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(54) **ACTUATING DEVICE FOR ACTUATING A CABLE**

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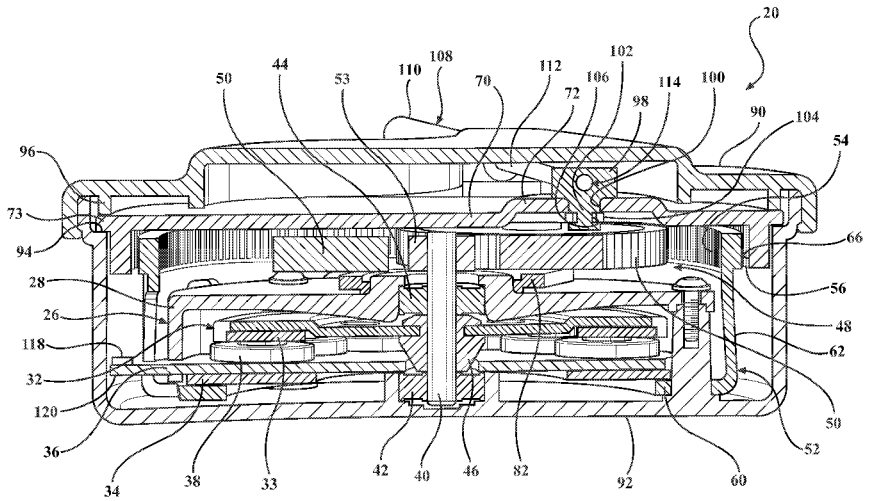
(57) **ABSTRACT**

The invention provides an actuating device for actuating a cable. The actuating device comprises a housing defining an interior and a motor assembly including a shaft. The actuating device also comprises at least two planetary gears and a flex gear having an inner surface and an outer surface with the inner surface partially engaged with the planetary gears. The actuating device additionally comprises an output member having a drive portion and a mounting interface with the drive portion engaged with a section such that the output member is rotatable relative to the housing when the shaft rotates. The actuating device additionally comprises a connector coupled to the mounting interface for securing the cable to the mounting interface. The connector moves relative to the housing and in unison with the output member during the rotation of the output member for activating the cable during operation of the actuating device.

18 Claims, 8 Drawing Sheets



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H02K 7/116 (2006.01)
B60N 2/20 (2006.01)

(58) **Field of Classification Search**
USPC 74/640; 475/149, 182
See application file for complete search history.

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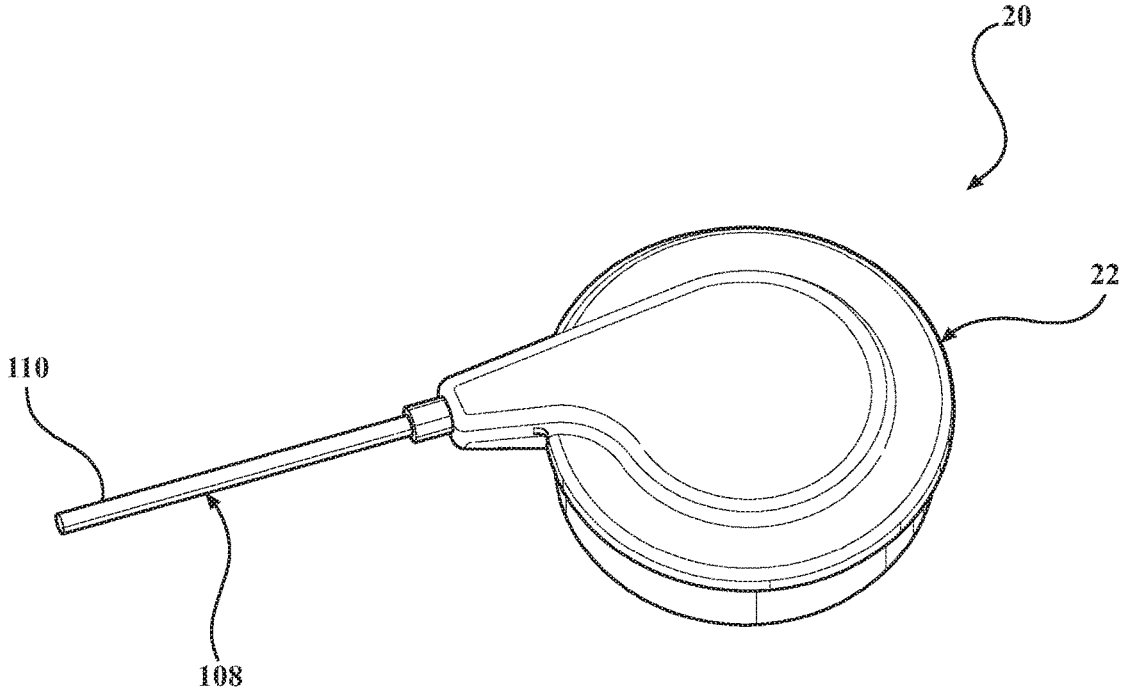

FIG. 1

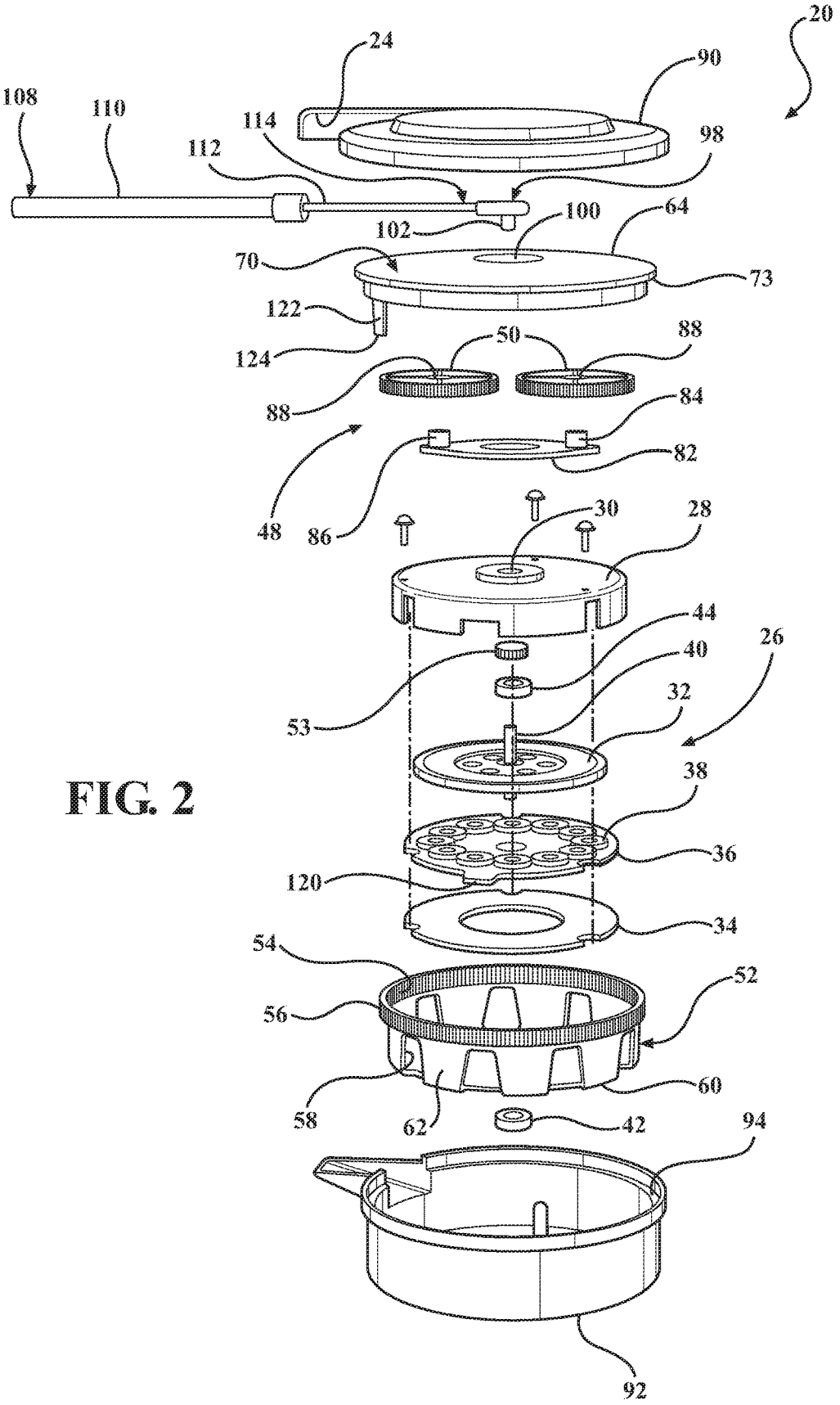
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FIG. 2

