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Provisional Application for Patent Cover Sheet					
This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c)					
Inventor(s)					
Inventor 1					Remove
Given Name	Middle Name	Family Name	City	State	Country i
Derek	A.	Sauder	Tremont	IL	US
Inventor 2					Remove
Given Name	Middle Name	Family Name	City	State	Country i
Timothy	A.	Schaefer	Tremont	IL	US
Inventor 3					Remove
Given Name	Middle Name	Family Name	City	State	Country i
Jeremy	J.	Hodel	Morton	IL	US
All Inventors Must Be Listed -- Additional Inventor Information blocks may be generated within this form by selecting the Add button.					Add
Title of Invention		Seed Meter			
Attorney Docket Number (if applicable)		27151.00089			
Correspondence Address					
Direct all correspondence to (select one):					
☒ The address corresponding to Customer Number			☐ Firm or Individual Name		
Customer Number			23452		

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.	
☒ No.	
☐ Yes, the name of the U.S. Government agency and the Government contract number are:	

Entity Status

Applicant claims small entity status under 37 CFR 1.27

☒ Yes, applicant qualifies for small entity status under 37 CFR 1.27☐ No**Warning**

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

Signature

Please see 37 CFR 1.4(d) for the form of the signature.

Signature	/Thomas J. Oppold/			Date (YYYY-MM-DD)	2011-03-22
First Name	Thomas	Last Name	Oppold	Registration Number (If appropriate)	42054

This collection of information is required by 37 CFR 1.51. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 8 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. **DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. This form can only be used when in conjunction with EFS-Web. If this form is mailed to the USPTO, it may cause delays in handling the provisional application.**

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	27151.00089
		Application Number	
Title of Invention	SEED METER		
The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.			

Secrecy Order 37 CFR 5.2

☐	Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)
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Applicant Information:

Applicant 1					
Applicant Authority		☒ Inventor		☐ Legal Representative under 35 U.S.C. 117	
				☐ Party of Interest under 35 U.S.C. 118	
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Derek	A.	Sauder		
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service					
City	Tremont	State/Province	IL	Country of Residence	US
Citizenship under 37 CFR 1.41(b)		US			
Mailing Address of Applicant:					
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Applicant 2					
Applicant Authority		☒ Inventor		☐ Legal Representative under 35 U.S.C. 117	
				☐ Party of Interest under 35 U.S.C. 118	
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Timothy	A.	Schaefer		
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service					
City	Tremont	State/Province	IL	Country of Residence	US
Citizenship under 37 CFR 1.41(b)		US			
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Address 1		14044 N. Lake Windermere Rd.			
Address 2					
City	Tremont	State/Province	IL		
Postal Code	61568	Country	US		
Applicant 3					
Applicant Authority		☒ Inventor		☐ Legal Representative under 35 U.S.C. 117	
				☐ Party of Interest under 35 U.S.C. 118	
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Jeremy	J.	Hodel		
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service					
City	Morton	State/Province	IL	Country of Residence	US

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	27151.00089	
		Application Number		
Title of Invention	SEED METER			
Citizenship under 37 CFR 1.41(b)		US		
Mailing Address of Applicant:				
Address 1	357 S. Glen Ave			
Address 2				
City	Morton	State/Province	IL	
Postal Code	61550	Country	US	
All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the Add button.				Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below. For further information see 37 CFR 1.33(a).			
☐ An Address is being provided for the correspondence Information of this application.			
Customer Number	23452		
Email Address	ipgroup@larkinhoffman.com	Add Email	Remove Email

Application Information:

Title of the Invention	SEED METER		
Attorney Docket Number	27151.00089	Small Entity Status Claimed	☒
Application Type	Provisional		
Subject Matter	Utility		
Suggested Class (if any)		Sub Class (if any)	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)	17	Suggested Figure for Publication (if any)	

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)
☐ Request Not to Publish. I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application has not and will not be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Enter either Customer Number or complete the Representative Name section below. If both sections are completed the Customer Number will be used for the Representative Information during processing.			
Please Select One:	☒ Customer Number	☐ US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	27151.00089
		Application Number	
Title of Invention	SEED METER		
Customer Number	23452		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78(a)(2) or CFR 1.78(a)(4), and need not otherwise be made part of the specification.

Prior Application Status		Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the Add button.			

Foreign Priority Information:

This section allows for the applicant to claim benefit of foreign priority and to identify any prior foreign application for which priority is not claimed. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(a).

			Remove
Application Number	Country	Parent Filing Date (YYYY-MM-DD)	Priority Claimed
			☐ Yes ☒ No
Additional Foreign Priority Data may be generated within this form by selecting the Add button.			

Assignee Information:

Providing this information in the application data sheet does not substitute for compliance with any requirement of part 3 of Title 37 of the CFR to have an assignment recorded in the Office.

Assignee 1			
If the Assignee is an Organization check here. ☒			
Organization Name	Precision Planting, Inc.		
Mailing Address Information:			
Address 1	23207 Townline Road		
Address 2			
City	Tremont	State/Province	IL
Country	US	Postal Code	61568
Phone Number		Fax Number	
Email Address			
Additional Assignee Data may be generated within this form by selecting the Add button.			

Signature:

A signature of the applicant or representative is required in accordance with 37 CFR 1.33 and 10.18. Please see 37 CFR 1.4(d) for the form of the signature.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number		27151.00089	
		Application Number			
Title of Invention		SEED METER			
Signature		/Thomas J. Oppold/		Date (YYYY-MM-DD)	
				2011-03-22	
First Name	Thomas	Last Name	Oppold	Registration Number	42054

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SEED METER

BACKGROUND

In recent years, growers of corn and other crops have recognized an increased need to plant one seed at a time (i.e., “singulate” seeds) at the appropriate spacing due to increased seed and crop input prices as well as an increased ability to monitor the economic impact of skips, doubles or misplaced seeds using modern planter monitors. For these reasons modern seed meters have been developed including features which improve the singulation of seeds. However, each added feature increases the amount of time that the user must spend replacing wear parts or making other adjustments prior to or during planting operations. Due to weather and other factors, the available time to plant corn and other crops is often extremely limited, with each planter required to cover hundreds of acres while limited to a planting speed of approximately five miles an hour.

Thus there is a need in the art for a seed meter having improved singulation capability but being easily repaired or modified by the user.

BRIEF DESCRIPTION OF THE DRAWINGS

- FIG. 1 illustrates a single row unit of a conventional row crop planter.
- FIG. 2 is a perspective view of a seed meter.
- FIG. 3 is a perspective view of a seed meter with certain components removed.
- FIG. 4 is a perspective view of a seed housing of a seed meter and singulator.
- FIG. 5 is a front elevation view of a seed housing of a seed meter.
- FIG. 6 is another perspective view of a seed housing of a seed meter and an associated singulator.
- FIG. 7 is a perspective view of a seed housing of a seed meter with the seed singulator removed.

FIG. 8 is a partial front elevation view of a seed housing of a seed meter with the seed singulator removed.

FIG. 9 is a rear elevation view of a seed meter.

FIG. 10 is a rear elevation view of a seed meter with certain components removed.

FIG. 11 is a rear elevation view of a seed meter with further components removed.

FIGs. 12A-12D are perspective views of a seed singulator and axial spring.

FIGs. 13A-13B are perspective views of a seed housing of a seed meter.

FIG. 13C is a partial perspective view of a seed housing of a seed meter.

FIG. 14 is a perspective view of a seed disc, vacuum seal and ejector wheel assembly.

FIG. 15 is a perspective view of a vacuum cover and vacuum seal.

FIG. 16 is a perspective view of a vacuum cover.

FIGs. 17A-17B are perspective views of an ejector wheel assembly.

DETAILED DESCRIPTION

Referring now to the drawings, wherein like reference numerals designate identical or corresponding parts throughout the several views, FIG. 1 illustrates a single row unit 10 of a conventional row crop planter. As is well known in the art, the row units 10 are mounted in spaced relation along the length of a transverse toolbar 12 by a parallel linkage 14 which permits each row unit 10 to move vertically independently of the toolbar and the other spaced row units in order to accommodate changes in terrain or upon the row unit encountering a rock or other obstruction as the planter is drawn through the field. Each row unit 10 includes a frame 16 which operably supports a seed

1 hopper 18, a furrow opening assembly 20, a seed meter 100, a seed tube 46 and a furrow
2 closing assembly 50.

3 The furrow opening assembly 20 comprises a pair of furrow opening discs 22
4 which are rotatably mounted on shafts 26 secured to a shank 30 comprising a part of the
5 row unit frame 16. The furrow opening assembly 20 further comprises a pair of gauge
6 wheels 32 rotatably supported by gauge wheel arms 35 also secured to the frame 16. As
7 the planter is drawn through the field, the rotating discs 22 cut a V-shaped furrow 40
8 through the soil surface 36. The egress end of the seed tube 46 is disposed between the
9 rearwardly diverging furrow opening discs 22.

10 In operation, as the planter is drawn through the field along direction of travel 38,
11 the seed hopper 18 communicates a constant supply of seeds 42 to the seed meter 100.
12 The seed meter 100 meters or dispenses individual seeds 42 at regularly spaced intervals
13 into the seed tube 46. The seed tube 46 directs the seeds downwardly and rearwardly
14 between the diverging furrow opening discs 22 before depositing the seeds into the V-
15 shaped furrow 40. The seeds are then covered with soil by the furrow closing assembly
16 50. A seed sensor 60 detects the passage of seeds through the seed tube 46 as is known in
17 the art.

18 A novel seed meter 100 is illustrated in the remaining figures. Referring to FIGs.
19 2 and 3, the seed meter 100 includes a housing comprised of vacuum cover 110 and seed
20 housing 105. As described further herein, the seed meter 100 functions by selecting one
21 seed at a time from seeds communicated into the seed housing 105 and depositing each
22 seed into seed exit 180.

23 A vacuum inlet 115 is coupled to the vacuum cover, placing the interior of the
24 vacuum cover in fluid communication with a vacuum source (not shown) such as a
25 vacuum impeller.

26 The seed housing 105 includes pivots 113 and tabs 103. When assembled, the
27 tabs 103 extend through holes in the vacuum cover 110 such that retaining springs 108
28 may be biased against pivots 113 and tabs 103 to retain the seed housing in position

1 against the vacuum cover.

2 Referring to FIG. 3, the seed meter 100 is shown with the vacuum cover 110 and
3 other components removed for clarity. A shaft 183 is rotatably coupled to bearings 184,
4 which are held in place by the vacuum cover 110. Bearings 184 are held in place by the
5 vacuum cover 110. A drive plate 186 is coupled to and rotates with the shaft 183. Drive
6 plate 186 is releasably coupled to seed disc 120. Seed disc 120 includes apertures 122
7 and preferably includes drive teeth 121. In operation, the seed disc 120 may be rotated
8 by a driven gear (not shown) coupled to drive teeth 121 (as described further herein) or
9 by a driven shaft (not shown) coupled to an adapter 185 (FIG. 2) mounted to the shaft
10 183.

11 Turning to FIG. 4, the interior of the seed housing 105 is shown. A brush 112 is
12 mounted to seed housing 105 such that its bristles contact the surface of seed disc 120. A
13 singulator 130 is mounted to the seed housing 105 (as described further herein) such that
14 the singulator contacts the seed disc 120.

15 Referring to FIGs. 5, 6, and 13A-C, seed is communicated into the seed meter 100
16 beneath the baffle 160. Seed collects in the seed housing 105 beginning above the seed
17 removal door 150.

