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(54) **IMPACT JAR DELAY, ACTIVATION INDICATOR, SHOCK ABSORBER, AND RELATCH ASSIST**

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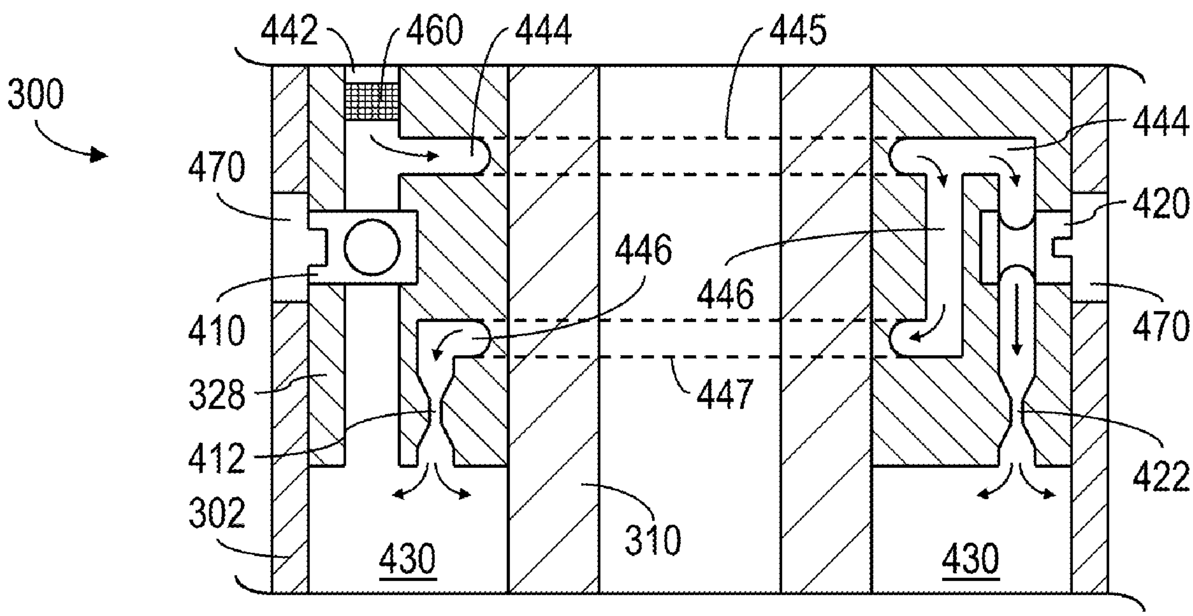
CPC *E21B 31/1135* (2013.01)

(57) **ABSTRACT**

An impact jar apparatus including a dynamic portion connectable to an upper tool string portion, a static portion connectable to a lower tool string portion, and a hydraulic manifold, an activation indicator, a relatch assist, and/or a shock absorber. The hydraulic manifold fluidly communicates with an annulus between the dynamic and static portions. The hydraulic manifold adjusts a delay between application of a trigger tension and consequent activation of the impact jar apparatus. The activation indicator, including a wire coil in the static portion and magnets carried by the dynamic portion, generates a magnetic field whereby a voltage pulse is generated in the wire coil in response to the magnetic field passing the wire coil upon activation of the impact jar apparatus. The relatch assist urges the dynamic and static portions toward a latched position. The shock absorber absorbs axial shock generated by activation of the impact jar apparatus.