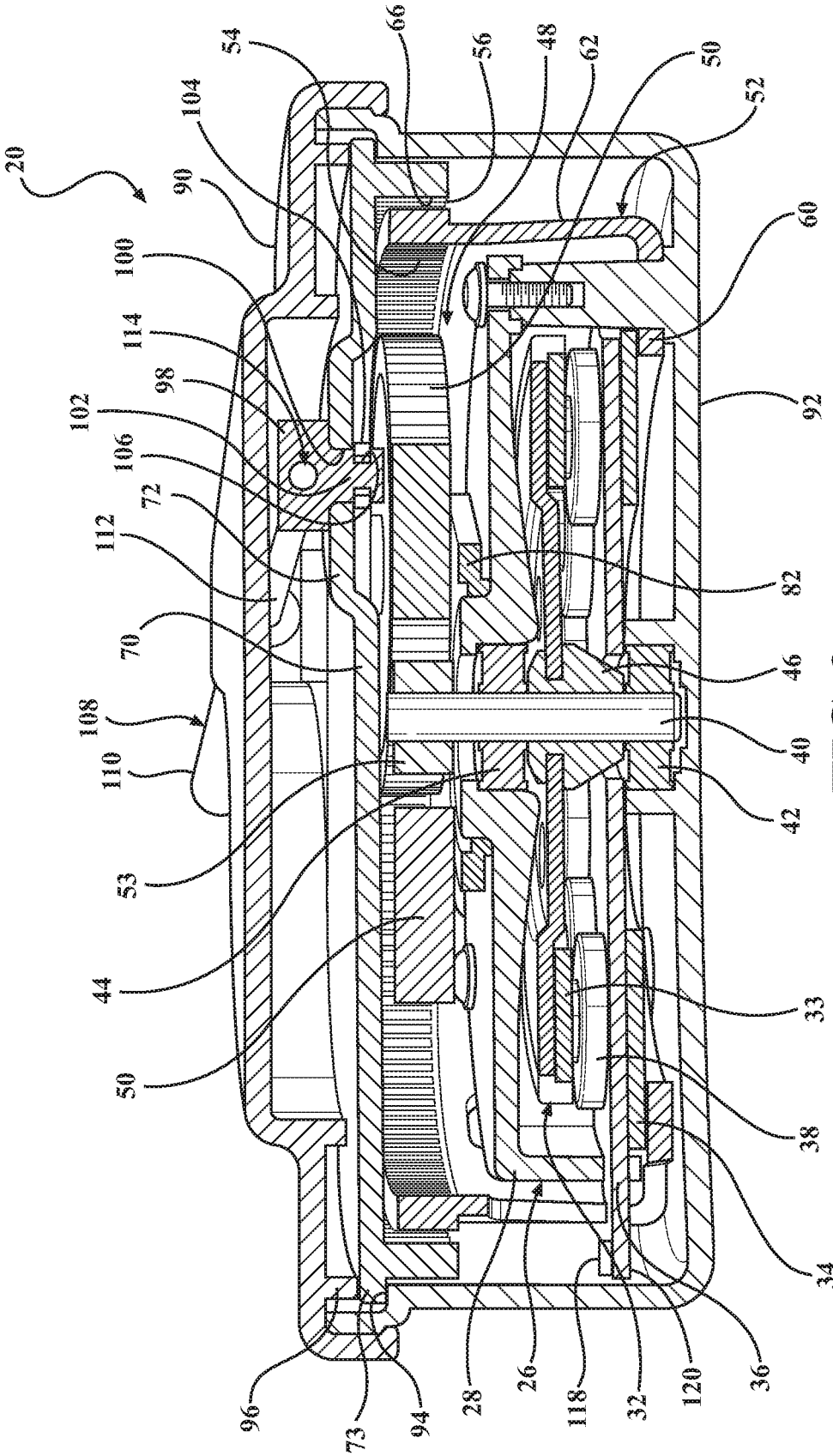
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FIG. 3

