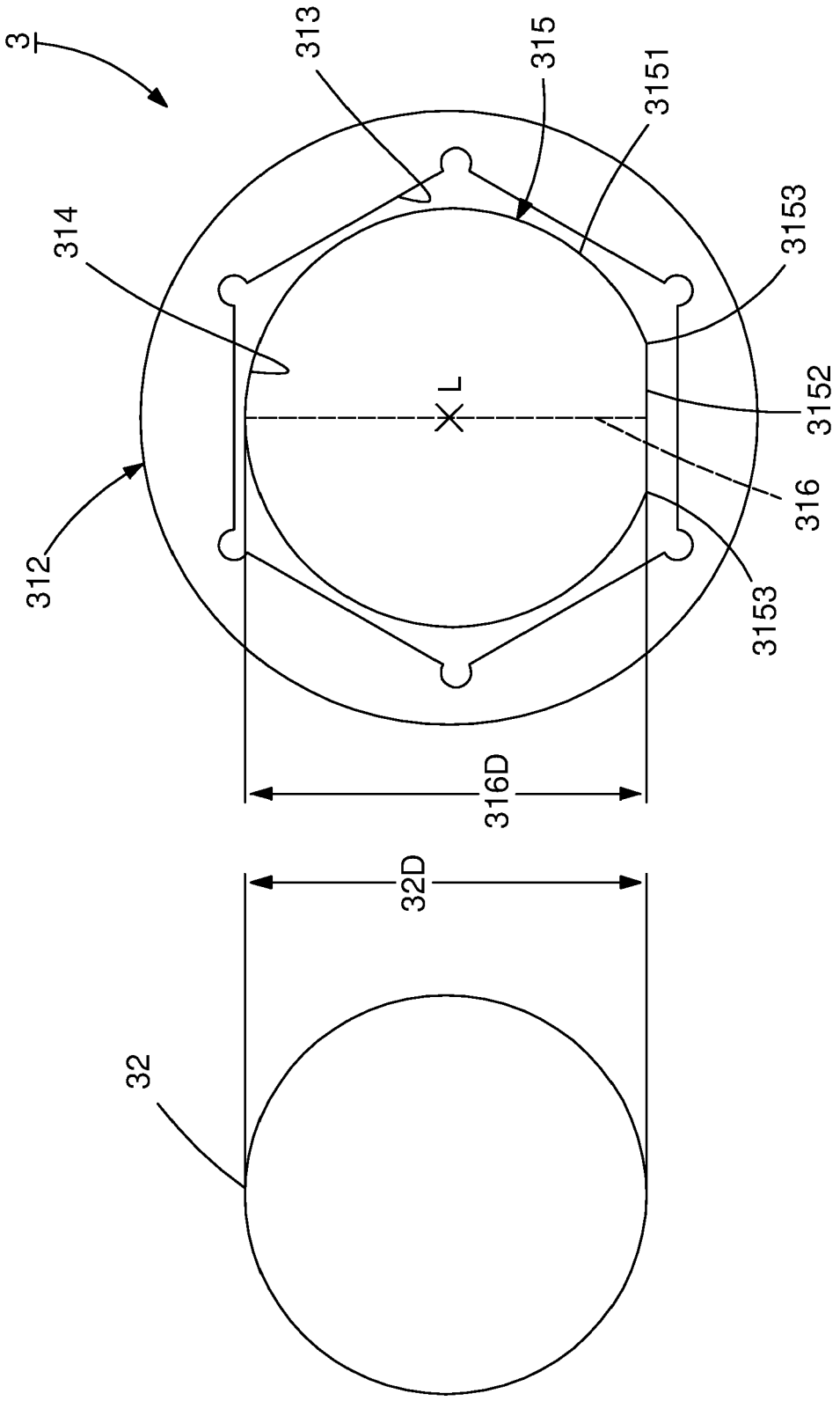

FIG. 4

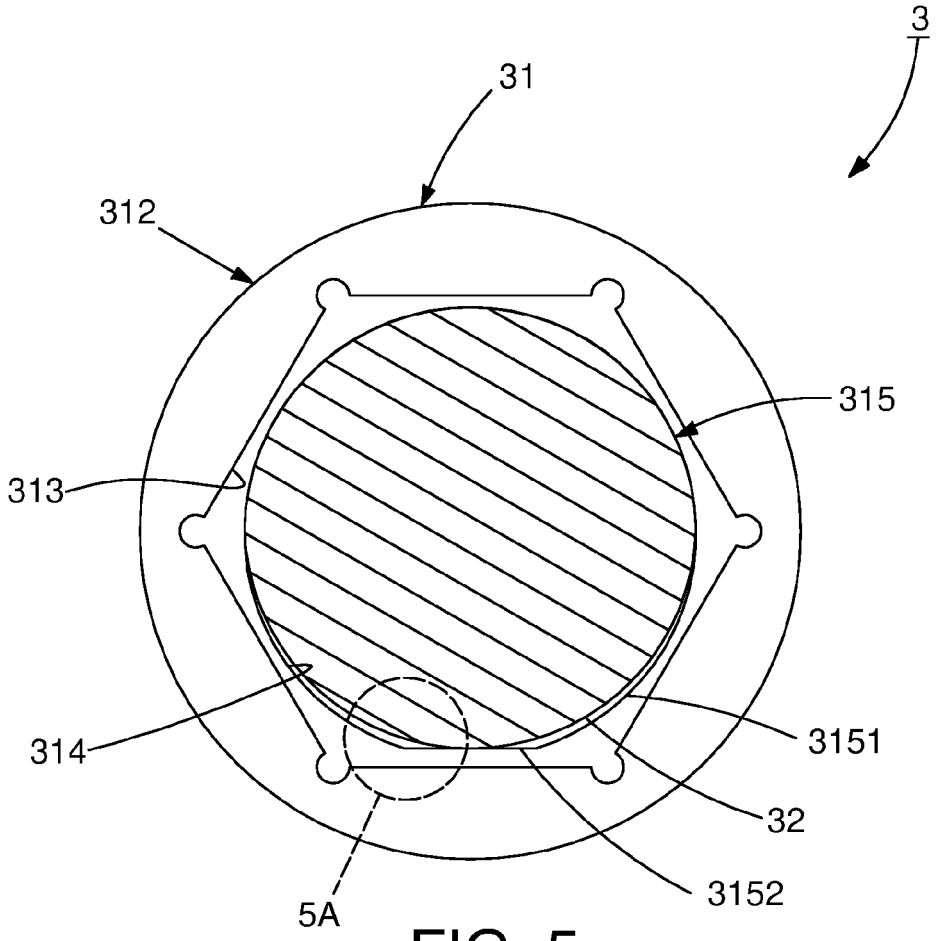