18 The height of baffle 160 may be adjusted along guides 164 and 166. The baffle
19 160 is mounted to the seed housing 105 by rivet 162, which extends outside the seed
20 housing 105 (as best seen in FIG. 13C) and may be moved vertically by the operator
21 along a notched slot 117 without disassembling the housing. Each notch in slot 117 is
22 sized to hold the rivet 162 in place such that the operator can select the height of baffle
23 160 by pushing the rivet up and down. As illustrated, visual indicators (e.g., 1 through 4)
24 may be printed adjacent to various positions of the rivet 162 (corresponding to various
25 heights of baffle 160) for ease of reference.

26 As best seen in FIG. 13C, the seed removal door 150 may be selectively removed
27 by the operator to remove seed from the seed housing 105. When the seed meter 100 is
28 in use, the seed removal door 150 is biased against the seed housing 105 by the spring

1 member 152, which is pivotally mounted to the seed housing 105 at the pivot 154. To
2 remove seed from the housing, the operator may pull the seed removal door 150 away
3 from the seed housing 105 (bending the spring member 152) and rotate the seed removal
4 door about the pivot 154. The seed removal door 150 preferably extends to the lowest
5 portion of the seed chamber within the seed housing 105 such that all or substantially all
6 seeds within the seed chamber may be removed from the seed meter 100 by moving seed
7 removal door 150.

8 Referring to FIGs. 6-8, the singulator 130 is releasably mounted to the seed
9 housing 105 so as to bias the singulator against the seed disc 120 while allowing the
10 singulator to “float” both axially and longitudinally with respect to the axis of rotation of
11 the seed disc. The singulator is releasably coupled to axial spring 137 by attachment ears
12 139. The axial spring 137 is preferably made of a material (e.g., spring steel) which is
13 elastically deformable. The axial spring 137 is mounted to bosses 142. The bosses 142
14 are sized such that the singulator 130 is biased against the face of the seed disc 120 when
15 the seed disc is in its normal position. Thus when the seed disc 120 is deflected axially
16 away from the vacuum cover 110, the tension in axial spring 137 increases, allowing the
17 singulator to remain in contact with the seed disc without interfering with the rotation of
18 the seed disc. Likewise, when the seed disc is deflected axially toward the vacuum cover
19 110, the tension in axial spring 137 decreases such that the singulator remains in contact
20 with the seed disc.

21 Radial spring 111 is mounted to the seed housing 105 such that in operation, the
22 radial spring biases the singulator radially against the seed disc 120 when the seed disc is
23 in its normal position.

24 It should be appreciated that the user may wish to replace singulator 130 in order
25 to choose a different lobe configuration for different seeds or due to wear on the
26 singulator lobes. Using the seed meter 100 described herein, the operator may easily
27 remove the singulator 130 by pulling the singulator away from the axial spring 137 with
28 sufficient force that the attachment ears 139 deflect away from each other and release the
29 singulator. Likewise the operator may replace the singulator 130 by pressing the

1 singulator between the attachment ears 139 with sufficient force that the attachment ears
2 first deflect away from each other to allow the singulator between them and then return to
3 a relaxed state in which the singulator 130 is again secured to the axial spring 137. In
4 this way the singulator 130 may be easily removed and replaced without the use of tools
5 and without removing or changing the location of axial spring 137, which remains in the
6 correct location to bias the singulator 130 against the seed disc 120 while allowing the
7 singulator 130 to “float” with deflections or curvatures of the seed disc.

8 Referring to FIGs. 12A-D, the singulator 130 is illustrated in detail attached to the
9 axial spring 137. The singulator 130 includes base 133, arms 136, upper lobe plate 134
10 and lower lobe plate 132. The upper lobe plate includes three singulation lobes, while the
11 lower lobe plate includes two singulation lobes. In operation, attachment ears 139 grasp
12 the base 133. It should be appreciated that other configurations of the singulator 130
13 could be used to achieve the objectives described herein.

14 Referring to FIGs. 10 and 11, the seed meter 100 is illustrated with the seed
15 housing 105 and other components removed so that the singulator 130 may be seen in its
16 preferred location biased against the seed disc 120. For clarity, only the upper and lower
17 lobe plates 132 and 134 are shown in FIG. 11. In operation, the seed disc rotates in the
18 direction indicated by arrow 129. As the seed apertures 122 turn through the seed
19 reservoir at the bottom of the seed housing 105, they are placed in fluid communication
20 with the vacuum source such that one or more seeds become entrained in the apertures.
21 As the seed-bearing apertures rotate between the lobe plates 132 and 134, the lobes
22 contact the seeds so as to remove any additional seeds, leaving one seed per aperture.
23 After the apertures 122 rotate past the 3 o’clock position as seen in the perspective of
24 FIG. 11, the apertures are no longer in contact with the vacuum source and the seeds are
25 released into seed exit 180.

26 Referring to FIGs. 14-16, the vacuum cover 110 includes a continuous mounting
27 groove 192 into which a vacuum seal 190 is press fit. In operation, the vacuum seal 190
28 is pressed against the seed disc 120 and the interior of the vacuum seal is in fluid
29 communication with the vacuum inlet 115 (FIG. 1) such that the apertures 122 located

1 within the vacuum seal 190 are placed in fluid communication with the vacuum source.

2 It has been found that seeds or partial seeds may become lodged in the seed
3 apertures 122 even after the apertures pass the seal 190 such that no vacuum is imposed.
4 This is undesirable because when the apertures re-enter the seed reservoir an additional
5 seed may not be entrained in an aperture holding a seed. Thus, referring again to FIGs.
6 14-16, a seed ejector assembly 170 is preferably mounted to the vacuum cover 110. The
7 seed ejector assembly 170 includes a shaft 174, a mounting clip 172, a lever arm 175 and
8 an ejector wheel 176 having plungers 177. The ejector wheel 176 is rotatably coupled to
9 the lever arm 175. The lever arm is rotatably coupled to the shaft 174. The shaft is
10 rotatably received within the mounting clip 172. As best seen in FIG. 15, the mounting
11 clip 172 is attached to mounting port 179, which is preferably formed integrally with the
12 vacuum cover 110. As best seen in FIG. 14, as the seed disc 120 rotates, the ejector
13 wheel 176 rotates and the plungers 177 enter each seed aperture 122, knocking out any
14 seeds, partial seeds or debris in the seed apertures. A compressed spring (not shown) is
15 preferably disposed between the lever arm 175 and the vacuum cover 110 (e.g., having a
16 first end held in place at a first end by knob 173 on the lever arm and having a second end
17 held in place by cavity 177 in the vacuum cover) in order to bias the ejector wheel 176
18 against the seed disc 120.

19 It should be appreciated that the user may wish to remove the seed ejector
20 assembly 170 or replace it due to wear on the ejector wheel 176 or for other
21 reasons. As illustrated in FIGs. 16, 17A and 17B, the mounting clip 172 may be easily
22 removed from and reattached to the mounting port 179 without the use of tools. The
23 mounting port 179 includes apertures 196 and tab 195. Mounting clip 172 includes rigid
24 hooks 197 and resilient hook 198. During installation, the user first inserts rigid hooks
25 197 into apertures 197, then preferably presses mounting clip 172 against vacuum cover
26 110 such that resilient hook 198 deflects around tab 195 and returns to a relaxed state
27 secured around tab 195. It should be appreciated that even if resilient hook 198 does not
28 deflect with respect to mounting clip 172, the mounting clip may deflect to allow resilient
29 hook 198 to deflect around the tab 195. Afterwards the mounting clip 172 is secured

1 against mounting port 179 until the user removes the mounting clip by bending the
2 mounting clip to release the resilient hook 198 from tab 195 and then moving the rigid
3 hooks 197 free of the apertures 196.

4 Although the various improvements described herein are illustrated with respect
5 to a vacuum-type seed meter, they would be equally applicable to other seed singulating
6 meters, including positive-air meters such as that disclosed in U.S. Pat. No. 4,450,979 to
7 Deckler, the disclosure of which is hereby incorporated herein in its entirety.

8 The foregoing description is presented to enable one of ordinary skill in the art to
9 make and use the invention and is provided in the context of a patent application and its
10 requirements. Various modifications to the preferred embodiment of the apparatus, and
11 the general principles and features of the system and methods described herein will be
12 readily apparent to those of skill in the art. Thus, the present invention is not to be
13 limited to the embodiments of the apparatus, system and methods described above and
14 illustrated in the drawing figures, but is to be accorded the widest scope consistent with
15 the spirit and scope of the appended claims.

CLAIMS

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1. A seed meter for an agricultural planter, comprising:
a meter housing including a seed housing;
a seed disc rotatably mounted within said meter housing;
a spring coupled to said seed housing; and
a singulator releasably coupled to said spring,
wherein said spring resiliently biases said singulator against said seed disc.

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2. A seed meter for an agricultural planter, comprising:
a meter housing;
a seed disc rotatably housed within said meter housing, said seed disc including
seed entraining features; and
a seed ejector assembly releasably coupled to said vacuum cover, said ejector
wheel having plungers disposed to sequentially engage said seed entraining features.

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ABSTRACT

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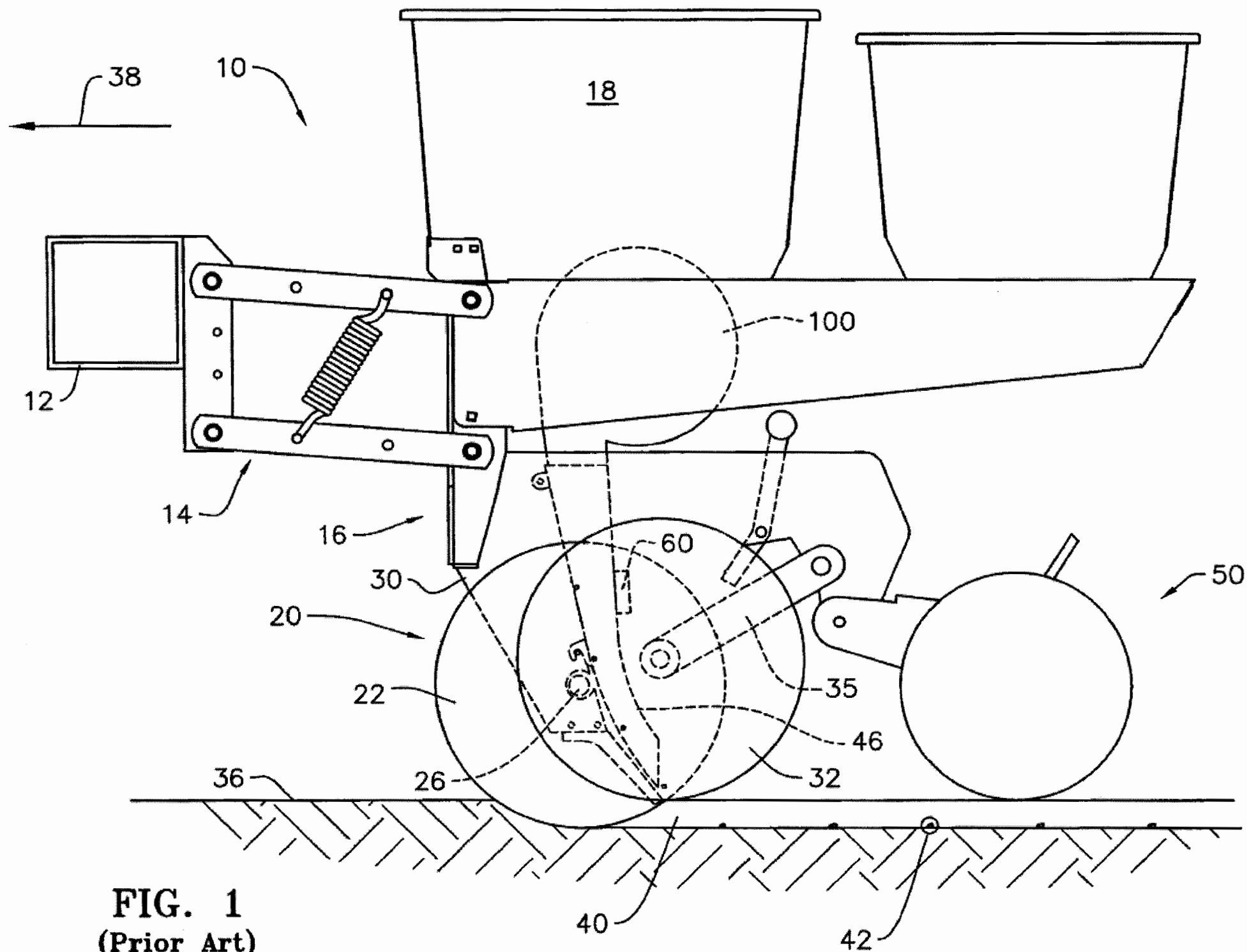
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A seed meter for an agricultural planter is provided having features for improving singulation of seeds. The features are mounted such that the user may easily remove and replace them without the use of tools.

