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(54) **PINCH QUILL, APPARATUS, AND FILM WINDING METHOD**

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Related U.S. Application Data

(60) Continuation of application No. 09/994,296, filed on Nov. 26, 2001, which is a division of application No. 09/459,676, filed on Dec. 13, 1999, now abandoned.

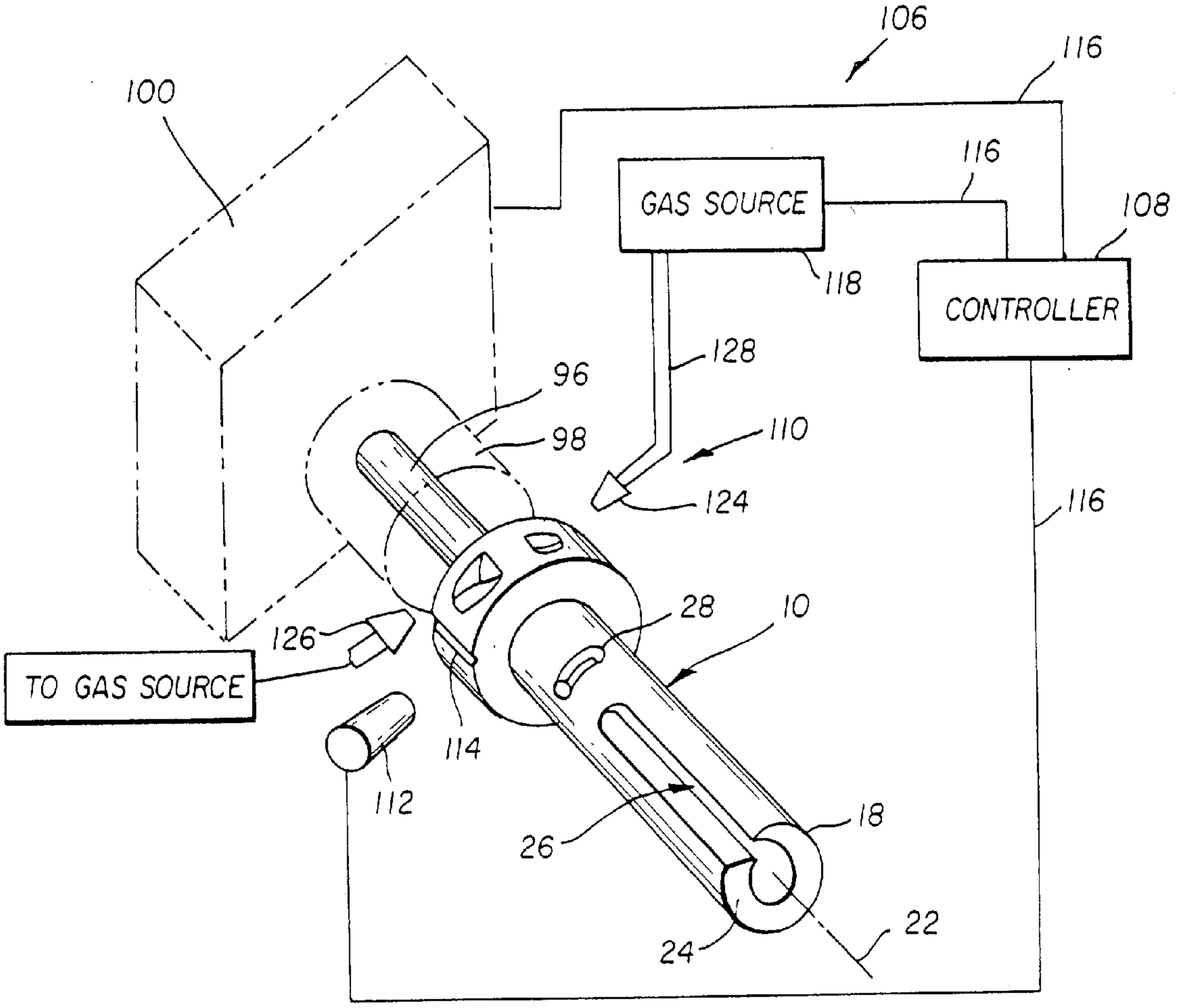
Publication Classification

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(52) **U.S. Cl.** **396/549**

(57) **ABSTRACT**

A pinch quill has a shank and a core and sheath apparatus. The core is rotatable about a longitudinal axis. The core has a recess sector and an adjoining recess sector. The chock sector has a greater radial dimension than the recess sector. The sheath is mounted coaxially over the core. The sheath is rotatable with the core about the axis. The sheath has an outer face, an inner face, and a longitudinal slot extending between the faces. The slot narrows to a throat at the inner face. The inner face includes a grip surface spaced apart from the throat. The grip surface is longitudinally aligned with the sectors. The sheath is pivotable about the axis between first and second angular orientations relative to the core. The slot is radially aligned with the chock sector at the first angular orientation. The grip surface is radially aligned with the chock sector at an intermediate angular orientation relative to the core. The intermediate angular orientation is between the first and second angular orientations. The core and sheath grip a filmstrip or other media strip in a quill-strip unit and method. A winder includes the pinch quill and a drive.



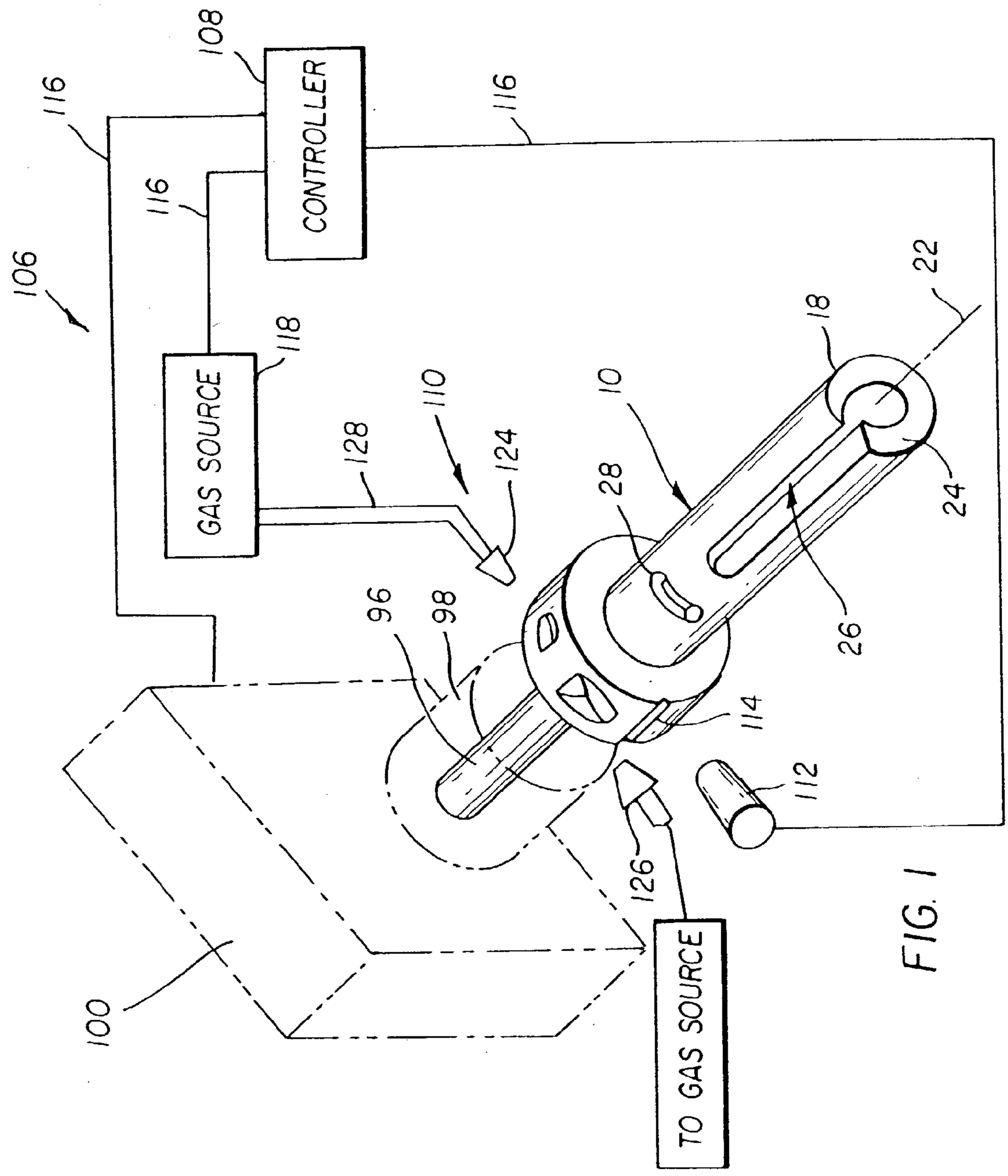

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GAS SOURCE
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TO GAS SOURCE

FIG. 1

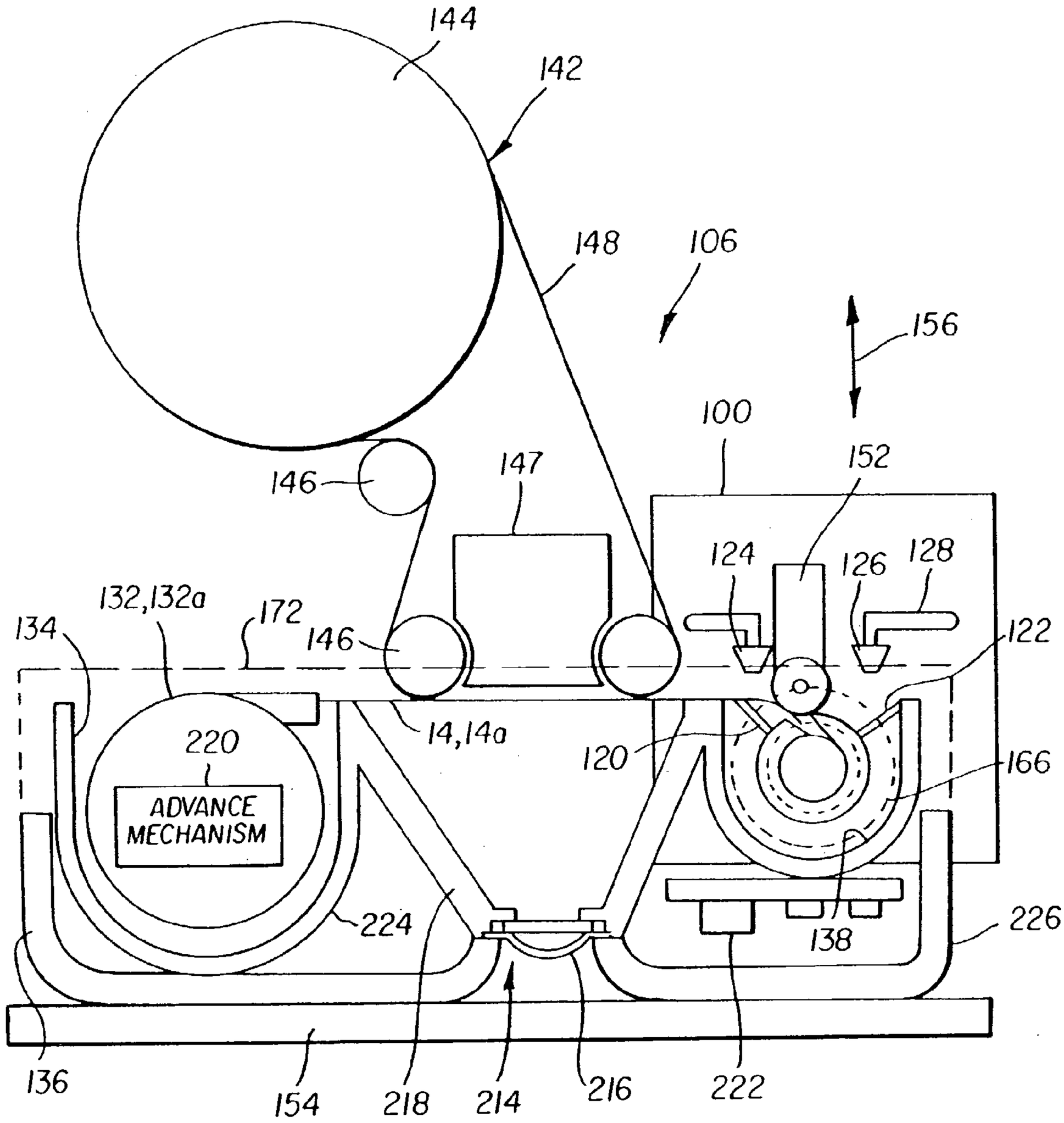

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ADVANCE MECHANISM
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FIG. 2

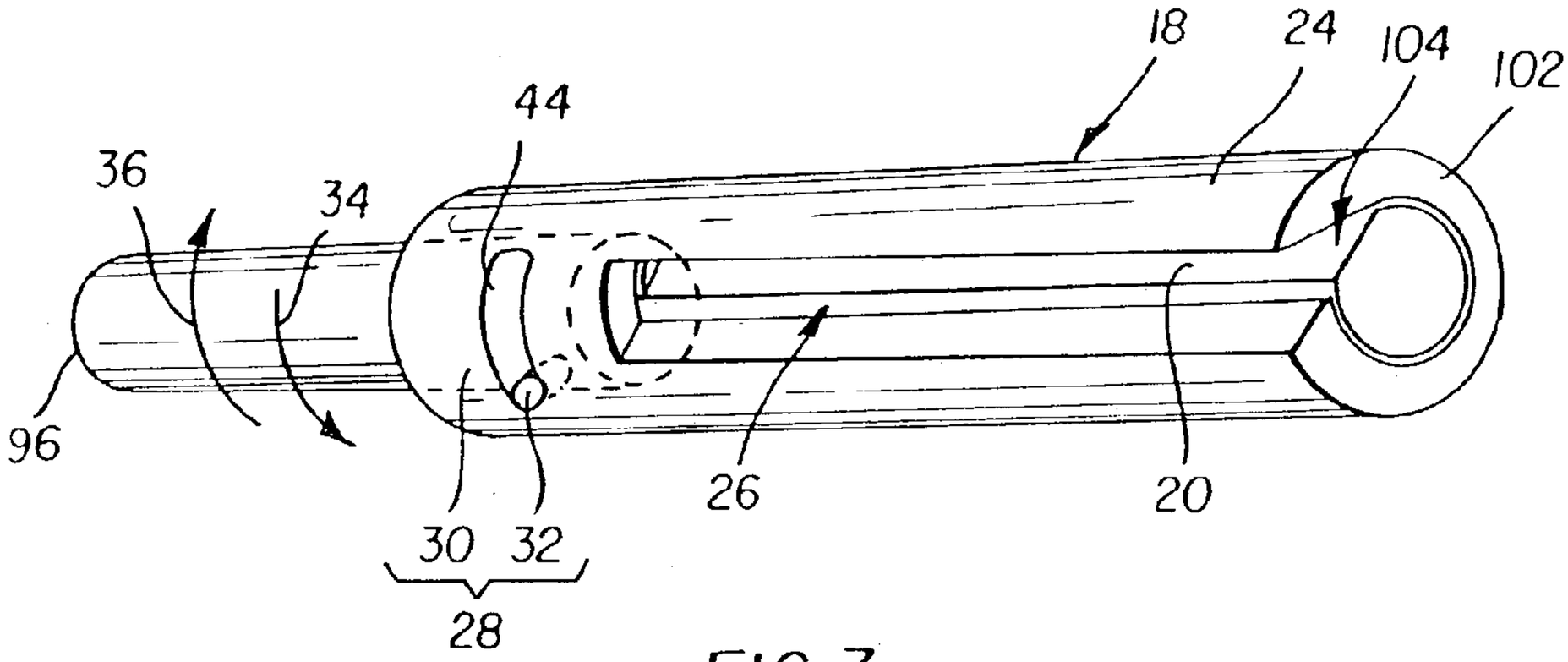


FIG. 3

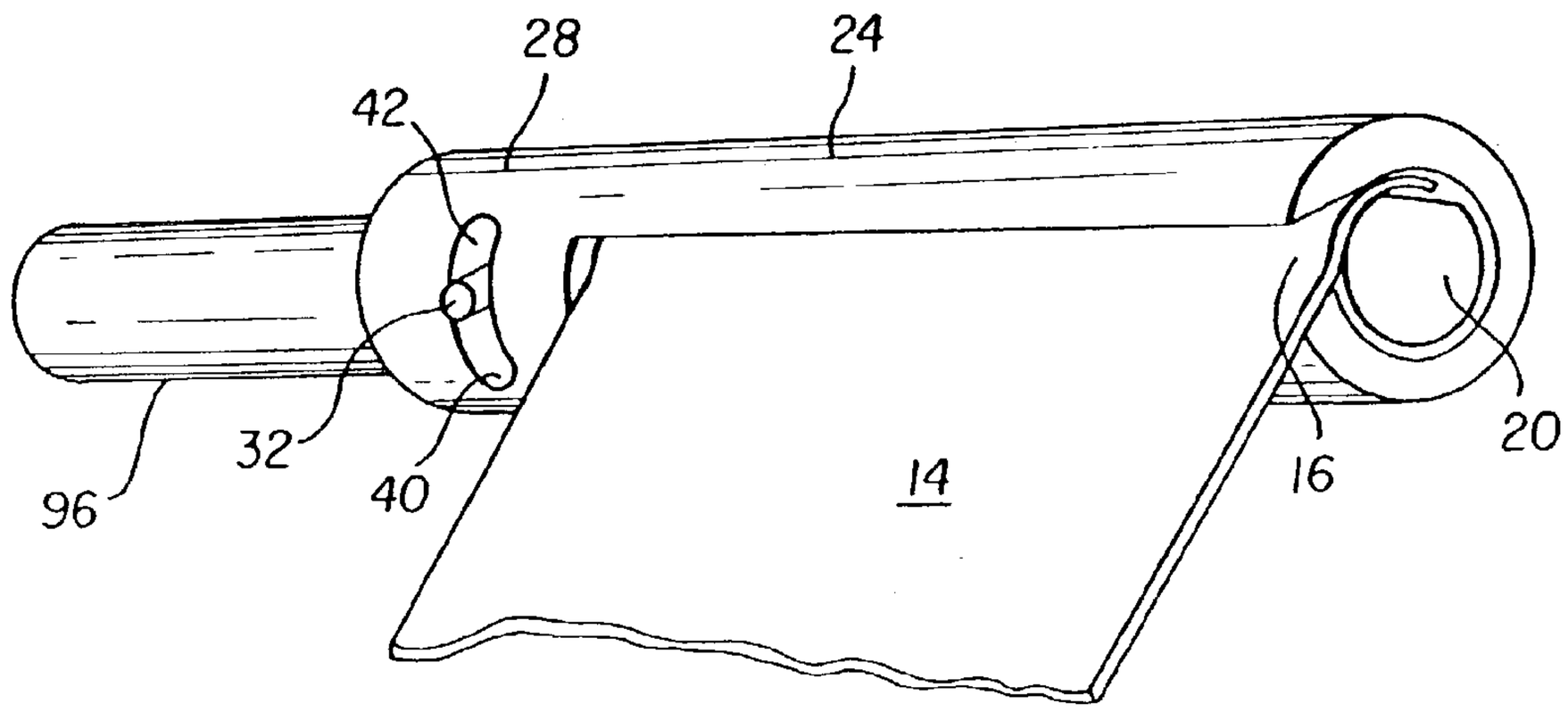


FIG. 4

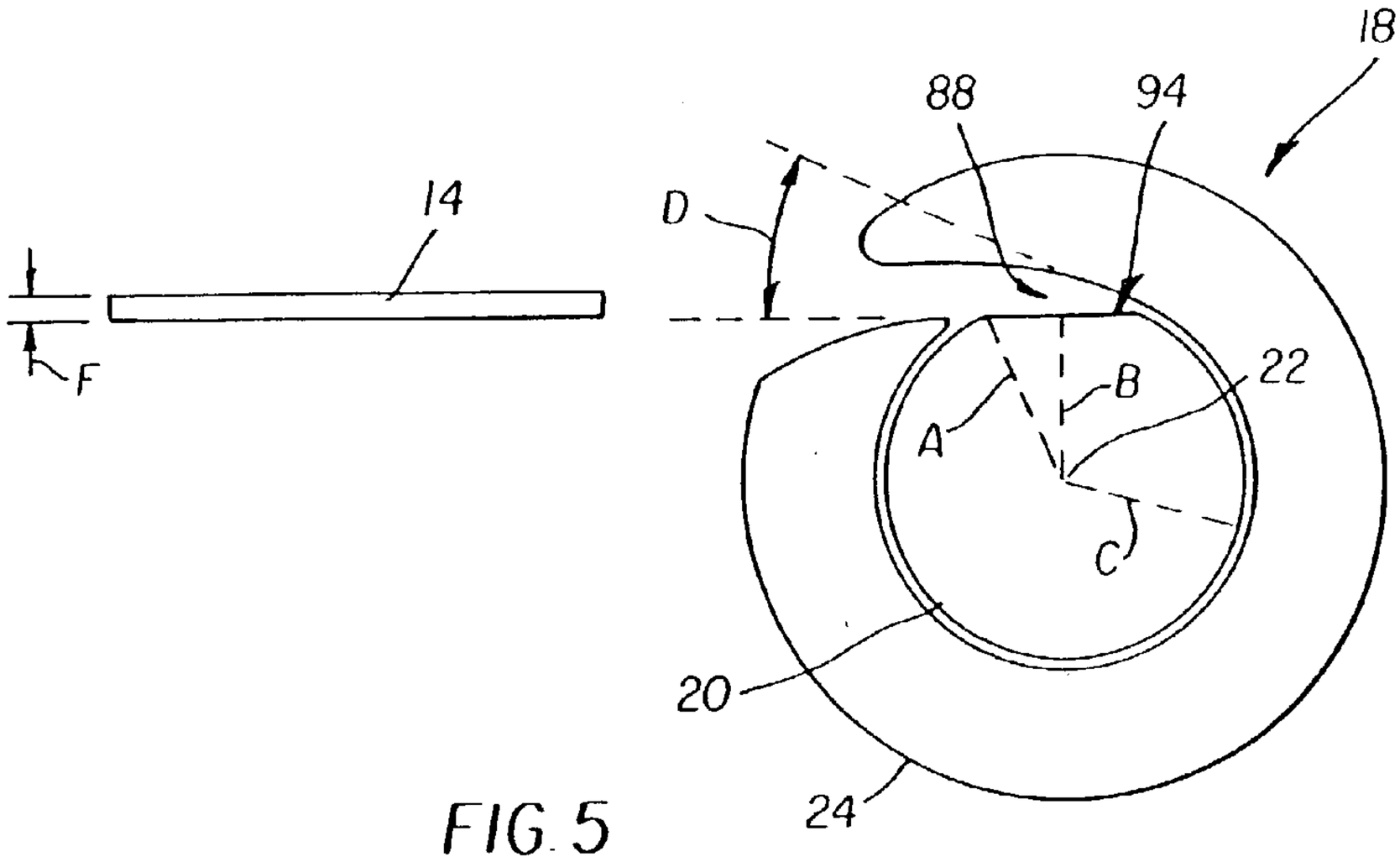

18
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A
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FIG. 5