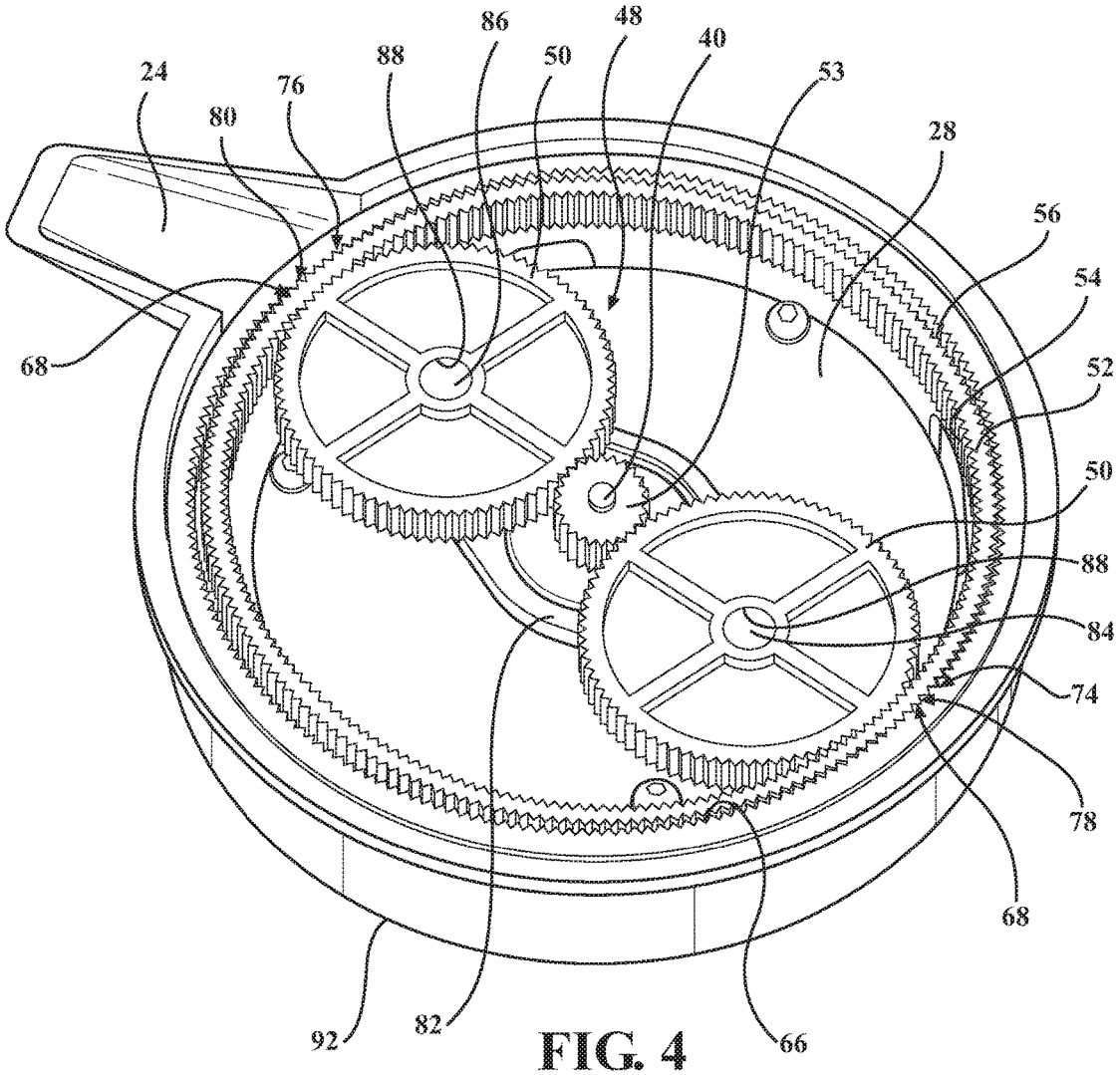

FIG. 4

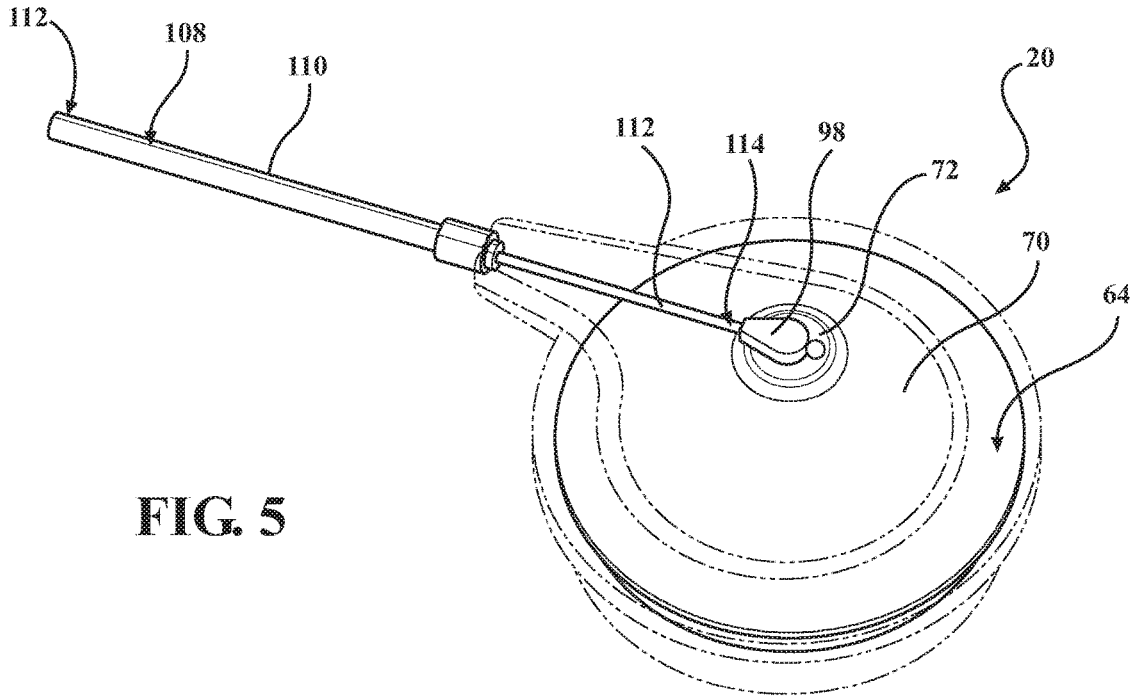
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FIG. 5

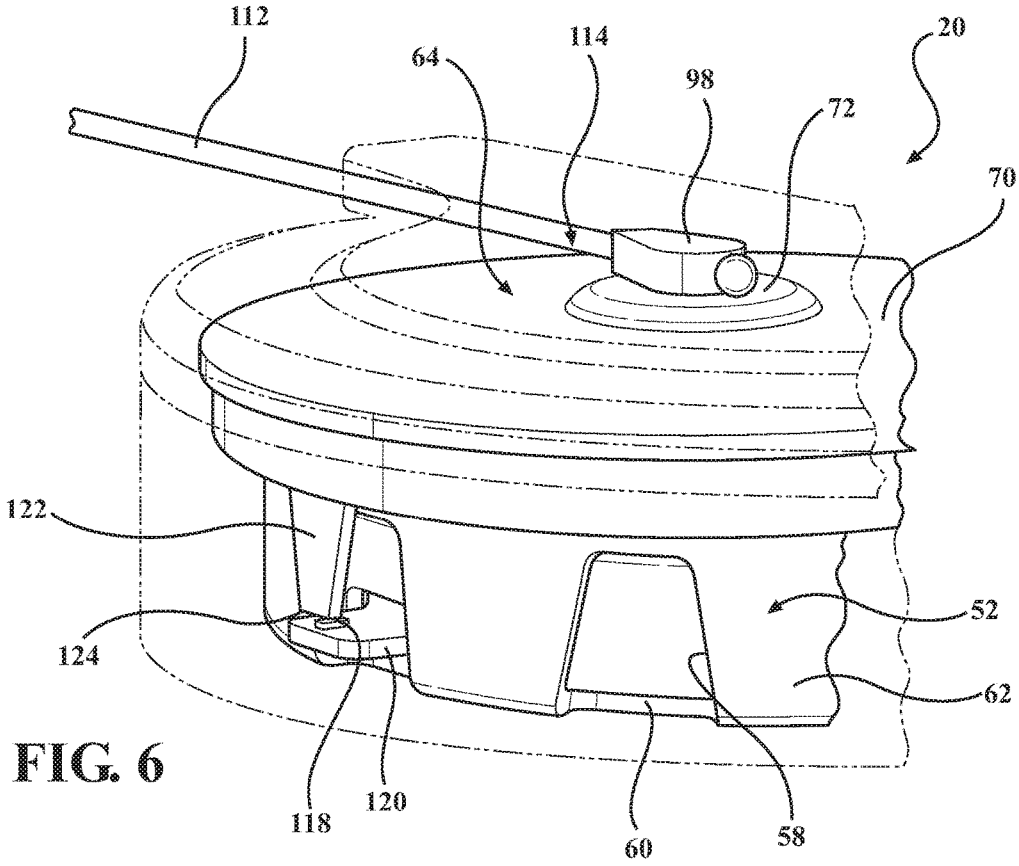
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FIG. 6