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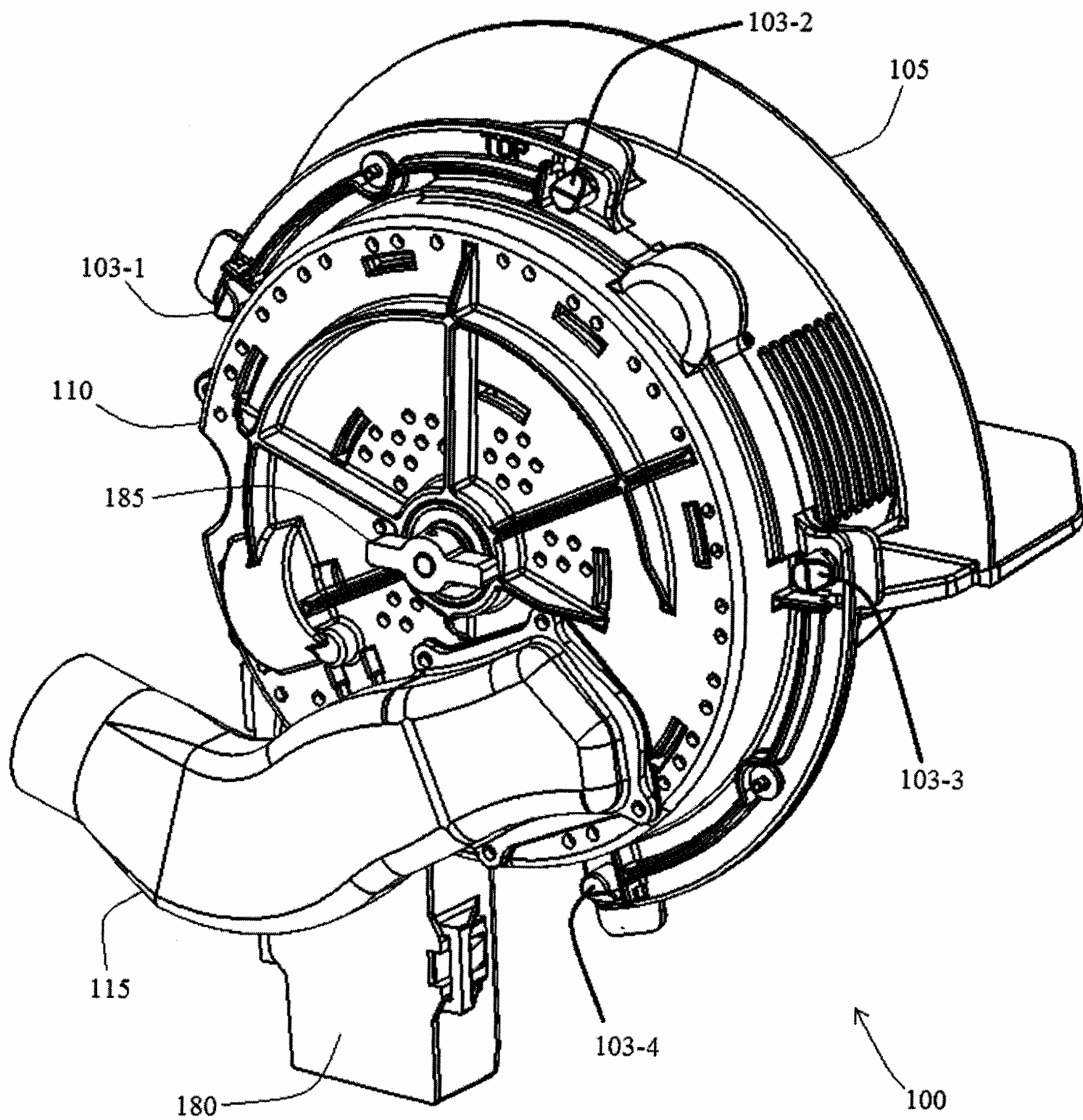