FIG. 5

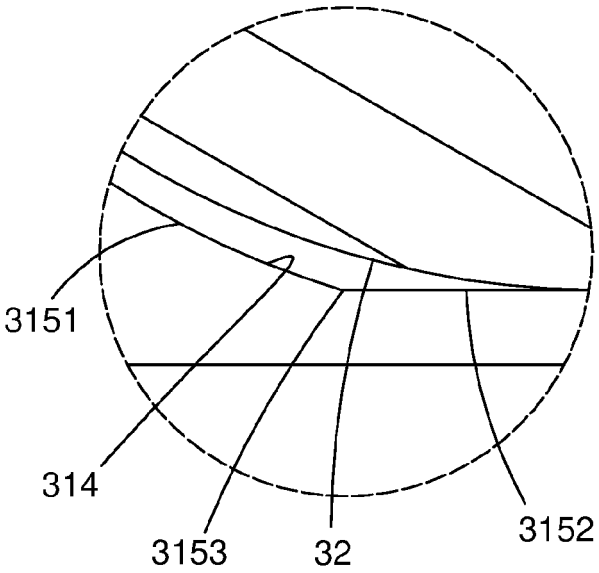

FIG. 5A

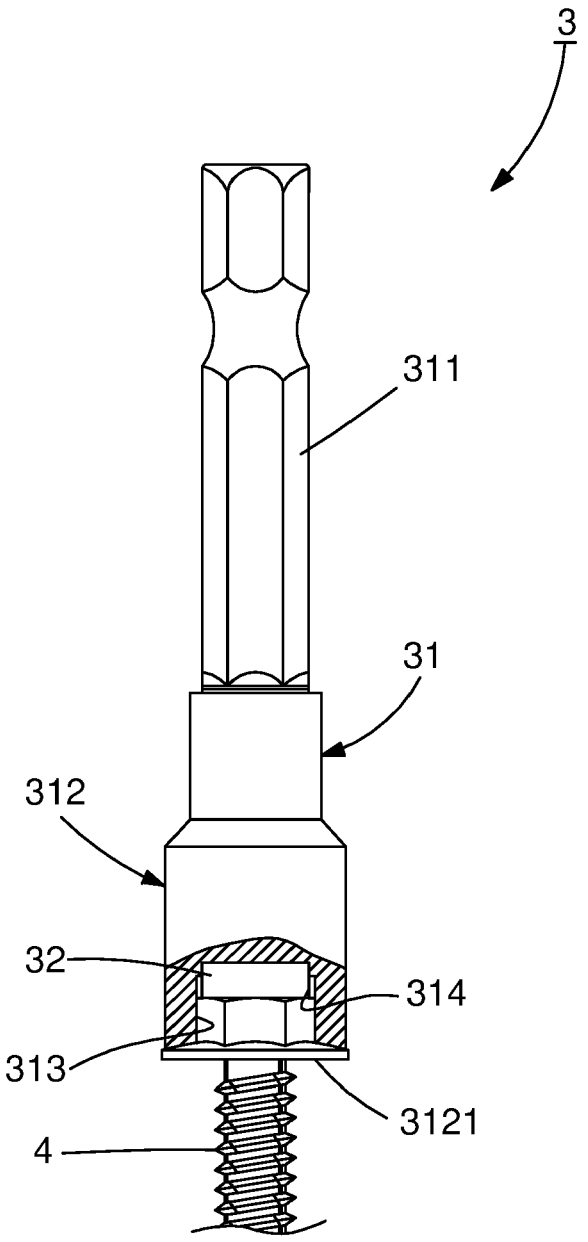

FIG. 6

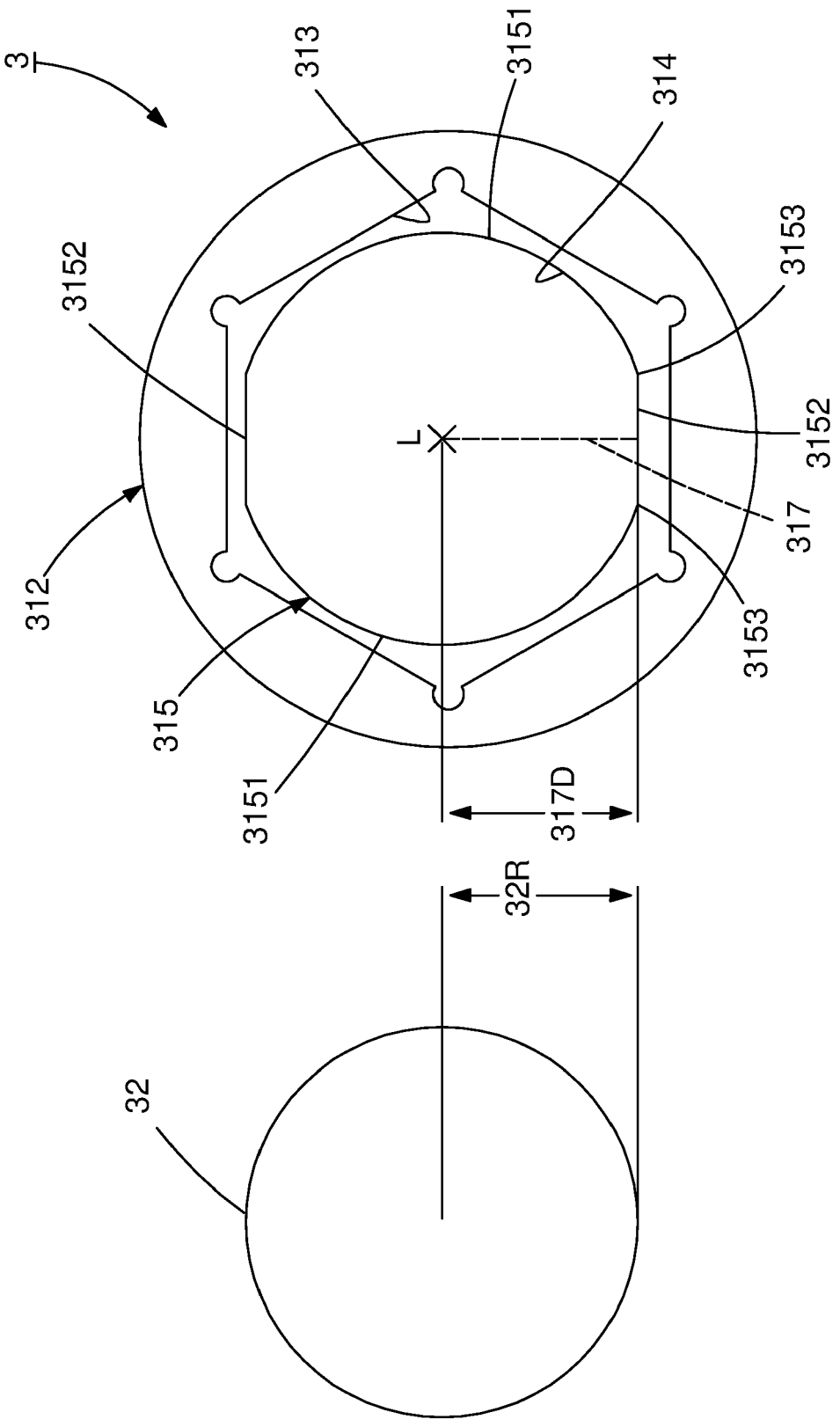
3
313
3151
314
3153
3152
L
3152
317
312
3153
315
3151
317D
32R
32