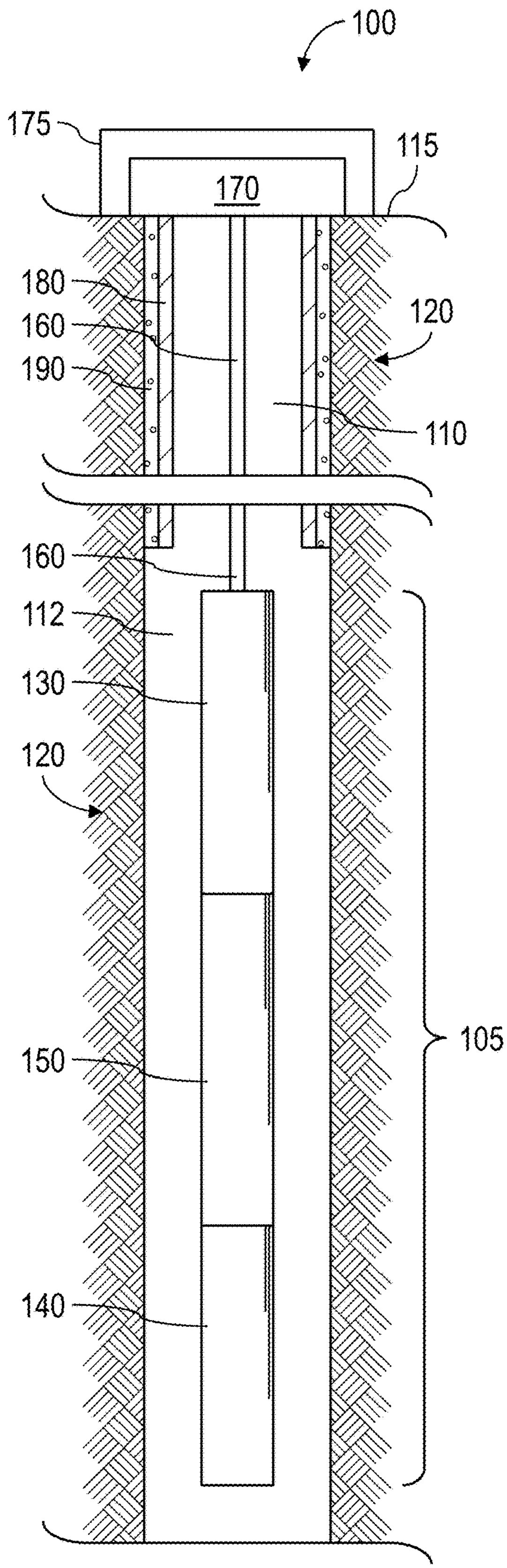


FIG. 1

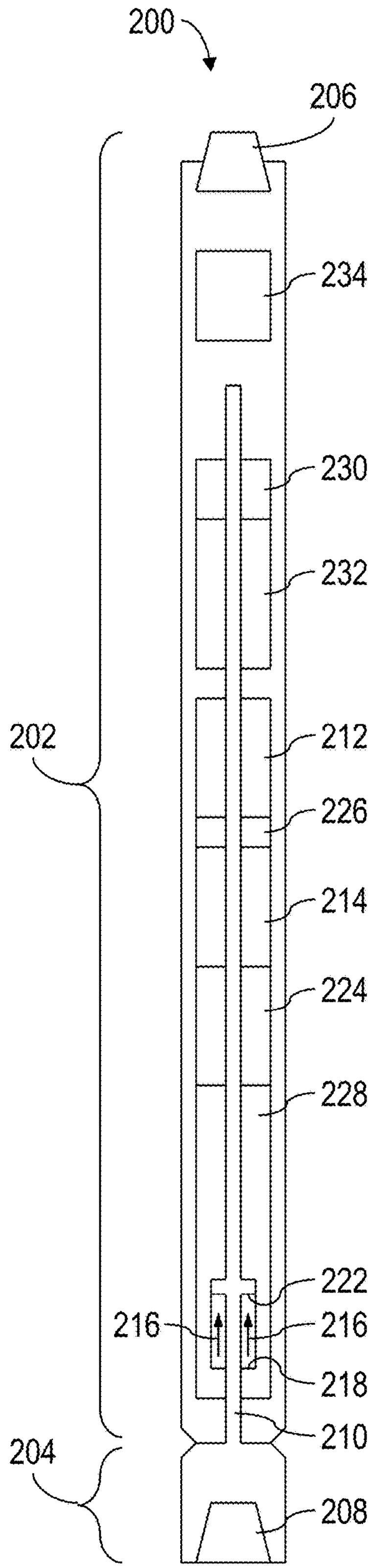


FIG. 2

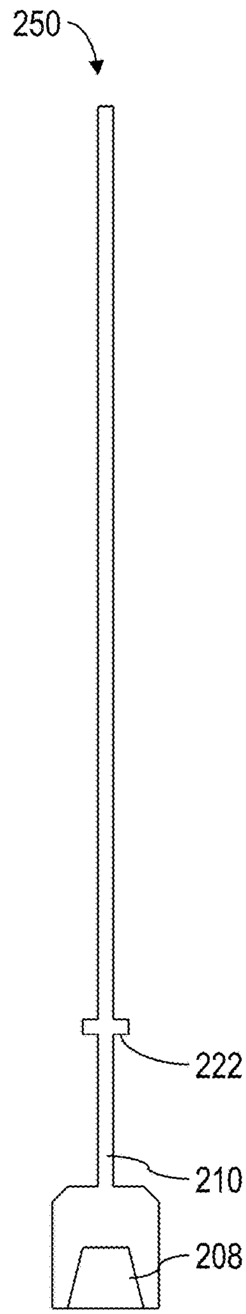


FIG. 3

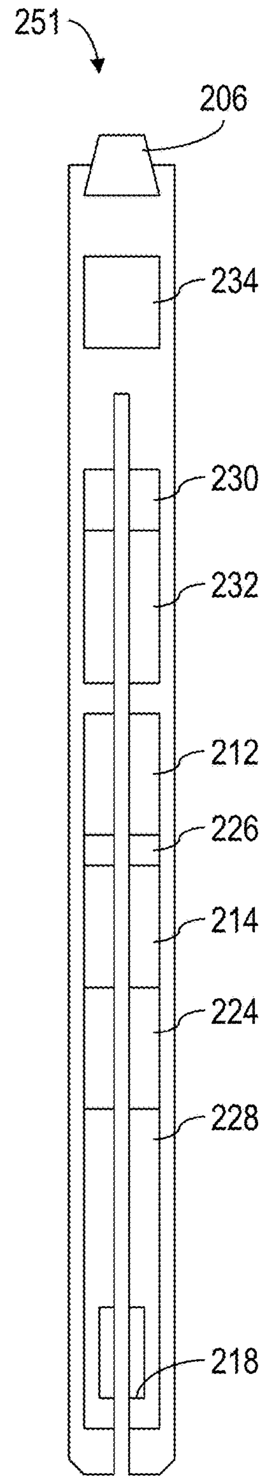


FIG. 4

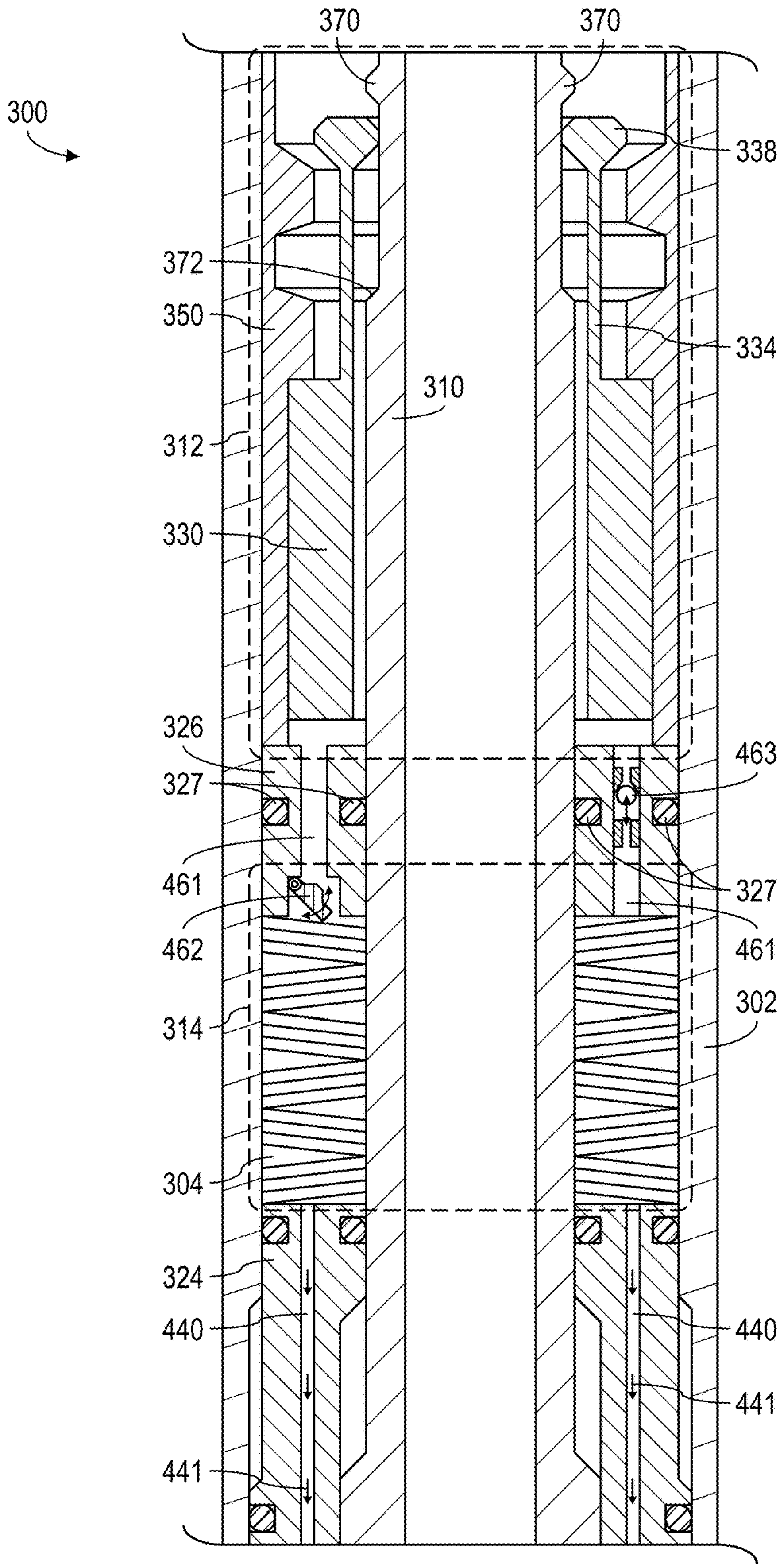