FIG. 2

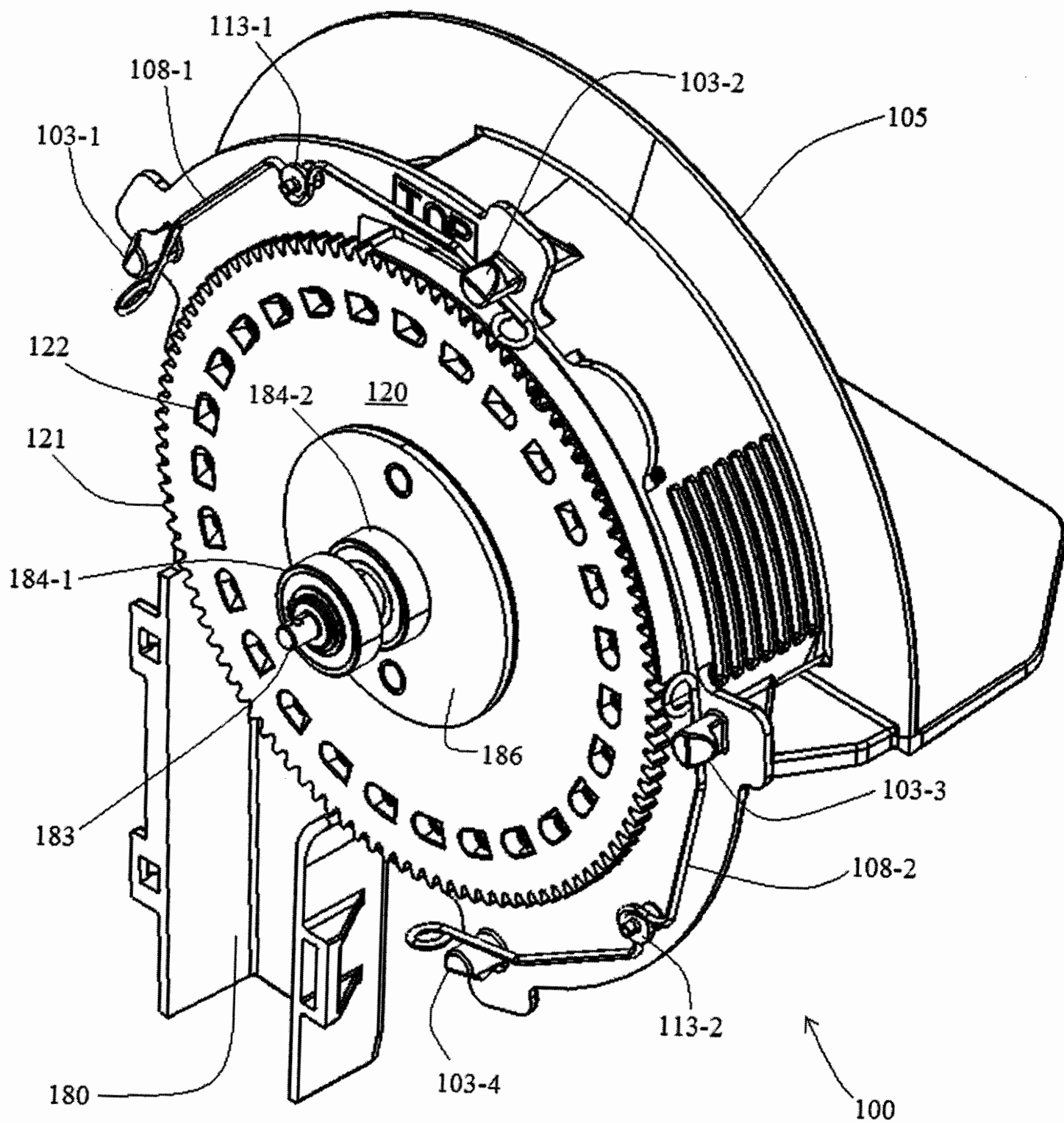


FIG. 3

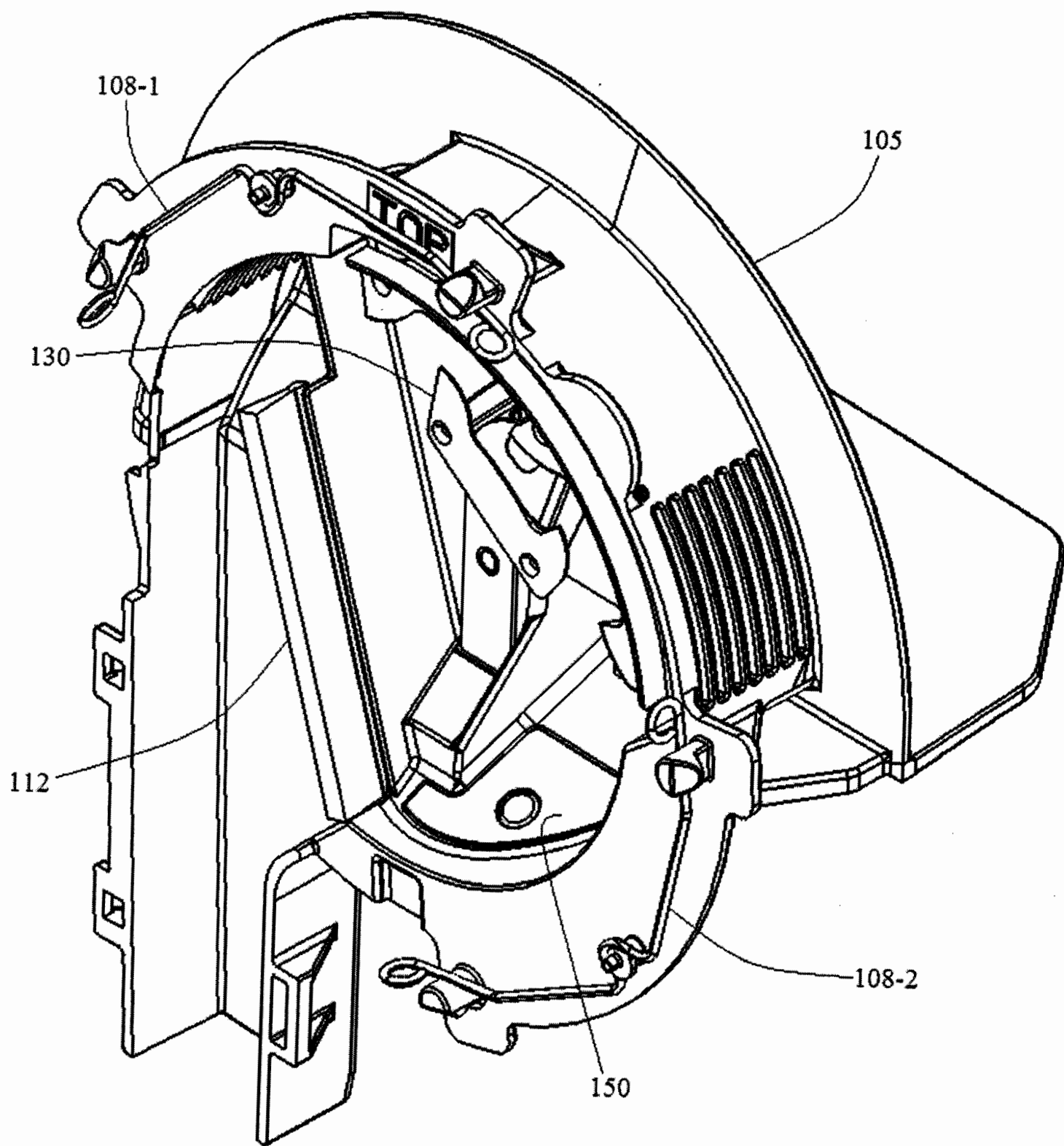


FIG. 4

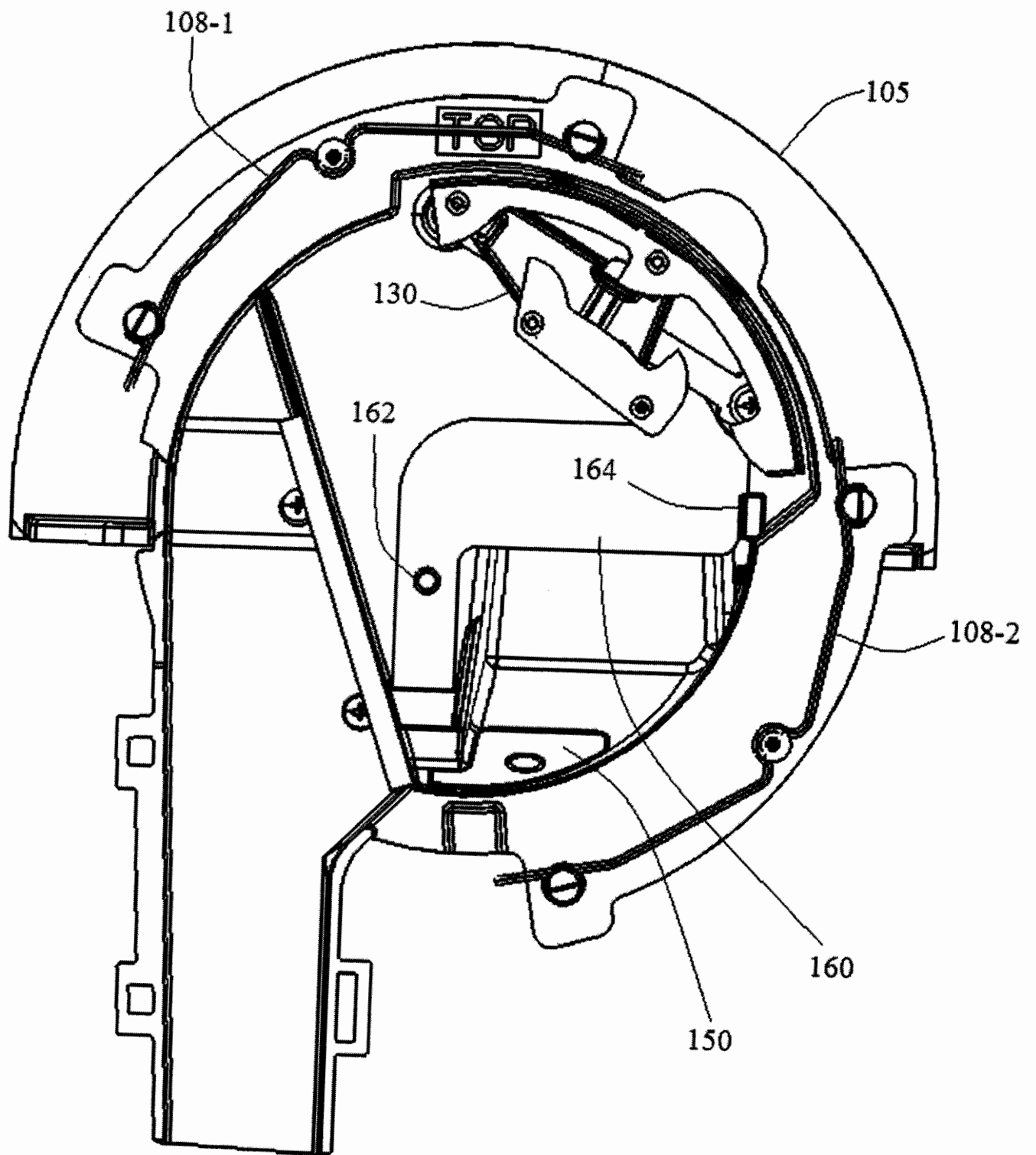


FIG. 5

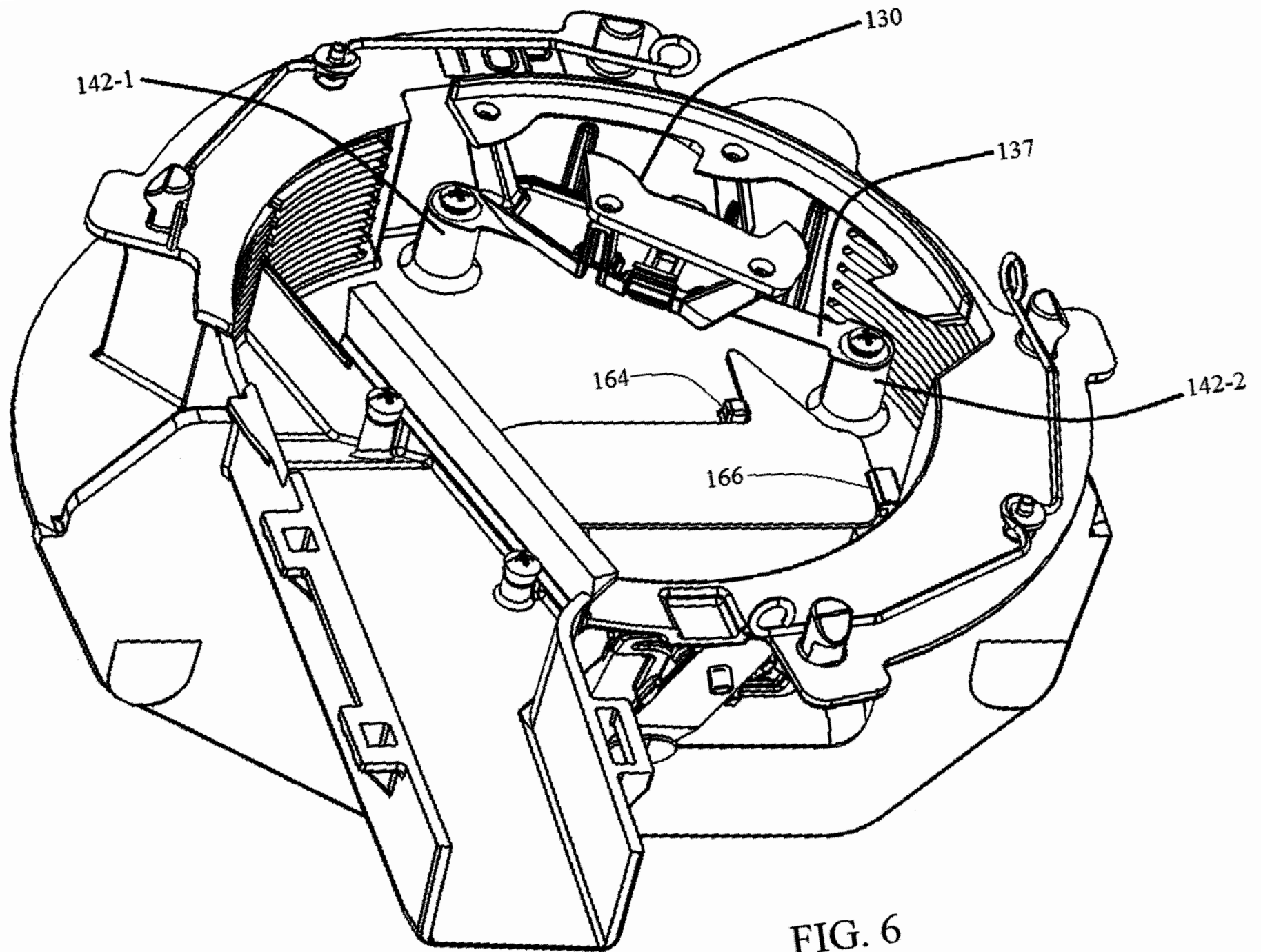