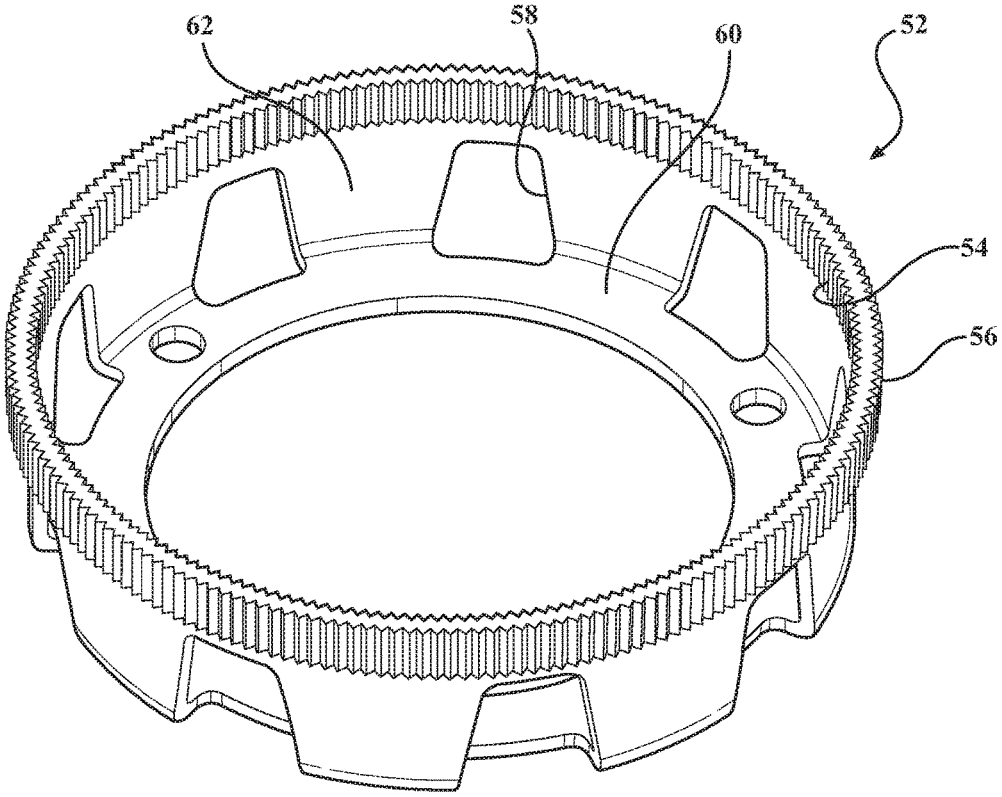

FIG. 7

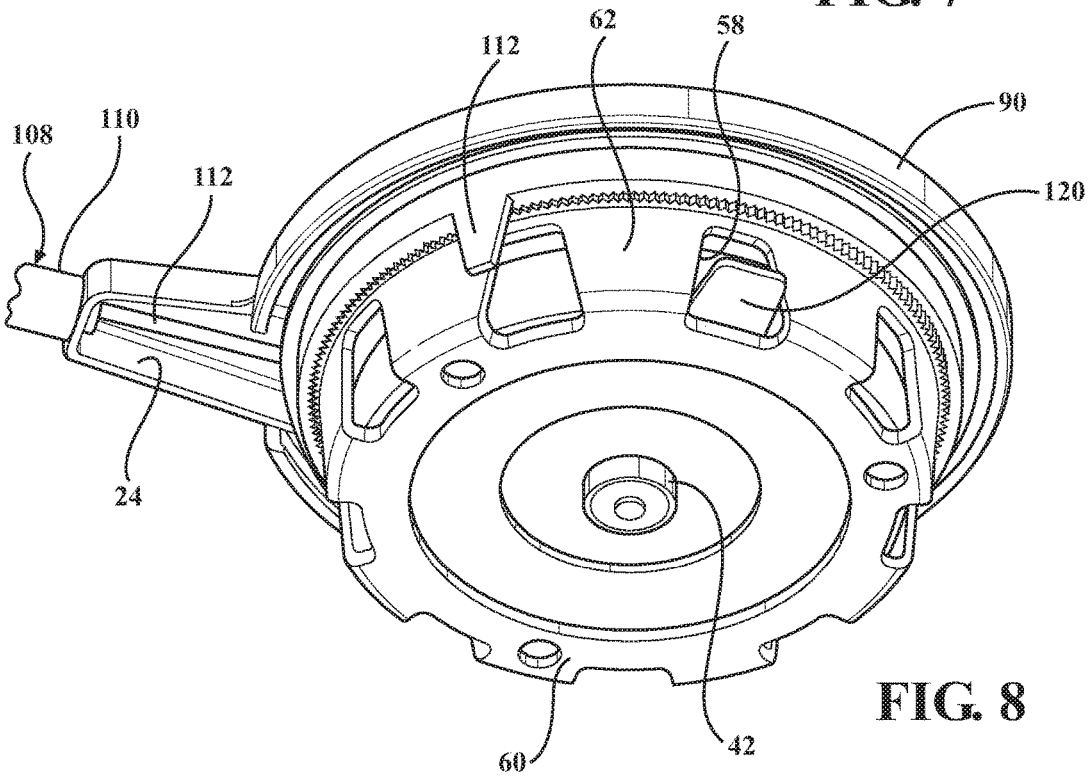

FIG. 8

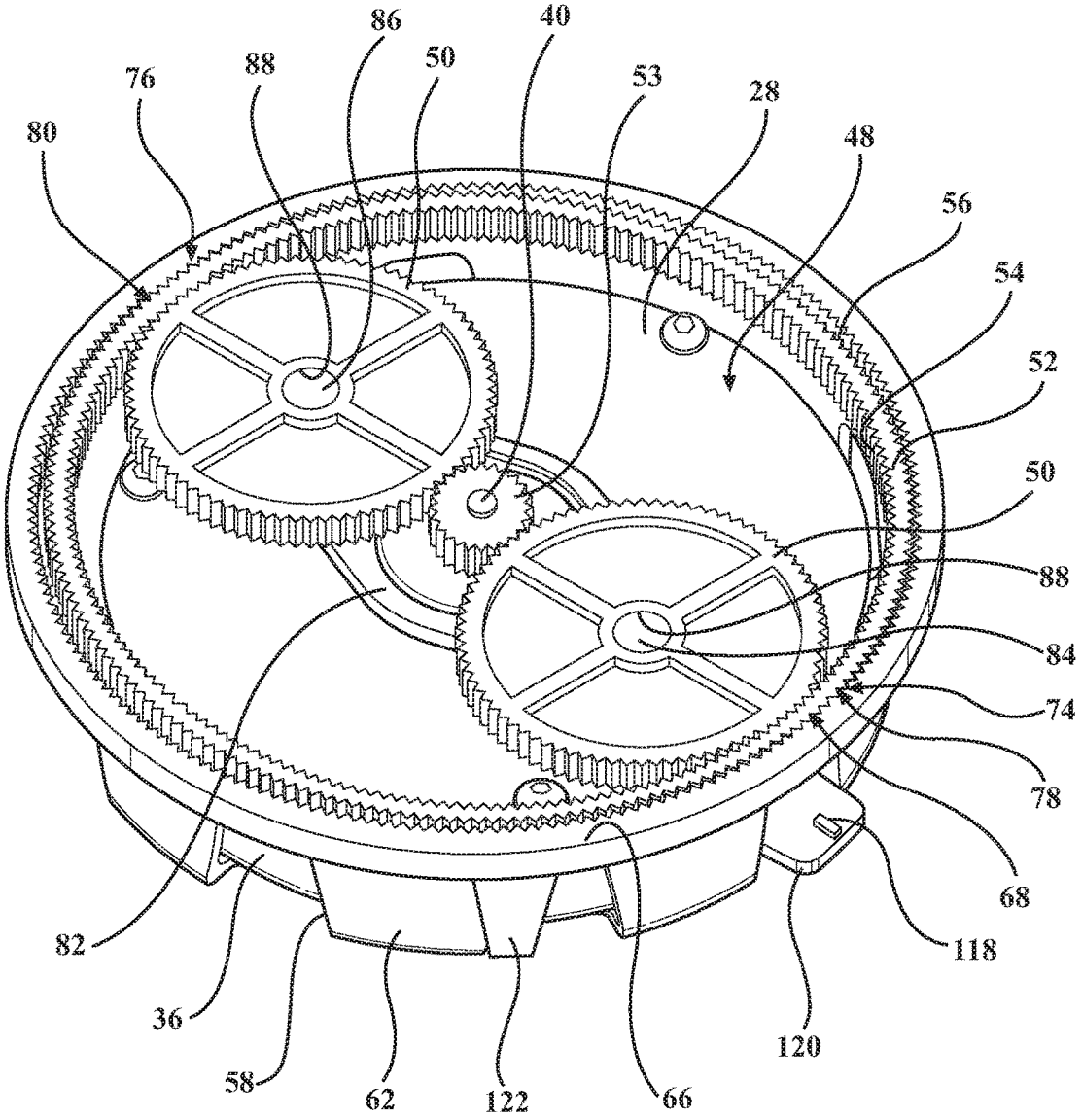
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FIG. 9