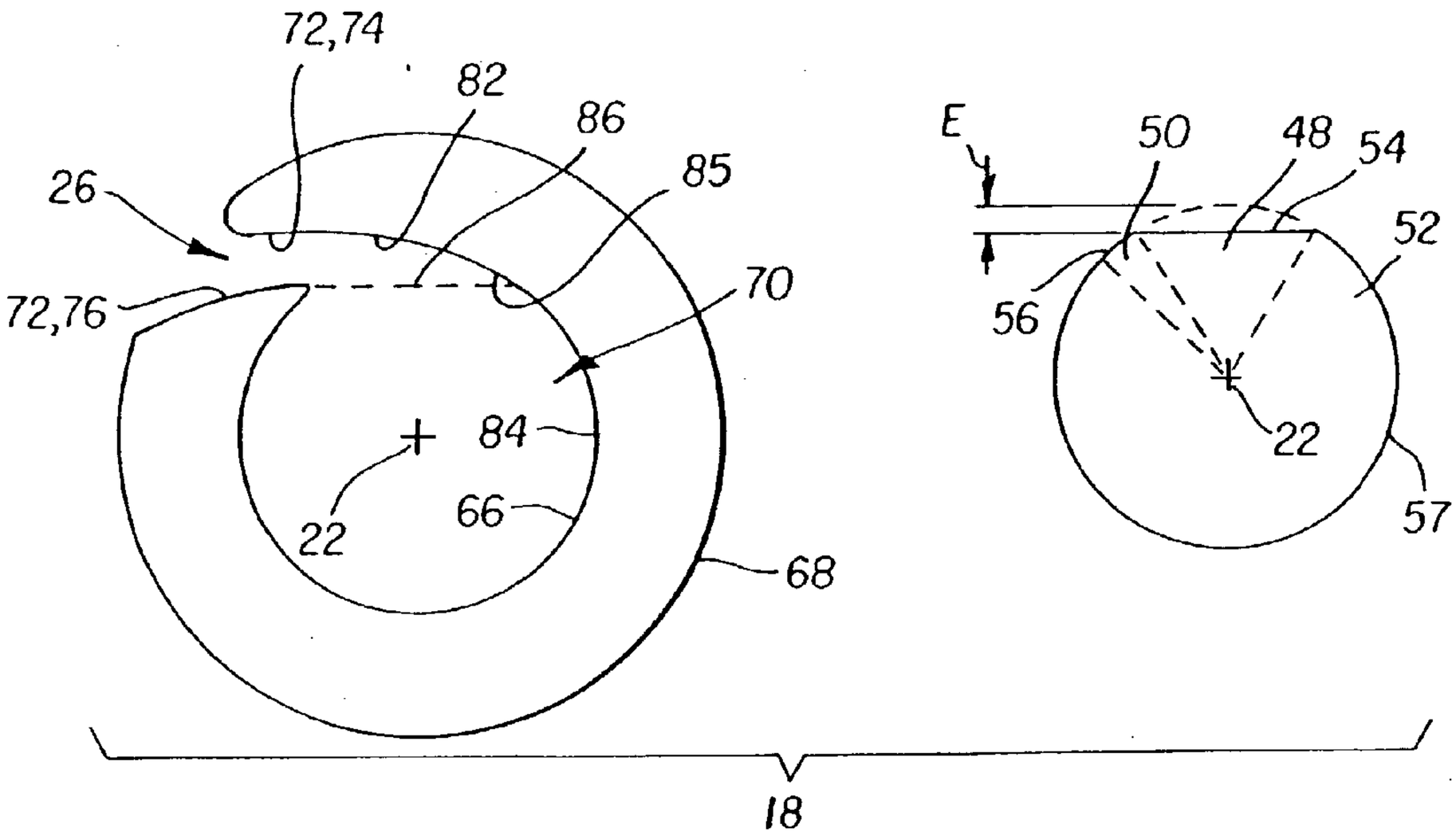

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FIG. 6

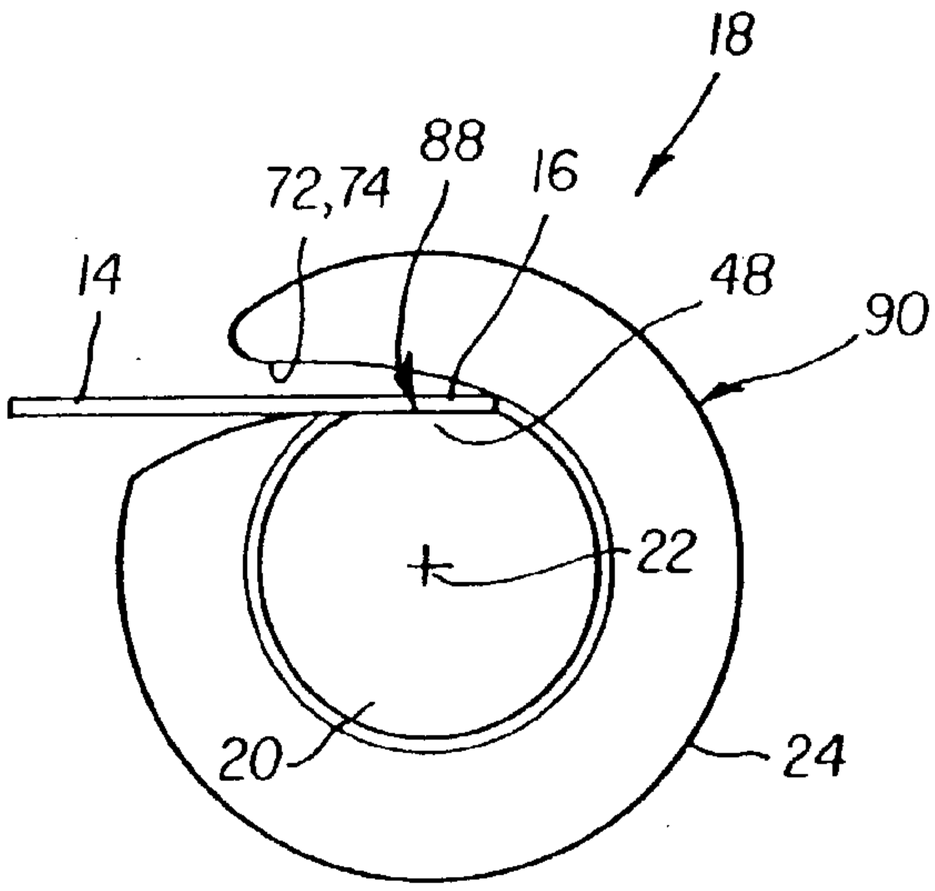


FIG. 7

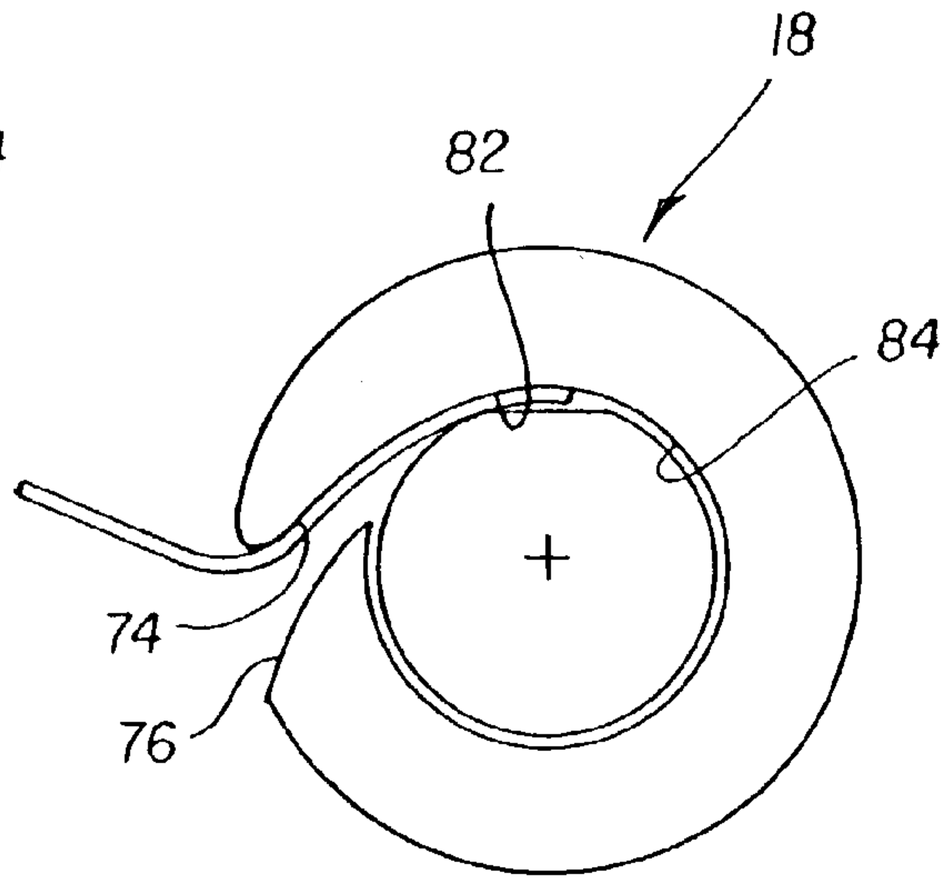


FIG. 8

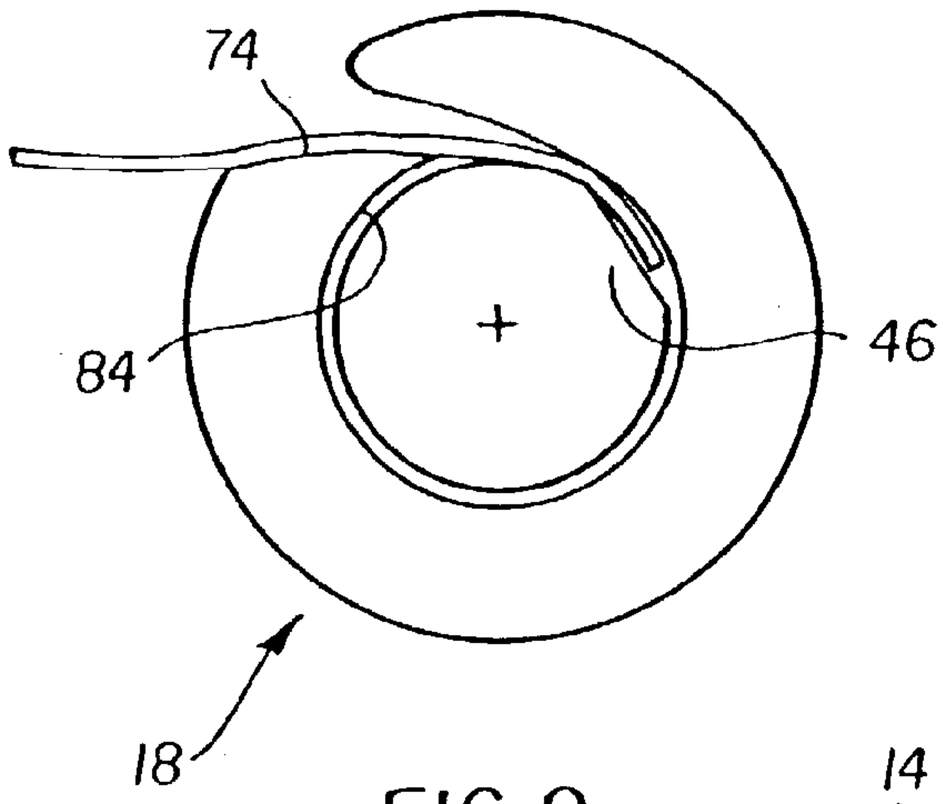


FIG. 9

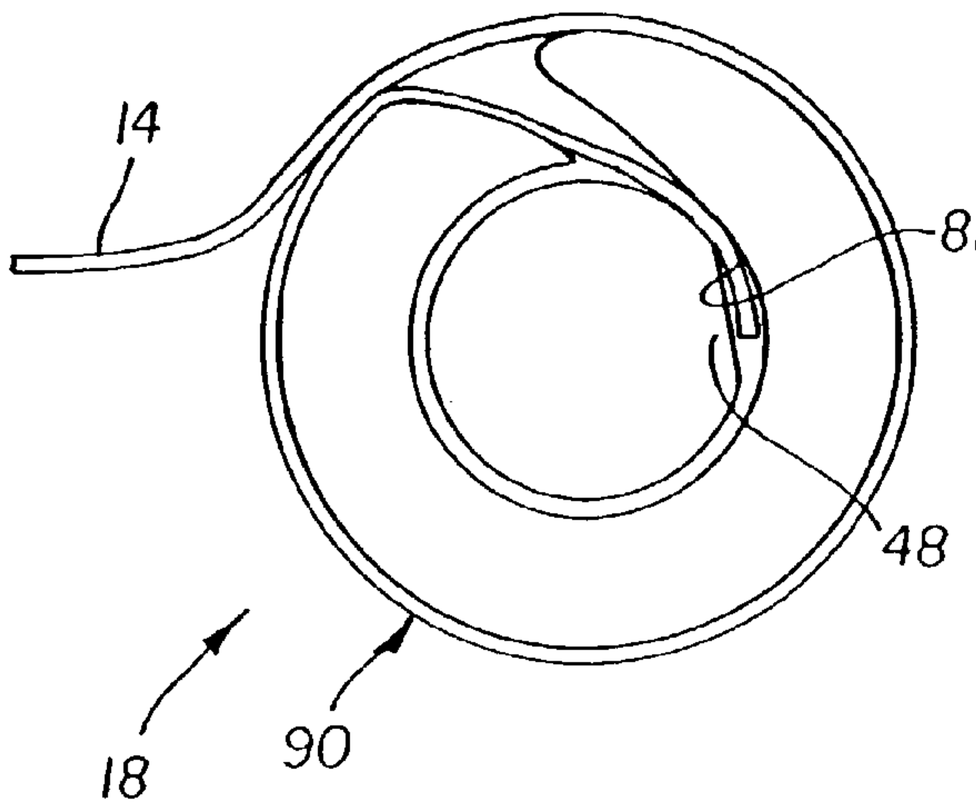


FIG. 10

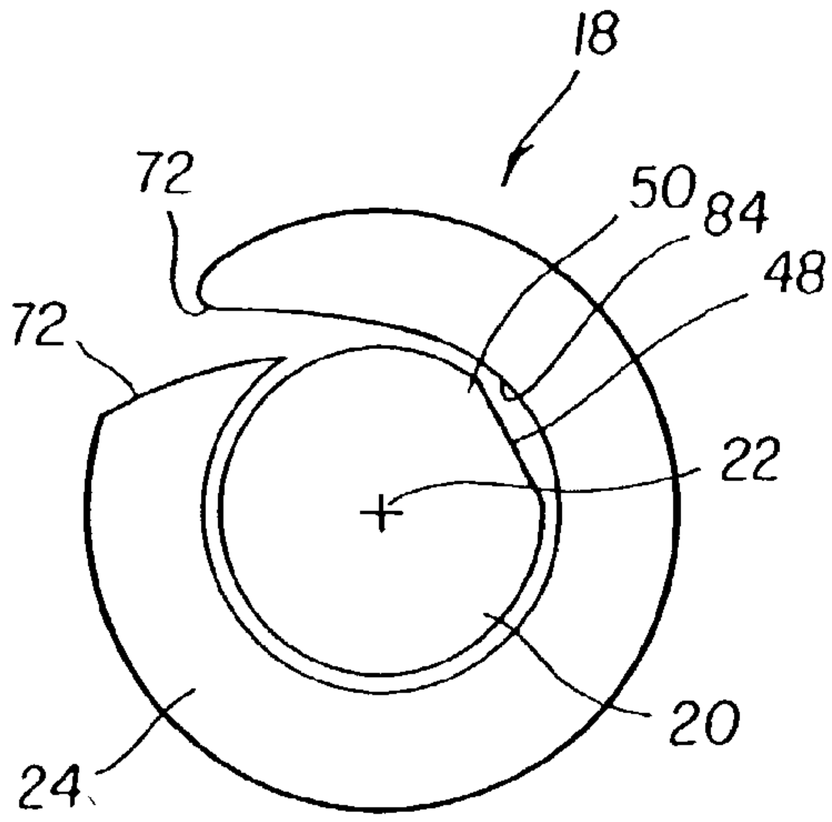


FIG. 11

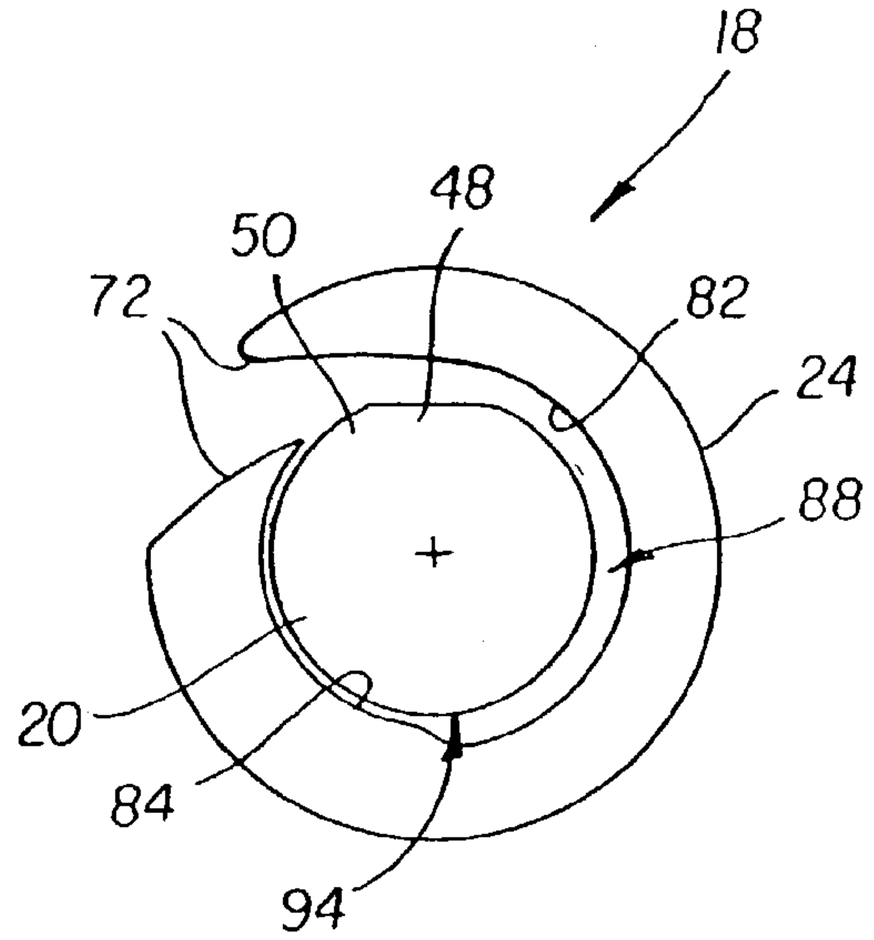


FIG. 12