FIG. 6

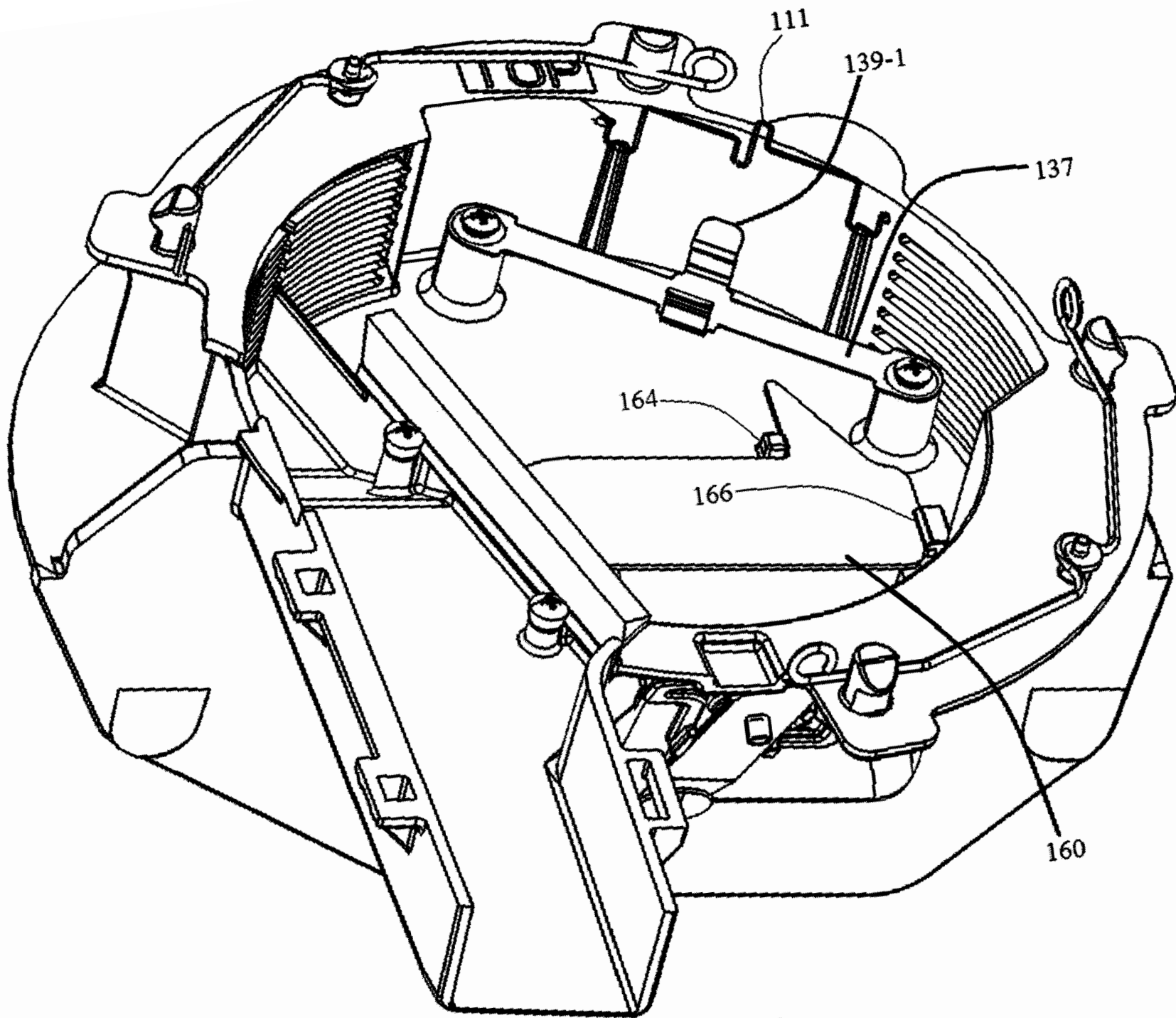


FIG. 7

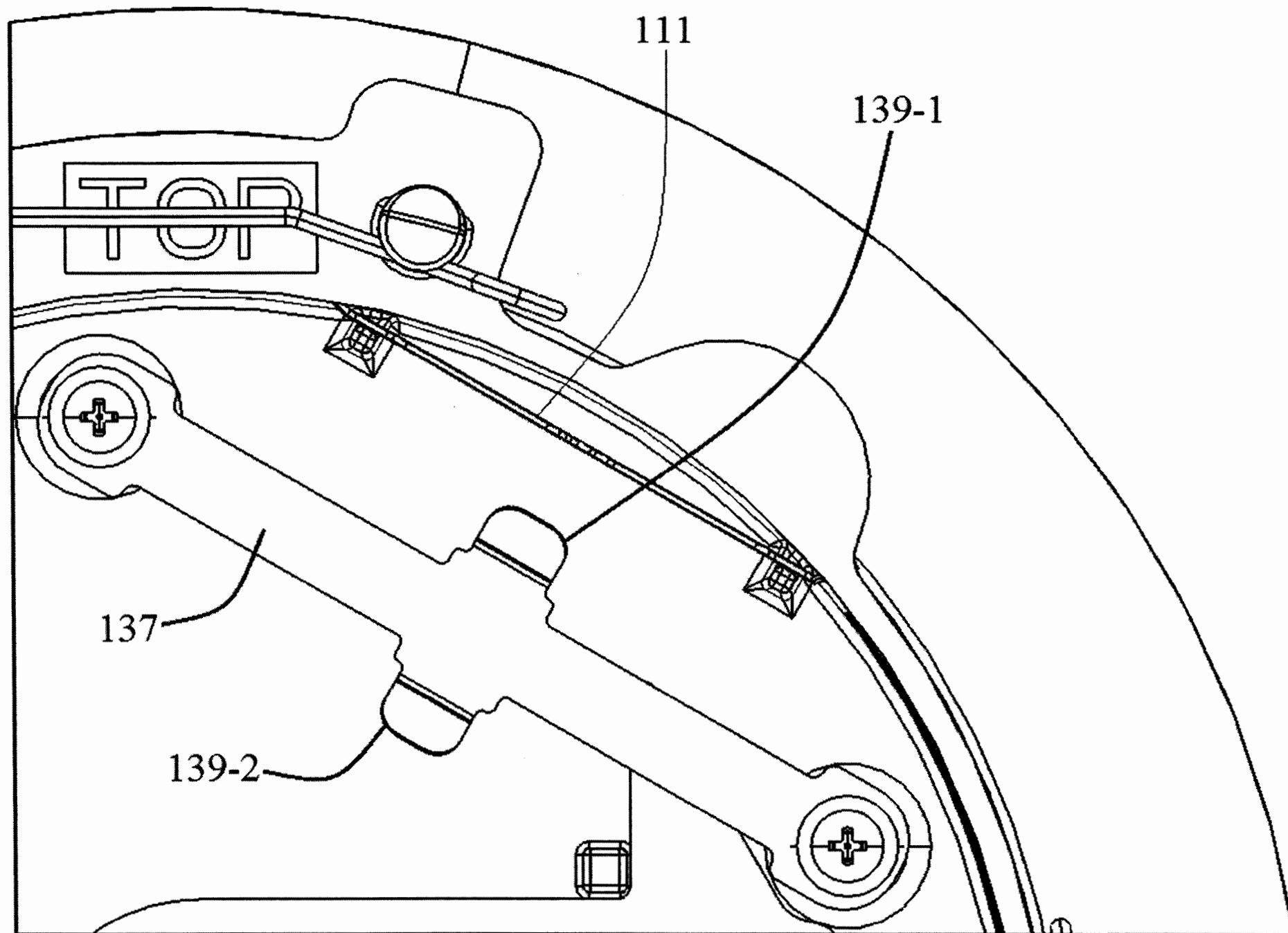


FIG. 8

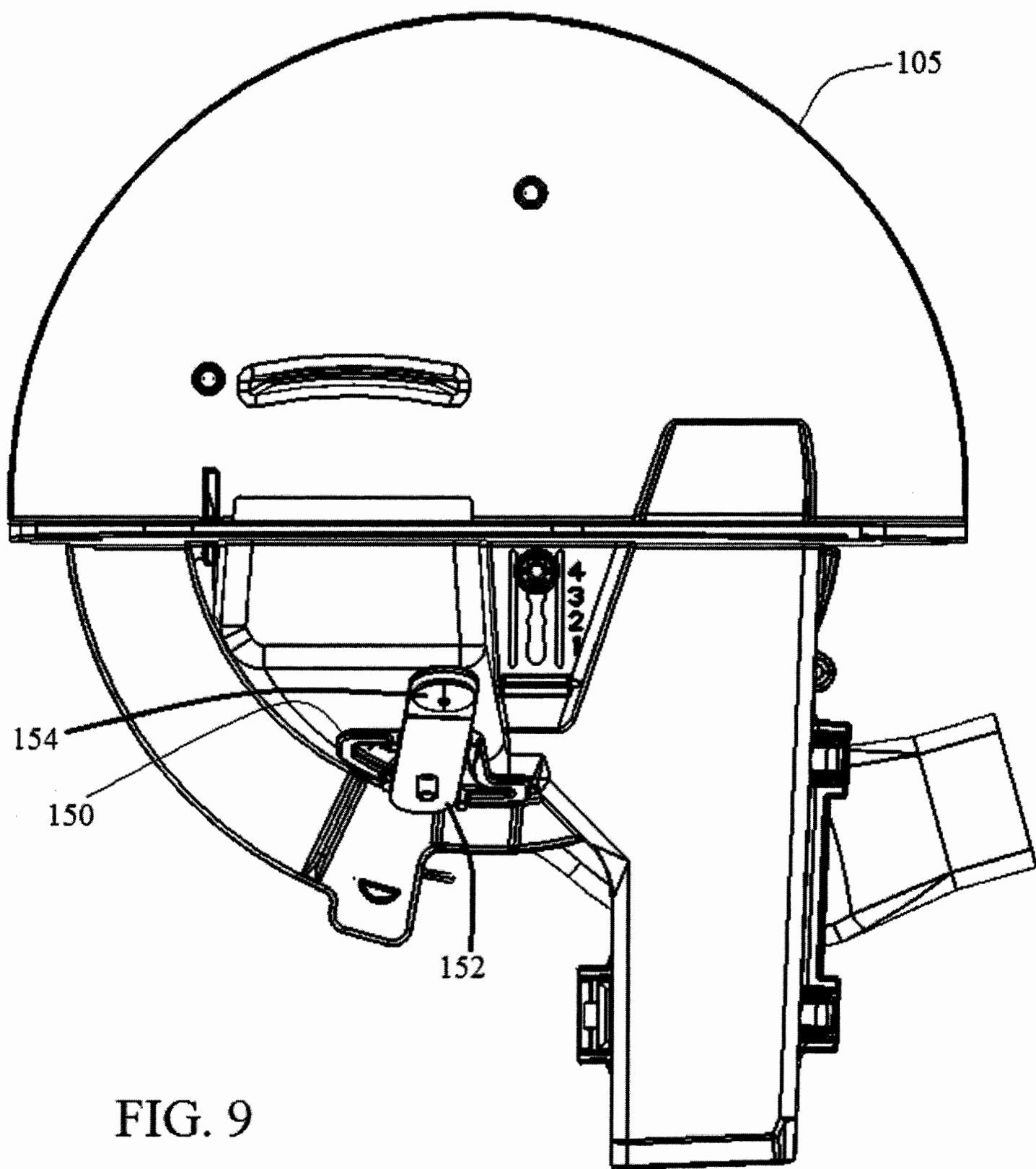
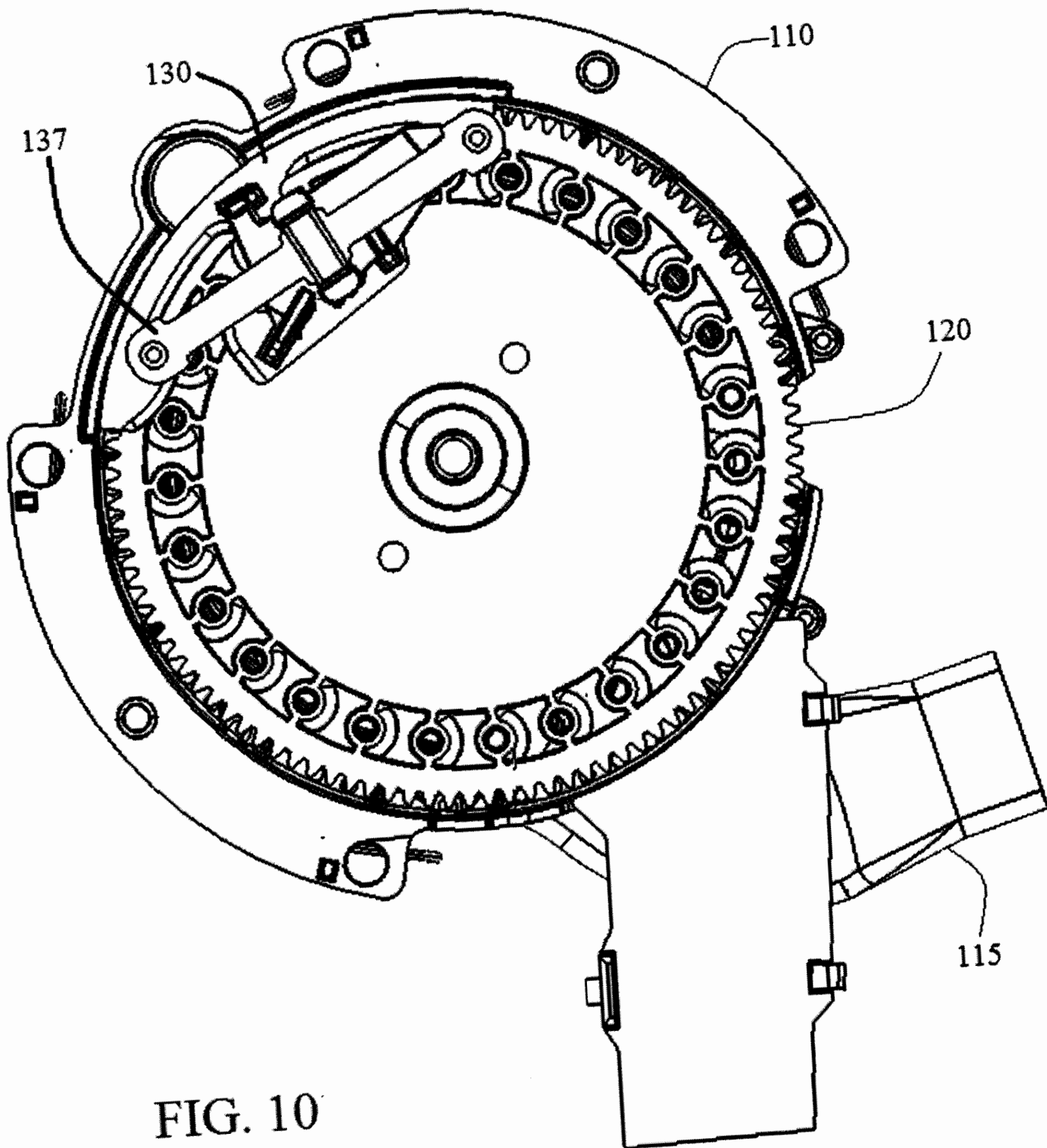