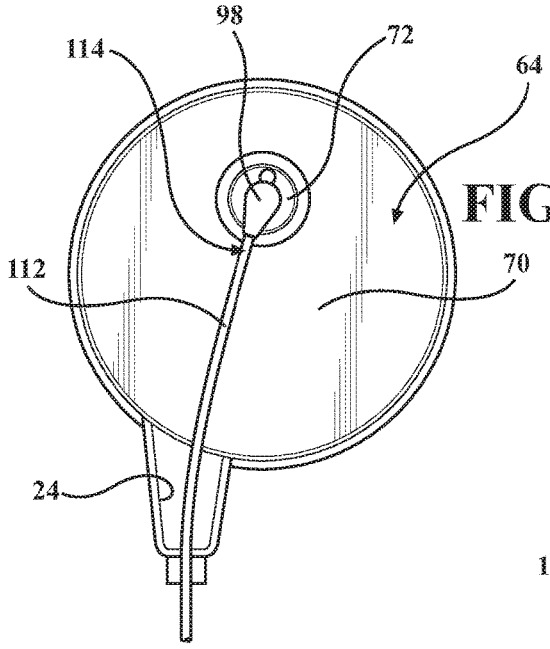

FIG. 10

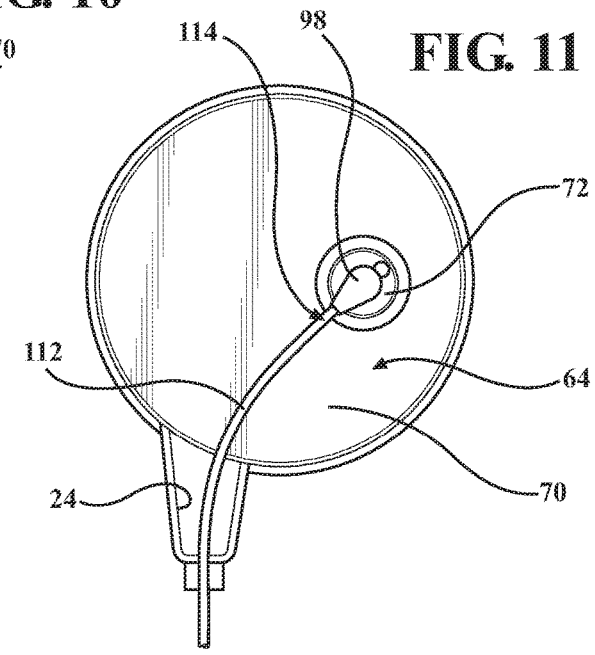

FIG. 11

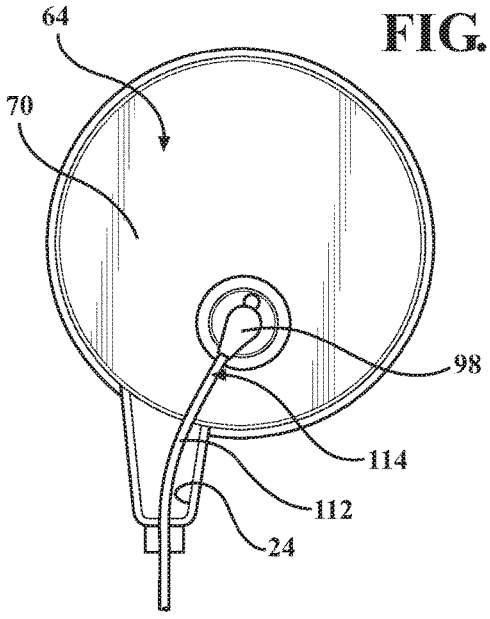

FIG. 12

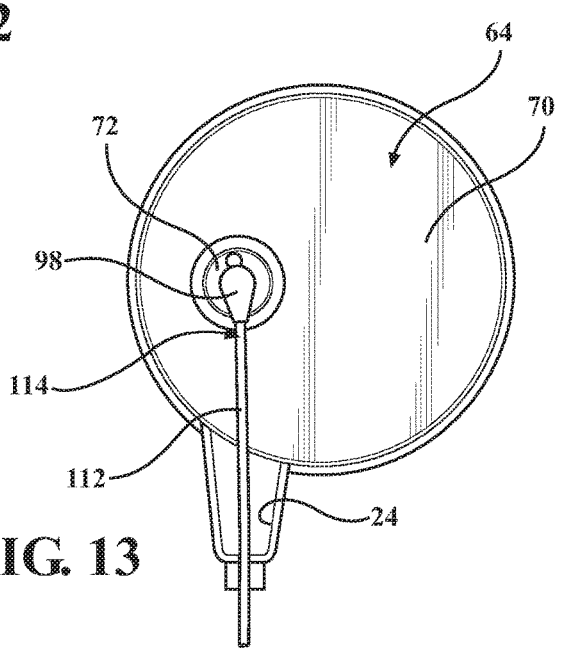

FIG. 13

ACTUATING DEVICE FOR ACTUATING A CABLE

The subject patent application is the National Stage of International Patent Application No. PCT/IB2014/065882, filed Nov. 7, 2014, the content of which is incorporated herein by reference in its entirety.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention generally relates to an actuating device for actuating a cable.

2. Description of the Related Art

Various actuating devices have been developed for actuating, releasing, moving, and/or adjusting various components. For example, actuating devices may be utilized in various environments, such as vehicle interiors. Actuating devices may be utilized to provide for powered releasing of locks, latches, and/or other similar components. Actuating devices may be located at a distance away from the lock, latch, and/or other similar component. A cable may be utilized to couple the actuating device to the lock, latch, and/or other similar component.

SUMMARY OF THE INVENTION AND ADVANTAGES

The invention provides an actuating device for actuating a cable. The actuating device comprises a housing defining an interior and a motor assembly including a shaft with the motor assembly disposed within the interior of the housing. The actuating device also comprises at least two planetary gears disposed within the interior of the housing with the at least two planetary gears coupled to the motor assembly. The actuating device further comprises a flex gear disposed within the interior of the housing with the flex gear having an inner surface and an outer surface with the inner surface partially engaged with the planetary gears. The actuating device additionally comprises an output member at least partially disposed within the interior of the housing. The output member has a drive portion and a mounting interface with the drive portion engaged with a section of the outer surface of the flex gear such that the output member is rotatable relative to the housing when the shaft of the motor assembly rotates. The actuating device additionally comprises a connector coupled to the mounting interface of the output member for securing the cable to the mounting interface with the connector moving relative to the housing and in unison with the output member during the rotation of the output member for activating the cable during operation of the actuating device.

The invention further provides an actuating device for actuating a cable. The actuating device comprising a housing defining an interior and a motor assembly including a shaft with the motor assembly disposed within the interior of the housing. The actuating device also comprises a gear system disposed within the interior of the housing with the gear system coupled to the motor assembly. The actuating device further comprises an output member at least partially disposed within the interior of the housing with the output member engaged with the gear system and rotatable relative to the housing during operation of the motor assembly. The actuating device additionally comprises a cable having a conduit and a core wire moveable within the conduit between a retracted position and an extended position with the core wire having first and second opposing ends. The actuating device also comprises a connector coupled to the output member with the first end of the cable coupled to the connector and moveable 360 degrees during the rotation of the output member to define an actuating cycle with the connector having a first location corresponding to the retracted position of the core wire and a second location corresponding to the extended position of the core wire with the first location approximately 180 degrees from the second location with the core wire moving between the retracted and the extended positions during said actuating cycle.

BRIEF DESCRIPTION OF THE DRAWINGS

Other advantages of the present invention will be readily appreciated, as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings.

FIG. **1** is a perspective view of the actuating device.

FIG. **2** is an exploded view of the actuating device.

FIG. **3** is a cross-sectional view of the actuating device.

FIG. **4** is a top perspective view of the actuating device with a first half of a housing removed and a mounting interface of an output member removed.

FIG. **5** is a perspective view of the actuating device with the first half of the housing shown in phantom and a second half of the housing shown in phantom.