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FIG. 5

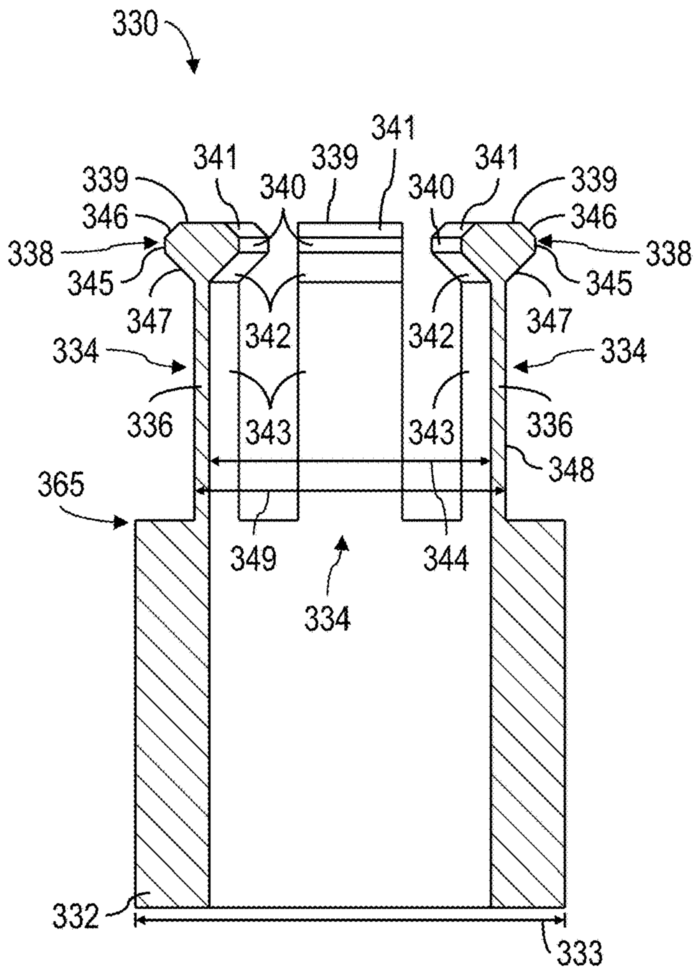
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FIG. 6

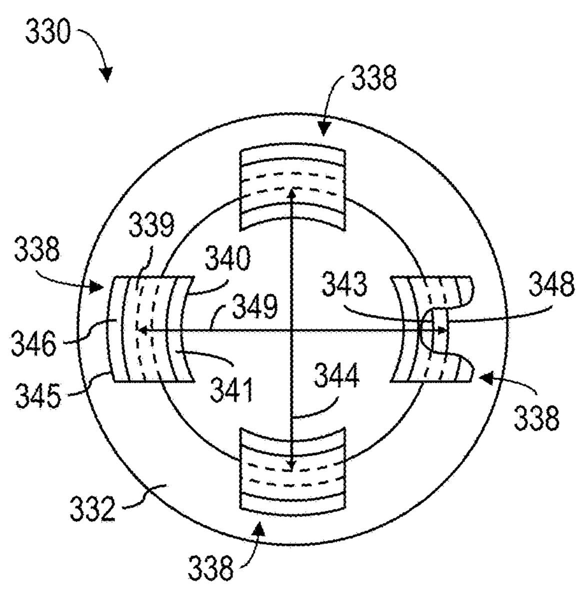
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FIG. 7