FIG. 9



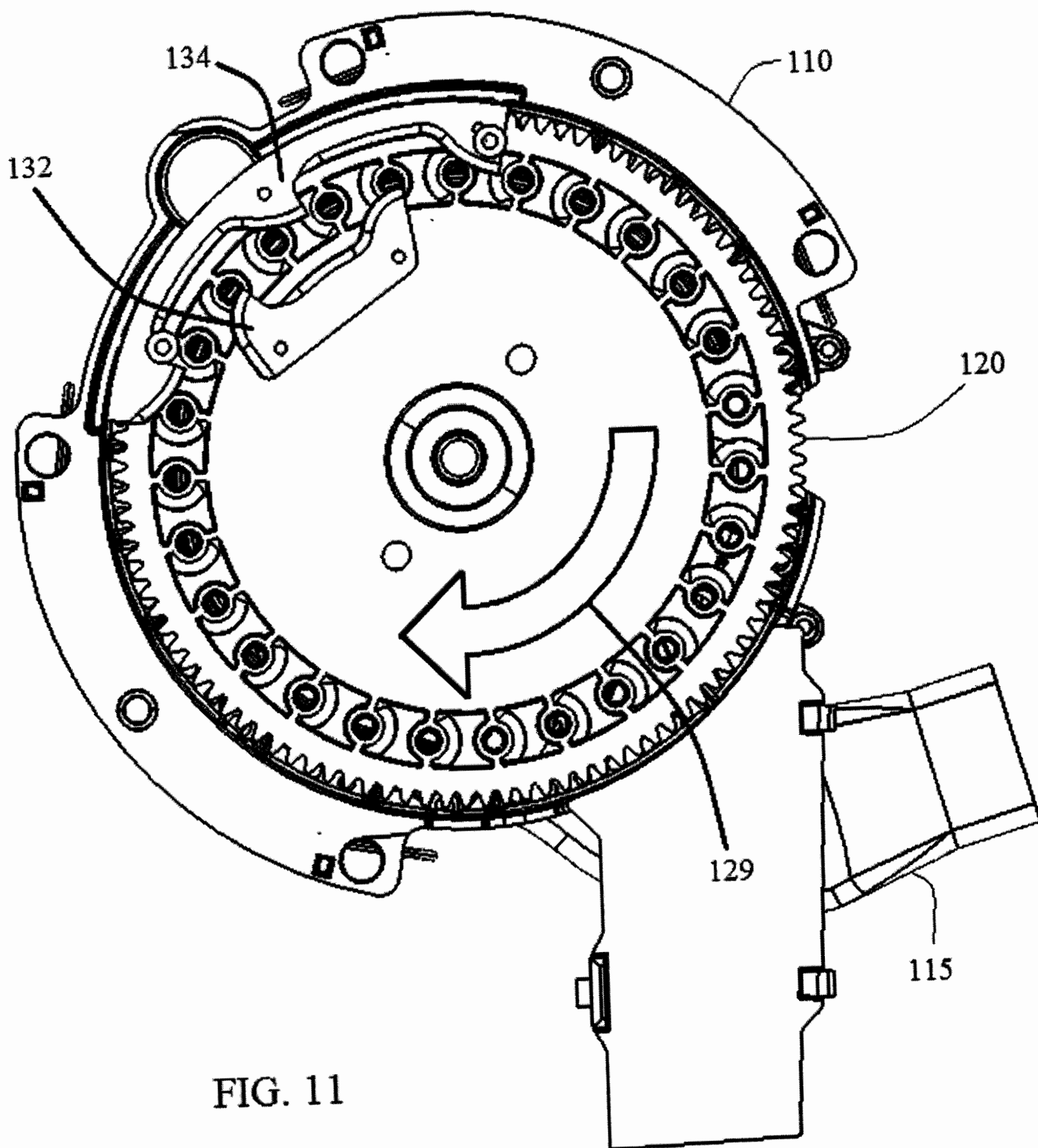


FIG. 11

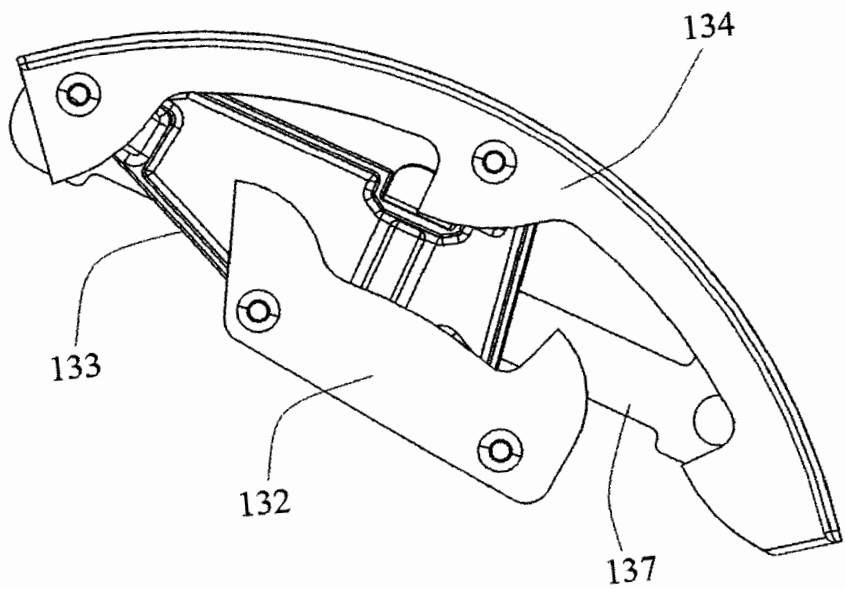


FIG. 12A

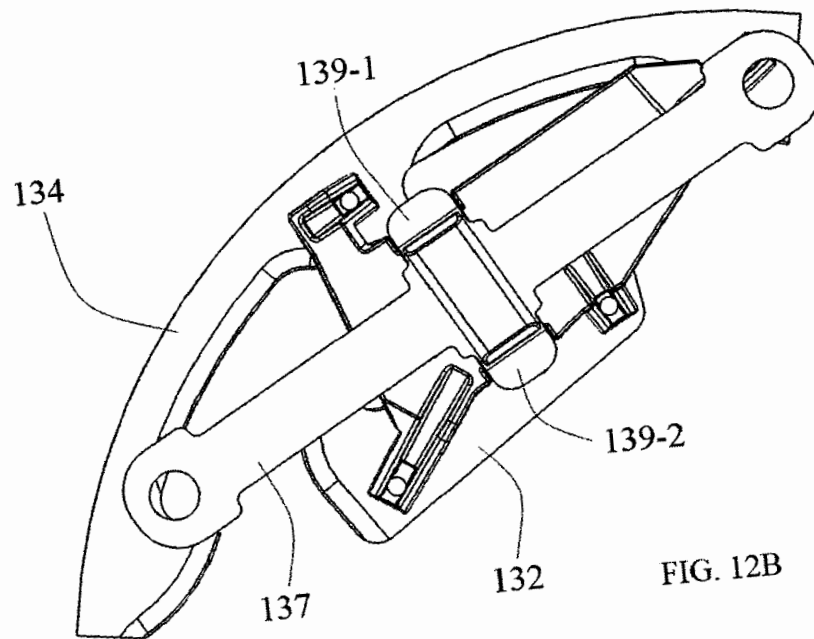


FIG. 12B

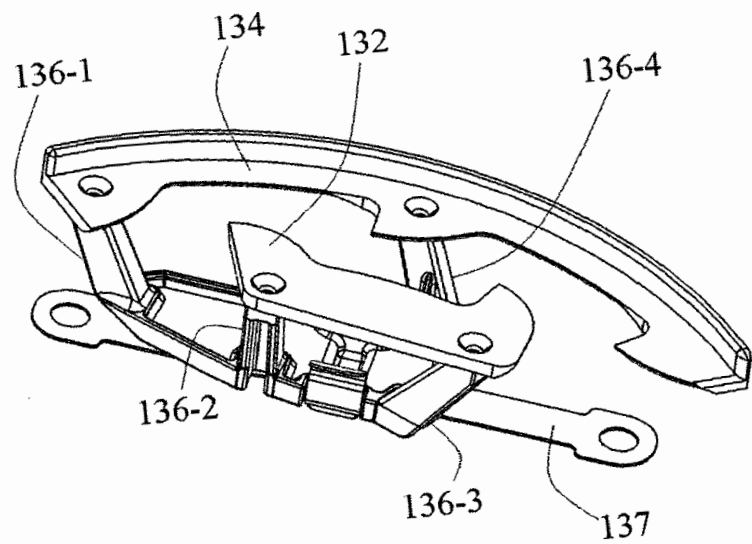


FIG. 12C