FIG. **6** is a side perspective view of the actuating device with both halves of the housing shown in phantom.

FIG. **7** is a perspective view of a flex gear.

FIG. **8** is a bottom perspective view of the actuating device with the second half of the housing removed.

FIG. **9** is a perspective view of the actuating device with a cable removed, the first and second halves of the housing removed, and the mounting interface removed.

FIG. **10** is a top view of the actuating device with the cable in an extended position.

FIG. **11** is a top view of the actuating device with output member rotated 90 degrees from the extended position.

FIG. **12** is a top view of the actuating device with the output member rotated 180 degrees from the extended position and with the cable in a retracted position.

FIG. **13** is a top view of the actuating device with the output member rotated 270 degrees from the extended position.

DETAILED DESCRIPTION OF THE INVENTION

With reference to the Figures, wherein like numerals indicate like parts throughout the several views, an actuating device **20** for actuating a cable is shown. The actuating device **20** is typically used in a vehicle for actuating a lock, a latch, or another similar component. The vehicle may include a seat having a seat bottom and a backrest extending from the seat bottom. The lock, the latch, or the other similar component is typically coupled to the seat used to release a seat-back latch. Typically, releasing the seat-back latch actuates a vehicle seat from an upward position to a stowage position. More specifically, the vehicle seat may have a seat bottom and a backrest with the backrest collapsing toward the seat bottom when the actuating device actuates the cable.

With reference to FIGS. **1-3**, the actuating device **20** includes a housing **22** defining an interior. The housing **22** defines an aperture **24** with the aperture **24** extending

outwardly from the interior of the housing **22**. The actuating device **20** also includes a motor assembly **26** disposed within the interior of the housing **22**. In one embodiment of the invention, and as shown throughout the Figures, the motor assembly **26** is a pancake motor. Pancake motors, as known in the art, provide for a compact motor assembly having a high power density and a high gear ratio, which provides the pancake motor with high torque due a high number of gear teeth being engaged. Pancake motors also reduce backlash and allow for rapid start-stop times. It is to be appreciated that the motor assembly **26** may be any type of motor without departing from the nature of the present invention. It is to be appreciated that the motor assembly **26** may have an axial oriented magnetic field or a radial oriented magnetic field without departing from the nature of the present invention.

The actuating device **20** also includes a casing **28** having an interior with the casing **28** disposed within the interior of the housing **22**. The motor assembly **26** is disposed within the interior of the casing **28**. The casing **28** defines a hole **30**. The motor assembly **26** further includes a rotor **32**, a flux plate **34**, and a printed circuit board **36** disposed within the interior of the casing with the printed circuit board **36** disposed between the rotor **32** and the flux plate **34**. More specifically, the rotor **32**, the flux plate **34**, and the printed circuit board **36** are disposed adjacent one another with the rotor **32** disposed between the printed circuit board **36** and the casing **28**, and with the flux plate **34** disposed between the housing **22** and the printed circuit board **36**.

The rotor **32** has a plurality of alternatively polarized magnets **33**. The printed circuit board **36** has a plurality of coils **38**, as best shown in FIGS. **2** and **3**. The plurality of coils **38** creates a magnetic field when supplied with a current, which, in turn, causes the rotor **32** to rotate, as described in further detail below. The flux plate **34** concentrates the magnetic field created by current in the plurality of coils **38** of the printed circuit board **36**. The concentration of the magnetic field causes a stronger magnetic field to be created around the rotor **32** in order to cause the rotor **32** to rotate with respect to the housing due to the plurality of alternatively polarized magnets **33**.

The motor assembly **26** includes a shaft **40**. In one embodiment, the shaft **40** extends from the housing **22** through the hole **30** of the casing **28**. The shaft **40** is coupled to the rotor **32** of the motor assembly **26**. The motor assembly further includes a first bearing **42** and a second bearing **44**. The first bearing **42** abuts the printed circuit board **36** and is coupled to the shaft **40**. The second bearing **44** abuts the casing **28** and is coupled to the shaft **40**. The motor assembly also includes a coupler **46** disposed within the interior of the casing **28**. The coupler **46** is mounted to and disposed between the rotor **32** and the shaft **40** such that rotation of the rotor **32** transmits rotational motion to the shaft **40** during operation of the actuating device **20**. More specifically, the rotor **32**, the coupler **46**, and the shaft **40** rotate in unison when current is supplied to the plurality of coils **38**.

In one embodiment, the actuating device **20** includes a gear system **48** disposed within the interior of the housing **22** with the gear system **48** coupled to the motor assembly **26**. The gear system **48** translates rotational motion from the motor assembly **26** to actuate the seat-back latch, as described in further detail below. The gear system **48** may comprise of any arrangement of gears without departing from the nature of the present invention.

In another embodiment, the gear system **48** is further defined as including at least two planetary gears **50**, a flex gear **52**, and an output member **64**. The planetary gears **50** are disposed within the interior of the housing **22**. The planetary gears **50** are coupled to the motor assembly **26** such that rotational motion is translated from the motor assembly **26** to the planetary gears **50**, as described in further detail below. The gear system **48** also includes a pinion **53** engaged with the planetary gears **50**. The pinion **53** is coupled to the shaft **40** of the motor assembly **26** such that the pinion **53** translates rotational motion to the planetary gears **50** from the shaft **40**.

The flex gear **52** is disposed within the interior of the housing **22**. The flex gear **52** has an inner surface **54** and an outer surface **56** with the inner surface **54** partially engaged with the planetary gears **50**, as best shown in FIG. **4**. The flex gear **52** is made of an elastically deformable material. The flex gear **52** defines a plurality of voids **58**. The plurality of voids **58** of the flex gear **52** reduce the overall weight of the flex gear **52**, which, in turn, reduces the overall weight of the actuating device **20**. The flex gear **52** has a base **60** and a gear wall **62**. The base **60** of the flex gear **52** is rigidly fixed to the housing **22** such that the flex gear **52** does not rotate with respect to the housing **22** during rotation of the shaft **40** of the motor assembly **26**.

The gear wall **62** of the flex gear **52** has a rest state and an engaged state. The rest state of the gear wall **62** occurs when the gear wall **62** is disengaged from the planetary gears **50**. The engaged state occurs when the gear wall **62** is engaged with the planetary gears **50**. When the gear wall **62** of the flex gear **52** is in the engaged state, the gear wall **62** has a first diameter. When the gear wall **62** of the flex gear **52** is in the rest state, the gear wall has a second diameter. The second diameter of the gear wall **62** of the flex gear **52** is greater than the first diameter. As shown throughout the Figures, the gear wall **62** of the flex gear **52** is in the engaged state such that the gear wall **62** defines the second diameter. Due to internal stress of the elastically deformable material, the gear wall **62** of the flex gear **52** returns to the rest state when the planetary gears **50** are removed from the actuating device **20**.

The output member **64** is at least partially disposed within the interior of the housing **22**. The output member **64** has a drive portion **66** engaged with a section **68** of the outer surface **56** of the flex gear **52** such that the output member **64** is rotatable relative to the housing **22** when the shaft **40** of the motor assembly **26** rotates. The output member **64** also has a mounting interface **70**. The mounting interface **70** has a segment **72** elevated toward the housing **22**. The output member also has a ledge **73** extending from the mounting interface **70** about a perimeter of the drive portion **66**.