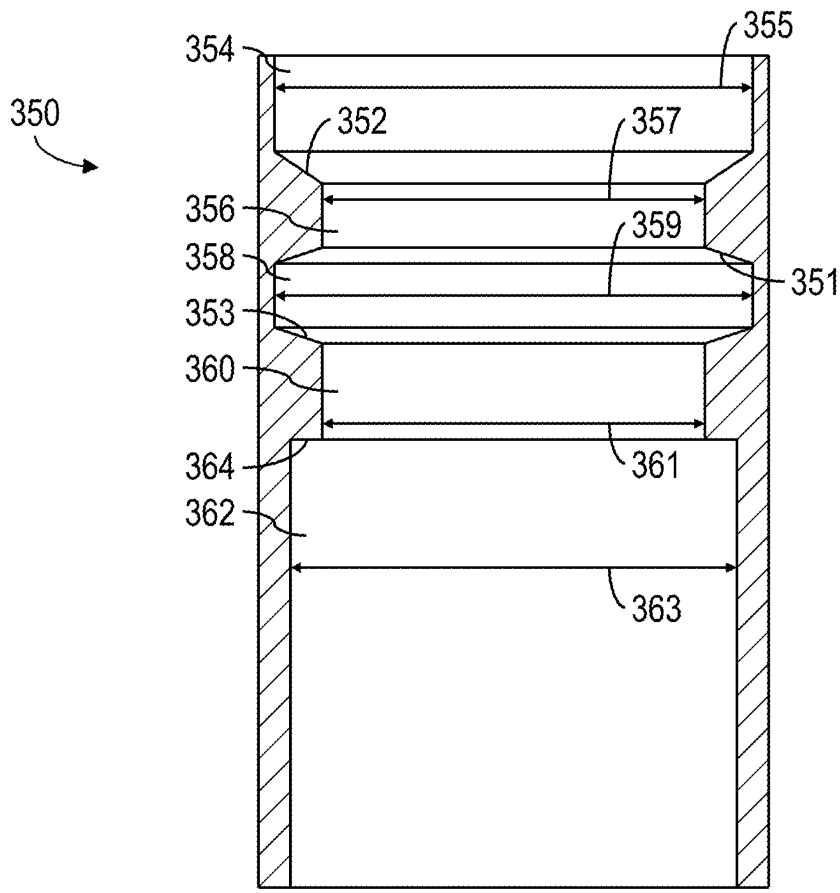

FIG. 8

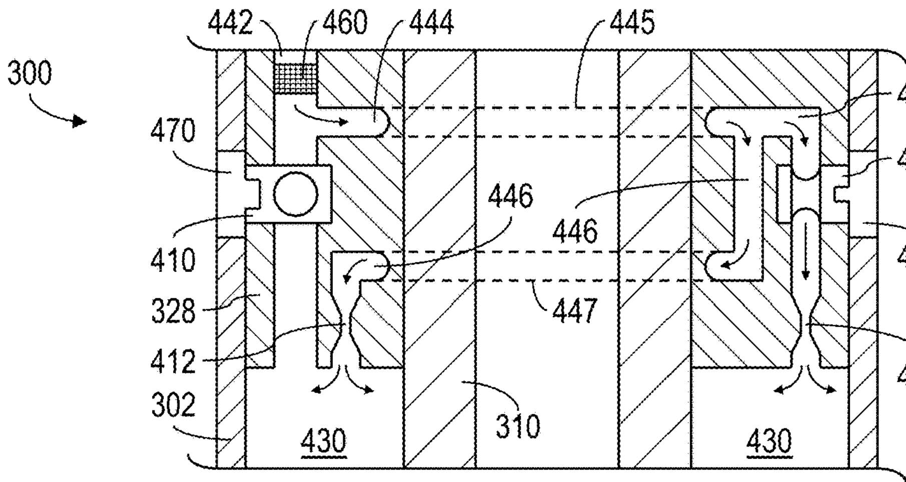

FIG. 9

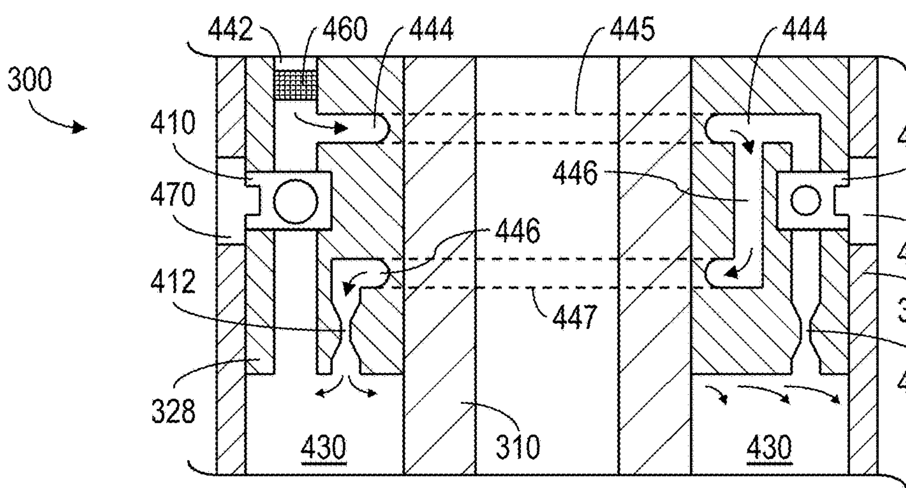

FIG. 10

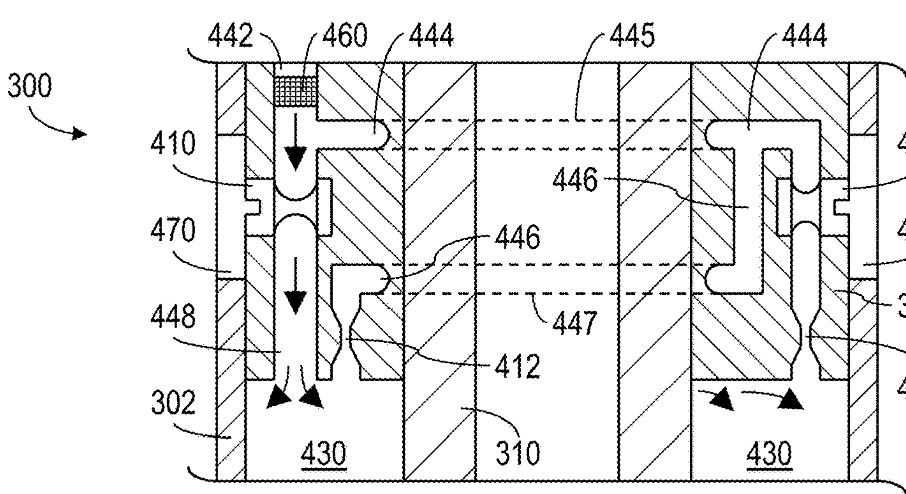

FIG. 11

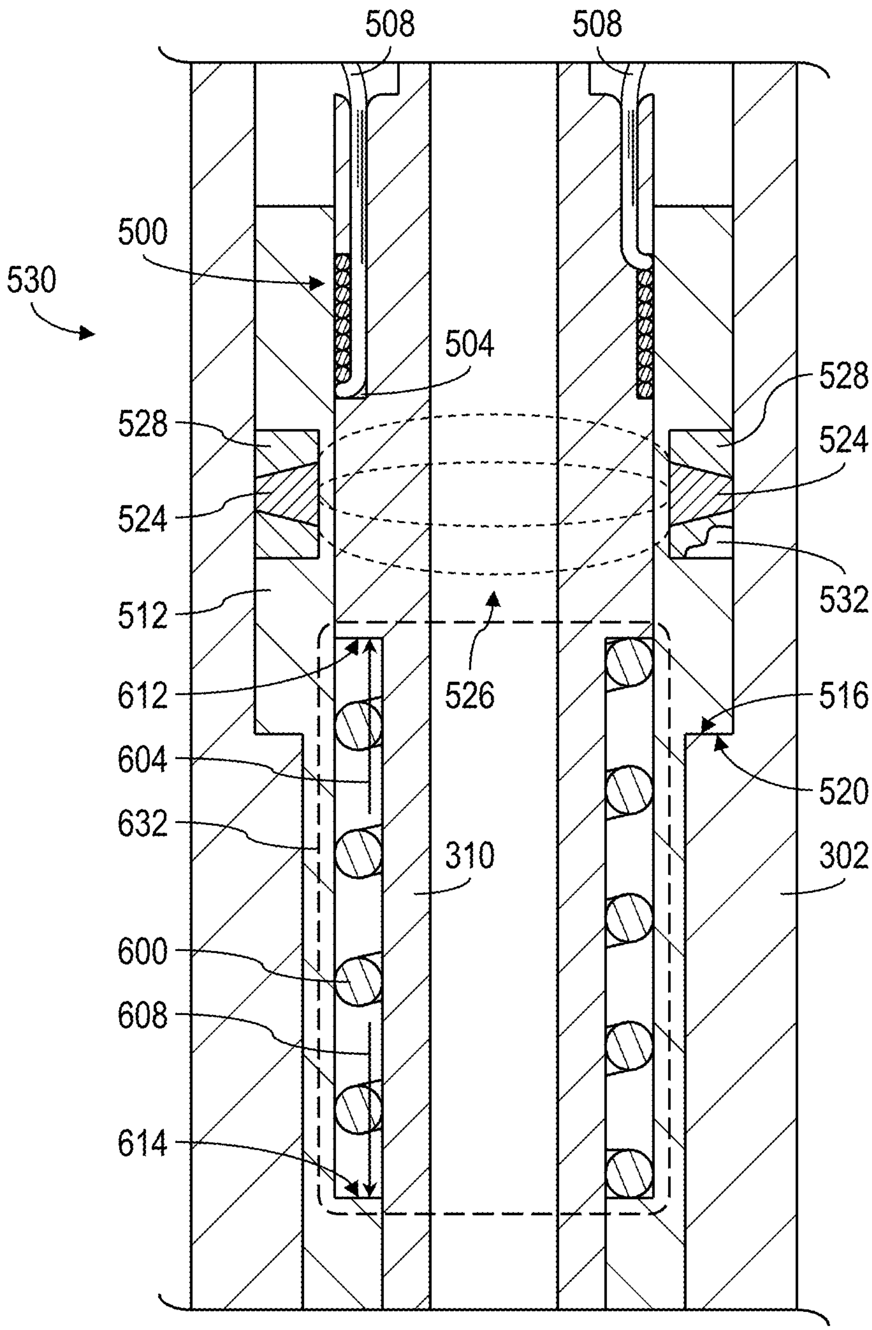
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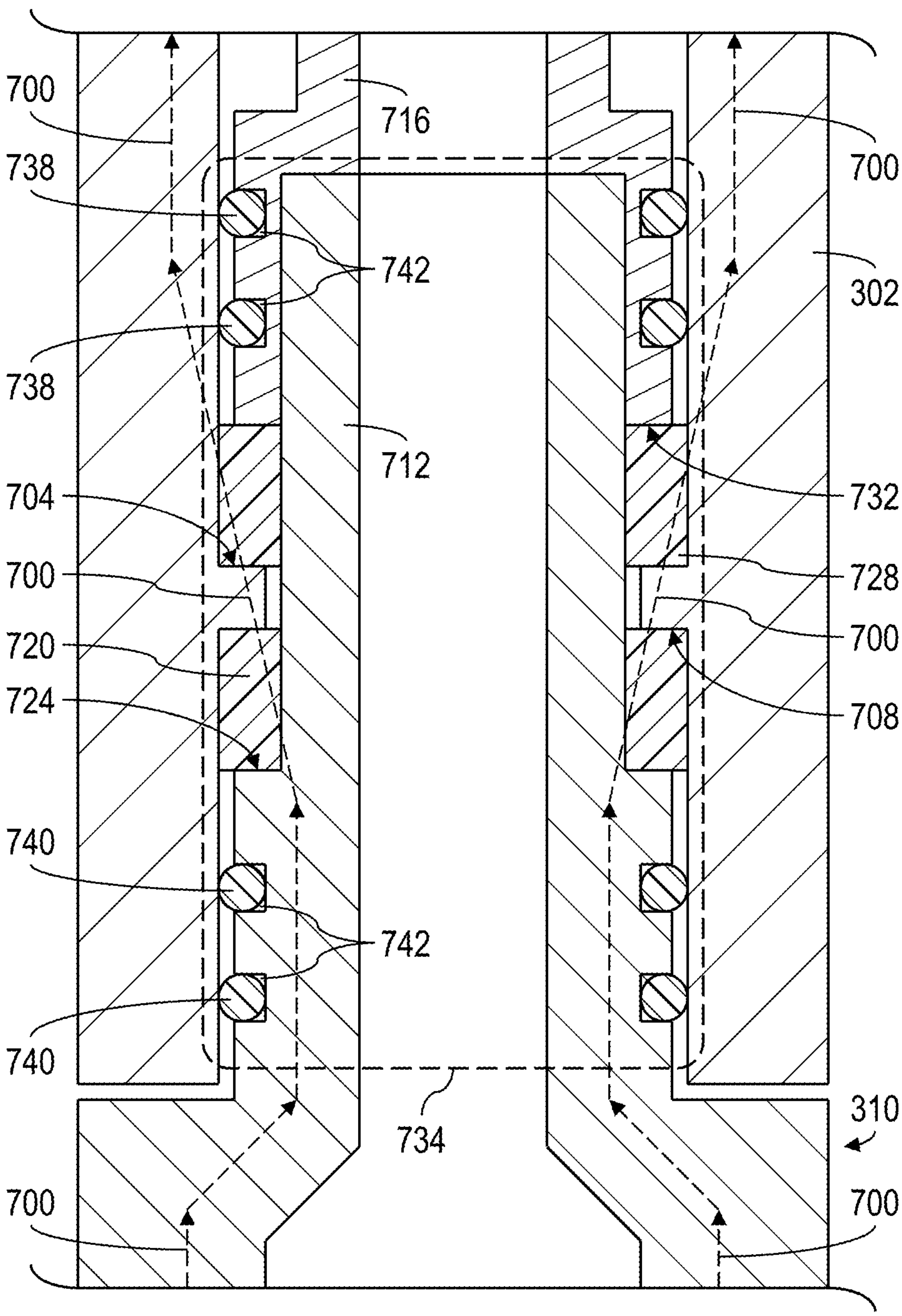
FIG. 12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734
310
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700

FIG. 13

IMPACT JAR DELAY, ACTIVATION INDICATOR, SHOCK ABSORBER, AND RELATCH ASSIST

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to and the benefit of U.S. Provisional Application No. 63/555,394, titled "Impact Jar Delay, Surface Indicator, Shock Absorber, and Relatch Assist," filed Feb. 19, 2024, the entire disclosure of which is hereby incorporated herein by reference.

BACKGROUND OF THE DISCLOSURE

[0002] Drilling operations have become increasingly expensive as the need to drill deeper, in harsher environments, and through more difficult materials have become reality. Additionally, testing and evaluation of completed and partially finished wellbores has become commonplace, such as to increase well production and return on investment.

[0003] In working with deeper and more complex wellbores, it becomes more likely that tools, tool strings, and/or other downhole apparatus may become stuck within the wellbore. In addition to the potential to damage equipment in trying to retrieve it, the construction and/or operation of the well must generally stop while tools are fished from the wellbore. The fishing operations themselves may also damage the wellbore and/or the downhole apparatus.