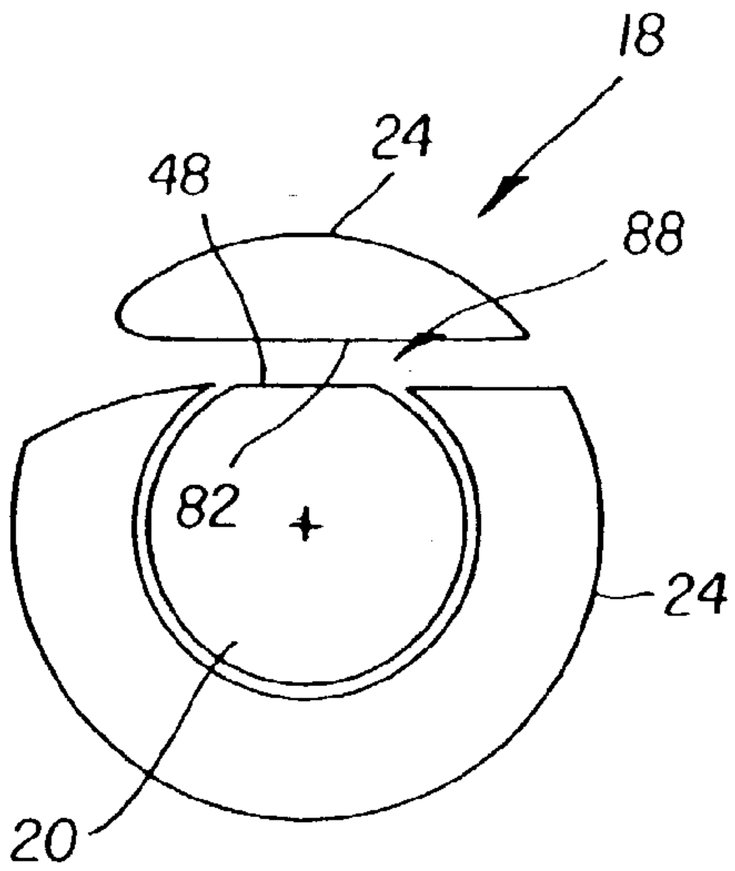


FIG. 13

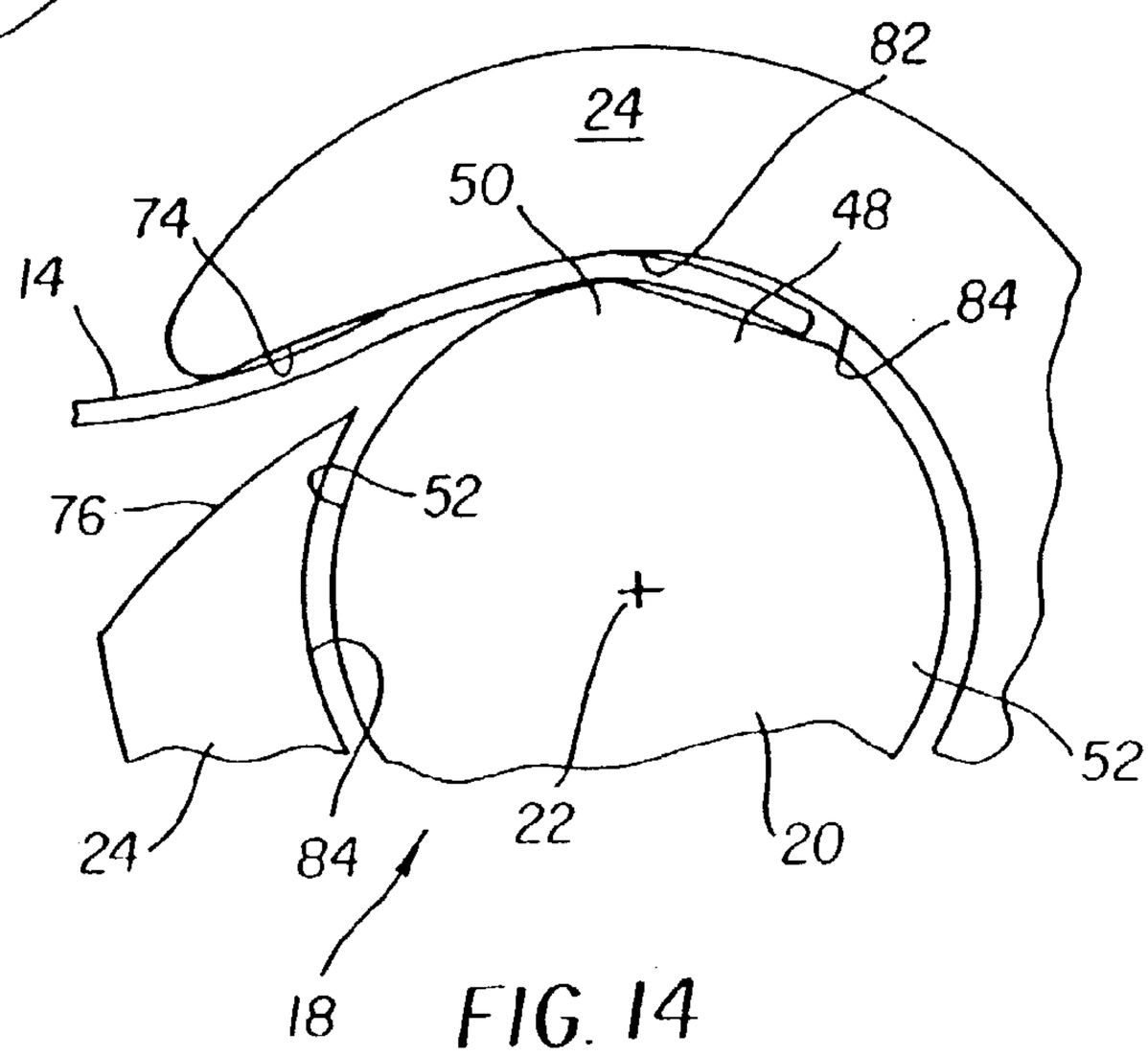


FIG. 14

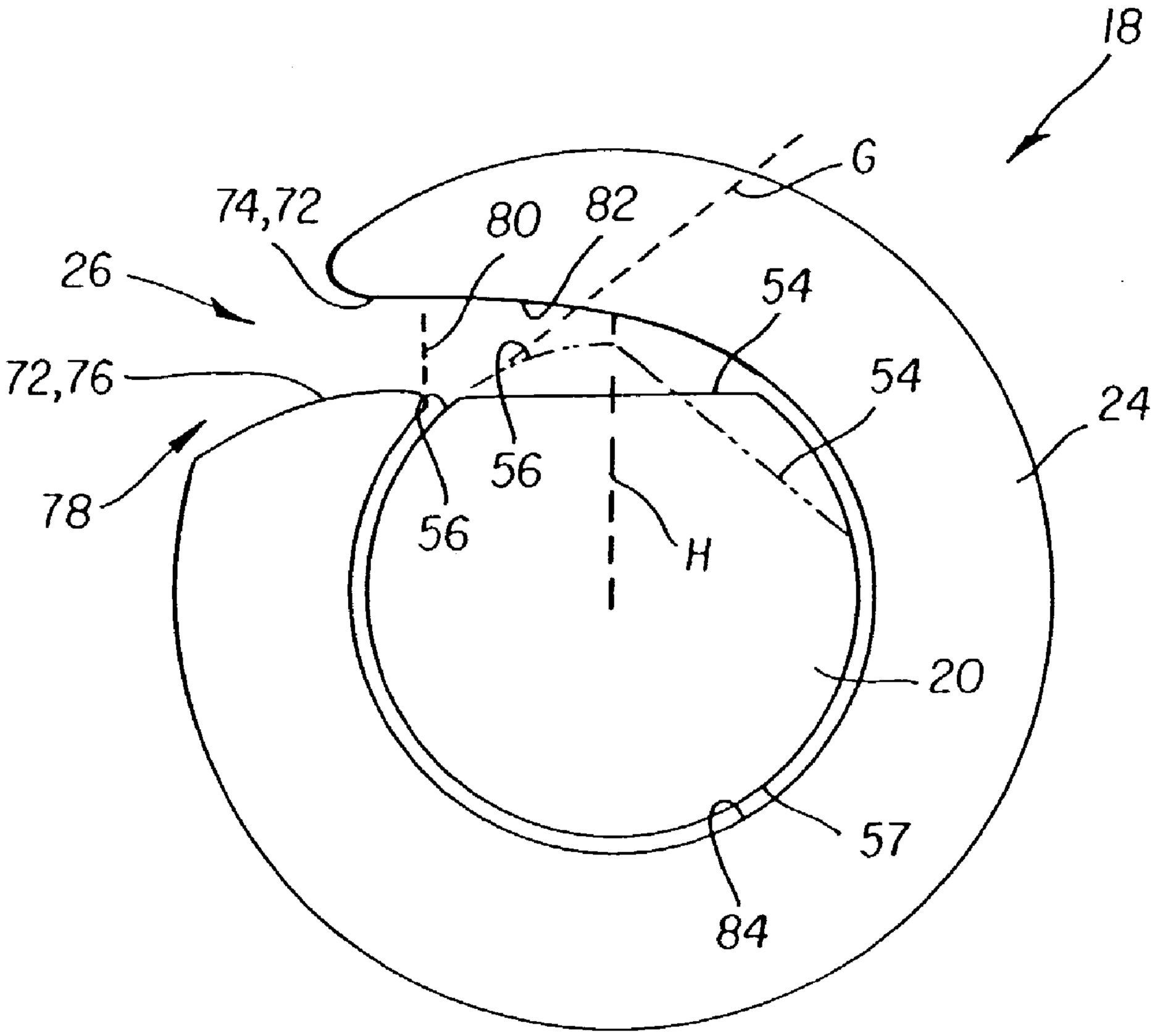


FIG. 15

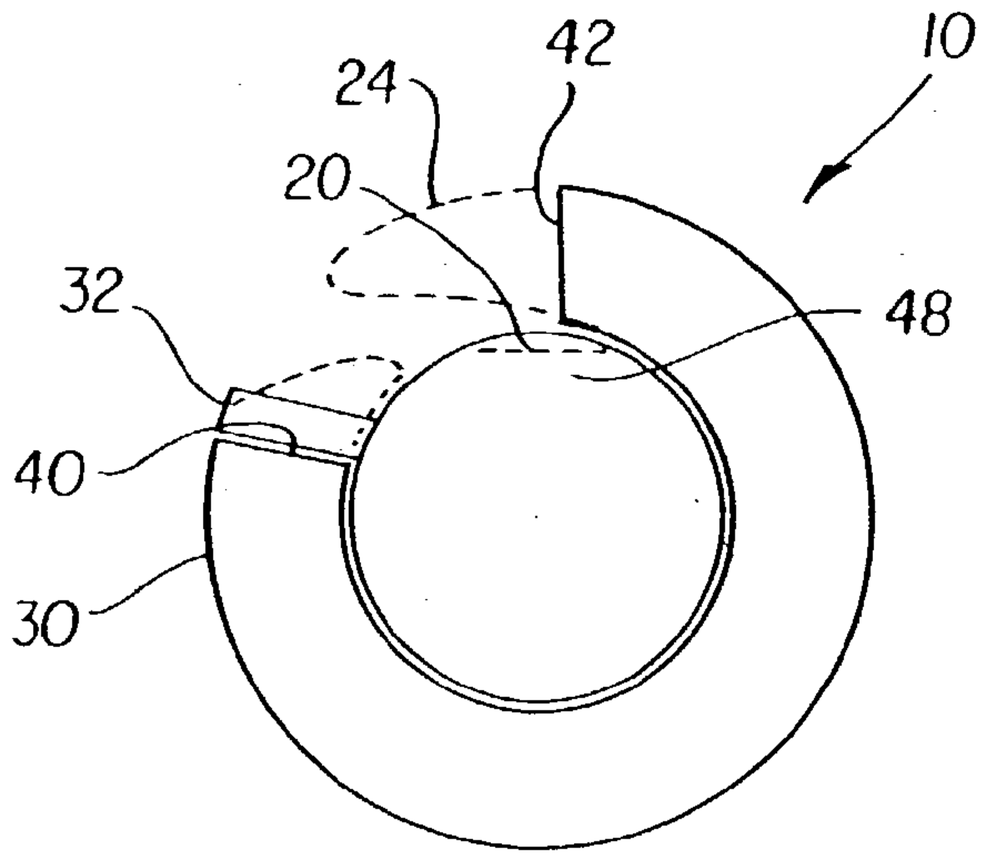


FIG. 16

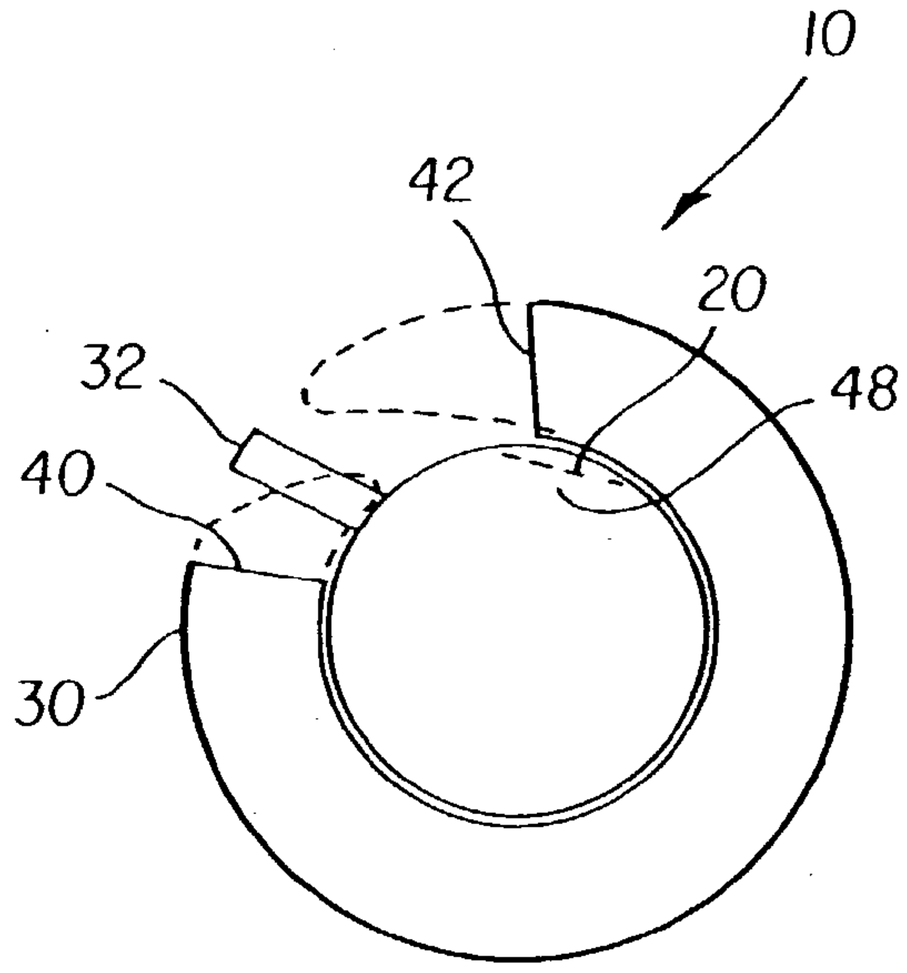


FIG. 17

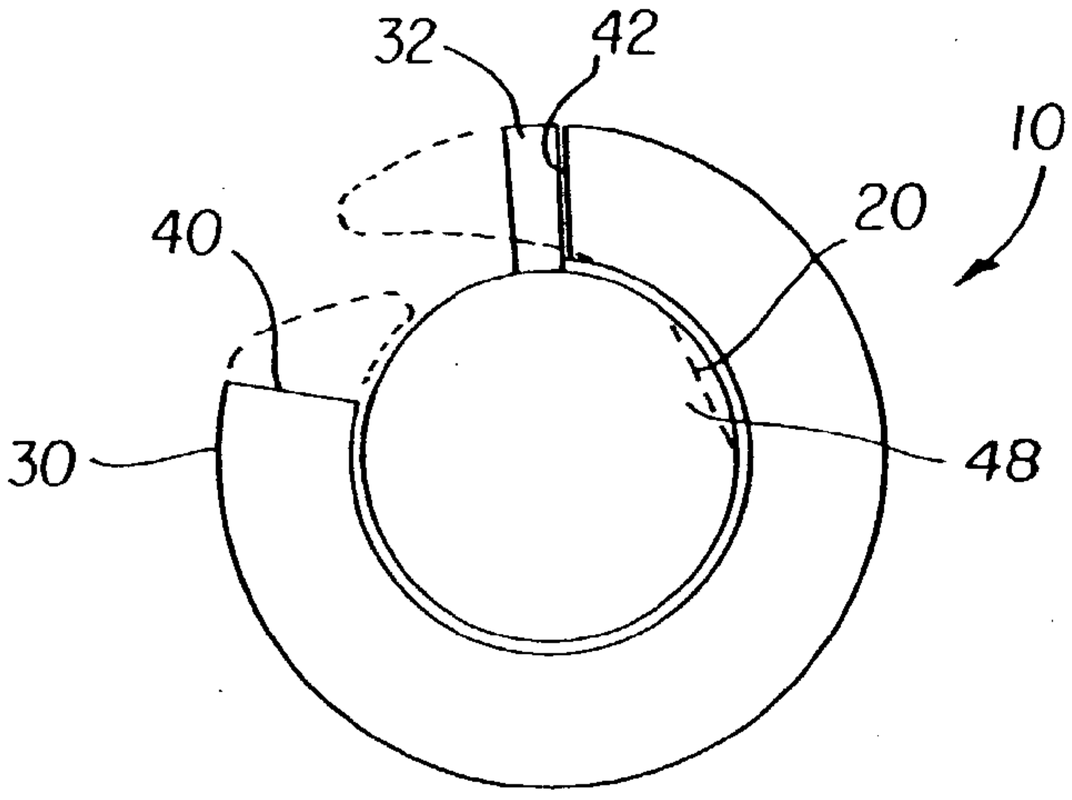


FIG. 18

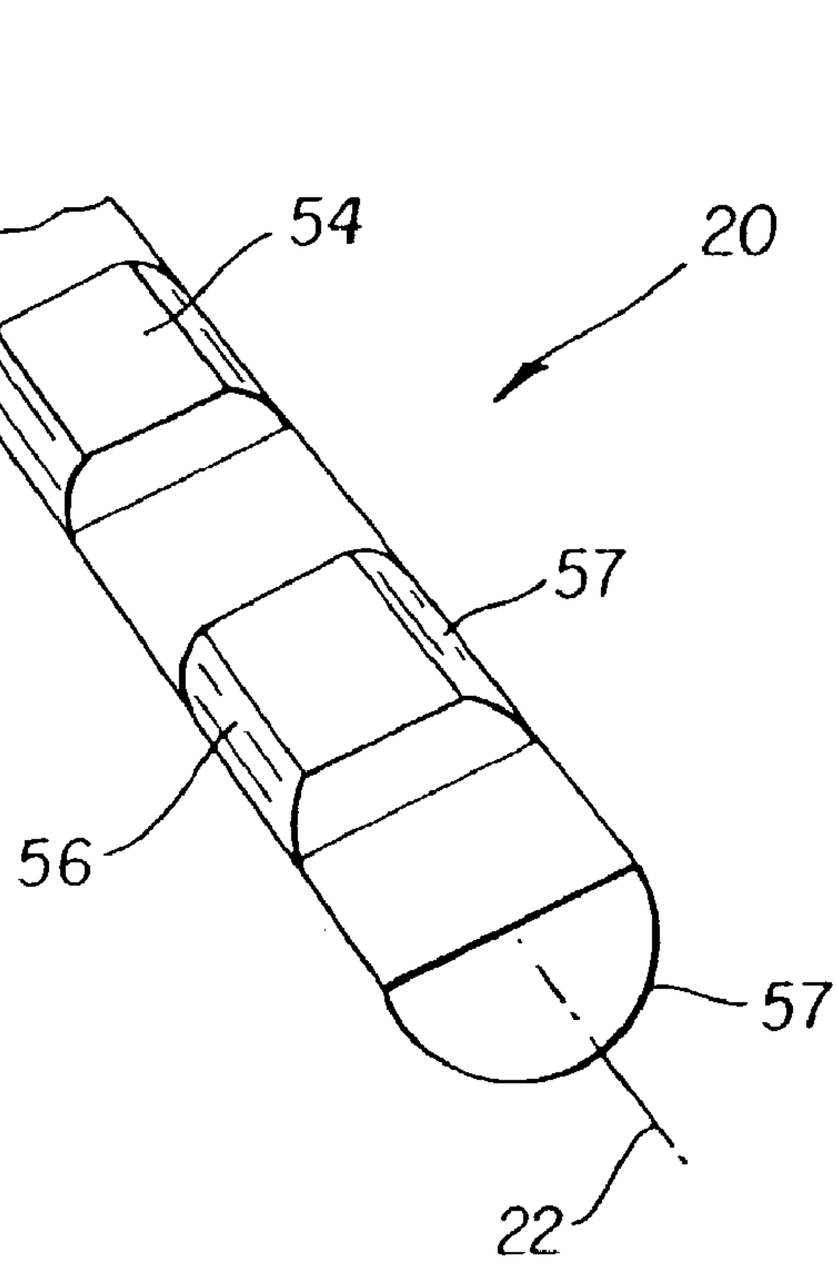


FIG. 19

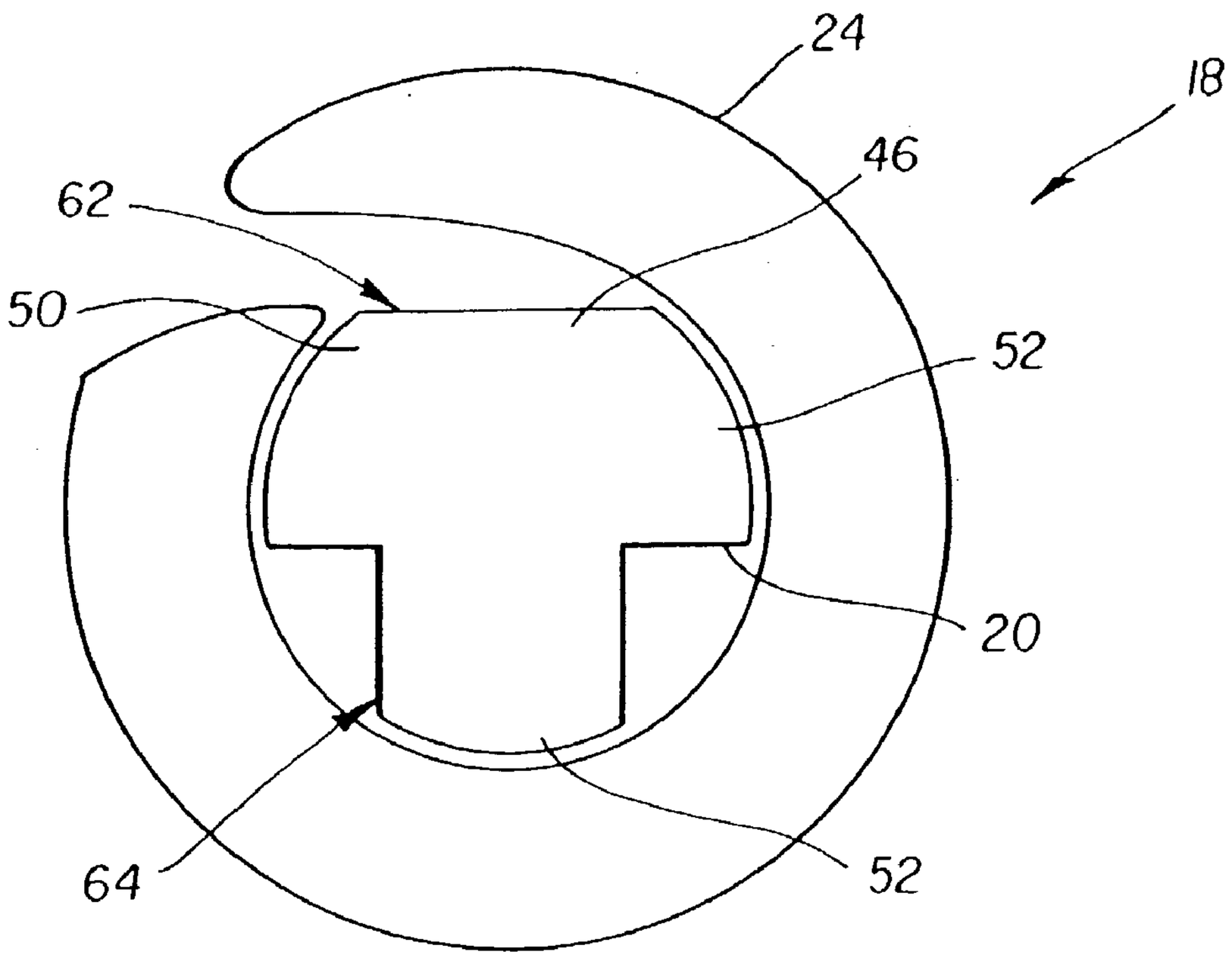


FIG. 20

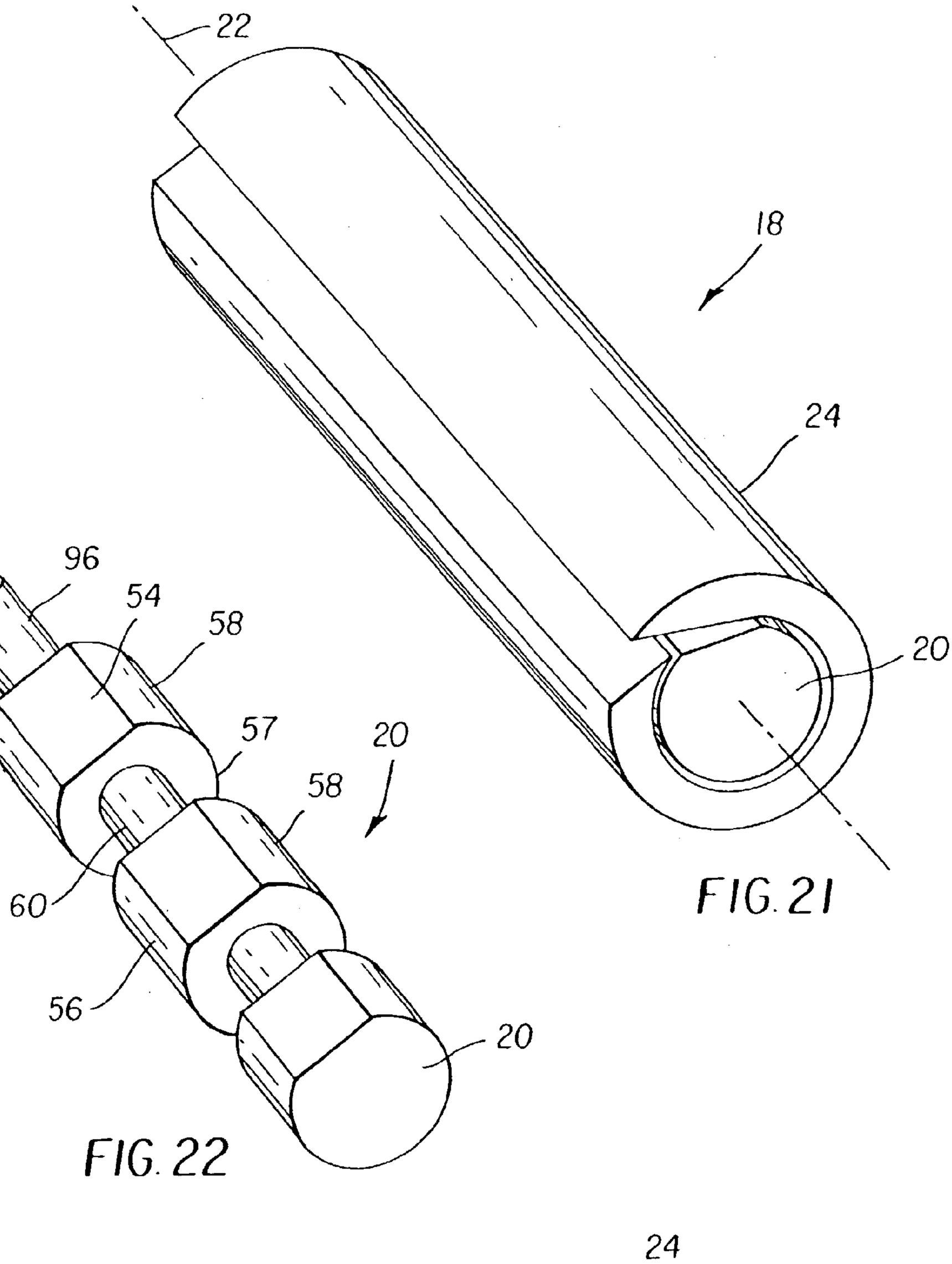