FIG. 7

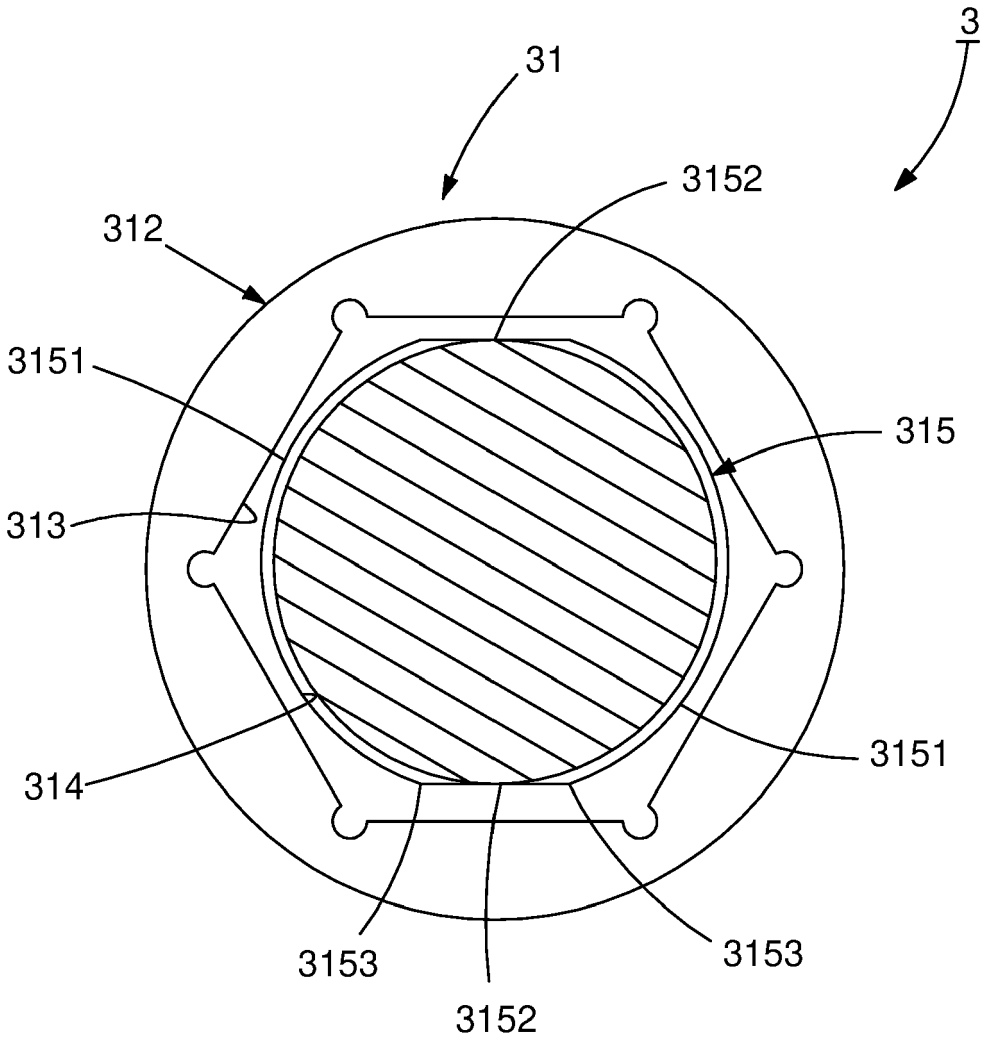

FIG. 8

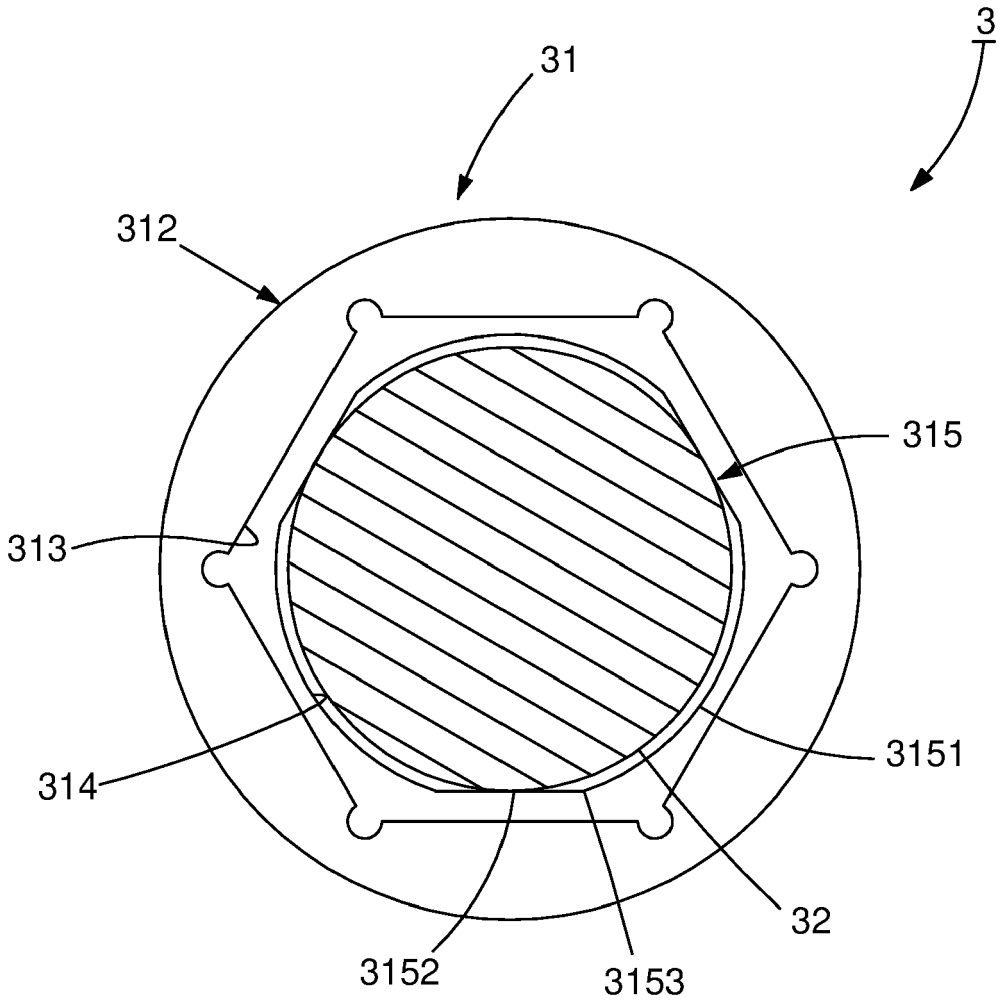

FIG. 9

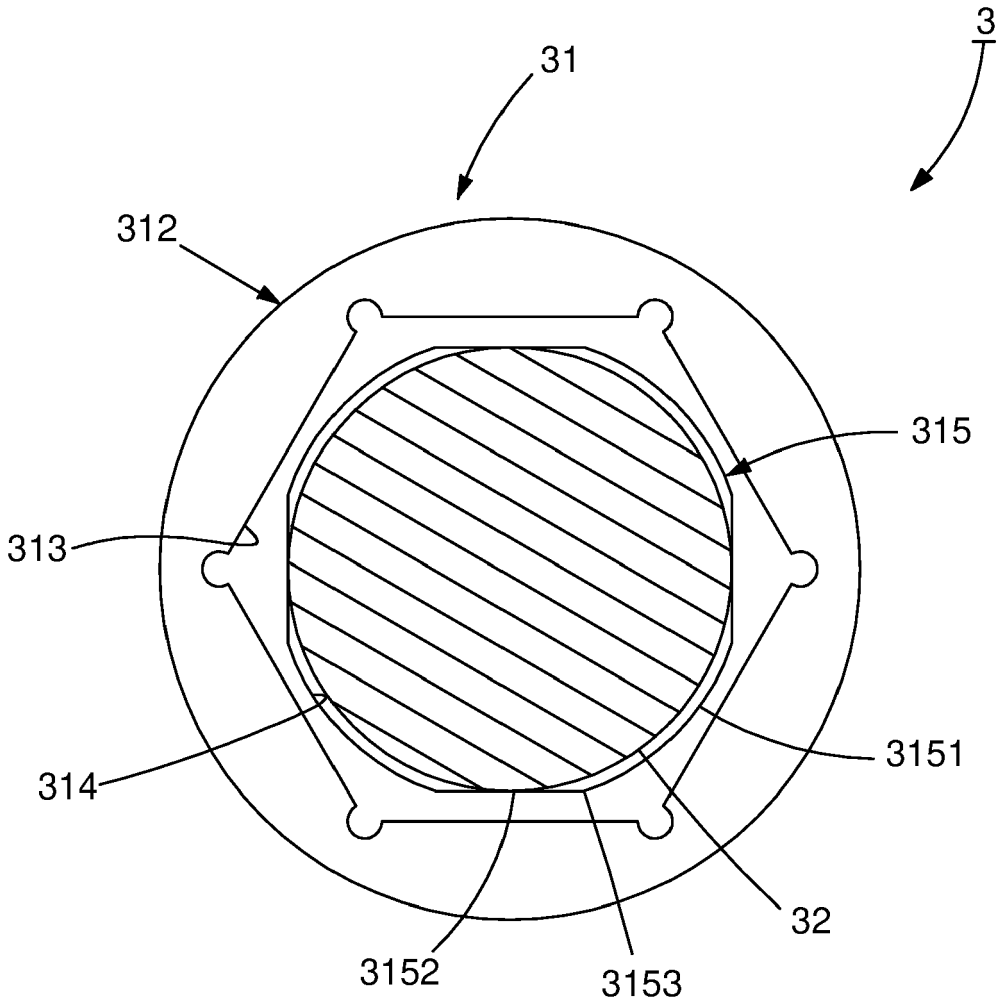

FIG. 10

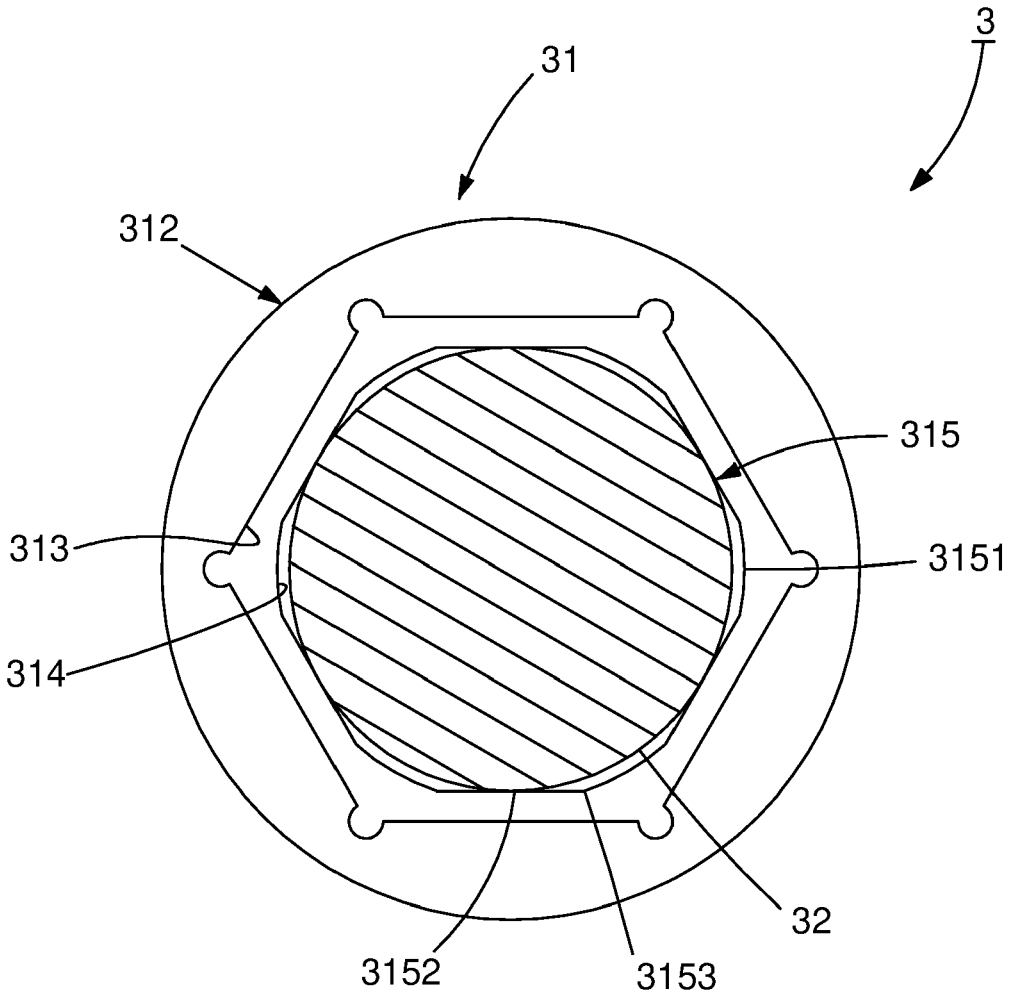

FIG. 11

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EUROPEAN SEARCH REPORT

Application Number
EP 20 15 1665

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 2018/104797 A1 (TODD GREG THOMAS [US] ET AL) 19 April 2018 (2018-04-19) * abstract; figures 2-5 * -----	1-4	INV. B25B23/00 B25B23/12
A	US 2015/336246 A1 (PETERS MICHAEL P [US] ET AL) 26 November 2015 (2015-11-26) * figures 61A,61B * -----	1-4	

TECHNICAL FIELDS SEARCHED (IPC)

B25B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	16 July 2020	Pothmann, Johannes

CATEGORY OF CITED DOCUMENTS

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16-07-2020

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2018104797 A1	19-04-2018	NONE	
US 2015336246 A1	26-11-2015	US 2015336246 A1	26-11-2015
		US 2018071899 A1	15-03-2018

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