[0004] One such downhole tool, referred to as a jar, may be used to dislodge a downhole apparatus when it becomes stuck within a wellbore. The jar is positioned in the tool string and/or otherwise deployed downhole to free the downhole apparatus. Tension load is applied to the tool string to trigger the jar, thus delivering an impact intended to dislodge the stuck portion of the tool string.

SUMMARY OF THE DISCLOSURE

[0005] This summary is provided to introduce a selection of concepts that are further described below in the detailed description. This summary is not intended to identify indispensable features of the claimed subject matter, nor is it intended for use as an aid in limiting the scope of the claimed subject matter.

[0006] The present disclosure introduces an impact jar apparatus including a dynamic portion, a static portion, and a hydraulic manifold. The dynamic portion has a first connector for connection to an upper portion of a downhole tool string for conveyance within a wellbore penetrating a subterranean formation. The static portion has a second connector for connection to a lower portion of the tool string. The hydraulic manifold is in fluid communication with an annulus defined between the dynamic and static portions. The hydraulic manifold is configurable to adjust a delay between application of a trigger tension to the tool string and consequent activation of the impact jar apparatus.

[0007] The present disclosure also introduces an impact jar apparatus including a dynamic portion, a static portion, and an activation indicator. The dynamic portion has a first connector for connection to an upper portion of a downhole tool string for conveyance within a wellbore penetrating a subterranean formation. The static portion has a second connector for connection to a lower portion of the tool string. The activation indicator provides real-time surface confirmation that the impact jar apparatus has activated. The activation indicator includes a wire coil and magnets. The wire coil is disposed within an external recess of the static portion. The magnets are carried by the dynamic portion and generate a magnetic field such that a voltage pulse is generated in the wire coil in response to the magnetic field passing by the wire coil upon activation of the impact jar apparatus.

[0008] The present disclosure also introduces an impact jar apparatus including a dynamic portion, a static portion, and a relatch assist. The dynamic portion has a first connector for connection to an upper portion of a downhole tool string for conveyance within a wellbore penetrating a subterranean formation. The static portion has a second connector for connection to a lower portion of the tool string. The relatch assist urges the dynamic and static portions toward a latched position.

[0009] The present disclosure also introduces an impact jar apparatus including a dynamic portion, a static portion, and a shock absorber. The dynamic portion has a first connector for connection to an upper portion of a downhole tool string for conveyance within a wellbore penetrating a subterranean formation. The static portion has a second connector for connection to a lower portion of the tool string. The shock absorber absorbs axial shock generated by activation of the impact jar apparatus.

[0010] These and additional aspects of the present disclosure are set forth in the description that follows, and/or may be learned by a person having ordinary skill in the art by reading the material herein and/or practicing the principles described herein. At least some aspects of the present disclosure may be achieved via means recited in the attached claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The present disclosure is understood from the following detailed description when read with the accompanying figures. It is emphasized that, in accordance with the standard practice in the industry, various features are not drawn to scale. In fact, the dimensions of the various features may be arbitrarily increased or reduced for clarity of discussion.

[0012] FIG. **1** is a schematic view of at least a portion of an example implementation of a wellsite system according to one or more aspects of the present disclosure.

[0013] FIG. **2** is a schematic view of at least a portion of an example implementation of an impact jar apparatus of the wellsite system shown in FIG. **1** according to one or more aspects of the present disclosure.

[0014] FIG. **3** is a schematic view of a static portion of the impact jar apparatus shown in FIG. **2** according to one or more aspects of the present disclosure.

[0015] FIG. **4** is a schematic view of a dynamic portion of the impact jar apparatus shown in FIG. **2** according to one or more aspects of the present disclosure.

[0016] FIG. **5** is a schematic sectional view of a portion of an example implementation of the impact jar apparatus shown in FIGS. **2**-**4** according to one or more aspects of the present disclosure.

[0017] FIG. **6** is a schematic sectional view of an inner latch portion of the impact jar apparatus shown in FIG. **5** according to one or more aspects of the present disclosure.

[0018] FIG. **7** is a schematic top view of the inner latch portion shown in FIG. **6** according to one or more aspects of the present disclosure.

[0019] FIG. **8** is a schematic sectional view of an outer latch portion of the impact jar apparatus shown in FIG. **5** according to one or more aspects of the present disclosure.

[0020] FIG. **9** is a schematic sectional view of a first configuration of a hydraulic manifold portion of the impact jar apparatus shown in FIG. **5** according to one or more aspects of the present disclosure.

[0021] FIG. **10** is a schematic sectional view of a second configuration of the hydraulic manifold portion shown in FIG. **9** according to one or more aspects of the present disclosure.

[0022] FIG. **11** is a schematic sectional view of a third configuration of the hydraulic manifold portion shown in FIGS. **9** and **10** according to one or more aspects of the present disclosure.

[0023] FIG. **12** is a schematic sectional view of activation indicator and relatch assist portions of the impact jar apparatus shown in FIG. **5** according to one or more aspects of the present disclosure.

[0024] FIG. **13** is a schematic sectional view of a shock absorber portion of the impact jar apparatus shown in FIG. **5** according to one or more aspects of the present disclosure.

DETAILED DESCRIPTION

[0025] It is also to be understood that the following disclosure may provide different examples for implementing different features of various implementations. Specific examples of components and arrangements are described below to simplify the present disclosure. These are, of course, merely examples and are not intended to be limiting. In addition, the following disclosure may repeat reference numerals and/or letters in more than one implementation. This repetition is for simplicity and clarity and does not in itself dictate a relationship between the various implementations and/or configurations discussed. Moreover, the formation of a first feature over or on a second feature in the description that follows may include implementations in which the first and second features are formed in direct contact and/or implementations in which additional features may be formed interposing the first and second features, such that the first and second features may not be in direct contact.

[0026] FIG. **1** is a sectional view of at least a portion of an example implementation of a wellsite system **100** according to one or more aspects of the present disclosure. The wellsite system **100** comprises a tool string **105** suspended within a wellbore **110** that extends from a wellsite surface **115** into one or more subterranean formations **120**. The tool string **105** comprises a first portion **130**, a second portion **140**, and an impact jar apparatus **150** coupled between the first and second tool string portions **130**, **140**. The tool string **105** is suspended within the wellbore **110** via conveyance means **160** operably coupled with a tensioning device **170** and/or other surface equipment **175** disposed at the wellsite surface **115**. The wellbore **110** is depicted in FIG. **1** as being a cased-hole implementation comprising a casing **180** secured by cement **190**. However, one or more aspects of the present disclosure are also applicable to and/or readily adaptable for utilization in open-hole implementations lacking the casing **180** and cement **190**.