FIG. 22

FIG. 21

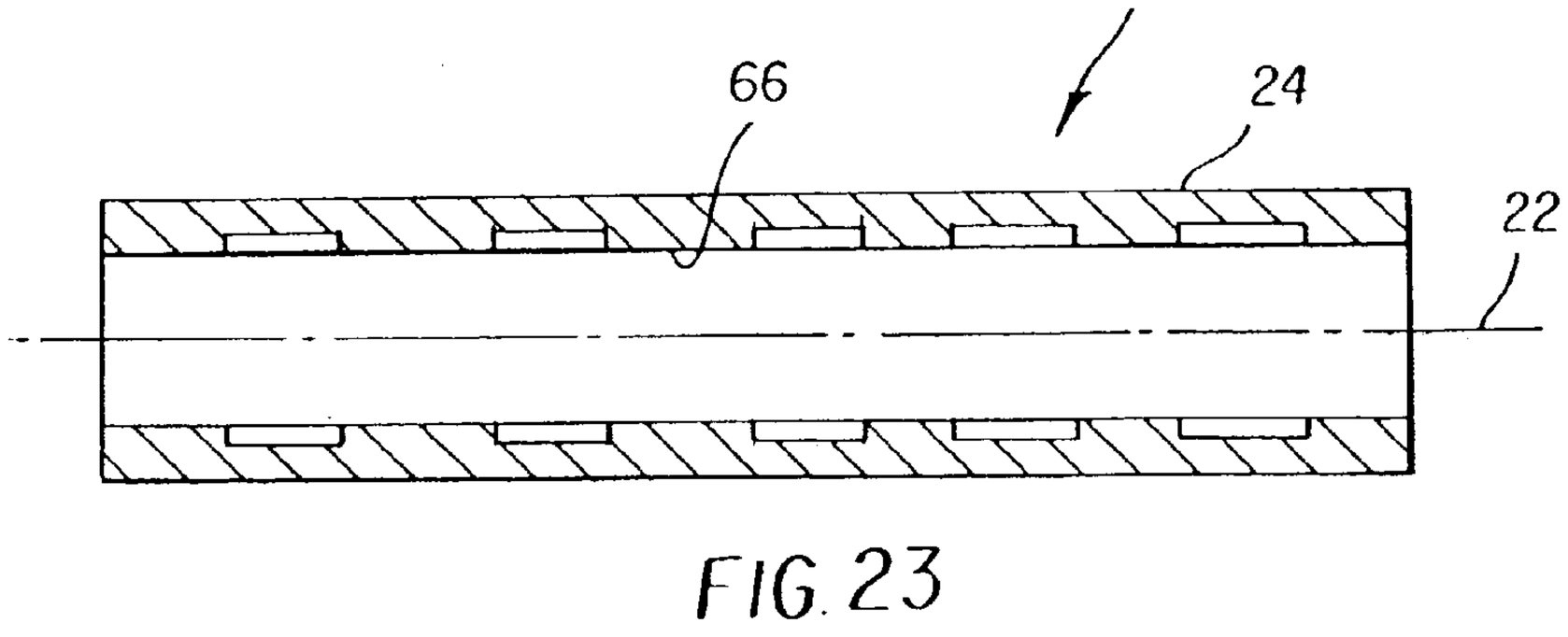


FIG. 23

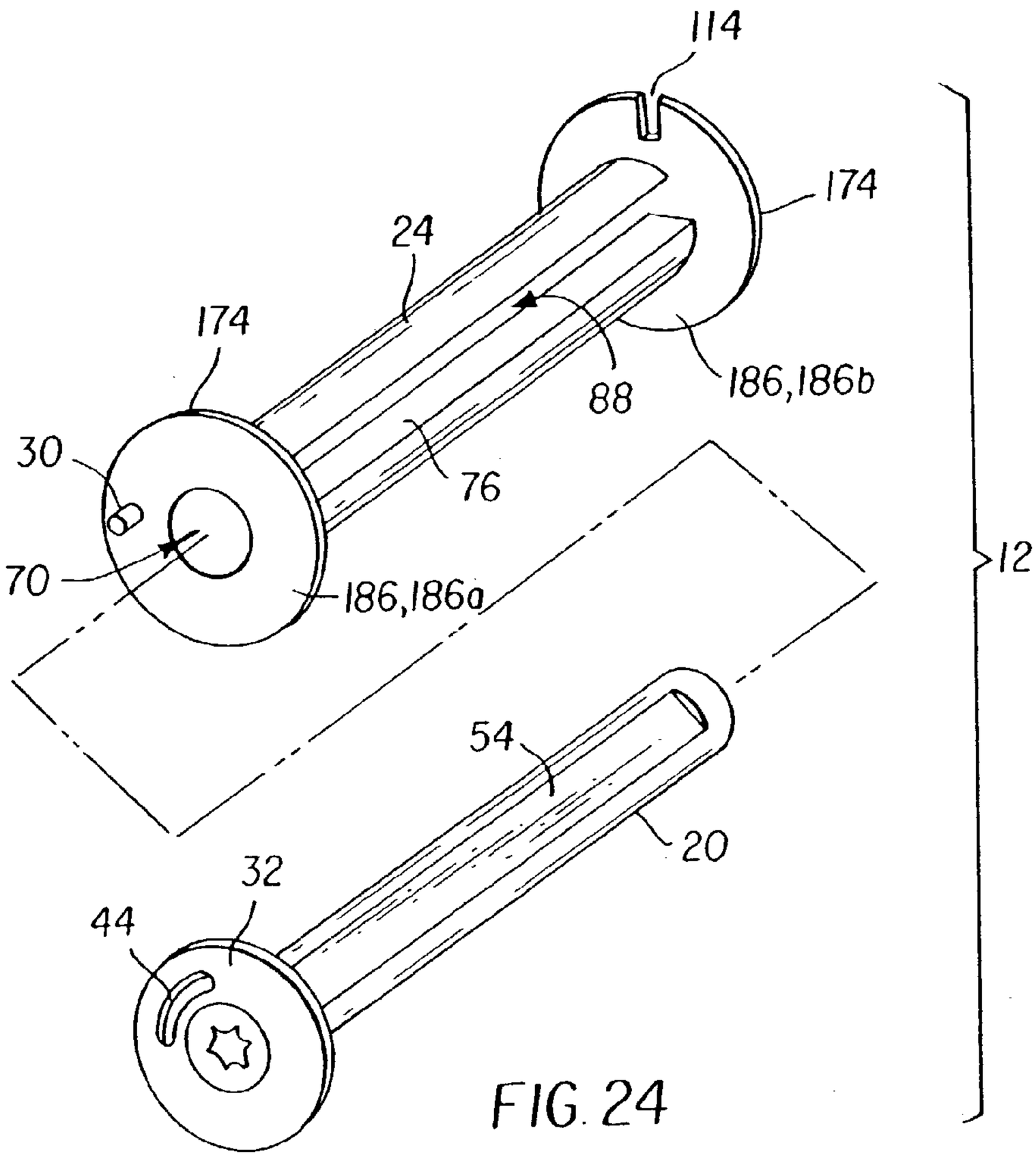

114
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186,186a
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FIG. 24

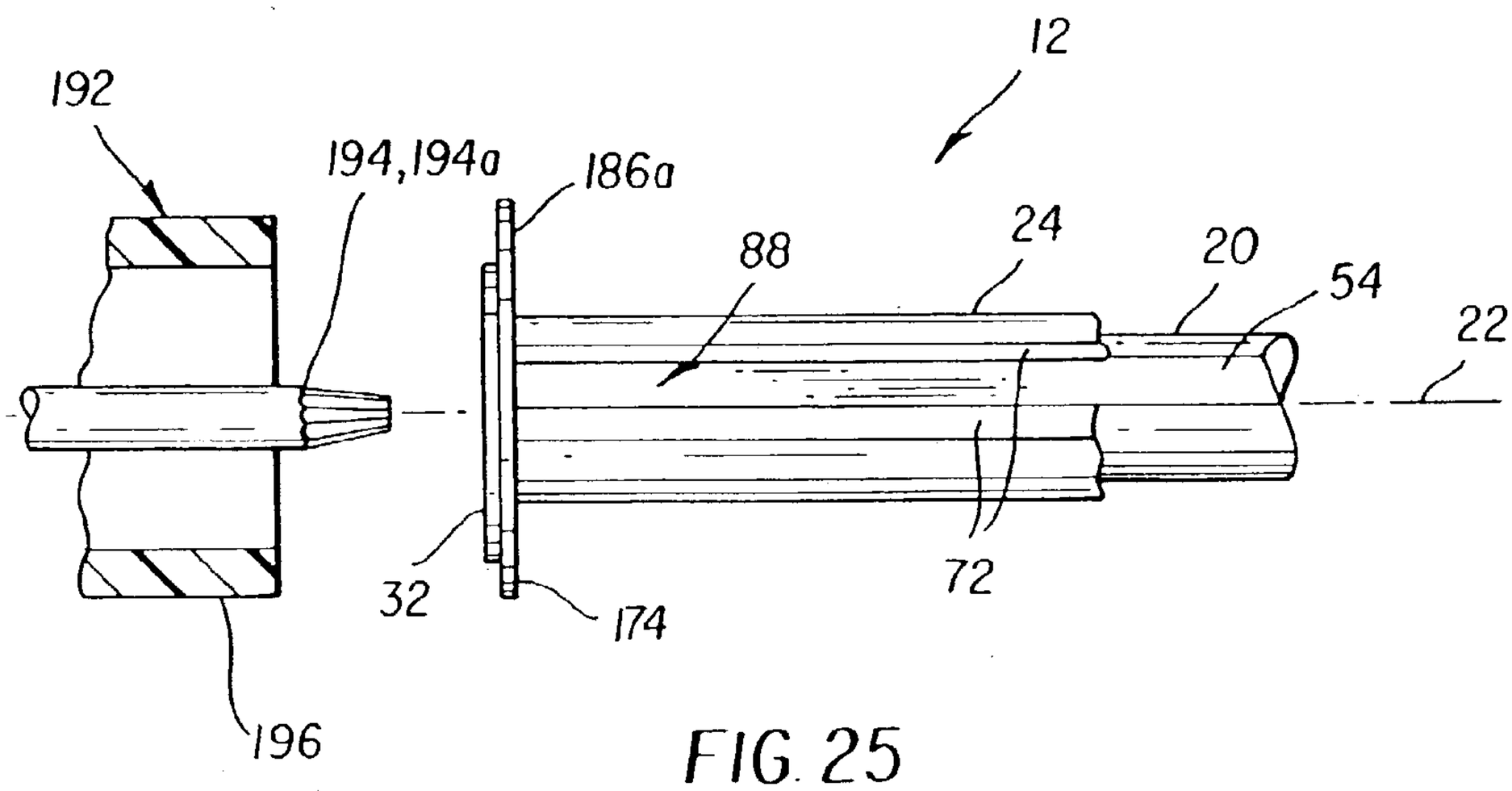

12
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194,194a
186a
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196