As best shown in FIG. **4**, the inner surface **54** of the flex gear **52** is further defined as a first area **74** and a second area **76**. The second area **76** is approximately 180 degrees from the first area **74** along the inner surface **54**. When the gear wall **62** of the flex gear **52** is in the engaged state, one of the planetary gears **50** is engaged with the first area **74** and the other one of the planetary gears **50** is engaged with the second area **76**. The section **68** of the outer surface **56** of the flex gear **52** is further defined as a first section **78** and a second section **80**. The first section **78** and the second section **80** are approximately 180 degrees apart from one another along the outer surface **56** of the flex gear **52**. The first area **74** of the flex gear **52** corresponds to the first section **78** of the outer surface **56**, and the second area **76** corresponds to the second section **80** of the outer surface **56**. Furthermore, both the first section **78** and the second section **80** of the outer surface **56** are engaged with the drive portion **66** of the output member **64**. The engagement of the first

section **78** and the second section **80** with the drive portion **66** defines the second diameter such that the gear wall **62** of the flex gear **52** remains in the engaged state during the operation of the actuating device **20**.

In order to help secure the planetary gears **50** with respect to the housing **22**, the actuating device **20** also includes a gear retainer **82** disposed within the interior of the housing **22**. Each of the planetary gears **50** are mounted to the gear retainer **82** such that each of the planetary gears **50** are rotatable relative to the housing **22** about the inner surface **54** of the flex gear **52** when the shaft **40** of the motor assembly **26** rotates. The gear retainer **82** abuts the casing **28**. The gear retainer **82** has a first cylinder **84** and a second cylinder **86** with the first cylinder **84** and the second cylinder **86** aligned linearly with the pinion **53**. Each of the planetary gears **50** define an opening **88** such that the first cylinder **84** extends through one of the openings **88** and the second cylinder **86** extends through the other one of the openings **88**. During operation of the actuating device **20**, one of the planetary gears **50** rotates about the first cylinder **84** and the other of the planetary gears **50** rotates about the second cylinder **86**. It is to be appreciated that the actuating device **20** may contain two or more planetary gears **50** without departing from the nature of the present invention. It is also to be appreciated that the gear retainer **82** may comprise zero or any number of cylinders without departing from the nature of the present invention.

The planetary gears **50** have first plurality of teeth, the outer surface **56** of the flex gear **52** has a second plurality of teeth, and the drive portion **66** of the output member **64** has a third plurality of teeth. The second plurality of teeth is greater than the first plurality of teeth and the third plurality of teeth is greater than the second plurality of teeth. The different plurality of teeth of the outer surface **56**, the flex gear **52**, and the drive portion **66** provides the gear system **48** with a high gear ratio.

To help with assembly and disassembly of the actuating device **20**, the housing may be further defined as a first half **90** of the housing **22** and a second half **92** of the housing **22** with the first half **90** of the housing **22** coupled to the second half **92** of the housing **22** to define the interior. More specifically, the first half **90** of the housing **22** is adjacent the output member **64**, and the second half **92** of the housing **22** is adjacent the flex gear **52**. The second half **92** of the housing **22** has a shelf **94**, and the first half **90** of the housing **22** has a protrusion **96** extending toward the shelf **94**. The ledge **73** of the output member **64** is disposed between the shelf **94** of the second half **92** of the housing **22** and the protrusion **96** of the first half **90** of the housing **22**. Since the ledge **73** of the output member **64** is disposed between the shelf **94** of the second half **92** of the housing **22** and the protrusion **96** of the first half **90** of the housing **22**, during operation of the actuating device **20** the output member **64** rotates with respect to the housing **22** with the ledge **73** remaining disposed and sliding between the shelf **94** of the second half **92** of the housing **22** and the protrusion **96** of the first half **90** of the housing **22**.

In another embodiment, the actuating device **20** further includes a connector **98** coupled to the mounting interface **70** of the output member **64** for securing the cable to the mounting interface **70**. The connector **98** moves relative to the housing **22** and in unison with the output member **64** during rotation of the output member **64** for activating the cable during operation of the actuating device **20**. More specifically, the connector **98** is coupled to the segment **72** of the mounting interface **70**. The connector **98** is pivotably coupled to the mounting interface **70** of the output member **64**. More specifically, the segment **72** of the mounting interface **70** defines a cavity **100**, and the connector **98** has a projection **102** extending through the cavity **100** for connecting the cable to the mounting interface **70** of the output member **64**. The connector **98** is coupled to the segment **72** of the mounting interface **70** by a clip **104**, as best shown in FIGS. **3** and **6**.

The projection **102** the connector **98** defines a groove **106**, and the clip **104** is partially disposed within the groove **106** for securing the cable to said mounting interface **70** of the output member **64**. It is to be appreciated that the connector **98** may be coupled to the segment **72** of the mounting interface **70** in any other suitable manner without departing from the scope of the present invention. In this embodiment, the drive portion **66** is engaged with the gear system **48** and the connector **98** is coupled to the mounting interface **70**. The gear system translates rotational motion of the motor assembly **26** to the output member **64**. The gear system may be any suitable arrangement of gears, sprockets, spur gears, straight-cut edge gears, helical (dry fixed) gears, double helical gears, bevel gears, planetary gears, harmonic gears, or the like without departing from the nature of the present invention.

In one embodiment, the actuating device **20** includes a cable **108** having a conduit **110** and a core wire **112**. The core wire **112** is moveable within the conduit **110** between a retracted position and an extended position. The retracted position and the extended position of the core wire **112** are described in further detail below. The core wire **112** has a first end **114** and a second end **116** opposite the first end **114**. The connector **98** is coupled to the output member **64** and the first end **114** of the core wire **112** is coupled to the connector **98**. The connector **98** is moveable 360 degrees during rotation of the output member **64** to define an actuating cycle. In the actuating cycle, the connector **98** has a first location corresponding to the retracted position of the core wire **112** and a second location corresponding to the extended position of the core wire **112**. The first location of the connector **98** is approximately 180 degrees from the second location of the connector **98**. The core wire **112** moves between the retracted position and the extended position during the actuating cycle.

With reference to FIGS. **10-13**, the actuating device **20** is shown in various positions in the actuating cycle. FIG. **12** shows the connector **98** of the actuating device **20** in the first location. As mentioned above, the first location of the connector **98** corresponds to the retracted position of the core wire **112**. When the core wire **112** is in the retracted position, the seat-back latch is in a locked position. As current is supplied to the plurality of coils **38** of the printed circuit board **36**, the connector **98** rotates with the output member **64** such that the connector **98** is in a position as shown in FIG. **13**.

FIG. **13** shows the connector **98** of the actuating device **20** between the first location and the second location. When the connector **98** is in the position as shown in FIG. **13**, the core wire **112** is moving from the retracted position toward the extended position. As the core wire **112** moves from the retracted position toward the extended position during the movement of the connector **98** with the rotation of the output member **64**, the seat-back latch may begin to actuate.

FIG. **10** shows the connector **98** of the actuating device **20** in the second location. As mentioned above, the second location of the connector **98** corresponds to the extended position of the core wire **112**. When the core wire **112** is in the extended position, the seat-back latch actuates to an unlocked position.

FIG. **11** shows the connector **98** of the actuating device **20** between the second location and the first location. When the connector is in the position as shown in FIG. **11**, the core wire **112** is moving from the extended position toward the retracted position. When the core wire **112** moves from the extended position toward the retracted position, the seat-back latch is moving toward the locked position. To complete the actuating cycle, the connector **98** returns to the first location, as shown in FIG. **12**.

In one embodiment, the output member **64** is rotatable in only one direction relative to the housing **22** during the actuating cycle. In this embodiment, the need for return springs or any other return mechanism are not needed as the connector **98** returns to the first position after rotation of output member **64** and actuation of the core wire **112**. It is to be appreciated that the output member **64** may rotate in more than one direction, and the output member **64** may rotate anywhere between zero to 360 degrees without departing from the nature of the present invention.