[0027] The tensioning device **170** is operable to apply an adjustable tensile force to the tool string **105** via the conveyance means **160**. Although depicted schematically in FIG. **1**, a person having ordinary skill in the art will recognize the tensioning device **170** as being, comprising, or forming at least a portion of a crane, winch, drawworks, top drive, and/or other lifting device coupled to the tool string **105** by the conveyance means **160**. The conveyance means **160** is or comprises wireline, slickline, e-line, coiled tubing, drill pipe, production tubing, and/or other conveyance means, and comprises and/or is operable in conjunction with means for communication between the tool string **105** and the tensioning device **170** and/or one or more other portions of the surface equipment **175**. The first and second tool string portions **130**, **140** may each be or comprise one or more downhole tools, modules, and/or other apparatus operable in wireline, while-drilling, coiled tubing, completion, production, and/or other implementations.

[0028] The impact jar apparatus **150** may be employed to dislodge and/or retrieve a portion of the tool string **105** that has become lodged or stuck within the wellbore **110**, such as the second tool string portion **140**. The impact jar apparatus **150** may be coupled to the second tool string portion **140** before the tool string **105** is conveyed into the wellbore **110**, such as in prophylactic applications, or after at least a portion of the tool string **105** (e.g., the second tool string portion **140**) has become lodged or stuck in the wellbore **110**, such as in "fishing" applications.

[0029] FIG. **2** is a schematic diagram of at least a portion of an example implementation of an impact jar apparatus **200** according to one or more aspects introduced by the present disclosure. The impact jar apparatus **200** is an example implementation of the impact jar apparatus **150** shown in FIG. **1**.

[0030] The impact jar apparatus **200** comprises an upper section **202** and a lower section **204**. The upper section **202** comprises a mechanical and electrical connector **206** for connecting to an upper tool string portion, such as the first tool string portion **130** shown in FIG. **1**. The lower section **204** comprises a mechanical and electrical connector **208** for connecting to a lower tool string portion, such as the second tool string portion **140** shown in FIG. **1**.

[0031] A tubular feature **210** affixed to the lower section **204** extends upward through several components of the upper section **202**. A latch **212** of the upper section **202** releasably retains the tubular feature **210** in a latched position. When the tool string **105** becomes lodged ("stuck") in the wellbore **110**, activation of the impact jar apparatus **200** is initiated by controlling the tensioning device **170** to apply axial tension to the tool string **105** via the conveyance means **160** sufficient to compress a biasing means (e.g., a Belleville stack) **214** such that relative axial motion of the tubular feature **210** and the latch **212** disengages the latch **212** from the tubular feature **210**. Consequently, as a result of the tension in the conveyance means **160**, the upper section **202** rapidly moves upward (as depicted in FIG. **2** by arrows **216**) until an impact surface **218** of the upper section **202** forcefully impacts a corresponding impact surface **222** of the tubular feature **210**, thereby applying an upward jarring force to the lower section **204** and, thus, the lower tool string portion **140**, in an attempt to dislodge the tool string **105** from the wellbore **110**.

[0032] The impact jar apparatus **200** may also include an adjuster **224** by which the "trigger tension" at which the impact jar apparatus **200** is activated may be manually adjusted at the wellsite surface **115** before the tool string **105** is conveyed into the wellbore **110**. For example, the adjuster **224** may be or comprise a rotatable component that adjusts the static compression (e.g., when no tension is applied by the tensioning device **170** or gravity) of the biasing means **214**. The rotatable component can be manually rotated at the wellsite surface **115** without disassembly of the impact jar apparatus **200** or the tool string **105**.

[0033] The impact jar apparatus **200** may also comprise a hydraulic piston **226** and a hydraulic manifold **228**, such as described below with respect to FIGS. **5** and **9-11**. The impact jar apparatus **200** may also comprise an activation indicator **230** and/or a relatch assist **232**, such as described below with respect to FIG. **12**. The impact jar apparatus **200** may also comprise a shock absorber **234**, such as described below with respect to FIG. **13**.

[0034] The above-described components of the impact jar apparatus **200** may be arranged other than as depicted in FIG. **2**. Moreover, many of the components of the impact jar apparatus **200** can be classified as belonging to a static portion **250** of the apparatus **200**, schematically depicted in FIG. **3**, and a dynamic portion **251** of the apparatus **200**, schematically depicted in FIG. **4**. Referring to FIGS. **1-4**, collectively, the static portion **250** generally comprises the tubular feature **210** that, during jarring operations, is indirectly coupled (e.g., by the lower connector **208**) to the lower tool string portion **140** which has become stuck in the wellbore **110**, thus being fixed in an axial position relative to the wellbore **110**. In such jarring operations, the dynamic portion **251** of the impact jar apparatus **200** (e.g., the latch **212**, the biasing means **214**, the adjuster **224**, and the hydraulic piston **226**, among other components) is indirectly coupled via the upper connector **206** to the upper tool string portion **130** and, thus, moves axially with the upper tool string portion **130** and the conveyance means **160** relative to the tubular feature **210** and the wellbore **110**, in response to tension applied by the conveyance means **160** via operation of the tensioning device **170**.

[0035] FIG. **5** is a schematic sectional view of a portion of an example implementation of the impact jar apparatus **200** shown in FIGS. **2-4**, designated in FIG. **5** by reference number **300**, according to one or more aspects introduced by the present disclosure. The impact jar apparatus **300** comprises a static portion (not referenced, but analogous to the static portion **250** shown in FIG. **3**), which includes a tubular feature **310** that is an example implementation of the tubular feature **210** shown in FIGS. **2** and **3**. The impact jar apparatus **300** also comprises a dynamic portion (not referenced, but analogous to the dynamic portion **251** shown in FIG. **4**), which includes a latch **312**, a biasing means **314**, an adjuster **324**, and a hydraulic piston **326** that, respectively, are example implementations of the latch **212**, the biasing means **214**, the adjuster **224**, and the hydraulic piston **226** shown in FIGS. **2** and **4**. The dynamic portion also includes an outer housing **302**, such as may be directly or indirectly coupled with a connector for mechanically and electrically connecting the impact jar apparatus **300** to an upper tool string portion (e.g., the tool string portion **130** shown in FIG. **1**). Although not depicted in FIG. **5**, such connector may be similar or analogous to the connector **206** shown in FIG. **2**.