FIG. 25

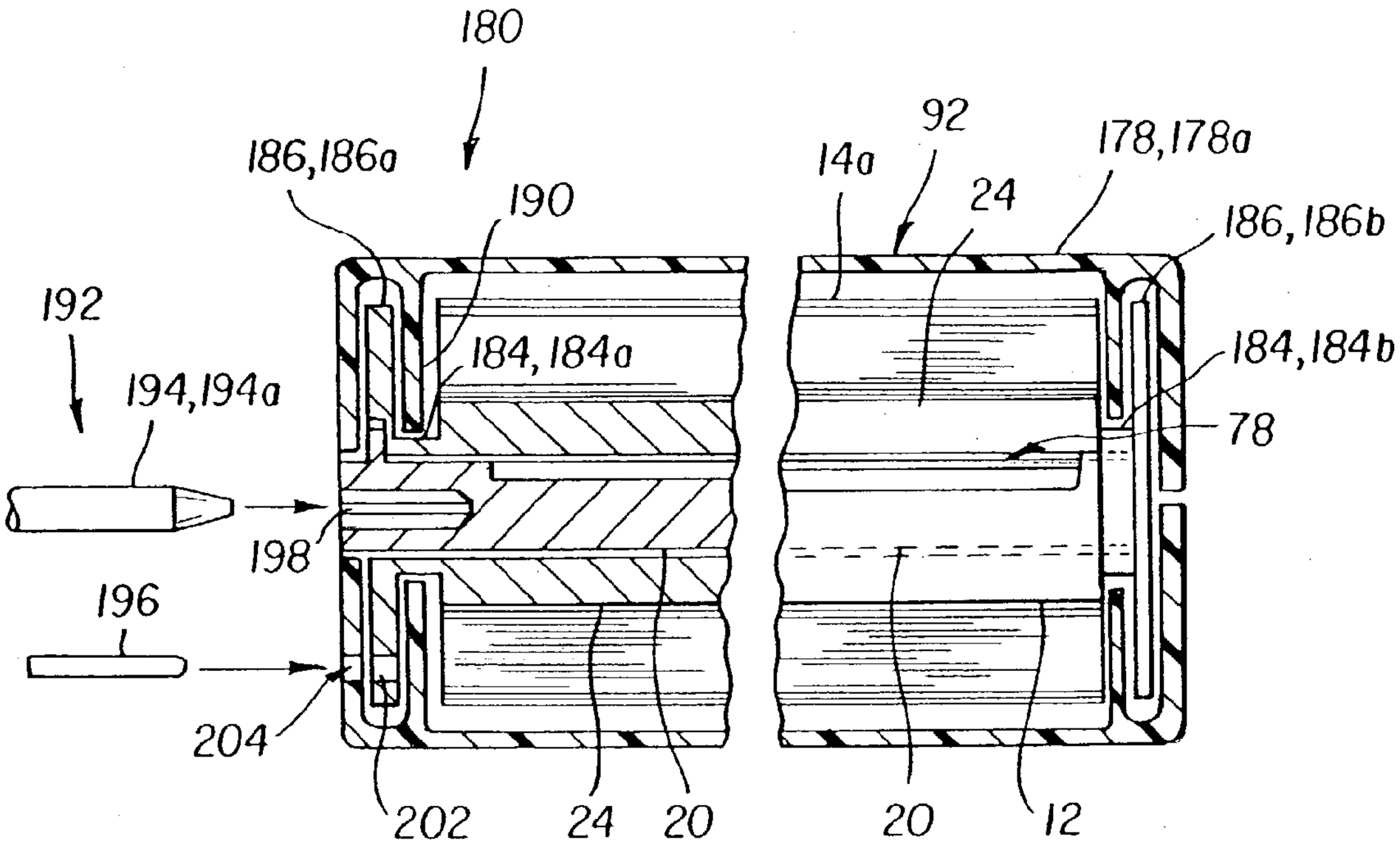

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186,186a
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14a
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178,178a
186,186b
184,184b
78
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12

FIG. 26

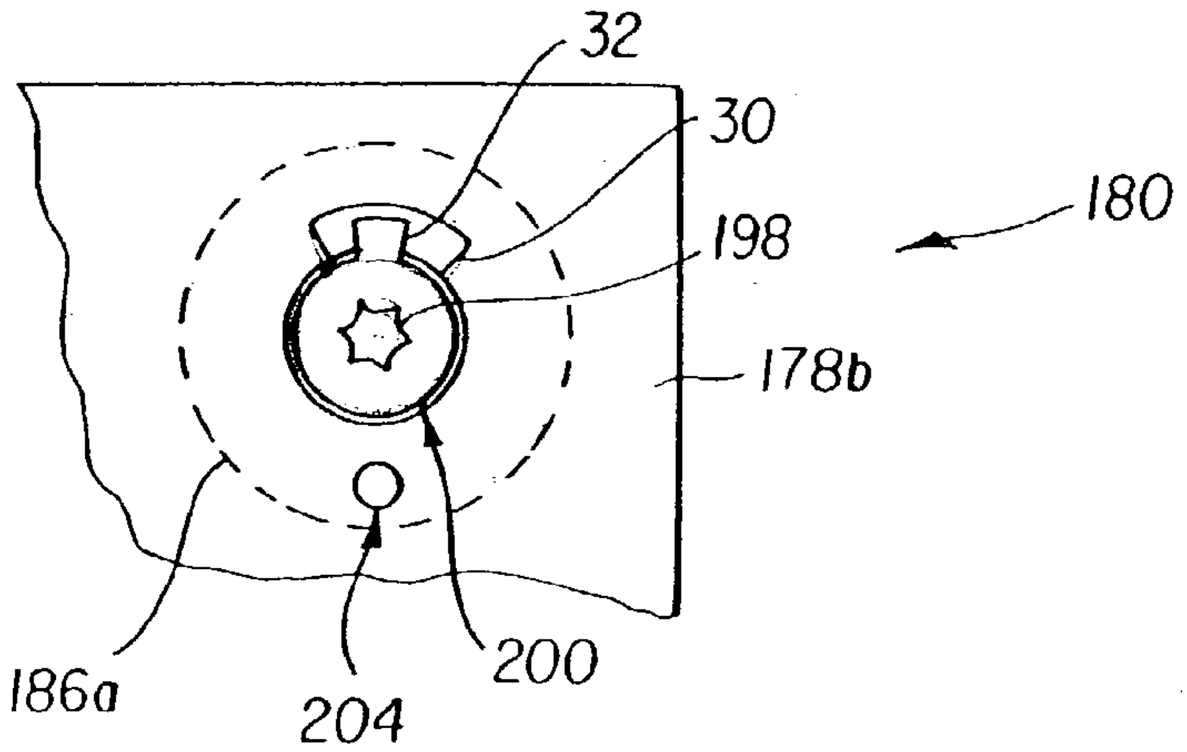

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178b
186a
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200

FIG. 27

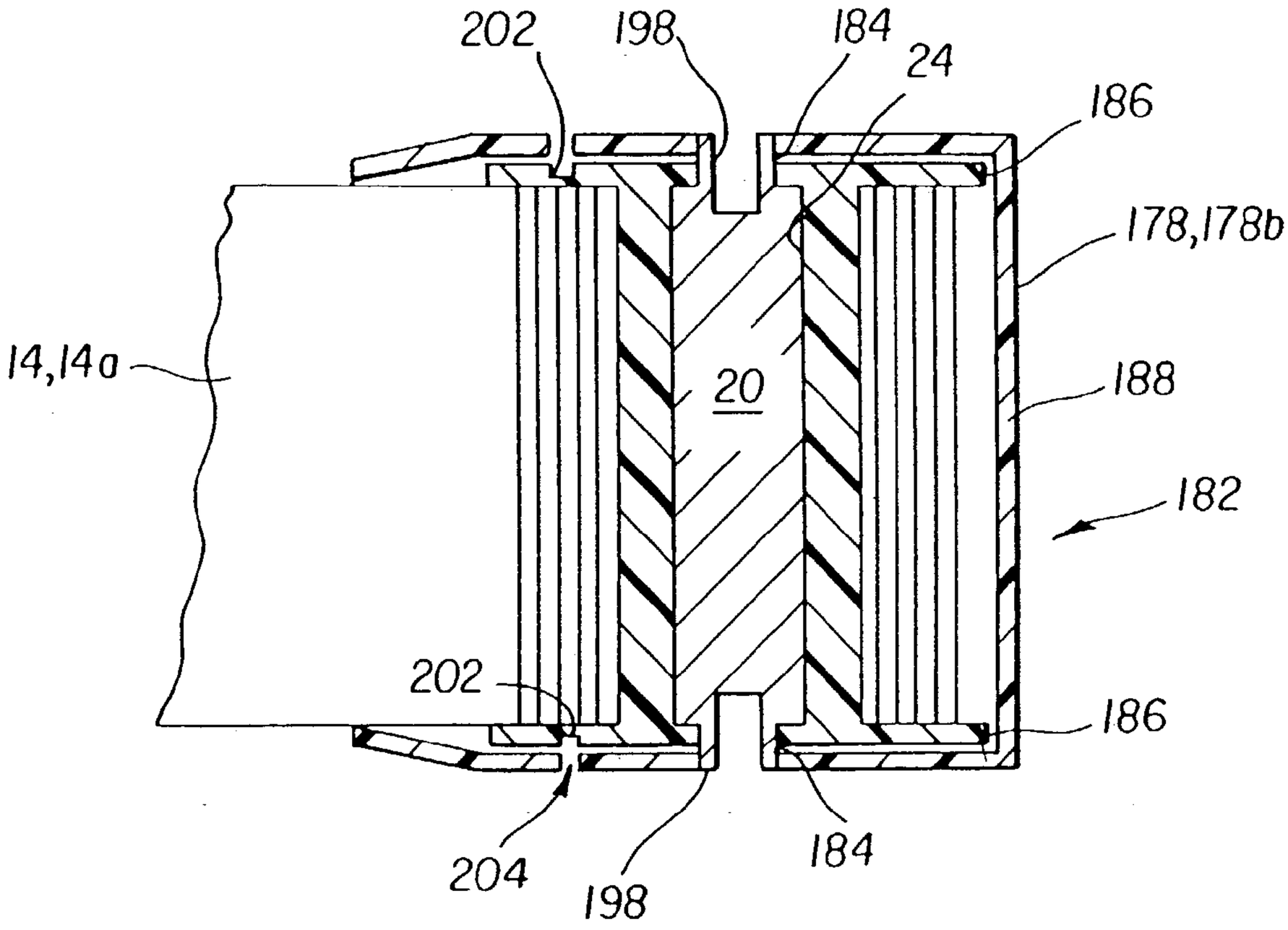

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186
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186
204
198
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FIG. 28

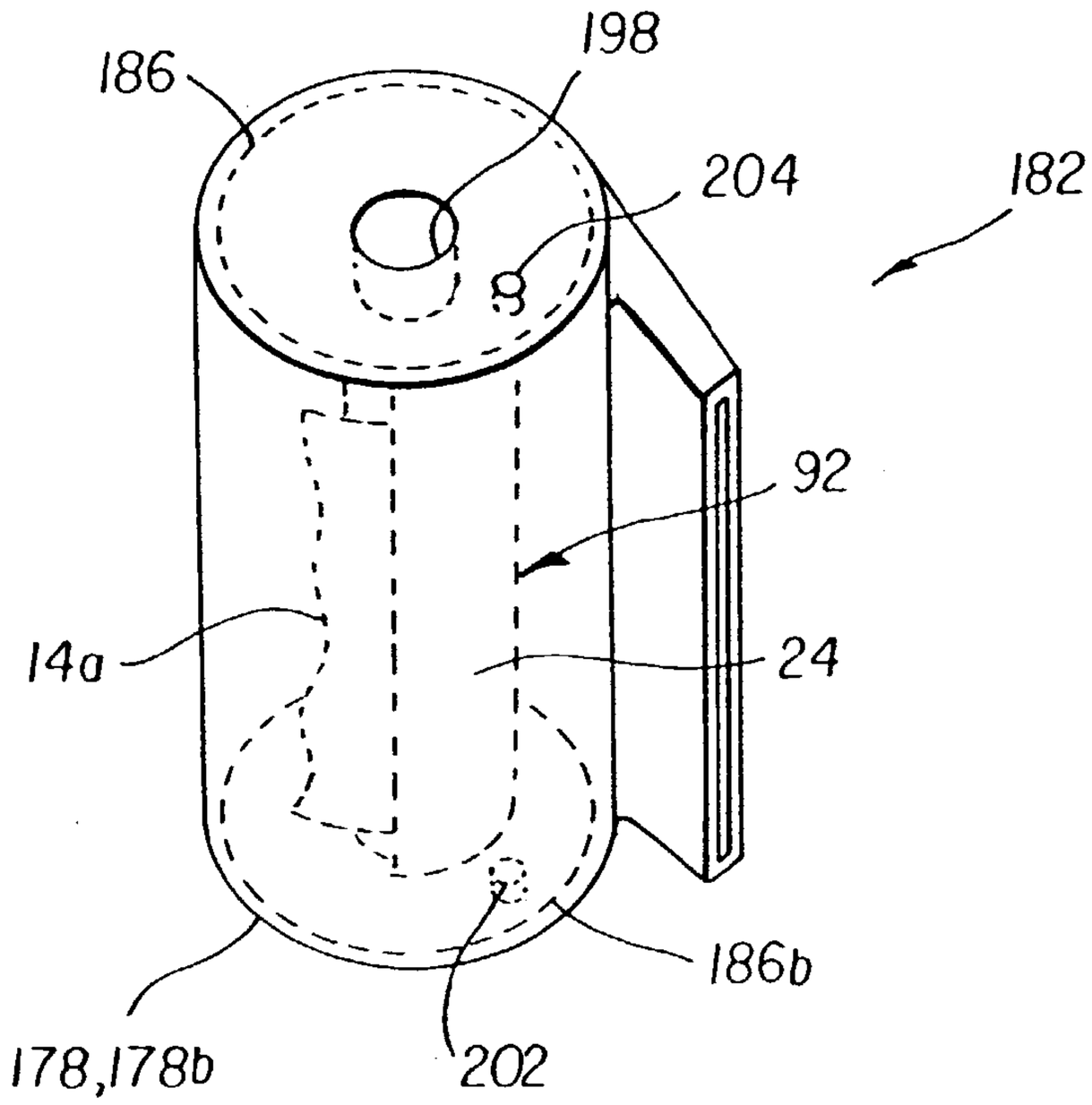

198
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182
92
14a
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186b
178,178b
202

FIG. 29

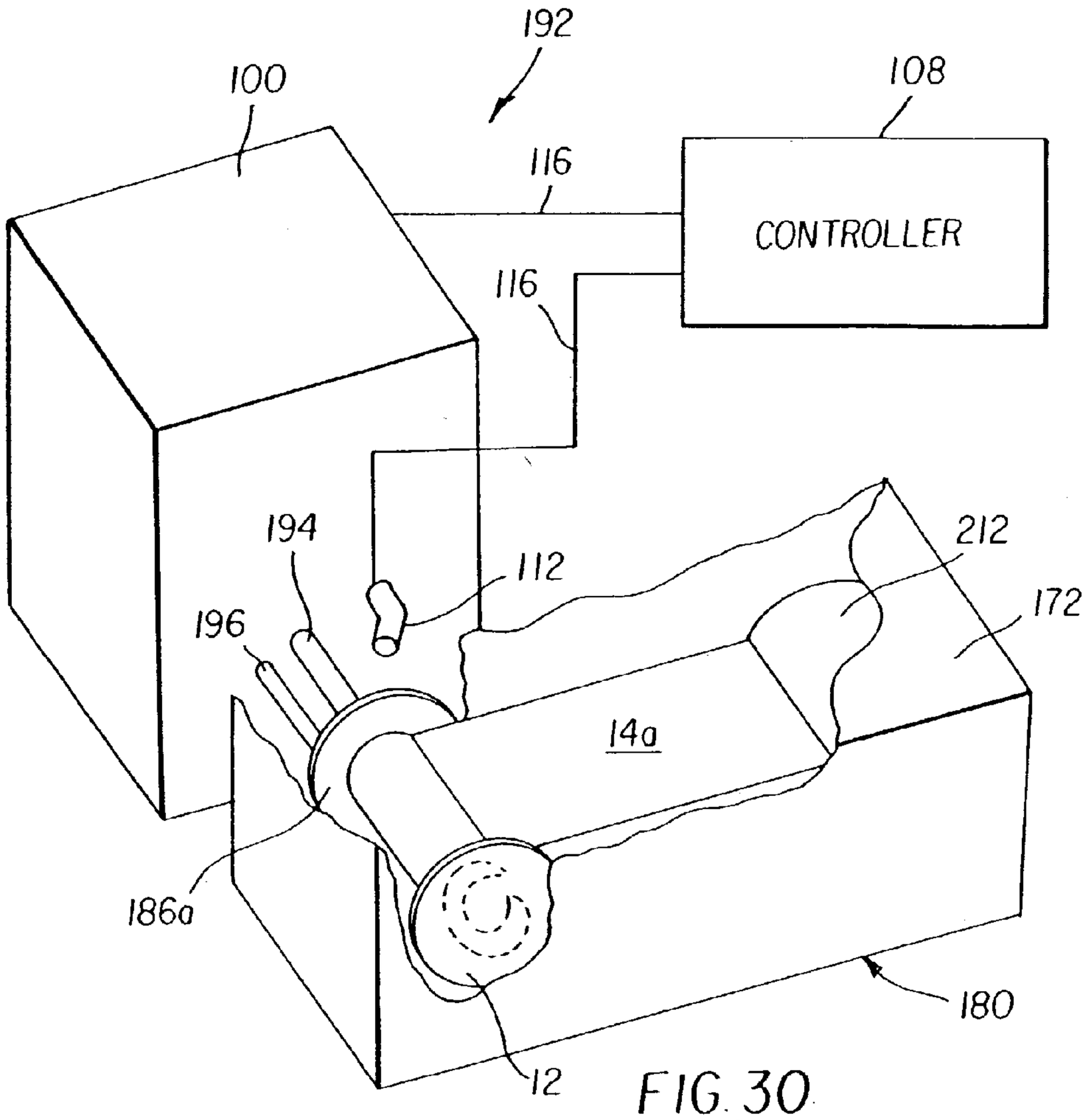

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CONTROLLER
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14a
186a
180
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FIG. 30

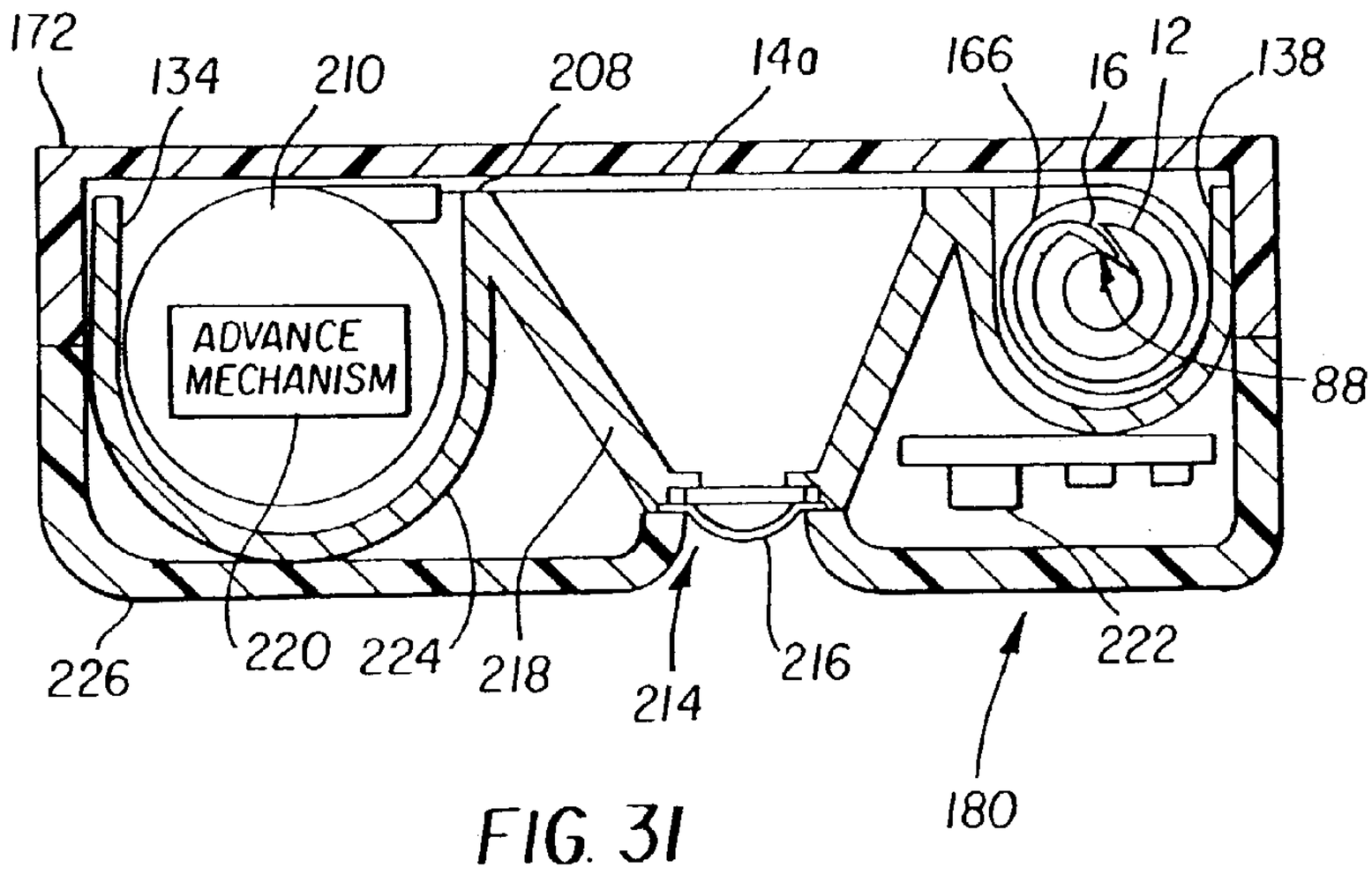

172
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ADVANCE MECHANISM
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FIG. 31