In another embodiment, the actuating device **20** includes a sensor **118** disposed within the interior of the housing **22** for determining rotation of the output member **64**. The printed circuit board **36** has a platform **120** extending outwardly and disposed between the flex gear **52**. The sensor **118** is rigidly coupled to the housing **22** such that the sensor **118** remains stationary relative to the output member **64** for measuring 360 degree rotation of the output member **64** during the actuation cycle. More specifically, the sensor **118** is disposed on the platform **120** for determining rotation of the output member **64**. The output member **64** has a finger **122** extending from the drive portion **66** toward the sensor **118**. The finger **122** is disposed between the housing **22** and the flex gear **52**. In one embodiment the sensor **118** is a magnetic activated sensor; however, it is to be appreciated that the sensor may be any type of sensor without departing from the nature of the present invention.

The actuating device also comprises an emitter **124** mounted on the output member **64** for interfacing with the sensor **118** during the actuating cycle. More specifically, the emitter **124** is mounted to the finger **122** of the output member, as best shown in FIG. **6**. The emitter **124** and the sensor **118** interact such that rotation of the output member **64** stops once the output member **64** completes the actuation cycle.

As briefly mentioned above, to release the seat-back latch, current is supplied to the printed circuit board **36**. The alternatively polarized magnets **33** of the rotor **32** rotate the shaft **40** of the motor assembly **26** due to the magnetic field formed by the current flowing to the printed circuit board **36**. Since the rotor **32** is coupled to the shaft **40**, rotation of the rotor **32** causes rotation of the shaft **40**. Rotation of the shaft **40** causes the pinion **53** to rotate. Rotation of the pinion **53** causes the at least two planetary gears **50** to rotate. The rotation of the planetary gears **50** causes the planetary gears **50** to engage with the flex gear **52**. Since the flex gear **52** is fixed to the housing **22**, the planetary gears **50** pivot and rotate about the shaft **40** when the pinion **53** is rotating. The gear retainer **82** also pivots about the shaft **40** during the rotation of the pinion **53**, which causes the planetary gears **50** to remain engaged with the inner surface **54** of flex gear **52** at the first area **74** and second area **76**.

The pivoting of the planetary gears **50** about the shaft **40** causes the flex gear **52** to interact with the output member **64**. More specifically, the outer surface **56** of the flex gear **52** engages the drive portion **66** of the output member **64** at the first section **78** and the second section **80** of the output member **64**. As mentioned above, the first section **78** corresponds with the first area **74** and the second section corresponds with the second area **76** such that the first area **74** and the first section **78** are approximately 180 degrees from the second area **76** and the second section **80**. The first section **78**, the first area **74**, the pinion **53**, the second section **80**, and the second area **76** are aligned linearly such that the outer surface **56** of the flex gear **52** remains engaged with the drive portion **66** of the output member **64** during rotation of the planetary gears **50** about the shaft **40** of the motor assembly **26**.

The rotation of the planetary gears **50** causes the output member **64** to rotate about the shaft **40** due to the flex gear **52** being fixed to the housing **22**. More specifically, since the second plurality of teeth of the flex gear **52** is less than the third plurality of teeth of the drive portion **66** of the output member **64** and because the flex gear **52** is fixed to the housing **22**, the output member **64** rotates about the shaft **40**. The rotation of the output member **64** causes the connector **98** to pull the core wire **112** further into the interior of the housing **22**, thereby releasing the seat-back latch. After the seat-back latch is actuated due to the core wire **112** being pulled further into the interior of the housing **22** by the connector **98** with the connector **98** being in the second location, as shown in FIG. **10**, the shaft **40** continues to rotate until the emitter **124** of the output member **64** returns to the sensor **118**, therefore completing the actuating cycle.

The invention has been described in an illustrative manner, and it is to be understood that the terminology that has been used is intended to be in the nature of words of description rather than of limitation. Many modifications and variations of the present invention are possible in light of the above teachings, and the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. An actuating device for actuating a cable, said actuating device comprising:

a housing defining an interior;

a motor assembly including a shaft with said motor assembly disposed within said interior of said housing;

at least two planetary gears disposed within said interior of said housing with said at least two planetary gears coupled to said motor assembly;

a flex gear disposed within said interior of said housing with said flex gear having an inner surface and an outer surface with said inner surface partially engaged with said planetary gears;

an output member at least partially disposed within said interior of said housing with said output member having a drive portion and a mounting interface with said drive portion engaged with a section of said outer surface of said flex gear such that said output member is rotatable relative to said housing when said shaft of said motor assembly rotates; and

a connector coupled to said mounting interface of said output member for securing the cable to said mounting interface with said connector moving relative to said housing and said mounting interface while moving in unison with said output member during said rotation of said output member for activating the cable during operation of the actuating device.

2. The actuating device as set forth in claim **1** wherein said flex gear comprises an elastically deformable material.

3. The actuating device as set forth in claim **2** wherein said flex gear has a base and a gear wall with said base rigidly fixed to said housing.

4. The actuating device as set forth in claim **2** wherein said flex gear defines a plurality of voids.

5. The actuating device as set forth in claim 3 wherein said gear wall of said flex gear has a rest state with said gear wall disengaged with said planetary gears, and an engaged state with said gear wall engaged with said planetary gears with said rest state having a first diameter and said engaged state having a second diameter with said second diameter greater than said first diameter.

6. The actuating device as set forth in claim 1 further comprising a gear retainer rotatably coupled to said housing with each of said planetary gears mounted to said gear retainer such that said planetary gears are rotatable relative to said housing about said inner surface of said flex gear when said shaft of said motor assembly rotates.

7. The actuating device as set forth in claim 5 wherein said inner surface of said flex gear is further defined as a first area and a second area approximately 180 degrees from said first area along said inner surface with one of said planetary gears engaged with said first area and the other one of said planetary gears engaged with said second area, and wherein said section of said outer surface of said flex gear is further defined as a first section and a second section approximately 180 degrees from said first section along said outer surface with said first area corresponding to said first section and said second area corresponding to said second section with said first and second sections of said outer surface engaged with said drive portion of said output member, thereby defining said second diameter such that said gear wall of said flex gear remains in said engaged state during said operation of said actuating device.

8. The actuating device as set forth in claim 1 wherein said planetary gears have first plurality of teeth, said outer surface of said flex gear has a second plurality of teeth, and said drive portion of said output member has a third plurality of teeth with said second plurality of teeth being greater than said first plurality of teeth and said third plurality of teeth being greater than said second plurality of teeth.

9. The actuating device as set forth in claim 1 further comprising a sensor disposed within said interior of said housing for determining rotation of said output member.

10. The actuating device as set forth in claim 9 wherein said sensor is a magnetic activated sensor.

11. The actuating device as set forth in claim 9 wherein said output member has a finger extending from said drive portion toward said sensor with said finger being disposed between said housing and said flex gear.

12. The actuating device as set forth in claim 1 wherein said motor assembly is a pancake motor comprising a casing defining an interior, and a flux plate, a printed circuit board, and a rotor disposed within said interior of said casing with said printed circuit board disposed between said rotor and said flux plate.

13. The actuating device as set forth in claim 12 wherein said shaft is coupled to said rotor of said pancake motor.

14. The actuating device as set forth in claim 13 wherein said pancake motor further comprising a coupler disposed within the interior of said casing of said pancake motor with said coupler mounted to said rotor and said shaft such that rotation of said rotor transmits rotation to said shaft.

15. The actuating device as set forth in claim 12 wherein said printed circuit board has a platform extending outwardly and disposed between said flex gear with said actuating device further comprising a sensor disposed on said platform for determining rotation of said output member.

16. The actuating device as set forth in claim 1 wherein said mounting interface of said output member has a segment elevated toward said housing with said connector coupled to said segment of said mounting interface.

17. The actuating device as set forth in claim 1 wherein said housing has a first half adjacent the output member and a second half adjacent the flex gear with said second half having a shelf and said first half having a protrusion extending toward said shelf and wherein said output member has a ledge disposed between said shelf and said protrusion.

18. The actuating device as set forth in claim 1 wherein said movement of said connector relative to said mounting interface is further defined as pivoting relative to said mounting interface as said connector moves in unison with said output member relative to said housing.

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