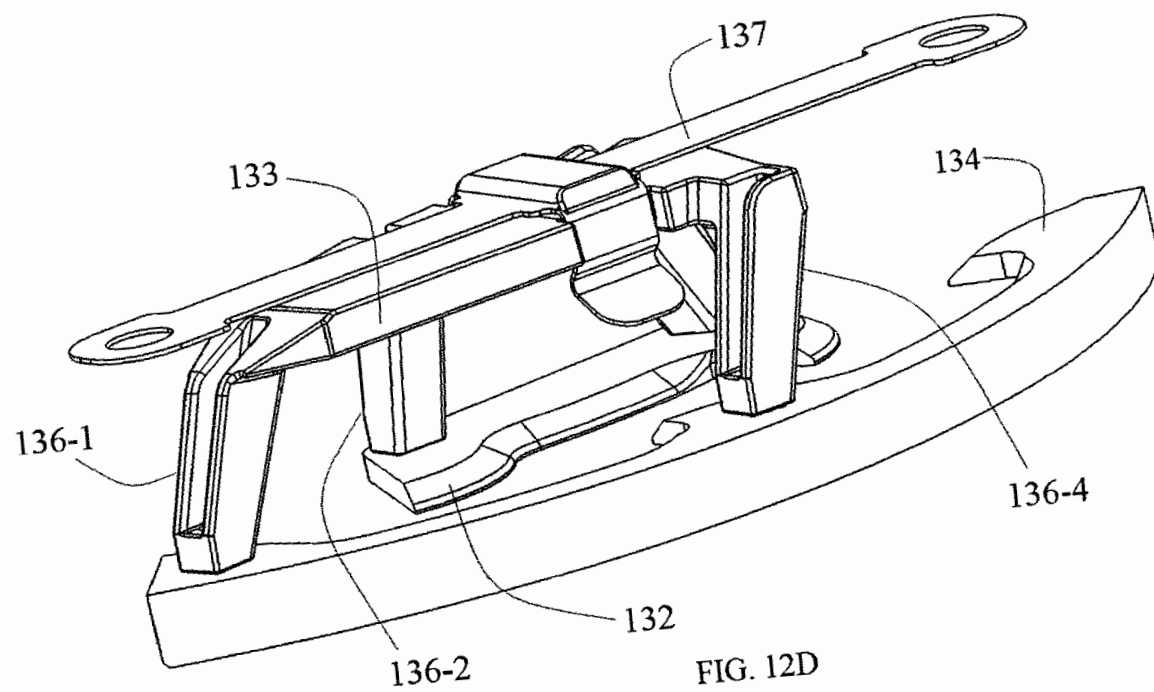


FIG. 12D

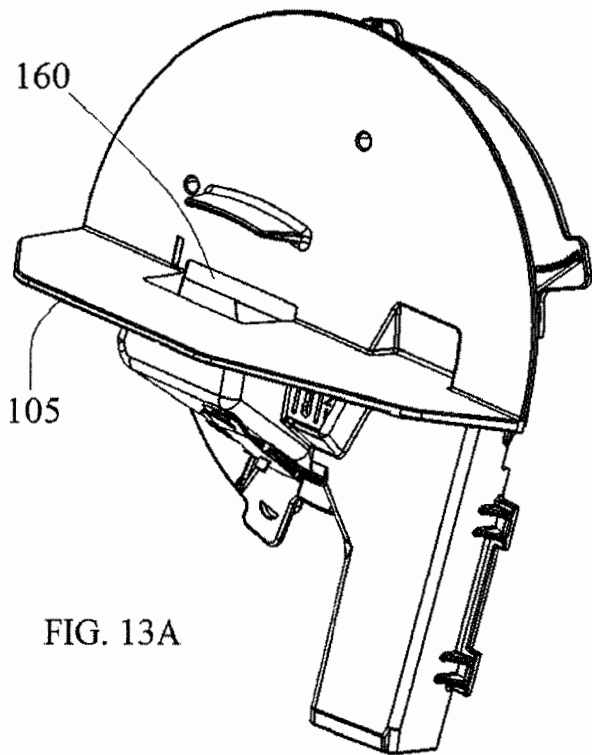


FIG. 13A

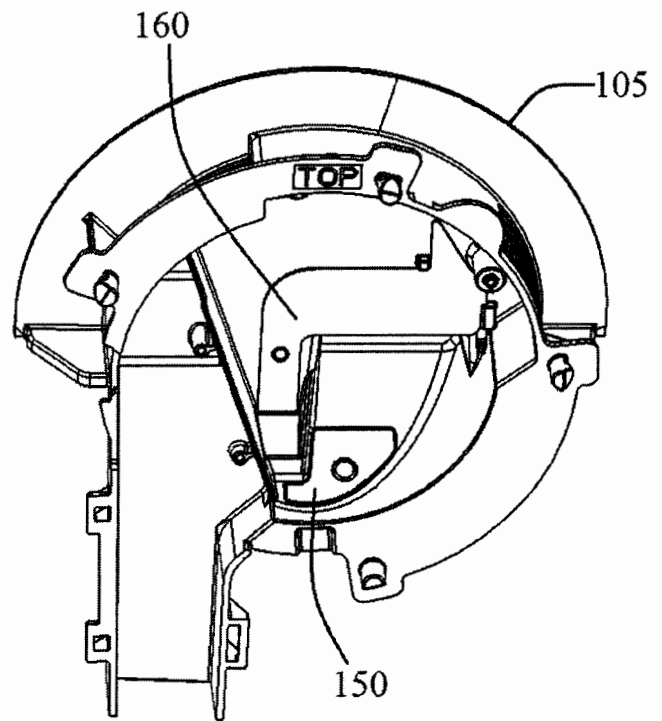


FIG. 13B

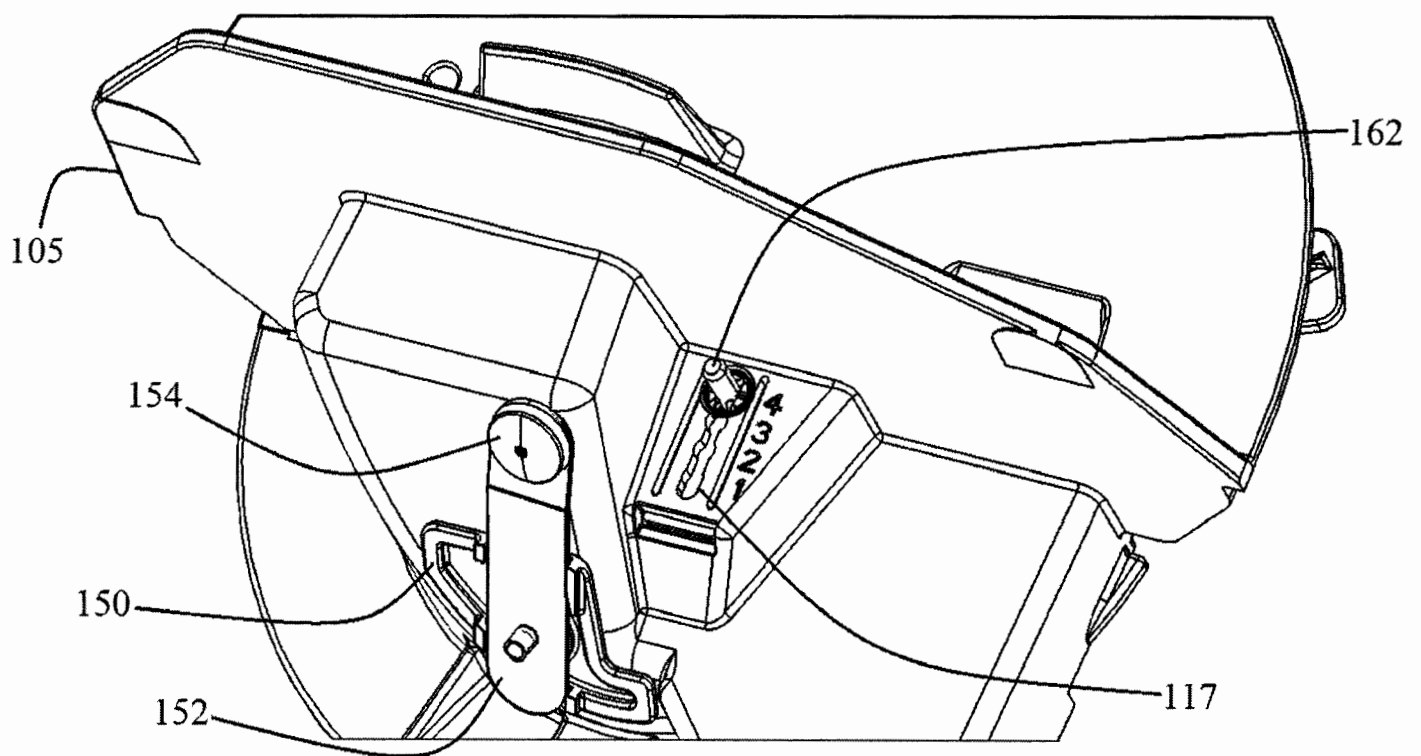


FIG. 13C

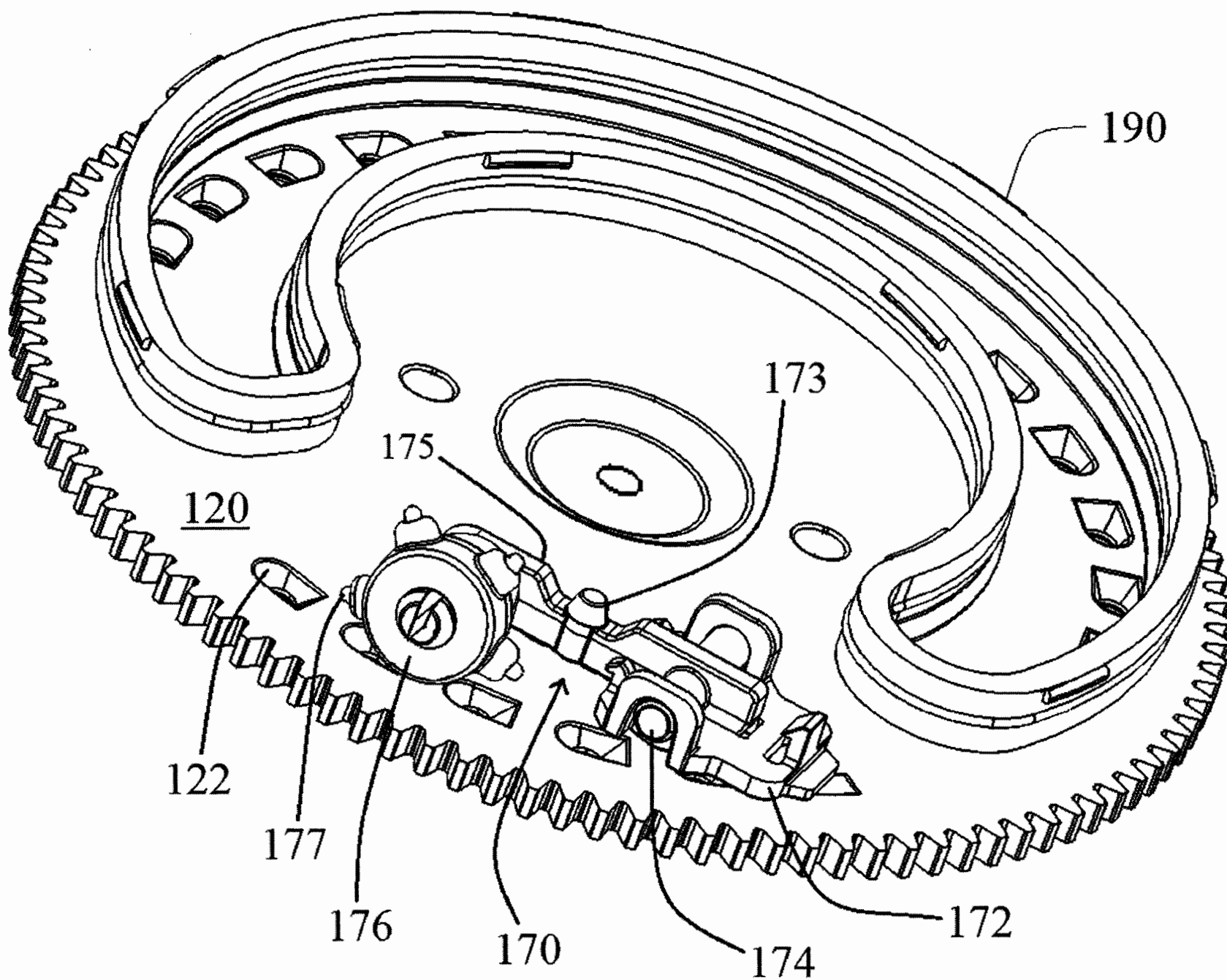