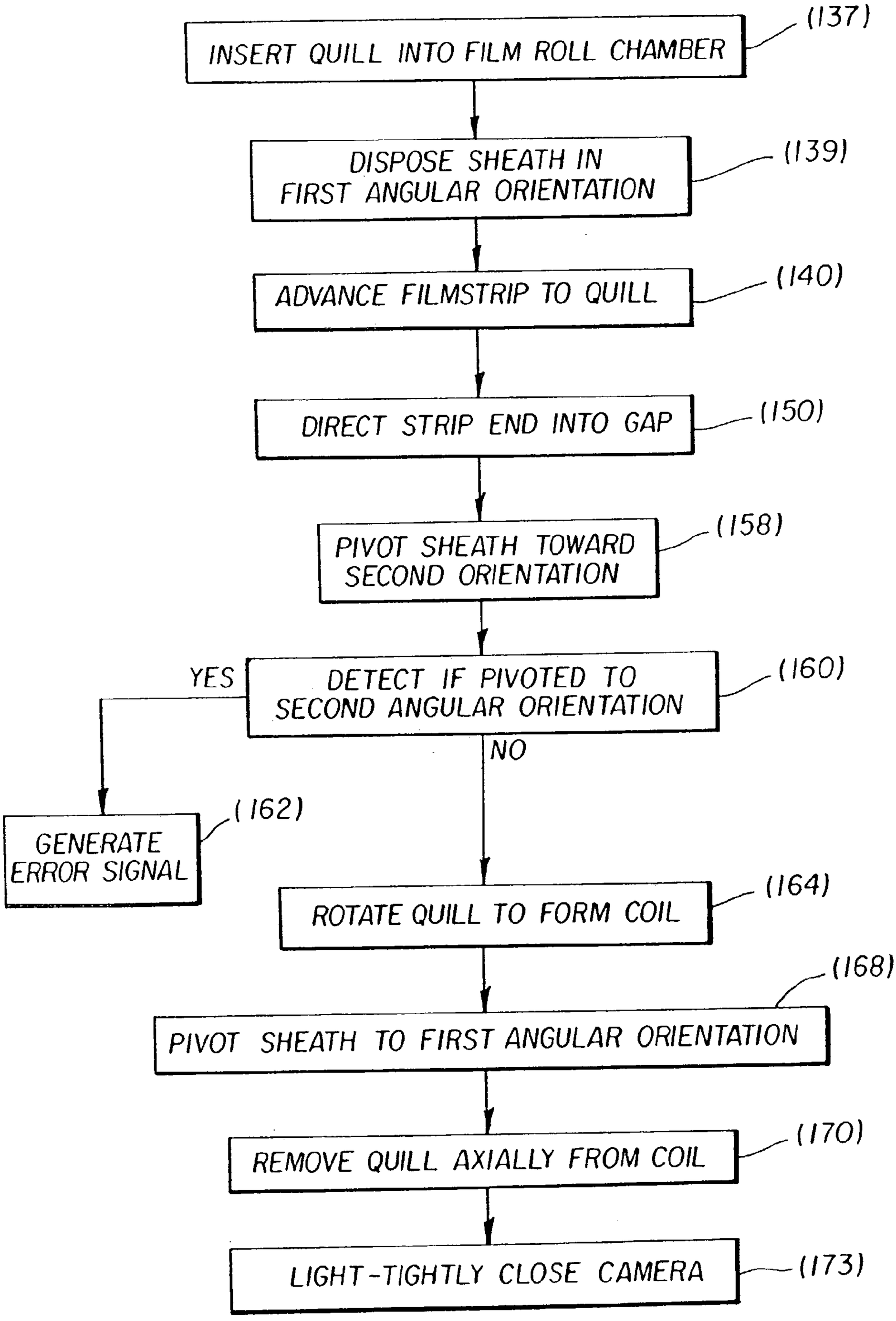

INSERT QUILL INTO FILM ROLL CHAMBER
(137)
DISPOSE SHEATH IN FIRST ANGULAR ORIENTATION
(139)
ADVANCE FILMSTRIP TO QUILL
(140)
DIRECT STRIP END INTO GAP
(150)
PIVOT SHEATH TOWARD SECOND ORIENTATION
(158)
DETECT IF PIVOTED TO SECOND ANGULAR ORIENTATION
(160)
YES
NO
GENERATE ERROR SIGNAL
(162)
ROTATE QUILL TO FORM COIL
(164)
PIVOT SHEATH TO FIRST ANGULAR ORIENTATION
(168)
REMOVE QUILL AXIALLY FROM COIL
(170)
LIGHT-TIGHTLY CLOSE CAMERA
(173)

FIG. 32

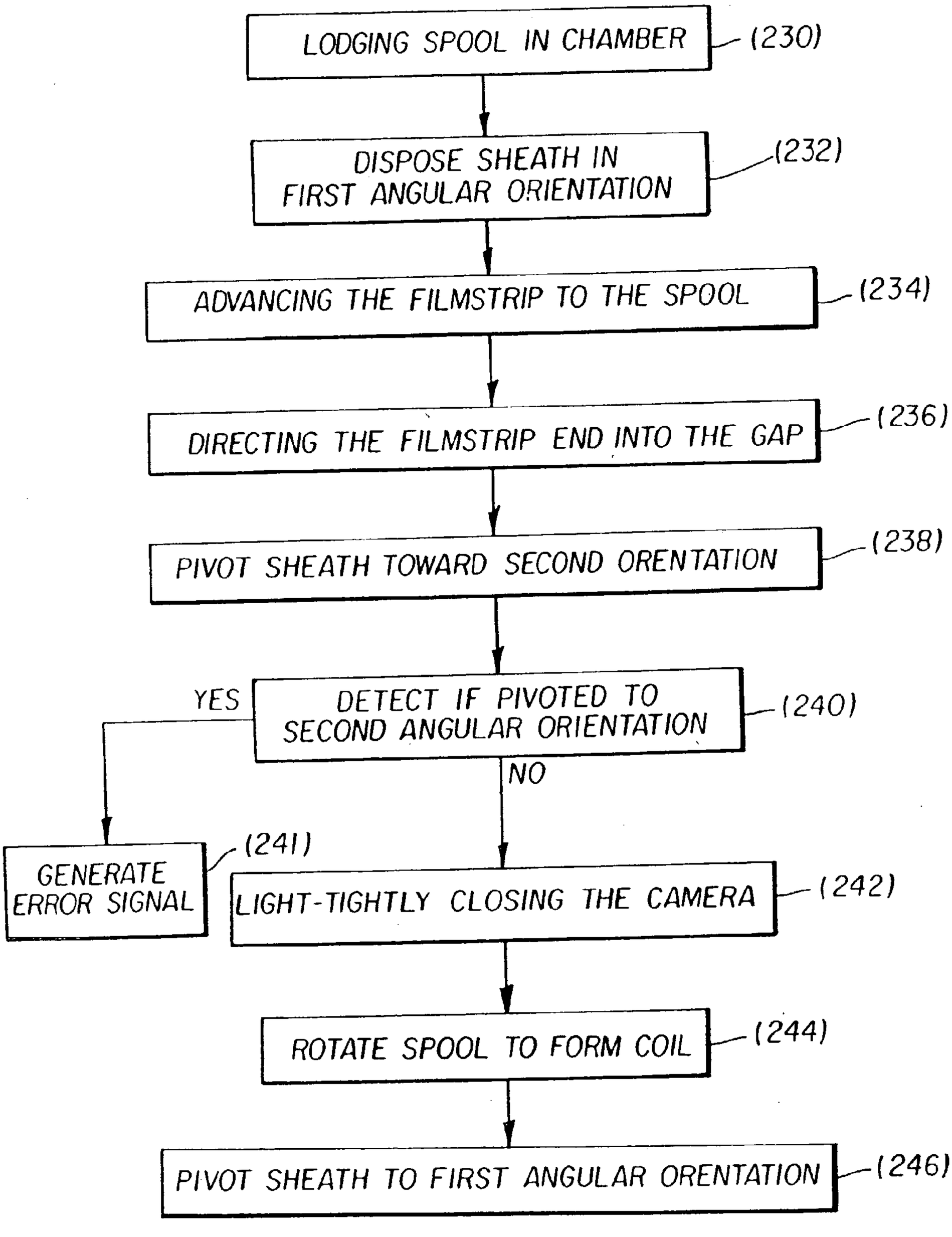

LODGING SPOOL IN CHAMBER
(230)
DISPOSE SHEATH IN FIRST ANGULAR ORIENTATION
(232)
ADVANCING THE FILMSTRIP TO THE SPOOL
(234)
DIRECTING THE FILMSTRIP END INTO THE GAP
(236)
PIVOT SHEATH TOWARD SECOND ORENTATION
(238)
YES
DETECT IF PIVOTED TO SECOND ANGULAR ORIENTATION
(240)
NO
GENERATE ERROR SIGNAL
(241)
LIGHT-TIGHTLY CLOSING THE CAMERA
(242)
ROTATE SPOOL TO FORM COIL
(244)
PIVOT SHEATH TO FIRST ANGULAR ORENTATION
(246)

FIG. 33

PINCH QUILL, APPARATUS, AND FILM WINDING METHOD

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This is a divisional of application Ser. No. 09/459,676, filed Dec. 13, 1999.

[0002] Reference is made to commonly assigned, co-pending U.S. patent application Ser. No. 09/460,127 filed Dec. 13, 1999, entitled: PINCH SPOOLS, ONE-TIME USE CAMERAS, APPARATUS, AND METHOD filed in the names of Stephen P. North and John M. Coval.

FIELD OF THE INVENTION

[0003] The invention relates to photographic film and film handling equipment and more particularly relates to clamping rollers, film winding apparatus, assemblies, and methods.

BACKGROUND OF THE INVENTION

[0004] A variety of spools and quills (here referred to collectively as "rollers") have been used to wind photographic filmstrips. A continuing problem has been attaching the filmstrip to the roller and later detaching the filmstrip. Tape has commonly been used to attach the filmstrip, but this adds additional steps and materials and presents a risk of contamination of processing materials by the adhesive unless the tape bearing segment of the film is segregated.

[0005] Another approach is to attach a narrowed end or leader attached to the filmstrip to the roller, by insertion in a slot or other structure and then winding. The filmstrip is held in place by frictional contact with the margins of the slot and other surfaces of the roller until a turn of the filmstrip overlaps. The increased friction tightens the filmstrip, cinching the filmstrip against the roller. Other approaches use an external guide in place of the slot to hold the filmstrip in place until cinching occurs. These procedures have the general shortcoming that cinching effectiveness decreases with increased winding speed. It is thus preferable, in these procedures, to always wind slowly or to cinch slowly and then increase winding speed after cinching is achieved. Winding speed can be increased by the use of structures on the roller that help grip the end of the filmstrip. U.S. Pat. No. 4,972,649 discloses a quill having a forked end and a spring positioned between the tines of the fork to help hold the end of the filmstrip.

[0006] Another approach similar to the above-described cinching procedures is to wedge the end of the filmstrip or leader into a narrow passage and then wind the filmstrip over the roller. This wedging procedure has the shortcoming that the better the filmstrip is wedged for initial film winding, the more difficult it is to remove the filmstrip later.

[0007] Another approach is to initially hold the filmstrip in place by pulling a vacuum through the roller. The vacuum can be released after one or more turns of filmstrip have been wound and the filmstrip is cinched. This approach requires that the filmstrip has good initial contact with the roller in order to establish the vacuum. U.S. Pat. No. 5,745,797 discloses a method and apparatus for winding film in the film roll chamber of a one-time use camera using a vacuum mandrel.

[0008] One-time use cameras are commonly sold preloaded with a cartridge of film. In order to reduce complexity and costs, a rewind mechanism is omitted from the camera. Instead, the film is prewound and during use is advanced back into the film canister. A number of approaches have been followed in loading and prewinding film cartridges for single use cameras. In some approaches, such as one taught in U.S. Pat. No. 4,972,649; film is prewound into a roll outside the camera body and then loaded. A shortcoming of these approaches is that the film roll must be handled after it is formed. This presents a risk of film damage and may add complexity to necessary equipment. In some other approaches, also taught in U.S. Pat. No. 4,972,649; the cartridge is loaded, the camera is light-tightly closed, and the film is then prewound using an exposed spool end. In still other approaches, such as taught by U.S. Pat. No. 5,311,231 and U.S. Pat. No. 5,745,797; the cartridge is loaded and then the rear opening of the camera body is closed and the film is prewound through a bottom opening, which is later sealed. In an approach taught by Japanese Kokai 6-295022, European Patent Application No. 0743546-A, and Japanese Kokai 8-171180, the film is wound onto a second spool, rather than being wound into a film roll. The back of the camera is not mandatory for guiding the film, since the second spool tends to restrain the film.

[0009] It would thus be desirable to provide improved quills, winders, apparatus, and methods in which film or other media is gripped easily for winding and released easily once coiled, but without requiring the use of a vacuum. It would also be desirable to provide for axial quill removal.

SUMMARY OF THE INVENTION

[0010] The invention is defined by the claims. The invention, in its broader aspects, provides a pinch quill that has a shank and a core and sheath apparatus. The core is rotatable about a longitudinal axis. The core has a recess sector and an adjoining recess sector. The chock sector has a greater radial dimension than the recess sector. The sheath is mounted coaxially over the core. The sheath is rotatable with the core about the axis. The sheath has an outer face, an inner face, and a longitudinal slot extending between the faces. The slot narrows to a throat at the inner face. The inner face includes a grip surface spaced apart from the throat. The grip surface is longitudinally aligned with the sectors. The sheath is pivotable about the axis between first and second angular orientations relative to the core. The slot is radially aligned with the chock sector at the first angular orientation. The grip surface is radially aligned with the chock sector at an intermediate angular orientation relative to the core. The intermediate angular orientation is between the first and second angular orientations. The core and sheath grip a filmstrip or other media strip in a quill-strip unit and method. A winder includes the pinch quill and a drive.

[0011] It is an advantageous effect of the invention that quills, winders, apparatus, and methods are provided in which film or other media is gripped easily for winding and released easily once coiled, without the use of a vacuum. It is also an advantageous effect that the quill can be removed axially.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The above-mentioned and other features and objects of this invention and the manner of attaining them

will become more apparent and the invention itself will be better understood by reference to the following description of an embodiment of the invention taken in conjunction with the accompanying figures wherein:

[0013] **FIG. 1** is semi-diagrammatical perspective view of an embodiment of the media winder, which includes an embodiment of the pinch quill. The pinch quill includes an embodiment of the core and sheath apparatus. The housing support and film advance mechanism of the winder are not shown.

[0014] **FIG. 2** is a semi-diagrammatical side view of the winder of **FIG. 1** and a camera frame assembly. The controller and related components are not shown. The position of the filmstrip coil after winding is indicated by dashed lines. The position of light-tight back, after placement on the camera frame assembly, is indicated by dashed lines.

[0015] **FIG. 3** is a perspective view of another embodiment of the pinch quill. The locations of internal parts of the coupling are indicated by dashed lines. The core and sheath are in the first angular orientation.

[0016] **FIG. 4** is the same view as **FIG. 3**, except that the end of a filmstrip is gripped between the core and sheath, which are in an intermediate angular orientation.

[0017] **FIG. 5** is a radial cross-sectional view of the core and sheath apparatus of **FIG. 1**. The cross-section is parallel to a radius from the longitudinal axis and is, thus, perpendicular to the longitudinal axis. A section of filmstrip cross-sectioned in the same direction is also shown.

[0018] **FIG. 6** is an exploded radial cross-sectional view of the core and sheath apparatus of **FIG. 5**.

[0019] FIGS. **7-10** are the same view as **FIG. 5**, of the core and sheath and a section of filmstrip, at different stages during winding. In **FIG. 7**, the core and sheath are in the first angular orientation. In FIGS. **8-10**, the core and sheath are in an intermediate orientation.

[0020] **FIG. 11** is the same view as **FIG. 5**, but the core and sheath are in the second angular orientation.

[0021] **FIG. 12** is a radial cross-sectional view of another embodiment of the core and sheath apparatus.

[0022] **FIG. 13** is a radial cross-sectional view of still another embodiment of the core and sheath apparatus.

[0023] **FIG. 14** is a radial cross-sectional view of yet another embodiment of the core and sheath apparatus.

[0024] **FIG. 15** is the same view as **FIG. 5**. The core and sheath are shown in the first angular orientation in solid lines and in an intermediate angular orientation in dashed lines. The throat and a tangent are also indicated by dashed lines.

[0025] **FIG. 16** is a radial cross-sectional view of the coupling of **FIG. 1** when the core and sheath are in the first angular orientation. The relative positions of the core and sheath are indicated by dashed lines.

[0026] **FIG. 17** is the same view as **FIG. 16**, but the core and sheath are in the intermediate angular orientation.

[0027] **FIG. 18** is the same view as **FIG. 16**, but the core and sheath are in the second angular orientation.

[0028] **FIG. 19** is a partial perspective view of the core of another embodiment of the core and sheath apparatus.

[0029] **FIG. 20** is a radial cross-sectional view of another embodiment of the core and sheath apparatus.

[0030] **FIG. 21** is a perspective view of another embodiment of the core and sheath apparatus.

[0031] **FIG. 22** is a perspective view of the core of the apparatus of **FIG. 21**.

[0032] **FIG. 23** is a longitudinal cross-sectional view of the sheath of another embodiment of the core and sheath apparatus.

[0033] **FIG. 24** is an exploded perspective view of an embodiment of the pinch spool, which includes the core and sheath apparatus of **FIG. 5**.

[0034] **FIG. 25** is a partially cut-away side view of the pinch spool of **FIG. 24** and the spindle and pivot tool of a spool winder.

[0035] **FIG. 26** is a partial cross-sectional view of an embodiment of the one-time use camera, which includes the core and sheath apparatus of **FIG. 5**. Also shown in partial view are the spindle and pivot tool of a spool winder.

[0036] **FIG. 27** is a bottom view of the camera of **FIG. 18**. The position of the primary flange of the pinch spool is indicated by a dashed line.

[0037] **FIG. 28** is a longitudinal cross-sectional view of an embodiment of the spool-media unit that is a film cartridge. The filmstrip is shown partially withdrawn and cut-away.

[0038] **FIG. 29** is a perspective view of the film cartridge of **FIG. 28**. The filmstrip is not shown except near the pinch spool.

[0039] **FIG. 30** is a perspective view of the one-time use camera of **FIG. 26** connected to a spool winder for film winding. The camera is shown partially-cut away.

[0040] **FIG. 31** is a cross-sectional view of another embodiment of the one-time use camera.

[0041] **FIG. 32** is a flow-chart of the quill winding method.

[0042] **FIG. 33** is a flow-chart of the spool winding method.

DETAILED DESCRIPTION OF THE INVENTION

[0043] Referring initially to FIGS. **1-5** and **24-29**, the pinch quill **10** and pinch spool **12** clamp the end of a media strip **14**, such as a filmstrip **14***a* to hold the strip **14** during initial winding; and, if desired, to retain the end **16** of the strip **14** when the strip **14** is unwound. The inventions are particularly advantageous for filmstrips and are generally described and illustrated herein in relation to filmstrips.

[0044] The pinch quill **10** and pinch spool **12** each have a core and sheath apparatus **18**. The core **20** of the apparatus **18** has a longitudinal axis **22**. The sheath **24** is mounted coaxially over the core **20**. The sheath **24** has a longitudinal slot **26**. The sheath **24** is rotated with the core **20** when the core **20** is rotated about the longitudinal axis **22**. The term "rotate" is used herein to refer to rotary movement about the

axis **22** over a range that is greater than a pivoting movement described below. In preferred embodiments, "rotating" refers to a movement through 360 degrees or more.

[**0045**] The pinch quill **10** and pinch spool **12** each have a coupling **28** joined to the core and sheath apparatus **18**. A coupling **28** has a first part **30** fixed to the sheath **24** and a second part **32** fixed to the core **20**. The term "fixed", used herein, refers to a joining of two items that maintains the items in invariant spatial relation to each other and the like relationship of two portions of a single item, made as one piece. The "fixed" items or portions, if mobile during use, move as a single unit and may or may not be subject to bending or other geometric distortion during use. The "fixed" items or portions may or may not be subject to disassembly or other separation and may be joined together through an intermediate item. The core **20** and sheath **24** are preferably rigid structures that do not perceptibly bend during use.

[**0046**] The core **20** and sheath **24** are joined together by the coupling **28** and the nesting of the core **20** within the sheath **24**. The coupling **28** allows the sheath **24** to pivot about the axis **22** relative to the core **20** over a fraction of a circle, through a sequence of different angular orientations of the core **20** to the sheath **24**. In currently preferred embodiments, the coupling **28** is longitudinally spaced from the slot **26**. First and second parts **30,32** of the coupling **28** are engaged at first and second angular orientations and obstructed from pivoting further in first and anti-winding directions of rotation (indicated by arrows **34,36**), respectively.

[**0047**] In the pinch quill **10** shown in FIGS. **3-4** and **16-18**, the first part **30** is an extension that is continuous with the sheath **24**. The extension has a pair of opposed stops **40,42** separated by an arcuate path **44**. The second part **32** is a slider that is joined to and extends radially outward from the core **20**. The slider **32** moves along the path **44** between the stops **42,44** as the sheath **24** pivots relative to the core **20**. At the first and second angular orientations, the stops **40,42**, respectively, are engaged by the slider **32** and block further pivoting in the first and anti-winding directions **34,36** respectively. The slider **32** is disengaged from the stops **40,42** at an intermediate angular orientation (shown in **FIG. 4**) between the first and second angular orientations. There are a plurality of intermediate angular orientations between the first and second angular orientations. In the following, the core and sheath are discussed only in terms of a single intermediate angular orientation. This is for convenience and reflects the fact that, for any particular media strip, there is a single intermediate angular orientation of the core and sheath at which the strip will be gripped.

[**0048**] In the pinch spool **12** shown in FIGS. **24-25**, is like the coupling **28** just discussed, but the first part **30** is a slider **32** that extends axially outward relative to the sheath and the second part **32** is an extension that has opposed stops **40,42**. In the pinch spool **12** of FIGS. **26-27**, the first part **30** is an extension and the second part **32** is a slider that extends radially outward.

[**0049**] For simplicity, it is currently preferred that the sheath **24** is freely pivotable between the first and second angular orientations; however, detents or releasable catches (not shown) can be provided at one or more of the angular orientations, such as a particular intermediate orientation. The coupling **28** is described herein in terms of interacting rigid parts **30,32**. A flexible connection (not illustrated) could also be used.

[**0050**] Referring now particularly to FIGS. **5-6**, the core **20** has a recess sector **48** and a chock sector **50** adjoining one side of the recess sector **48**. Between the recess sector **48** and the chock sector **50** is a support sector **52**. Each sector **48,50,52** is a three-dimensional portion of the core **20** and has a maximum cross-section in a plane perpendicular to the longitudinal axis **22** that is roughly the shape of a geometric sector. The chock sector **50** has a greater radial dimension (dashed line "A" in **FIG. 5**), relative to the longitudinal axis **22**, than the radial dimension (dashed line "B") of the recess sector **48**. The support sector **52**, preferably, has a maximum radial dimension (dashed line "C") that is the same as the radial dimension "A" of the chock sector **50**.

[**0051**] In the embodiment shown in **FIG. 5**, the core **20** has an invariant cross-section in the plane perpendicular to the longitudinal axis **22**. The support sector **52** adjoins the recess sector **48** and extends around to and adjoins the chock sector **50**. The recess sector **48**, chock sector **50**, and support sector **52** are each uniform in cross-section along said axis **22**. The recess sector **48** has a flat face **54** and the chock sector **50** has an arcuate face **56**. The support sector **52** has a face **57** that lies along a continuation of the same arc as the chock face **56**. The sectors **48**, **50**, **52** can have other shapes, but that is not currently preferred.

[**0052**] The sectors **48**, **50**, **52** can be discontinuous both circumferentially and longitudinally. **FIG. 22** shows an embodiment in which the core **20** overall is divided into contact segments **58** and inset spacer segments **60** along the longitudinal axis **22**. In this embodiment, the contact segments **58** each include a section of each of the sectors **48,50,52** including the sections of the faces **54**, **56**, **57**. In another embodiment shown in **FIG. 19**, the core is partially segmented, such that the faces **54,56** of the recess and chock sectors **48,50** are divided and a section of the support sector **57** is non-segmented. In another embodiment shown in **FIG. 20**, the core **20** is divided into longitudinal first and second contact segments **62,64**. The chock and recess sectors **48,50** are limited to the first contact segment. The second contact segment **64** has part of the support sector **52**.

[**0053**] Referring again primarily to FIGS. **5-6**, the sheath **24** has opposed outer and inner faces **66,68**. The inner face **68** defines a cylindrical core space **70** that is coaxial with the longitudinal axis **22** of the core **20**. The core **20** fits within the core space **70**. The longitudinal slot **26** extends between the outer and inner faces **66,68**. A margin **72** bounds the slot **26**. The margin **72** has opposed upper and lower portions **74,76** that extend longitudinally and parallel the axis **22**. (The terms "upper" and "lower", and other directional terms used herein, refer to apparent directions in the drawings are otherwise arbitrary. The disclosed inventions can be used in any absolute orientation.)

[**0054**] The slot **26** has an outside opening **78** to the exterior environment. The upper and lower portions **74,76** of the margin **72** can be non-converging; but, for ease of media strip **14** admission, it is highly preferred that the upper and lower portions **74,76** of the margin **72** converge toward each other, such that the slot **26** narrows from the outside opening **78** to a throat **80**. The throat **80**, which is the narrowest portion of the slot **26**, can immediately adjoin the interior of

the sheath **24** or can be set back slightly from the interior due to rounding of edges or the like. The throat **80** is indicated in **FIG. 15** by a dashed line.

[**0055**] The inner face **68** includes a grip surface **82**, a support surface **84**, and, in preferred embodiments, a transition **85**. The sheath **24** is disposed over the core **20** such that the grip surface **82** is aligned longitudinally with the recess sector **48** and chock sector **50**. The grip surface **82** adjoins and is interior to the upper portion **74** of the margin **72**. The transition **85** is opposite the upper portion **74** at the inner end of the grip surface **82**. The support surface **84** adjoins the transition **85**. In the embodiment shown in **FIG. 1**, the support surface **84** continues from the transition **85**, most of the way around the axis **22** to the lower portion **76** of the margin **72**. The support surface **84** is in contact with the support sector **52** of the core **20**.

[**0056**] Like the core **20**, the sheath **24** can be segmented. The segmenting can be limited to the sheath **24** or both the core **20** and the sheath **24** can be segmented. In the latter case, segments of the core **20** and sheath **24** can overlap fully or partially, as desired. **FIG. 23** illustrates a sheath **24** having a segmented grip surface **82** and support surface **84**.

[**0057**] Referring now particularly to FIGS. **5-6**, the grip surface **82** is disposed in spaced relation to the core space **70** and is at a greater radial separation from the longitudinal axis **22** than the support surface **84**. (Radial and like terms used herein are relative to the longitudinal axis **22**, unless specifically indicated otherwise.) The transition **85** extends between the grip and support surfaces **82**,**84** and is, preferably, abruptly rounded off or squared off.

[**0058**] The core space **70** is cylindrical and the grip surface **82** is aligned with an imaginary chord **86** (shown in **FIG. 6**) of the core space **70**. The grip surface **82** can be planar and roughly parallel to the chord **86** or slightly angled (angle "D" in **FIG. 5**) relative to the chord **86**. The angle is preferably less than about 25 degrees and more preferably less than about 15 degrees. The grip surface **82** can also be gently curved, as shown in **FIG. 5**, within a space defined by flat surfaces at those angles. The upper and lower portions **74**,**76** of the margin **72** can be cut back to enlarge the opening **78**.

[**0059**] In the first angular orientation of the sheath **24** relative to the core **20**, as shown in **FIGS. 5, 7**, and **15**, the margin **72** is radially aligned with the chock sector **50**; that is, a radius extending outward from the longitudinal axis **22** can intercept both the chock sector **50** and the margin **72**. In the first angular orientation, the recess sector **48** is aligned with the chord of the core space **70** and faces toward and is separated from the grip surface **82** by a gap **88** that is roughly rectangular or wedge shaped. The term "gap" refers to an empty space defined by the sheath **24** and core **20** in some angular orientations of the sheath **24** and core **20**. The gap **88** extends along the grip surface to the slot and has a minimum radial dimension that is no less than the thickness of a suitable media strip. The minimum radial dimension of the gap is also greater than the clearance between the support sector **52** and support surface **84**. The gap **88** extends through a portion of the cylindrical core space **70**. In the first angular orientation of the core **20** and sheath **24**, the slot **26** and the gap **88** are aligned and a media strip **14** can be introduced into the gap **88** through the slot **26**.

[**0060**] In the second angular orientation of the sheath **24** relative to the core **20**, as shown in **FIG. 11**, the chock sector **50** is radially aligned with an inner part of the grip surface **82**, or the transition, or preferably, with the support surface **84**. In the second angular orientation, the gap is closed; that is, the empty space between the core **20** and sheath **24** has a pinch point, at which the radial separation is less than the thickness of a suitable media strip. This separation can be equal to the clearance between the support sector **52** and support surface **84**, and is in the embodiment shown in **FIG. 11**.

[**0061**] Referring to FIGS. **8-10**, and **15**, in an intermediate angular orientation between the first and second angular orientations, the grip surface **82** is radially aligned with the chock sector **50**. In the intermediate angular orientation, the gap **88** is narrower than in the first angular orientation at a pinch point adjoining the chock sector **50**, but still extends through part of the core space **70**. In the intermediate angular orientation, a radius through the chock sector does not intersect the throat. Referring to **FIG. 15**, in preferred embodiments, a radius through the chock sector **50** in the intermediate angular orientation intersects the grip surface **82** at the middle of the gap **88** between the throat **80** and the inner terminus **94** of the gap **88**. This helps reduce any risk of slippage of the media strip **14**. In these embodiments, a tangent ("G" in **FIG. 15**) can be drawn from the chock surface **50** in the first angular orientation. A radius ("H" in **FIG. 15**) drawn from the chock sector **50**, in the intermediate angular orientation, intersects the grip surface **82** interior to the tangent "G".

[**0062**] In both the second and intermediate angular orientations, the lower portion **76** of the margin **72** is radially aligned with a portion of the support sector **52**. The chock sector **50** is radially closer to the inner face **68** of the sheath **24** in the second angular orientation than in the intermediate orientation.

[**0063**] The media strip **14** is gripped by the core and sheath apparatus **18** in the manner shown in FIGS. **7-10**. In **FIG. 7**, the sheath **24** and core **20** are disposed in the first angular orientation and a media strip **14** is introduced into the gap **88** through the slot **26**.

[**0064**] In **FIG. 8**, the sheath **24** is then pivoted relative to the core **20**, in a counterclockwise direction for FIGS. **7-10**, until the end **16** of the strip **14** is held between the chock sector **50** and the grip surface **82** and the sheath **24** assumes an intermediate angular orientation relative to the core **20**. The strip **14** is held in place by contact with the grip surface **82** and chock sector **50**. The extreme end or tip **87** of the strip **14** is not gripped. As shown in **FIG. 6**, the upper portion **74** of the margin **72** may frictionally contact the strip **14**, depending upon the angle at which the strip **14** is delivered to the apparatus **18** and the tension in the strip **14**. Frictional contact between the sheath **24** and core **20** also tends to hold the strip **14** in position within the gap **88**.

[**0065**] The core **20** is then rotated in a clockwise direction, as shown in **FIG. 9**. The chock sector **50** pushes the strip **14** against the grip surface **82** and, through the strip **14**, causes the sheath **24** to rotate with the core **20** about the axis **22**. The strip **14** comes into contact with the lower portion **76** of the margin **72** and then wraps over the outer face **66** of the sheath **24** as shown in **FIG. 10**. Additional turns (not shown) are wrapped over the initial turn.

[**0066**] When present, the strip **14** blocks relative movement of the sheath **24** and core **20** from the intermediate

angular orientation to the second angular orientation. If a strip **14** is not present in the gap **88** when the sheath **24** is moved from the first angular orientation toward the second angular orientation, then the sheath **24** moves past the intermediate angular orientation and into the second angular orientation, as shown in **FIG. 1**. As shown in FIGS. **16-18**, the extent of relative rotation of the sheath **24** and core **20** to attain the second angular orientation is determined by the relative positions of the stops **40,42** of the coupling **28**.

[**0067**] The pinch quill **10** and pinch spool **12** can theoretically be used with any thickness of strip **14** that can be introduced into the gap **88**. It is not particularly advantageous, however, to use the pinch quill **10** and pinch spool **12** to hold media **14** having a thickness of greater than two-thirds of a maximum gap thickness, that is, the maximum thickness of a strip **14** that can be introduced into the gap **88**.

[**0068**] The quill-strip unit **90** and spool-media unit **92** of the invention, each include a media strip **14** gripped by a pinch quill **10** or a pinch spool **12**, respectively. The media strip **14** has a thickness less than two-thirds of the maximum gap thickness. It is preferred that the strip units **90,92** include media **14** having a nominal thickness near the middle of the range of strip thicknesses capable of being gripped by the pinch quill **10** or pinch spool **12**. This ensures that the strip **14** is held by the chock sector **50** and the grip surface **82**, rather than by the chock sector **50** and the margin **72**. This thickness also ensures that the strip **14** is easily removed from between the opposed grip surface **82** and chock sector **50** when the sheath **24** is in the first angular orientation and maximizes available tolerances for the thickness dimension of the strip **14** and the corresponding dimensions of the pinch quill **10**.

[**0069**] In the embodiment shown in FIGS. **7-10**, the transition **85** and the inner terminus **94** of the gap **88** is straight in from the slot **26**. In an alternative embodiment, shown in **FIG. 12**, the gap **88** is recurvate. This is embodiment is not preferred, because the curved gap **88** adds friction and thus can make insertion and removal of the media strip **14** more difficult. In another embodiment, shown in **FIG. 13**, the gap **88** extends through the sheath **24** to the outside. This embodiment is not preferred, because the media strip **14** can extend outward through the gap **88**, which presents a risk of crimping, or scuffing, or other damage.

[**0070**] Referring to FIGS. **7-10**, it is preferred, to ensure easy removal of the media strip **14**; that the gap **88**, in the first angular orientation, is wider, at all points capable of receiving the filmstrip **14***a*, than the nominal thickness of the filmstrip **14***a*. The inner terminus of the gap **88** can be squared off or rounded to a greater dimension than the strip **14** nominal thickness such that the tip of the end of the strip **14** will not jam between the sheath **24** and core **20**. In the embodiment shown in FIGS. **7-10**, the recess face **54** is flat and has only sliding contact with the strip **14**. The overlying transition **85** is rounded off and then extends downward to meet the recess face **54** at a roughly perpendicular angle. An alternative embodiment is shown in **FIG. 14**. In this embodiment, the inner face **68** of the sheath **24** and the recess sector **48** of the core **20** converge gradually. This allows the tip **87** of the end **16** of the media strip **14** to be wedged between the inner face **68** and the recess sector **48** and also allows the end **16** of the media strip **14** to be gripped between the chock sector **50** and the grip surface **82**, in the intermediate angular orientation. This embodiment is not preferred. Removal and insertion of the media strip **14** is more difficult and the media **14** is not retained in place any better than in the other embodiments disclosed.

[**0071**] In a particular embodiment of the invention shown in FIGS. **5-6**, the recess sector **48** lies along the chord **86** of the core space **70**. The chord **86** is perpendicular to a radius and spaced in from the circumference by a dimension ("E" in **FIG. 6**) equal to twice the thickness ("F" in **FIG. 5**) of the media strip **14**. The core **20** in this embodiment has a diameter that is six-tenths of the diameter of the sheath **24**. The core **20** is spaced from the inner surface of the sheath **24** by a separation less than or equal to two-tenths of the thickness of the strip **14**. The grip surface **82** extends outward at an angle of roughly 5 degrees to the chord **86**. The lower portion **76** of the margin **72** is angled downward toward the outer face **66** at an angle of roughly twenty-five degrees from the chord **86**.

[**0072**] The longitudinal dimension of the core **20** and sheath **24** is not critical in so far as film strips are concerned. The pinch quill **10** and pinch spool **12** can be readily sized for such current films as Type 135 film ("35 mm"), Advanced Photo System film, Type 120 film, and Type 220 film. The pinch quill **10** and pinch spool **12** are less advantageous for wide media, that is media for which the longitudinal dimension of the core **20** and sheath **24** would be so large that slippage and resulting telescoping would be likely to occur.

[**0073**] Referring now primarily to FIGS. **1-4**, the pinch quill **10** has the core **20**, sheath **24**, and coupling **28** above-described and a shank **96** that is fixed to one end of the core **20** or the sheath **24**. It is currently preferred that the shank **96** is attached to the core **20**, since the core **20** is within the sheath **24**. The shank **96** that is sized and shaped such that the shank **96** can be firmly gripped by a holder **98** (indicated in **FIG. 1** by dashed lines) of a drive **100**. For example, some convenient shapes are a uniform cross-section of circular, octagonal, or rectangular shape. The holder **98** is a chuck or collet or the like, which is rotated by the drive **100**. The shank **96** is concentric with the core **20** and is held by the holder **98** such that the rotation of the holder **98** and core **20** is about the longitudinal axis **22**.

[**0074**] Opposite the shank **96**, the core **20** has an end face **102**. It is preferred that the end face **102** is interrupted by an end-opening **104** of the slot **26**, as shown in FIGS. **1**, and **3-4**. It is further preferred that the slot **26** has uniform dimensions in cross-section perpendicular to the axis **22**, including at the end face **102** to reduce possible binding or misplacement of the media strip **14** during insertion and removal. The end opening **104** permits movement of the media strip **14** in and out of the gap **88**, when the core and sheath are in the first angular orientation, in an axial direction, that is, a movement along the longitudinal axis **22**.

[**0075**] The quill winder **106** has the pinch quill **10** mounted in a quill holder **98** of a drive **100**. The holder **98** rotates the quill **10** to wind the media strip **14**. The drive **100** has a motor (not shown) and can be a servomotor or the like. The quill winder **106** can be controller manually or can have a controller **108** using a microprocessor or the like or can be controlled by other automatic means. The sheath **24** can be pivoted relative to the core **20** by hand, but it is preferred that

the quill winder **106** include a pivoter **110** operatively connected to the sheath **24**. The pivoter **110** can be a lever (not shown), operated by a servomotor or solenoid or the like (not shown), that pushes on the slider **32** or the sheath **24** to pivot the sheath **24** relative to the core **20**. The sheath **24** can alternatively be held in place by a lever, or the like, while the core **20** is pivoted. In an automated process, the pivoting can be detected by a sensor **112** that reads a notch or other mark **114** that moves indicative of the pivoting. A signal of this condition can be sent along a communication path **116** to the controller **108**, which can signal to stop a drive **100** and order other actions.