FIG. 14

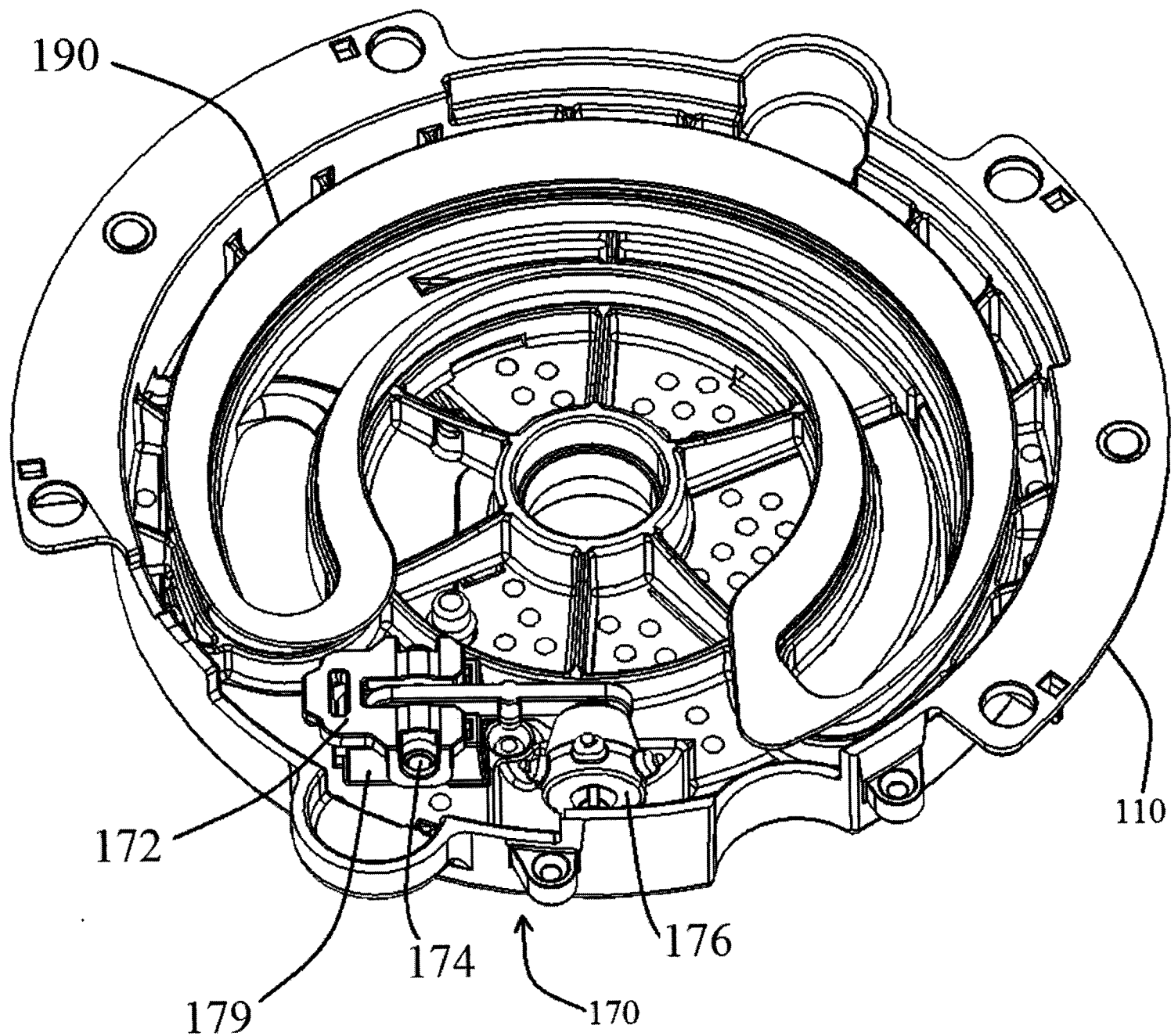


FIG. 15

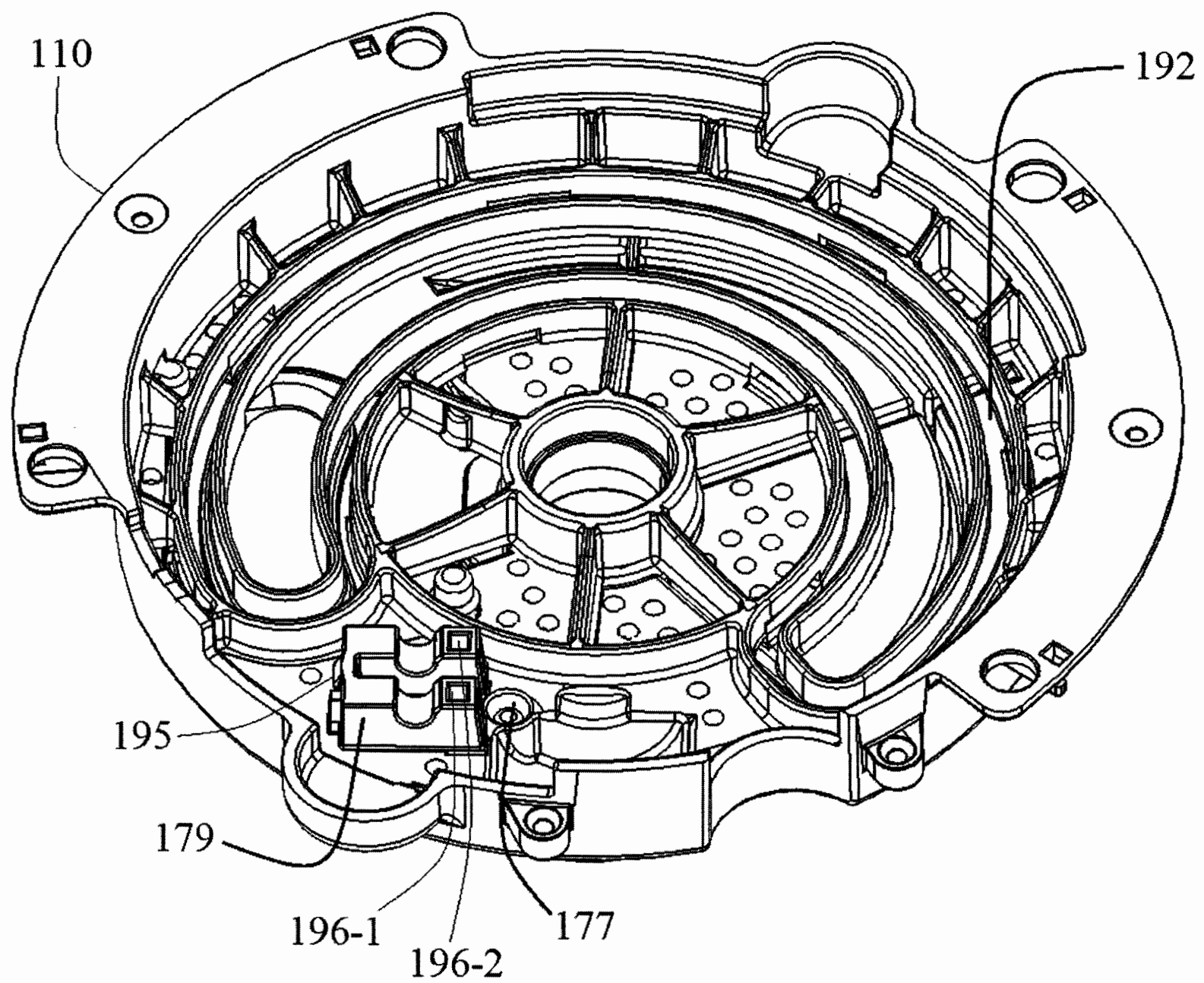


FIG. 16

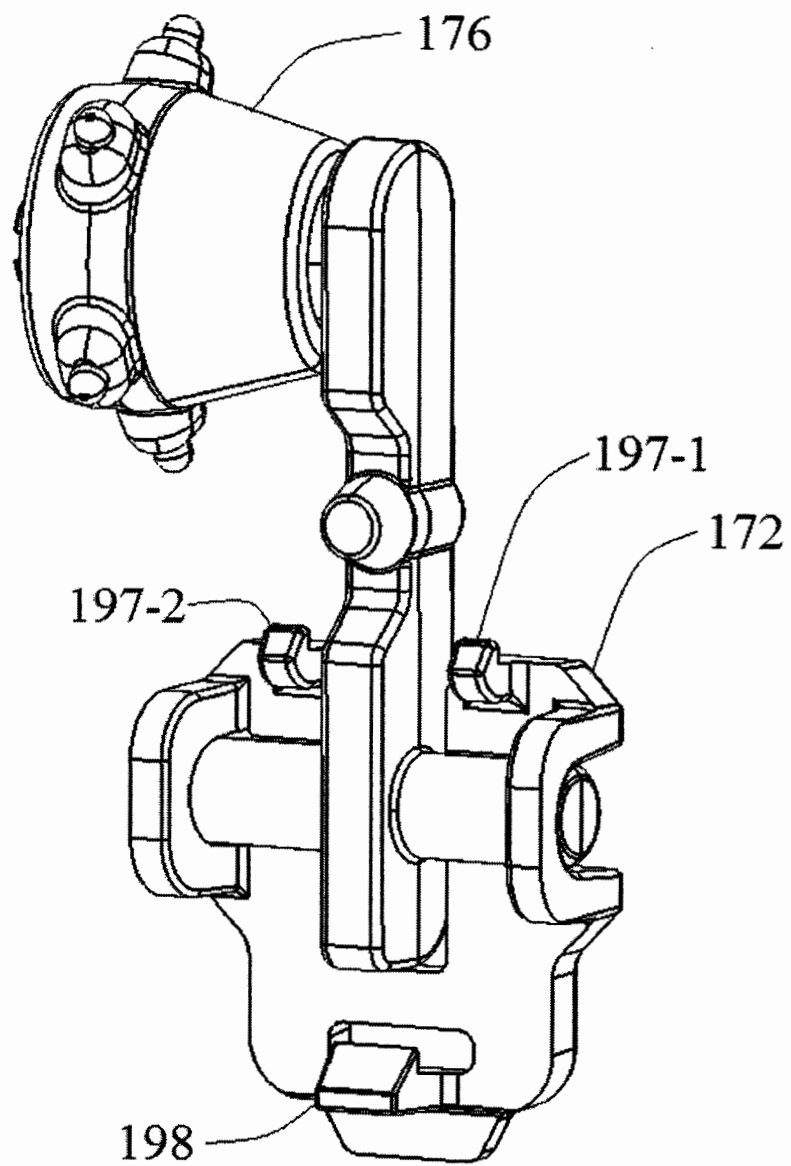


FIG. 17A

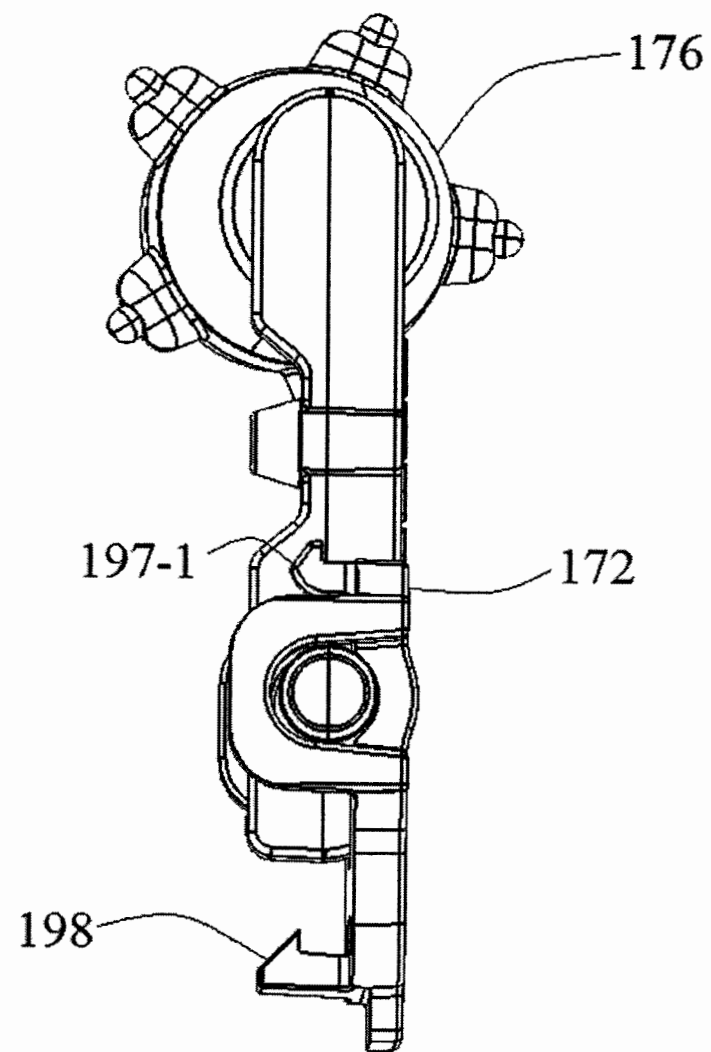


FIG. 17B