[**0076**] In a particular embodiment of the invention, the pivoter **110** includes a gas source **118** and first and second vanes **120,122** fixed to the sheath **24**. The vanes **120,122** are disposed to impel the sheath **24** in opposed first and anti-winding directions of rotation **34,36** about the axis **22**, respectively, in response to gas jets (not illustrated). Each jet is delivered by a nozzle **124,126** that opens toward a respective vane **120,122**. The nozzles **124,126** are joined by gas tubes **128** to the gas source **118**. Communications paths **116** connect the gas source **118**, sensor **116**, and drive **100** to the controller **108**. Vanes **120,122** can have a variety of shapes, as is known to those of skill in the art.

[**0077**] Referring now particularly to FIGS. **1-4** and **32**, in the quill strip winding method, the pinch quill **10** is placed in an operative position relative to a media supply **132**. The nature of the media supply **132** is not critical. The pinch quill **10** can wind a media strip **14** from roll or, a large or small spool. The spool can be unenclosed or covered by a housing. For convenience, the method is generally described, in the following, in terms of the embodiment shown in **FIG. 2**, but it will be understood that like considerations apply to other embodiments. In **FIG. 2**, the media supply **132** is a film cartridge **132***a* that is located in the film cartridge chamber **134** of a one-time use camera frame assembly **136**. The pinch quill **10** is inserted **(137)** into an operative position within a film roll chamber **138** of the camera frame assembly **136**. The camera frame assembly **136** has an open back and the film roll chamber **138** has an open end facing the drive **100**. Thus, the movement of the pinch quill **10** into the film roll chamber **138** can be axial or perpendicular to the axis **22**.

[**0078**] Within the film roll chamber **138**, the pinch quill **10** is disposed **(139)** in the first angular orientation. The pinch quill **10** can be pivoted to this orientation before or after placement in the film roll chamber **138** and can be left in the first angular orientation by the preceding cycle. If pivoting is needed, an air jet is directed against the first vane **120**, impelling the sheath **24** to rotate in a winding direction of rotation (indicated by arrow **34** in **FIG. 3**) until the slider **32** of the coupling **28** encounters the first stop **40**.

[**0079**] The end of the filmstrip **14** is advanced **(140)** out of the cartridge **132***a* to the quill **10**. This can be done by hand, but is preferably performed by automated equipment. For example, **FIG. 2** illustrates a vacuum belt **142** that drives the filmstrip **14***a* to the film roll chamber **138**. The vacuum belt **142** has a powered drive roller **144**, a series of idler rollers **146**, a vacuum source **147**, and an endless belt **148**. The vacuum source **147** lifts the filmstrip **14***a*, which is then advanced by the belt **148** to the opening of the film roll chamber **138**. A wide variety of equipment for this purpose and for other aspects of camera assembly is well known to those of skill in the art.

[**0080**] The end of the filmstrip **14***a* is then directed **(150)** in the gap **88** between the core **20** and sheath **24**. The directing can be manual, but is preferably automated by use of one or more guides **152** that urge the filmstrip into the gap **88**. Suitable guides for this purpose are well known to those of skill in the art. Guide **152**, shown in **FIG. 2**, and other components of the quill winder **106** are movable relative to the camera frame assembly and a support or transport system **154** in directions indicated by double-headed arrow **156**, as needed.

[**0081**] An air jet is next directed against the second vane **122**. The blowing of the air jet against the vane **122** impels the sheath **24** to pivot **(158)** in the anti-winding direction of rotation (indicated by arrow **36** in **FIG. 3**) toward the second angular orientation. If the strip end is present in the gap **88**, then the sheath **24** closes against the strip **14** and the core and sheath assume the intermediate angular orientation. The end of the strip is clamped by the grip portion and the chock sector. If an error has occurred and the strip **14** is not present in the gap **88**, then the sheath **24** continues to rotate until the slider **32** of the coupling **28** encounters the second stop **42**. This rotation can be detected **(160)** by the sensor **112** to generate **(162)** an error signal to the controller which can initiate further action.

[**0082**] The sheath **24** is next rotated **(164)** with the core **20**, in the winding direction of rotation, until the strip **14** forms a coil **166**. When winding is finished, an air jet is directed against the first vane **120** impelling the sheath **24** to pivot **(168)**, relative to the core **20**, in the anti-winding direction of rotation until the pinch quill **10** releases from the strip **14**. The filmstrip **14***a* is resilient and clock-springs radially outward to the limits of the film roll chamber **138** or other housing, when the pinch quill **10** releases from the strip **14**. The filmstrip remains in a loose coil. The end of the filmstrip **14***a* may or may not remain in the gap **88** depending upon factors including the length and resilience of the film and the extent of clock-springing. The pinch quill **10** is then removed **(170)** from the coil **166** in an axial direction through the end-opening **104**. The camera frame assembly **136** is then closed **(173)** light-tightly by placing a back **172** (indicated by dashed line in **FIG. 2**) over the chambers.

[**0083**] Referring now particularly to FIGS. **24-31**, the pinch spool **12** has the core **20**, sheath **24**, and coupling **28** above-described and one or more support rims **174**. The support rim or rims **174** are annular in shape. The pinch spool **12** forms a spool-media unit **92** with the media strip **14** gripped by the pinch spool **12**. The spool-media unit **92** can also include a housing **178** that holds and supports the pinch spool **12** and media **14**. The support rim or rims **174** bear against the housing **178** so as to permit rotation of the spool **12** relative to the housing **178**. The housing **178** is preferably shaped so as to closely adjoin the support rim or rims **174** such that the support rim or rims **174** hold the spool **12** in position within the housing **178**. In preferred embodiments, the media is film and the housing **178** is a body **178***a* of a one-time use camera **180** or the canister **178***b* of a film cartridge **182**.

[**0084**] Each support rim **174** is part of a hub **184** or part of a flange **186**, that is fixed to either the core **20** or the sheath **24** and is offset from the slot **26**. Each support rim **174** is preferably an external circumference and longitudinally spaced apart from the slot **26** to protect the media strip

14 from possible misalignment against the support rim **174**. It is preferred that each support rim **174** has a maximum radial dimension that is larger or smaller than a maximum radial dimension of the outer face **66** of the sheath **24**. This allows interspacing with sections of the housing so as to hold the pinch spool **12** in position, while at the same time blocking media from jamming between the pinch spool **12** and the housing **178**. The interspacing can also be readily configured to provide a light lock for light sensitive media.

[**0085**] In FIGS. **24-25** and **28-29**, the pinch spool **12** has primary and secondary flanges **186***a*,**186***b* that are joined directly to opposite ends of the sheath **24**. Each flange **186** has a circumferential support rim **174**. In FIGS. **28-29**, the housing is a film cartridge canister **178***b* and the support rims **174** of the flanges **186** bear on the sidewall **188** of the canister **178***b*.

[**0086**] In FIGS. **26-27**, the pinch spool **12** has primary and secondary hub **184***a*,**184***b* that are directly connected to opposite ends of the sheath **24**. Primary and secondary flanges **186***a*,**186***b* are joined to respective hubs **184***a*,**184***b*, in spaced relation to the sheath **24**. Each hub **184** and each flange **186** has a circumferential support rim **174**. The housing is a one-time use camera body **178***a*. The support rims **174** or the hubs **184** bear on abutments **190** of the body **178***a*. The support rims **174** of the flanges **186** do not contact the body **178***a*. By changing dimensions of the body **178***a* or other housing **178**, support could be provided at all of the support rims **174**, or by a single support rim **174** at one end, or by some combination of hub and flange support rims. The embodiment shown in FIGS. **26-27** provides good support without excessive friction and also provides a light-lock at the axial ends of the pinch spool **12**.

[**0087**] The spool-media unit **92** is used with a spool winder **192** to wind a media strip **14** from a media supply **132**, such as a large or small cartridge, or spool, or roll, onto the pinch spool **12**. The spool winder **192** has a drive **100** that rotates a rotary tool **194**, which rotates to wind the media strip **14**, and a pivot tool **196**, which provides for relative pivoting of the sheath **24** as to the core **20**. The rotary tool **194** can take a variety of forms. For example, the rotary tool **194** can be a driven wheel (not shown) that frictionally engages the surface or edge of one of the flanges **186**. This approach is unsuitable for embodiments of the spool-media unit **92** in which access to flanges **186** is blocked by the housing **178** prior to film winding onto the pinch spool **12**. In such embodiments, it is preferred that the rotary tool **194** is a spindle **194***a* that is positioned concentric with the longitudinal axis **22** and that the end of the pinch spool **12** is exposed through the housing **178**.

[**0088**] The pinch spool has a spindle seat **198**. The end of the spindle **194***a* and the spindle seat **198** have complementary shapes that provide for a non-slip transfer of rotational force. In FIGS. **25-26**, the end of the spindle **194***a* is shaped like a screwdriver bit and the spindle seat **198** has the shape of a corresponding socket.

[**0089**] The spindle seat **198** is fixed to the sheath **24** or, preferably, is fixed to the core **20**. In FIGS. **15-16**, the spindle seat **198** is continuous with the core **20** and the primary flange **186***a*. In FIGS. **17-18**, the spindle seat **198** is continuous with the coupling **28** and core **20**. In both cases, the spindle seat **198** surrounds a blind cavity that is light-tight relative to a media strip **14** held by the core **20** and sheath **24**. The housing **178** can have an opening **200**, through which the spindle seat **198** is exposed, as shown in **FIG. 27**. The opening **200** can be covered, when unneeded by a label (not shown) or other structure.

[**0090**] Referring now to FIGS. **28-29**, the pinch spool **12** can have a spindle seat **198** at either end. This is useful if access is needed to both ends of the pinch spool **12**. For example, such a pinch spool **12** could be useful with two different spool winders **192** having opposite directions of rotation. This can also be useful where the pinch spool **12** is part of film cartridge or other spool-media unit **92** that has a handedness. The two spindle seats **198** can have the same configuration or can differ.

[**0091**] The spool winder **192** provides a means for relative pivoting the core **20** and sheath **24**. This can be done by holding the sheath **24** in place, while the core **20** is pivoted, or pivoting the sheath **24** while holding the core **20** in place. In either case, the sheath **24** is readily accessible and can be gripped or otherwise engaged by a wide variety of tools. In particular embodiments, the pinch spool **12** has a pivot tool seat **202** fixed to the sheath **24**. The pivot tool seat **202** is spaced radially from the spindle seat **198** and longitudinally from the slot **26**, and is preferably spaced radially from the support rims **174**. The pivot tool seat **202** is shaped to match a particular pivot tool **196**. Referring to FIGS. **15-16**, the pivot tool **196** is a hollow, cylindrical tube that rotates with the spindle **194***a*, except during pivoting. The tube has a flattened end that engages a matching flat portion of the surface of the primary flange **186***a*. Referring to FIGS. **17-18**, the pivot tool **196** is a small pin that extends through an opening **204** in the housing **178** and engages the matching pivot tool seat **202** in the primary flange **186***a*, to hold the sheath **24** in place while the core **20** is pivoted.

[**0092**] Referring now to **FIG. 31, a** one-time use camera **180** includes the pinch spool **12** and strip **14** of film coiled about the pinch spool **12** in a film roll chamber **138**. The filmstrip **14***a* extends from the film roll chamber **138** across an exposure frame **208** to the canister **210** of a cartridge **212** within a film cartridge chamber **134**. The cartridge **212** holds the filmstrip **14***a*, but may or may not be a spool-media unit **92**. The body **178***a* of the camera **180** includes an exposure system **214** that has a lens **216** and baffle **218** that direct light to the exposure frame **208**, and an advance mechanism **220** (represented as a box) that moves the film from frame-to-frame for exposure. The camera **180** can include other components **222**, such as a flash board, well known to those of skill in the art. The camera components are held by a frame **224** and enclosed within front and back **226**,**172**. The end of the pinch spool **12** can be exposed through the camera body **178***a* in the same manner as shown in **FIG. 18**.

[**0093**] As shown in **FIG. 31**, in the completed camera **180**, the core **20** and sheath **24** of the pinch spool **12** are in the first angular orientation and the filmstrip **14***a* is not gripped by the pinch spool **12**. This allows a user to advance the entire filmstrip **14***a* out of the film roll chamber **138**, during use. The film can then be removed from the camera **180** for processing, without doing anything to the pinch spool **12**. **FIG. 31** illustrates the filmstrip **14***a* as a short spiral of spaced apart turns having an end disposed within the gap **88** between the sheath **24** and core **20**. This is diagrammatical. The filmstrip **14***a* is resilient and thus is sprung outward, within the film roll chamber **138**, away

from the pinch spool **12**. The end of the filmstrip **14***a* may or may not be present in the gap **88**; in either case, the end of the filmstrip **14***a* is freely separable from the pinch spool **12** and the film roll chamber **138**. The pinch spool **12** does not rotate during camera use. The pinch spool **12** may guide the filmstrip **14***a* to some extent, but is otherwise non-functional during picture-taking.

[**0094**] In the spool winding method, a pinch spool **12** is first lodged **(230)** in a housing **178**, such as the film roll chamber **138** of a one-time use camera **180**. The spool **12** is disposed in operative relation to a media supply **132**. As with the quill winding method, the nature of the media supply **132** is not critical. It is preferred that the media supply **132** is a film cartridge **212** disposed within the film cartridge chamber **134** of the one-time use camera frame assembly **136** opposite the film roll chamber **138**. The camera frame assembly **136** has an open back.

[**0095**] Within the film roll chamber **138**, the pinch quill **10** is disposed **(232)** in the first angular orientation. The pinch quill **10** can be in the first angular orientation when lodged in the film roll chamber **138** or can be pivoted to this orientation after placement in the film roll chamber **138**. Relative pivoting of the core **20** and sheath **24** can be accomplished in any manner. In a particular embodiment shown in **FIG. 30**, the spindle **194***a* is connected to the spindle seat **198** and the pivot tool **196** is connected to the pivot tool seat **202**. The pivot tool **196** holds the sheath **24** in place while the core **20** is pivoted in the anti-winding direction of rotation until the first angular orientation is achieved.

[**0096**] The end of the filmstrip **14** is advanced **(234)** out of the cartridge **212** to the spool **12** and directed **(236)** into the gap between the core **20** and sheath **24**. This can be done by hand, but is preferably performed by automated equipment, such as a vacuum belt **142** and guide **152**. **FIG. 2** illustrates such equipment. (The quill, quill drive, and pivoter shown in **FIG. 2** would be eliminated in this usage.)

[**0097**] The core **20** and sheath **24** of the pivot spool **12** are next relatively pivoted **(238)** toward the second angular orientation until the core and sheath assume an intermediate angular orientation and the end of the filmstrip is gripped between the grip portion and chock sector. In the embodiment of **FIG. 30**, the pivot tool **196** holds the sheath **24** in place while the core **20** is pivoted in the winding direction of rotation until the intermediate angular orientation is achieved. As in the quill winding method, if an error has occurred and the strip **14** is not present in the gap **88**, then the sheath **24** continues to rotate until the slider **32** of the coupling **28** encounters the second stop **42** and assumes the second angular orientation. This rotation can be detected **(240)** by the sensor **112** to generate **(241)** an error signal to the controller **108** which can initiate further action. The sensor **112** can operate in any of a variety of ways, such as detecting over-rotation of the core **20** or the presence of a notch or other mark **114**. With a closed camera, it may be more practical to detect the position of the slider (see, for example, the positions of the slider and sensor in **FIGS. 27 and 30**).

[**0098**] The camera can be light-tightly closed **(242)** at this time or operations can be continued in a darkroom. The light-tightly closed camera has an exposed spindle seat **198** and pivot tool seat **202**. (See, for example, **FIG. 27**) For example, a back **172** can be assembled with the camera frame assembly to light-tightly close the camera. The spindle and pivot tool can be withdrawn and the camera can be moved to a lighted environment in which a spindle and pivot tool can again be connected to the respective seats.

[**0099**] The core **20** is next rotated **(244)** in the winding direction of rotation. The filmstrip **14***a* end acting on the sheath **24** causes the sheath **24** to rotate along with the core **20**. Rotation is continued until the filmstrip **14***a* is wound into a coil.

[**0100**] The core **20** and sheath **24** are next relatively pivoted **(246)** to the first angular orientation. In the embodiment of **FIG. 30**, the sheath **24** is held in place by the pivot tool **196** and the core **20** is pivoted relative to the sheath **24** in the winding direction of rotation. This alters the core **20** and sheath **24** from the intermediate angular orientation to the first angular orientation and releases the end of the filmstrip **14***a* from the core **20** and sheath **24**. The filmstrip **14***a* coil clock-springs outward. The filmstrip remains coiled loosely around the spool between the flanges. The spindle **194***a* and pivot tool **196** are removed. The spindle seat **198** and pivot tool seat **202** can be left exposed during camera usage or can be covered by a label or the like.

[**0101**] The invention has been described in detail with particular reference to certain preferred embodiments thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention.

What is claimed is:

1. A media strip winding method comprising the steps of:

placing an end of a strip in a gap between a core and a sheath, said gap loosely receiving said end;

pivoting said sheath, relative to said core, in an anti-winding direction of rotation until said sheath closes against said end;

following said pivoting, rotating said sheath with said core in a winding direction of rotation opposite said anti-winding direction of rotation, until said strip forms a coil;

pivoting said sheath, relative to said core, in said winding direction of rotation until said sheath releases from said strip; and

removing said core and said sheath from said coil in an axial direction.

2. The method of claim 1 further comprising prior to said placing, inserting said core and sheath into a camera film chamber.

3. The method of claim 2 further comprising, following said removing, light-tightly closing said camera.

4. The method of claim 3 wherein said pivoting steps each further comprise blowing against one of a pair of vanes joined to said sheath until said sheath rotates in the respective said direction of rotation.

5. The method of claim 1 wherein said pivoting steps each further comprise blowing against one of a pair of vanes joined to said sheath until said sheath rotates in the respective said direction of rotation.

6. The method of claim 1 further comprising closing said gap during said pivoting of said sheath in said anti-winding direction of rotation.

7. The method of claim 1 wherein said gap is between a flat face of said core and an inner wall of said sheath.

8. The method of claim 1 further comprising, prior to said placing, inserting said end of said strip through a throat of said sheath into said gap.

9. The method of claim 1 further comprising, during said rotating, gripping said end of said strip between an inner wall of said sheath and a sector of said core.

10. The method of claim 1 further comprising, during said rotating, gripping said end of said strip between a grip surface of an inner wall of said sheath and a chock sector of said core, said said inner wall having a support surface defining a cylindrical core space, said grip surface being radially spaced from said core space.

11. The method of claim 10 wherein said core has a recess sector adjoining said chock sector and said chock sector has a greater radial dimension than said recess sector.

12. The method of claim 11 wherein said recess sector has a flat face and said chock sector has an arcuate face.

13. The method of claim 1 wherein said strip is a filmstrip.

14. The method of claim 1 following said pivoting of said sheath in said winding direction of rotation, blocking further pivoting in said winding direction.

15. A media strip winding method comprising the steps of:

placing an end of a strip in a gap between a core and a sheath, said gap loosely receiving said end;

pivoting said sheath, relative to said core, in an anti-winding direction of rotation until said gap closes against said end at a pinch point between an inner wall of said sheath and a sector of said core;

following said pivoting, rotating said sheath with said core in a winding direction of rotation opposite said anti-winding direction of rotation, until said strip forms a coil;

pivoting said sheath, relative to said core, in said winding direction of rotation until said sheath releases from said strip; and

removing said core and said sheath from said coil in an axial direction.

16. The method of claim 15 wherein said gap is between a flat face of said core and an inner wall of said sheath.

17. The method of claim 15 wherein said pivoting steps each further comprise blowing against one of a pair of vanes joined to said sheath until said sheath rotates in the respective said direction of rotation.

18. The method of claim 17 further comprising, prior to said placing, inserting said core and sheath into a camera film chamber and, following said removing, light-tightly closing said camera.

19. The method of claim 15 further comprising, during said rotating, gripping said end of said strip between a grip surface of an inner wall of said sheath and a chock sector of said core, said said inner wall having a support surface defining a cylindrical core space, said grip surface being radially spaced from said core space, said core having a recess sector adjoining said chock sector, said chock sector having a greater radial dimension than said recess sector.

20. A media strip winding method comprising the steps of:

placing an end of a strip in a gap between a flat face of a core and an aligned grip surface of an inner wall of a sheath, said gap loosely receiving said end;

pivoting said sheath, relative to said core, in an anti-winding direction of rotation until said end is pinched between said grip surface and an arcuate chock sector of said core, said chock sector adjoining a recess sector having said flat face;

following said pivoting, rotating said sheath with said core in a winding direction of rotation opposite said anti-winding direction of rotation, until said strip forms a coil;

pivoting said sheath, relative to said core, in said winding direction of rotation until said sheath releases from said strip; and

removing said core and said sheath from said coil in an axial direction.

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