[0036] The latch **312** includes an inner latch portion **330** and an outer latch portion **350**. The outer latch portion **350** is threadedly and/or otherwise secured to the housing **302** and, thus, travels with the housing **302**. The inner latch portion **330** is sandwiched between the outer latch portion **350** and the tubular feature **310** in a manner permitting axial movement of the inner latch portion **330** relative to the outer latch portion **350** and the tubular feature **310**, as further described below. The biasing means **314** and the hydraulic piston **326**, collectively, are axially retained between the outer latch portion **350** and the adjuster **324** within an annulus **304** defined between the housing **302** and the tubular feature **310**. The adjuster **324** is threadedly engaged with the housing **302**, such that rotation of the adjuster **324** moves the adjuster **324** axially relative to the housing **302**, thereby further compressing or decompressing the biasing means **314** between the adjuster **324** and the hydraulic piston **326**. Such rotation of the adjuster **324** therefore adjusts the static compression of the biasing means **314** to thereby adjust the trigger tension. The biasing means **314** is depicted as a Belleville washer stack, although one or more compression springs and/or other mechanical biasing members may alternatively (or additionally) be utilized.

[0037] FIGS. **6-8** each demonstrate one or more aspects introduced by the present disclosure. FIG. **6** is a schematic sectional view of the inner latch portion **330**. FIG. **7** is a schematic top view of the inner latch portion **330**. FIG. **8** is a schematic sectional view of the outer latch portion **350**. The following description refers to FIGS. **6-8**, collectively.

[0038] The inner latch portion **330** comprises an annular body **332** and a plurality of flexible collet fingers **334** extending upward from the body **332**. Each flexible collet finger **334** has a thinned deflection segment **336** extending between the annular body **332** and a radially enlarged end **338**. For example, in the depicted example implementation, each end **338** is defined by: a top surface **339**; an inner curved surface **340**; an optional upper inner tapered surface **341** transitioning between the top surface **339** and the inner curved surface **340**; a lower inner tapered surface **342** transitioning between the inner curved surface **340** and a cylindrical surface **343** defined by an inner diameter **344** of the deflection segment **336**; an outer curved surface **345**; an upper outer tapered surface **346** transitioning between the top surface **339** and the outer curved surface **345**; and a lower outer tapered surface **347** transitioning between the outer curved surface **345** and a cylindrical surface **348** defined by an outer diameter **349** of the deflection segment **336**.

[0039] The upper inner tapered surface **341** is configured to interact with a correspondingly tapered protrusion (or some other ridge, shoulder, or protrusion) **370** extending outward from the tubular feature **310**. The lower inner tapered surface **342** is configured to interact with a correspondingly tapered outer surface **372** of the tubular feature **310**. The upper outer tapered surface **346** is configured to interact with a correspondingly tapered intermediate surface **351** of the outer latch portion **350**. The lower outer tapered surface **347** is configured to interact with correspondingly tapered upper and lower surfaces **352**, **353** of the outer latch portion **350**.

[0040] The tapered upper surface **352** transitions between a cylindrical surface **354** defined by an upper larger inner diameter **355** and a cylindrical surface **356** defined by an upper smaller inner diameter **357**. The tapered intermediate surface **351** transitions between the cylindrical surface **356** and a cylindrical surface **358** defined by an intermediate larger inner diameter **359**. The tapered lower surface **353**

transitions between the cylindrical surface **358** and a cylindrical surface **360** defined by a lower smaller inner diameter **361**. The outer latch portion **350** also includes a cylindrical surface **362** defined by a lower intermediate inner diameter **363** corresponding to an outer diameter **333** of the inner latch portion annular body **332**. The inner diameter **363** of the outer latch surface **362** is similar to but sufficiently larger than the outer diameter **333** of the inner latch body **332** so as to permit the outer latch portion **350** to slide axially along the inner latch portion **330**. A shoulder **364** defined by the step change between the cylindrical surfaces **360**, **362** provides a travel stop for an upper end **365** of the annular body **332** of the inner latch **330**.

[0041] In the description above, the correspondingly tapered surfaces have the same or similar taper angles so as to encourage the relative motion described below with respect to the jarring operation. However, other relationships between the tapered surfaces intended to contact each other are also within the scope of the present disclosure.

[0042] The following description refers to FIGS. **1**-**8**, collectively, in which the impact jar apparatus **150** of the tool string **105** is or comprises an instance of the impact jar apparatus **300**, the tubular feature **310** is coupled (at least indirectly) to the lower tool string portion **140**, and the lower tool string portion **140** has become stuck in the wellbore **110**, thus necessitating a jarring operation utilizing the impact jar apparatus **300**. During the jarring operation, the axial position of the tubular feature **310** is initially stationary (static), relative to the wellbore **110**, due to being coupled to the lower tool string portion **140** that is stuck in the wellbore **110**. Tension applied via the conveyance means **160** urges the dynamic (non-stuck) portion of the impact jar apparatus **300** upward, relative to the wellbore **110**, in conjunction with the upward movement of the upper tool string portion **130** and the conveyance means **160**.

[0043] The axially upward movement of the dynamic portion of the impact jar apparatus **300** initially causes the adjuster **324**, the biasing means **314**, the hydraulic piston **326**, and the inner and outer latch portions **330**, **350** to move upward relative to the tubular feature **310** until the tapered surface **341** (or the surface **339** if the tapered surface **341** is non-extant) contacts the tubular feature protrusion **370**. The protrusion **370** subsequently prevents further upward movement of the inner latch portion **330**, such that further upward movement of the housing **302** causes the outer latch portion **350** to move upward relative to the inner latch portion **330**, whereby the collet finger ends **338** become sandwiched between the tubular feature **310** and the cylindrical surface **356** of the outer latch portion **350**. Further upward movement of the housing **302** moves the cylindrical surface **356** past the collet finger ends **338**, thus permitting the collet finger ends **338** to expand radially into the recess (not referenced) of the outer latch portion **350** defined by the cylindrical surface **358** and the tapered surfaces **351**, **353**, thereby disengaging the inner latch portion **330** from the protrusion **370**. Such disengagement permits rapid upward movement of the dynamic portion of the impact jar apparatus **300** (and the upper tool string portion **130**) relative to the tubular feature **310**, resulting a feature of the dynamic portion of the impact jar apparatus **300** (e.g., the impact surface **218** shown in FIGS. **2** and **4**) applying an uphole-directed impact against a feature of the static portion of the impact jar apparatus **300** (e.g., the impact surface **222** shown in FIGS. **2** and **3**).

[0044] Upon the initial contact between the collet finger ends **338** and the tubular feature protrusion **370** (i.e., prior to the above-described impact), subsequent upward movement of the adjuster **324**, the biasing means **314**, the hydraulic piston **326**, and the outer latch portion **350** causes the hydraulic piston **326** to contact the bottom of the inner latch portion body **332**. Such contact prevents further upward movement of the hydraulic piston **326**, such that further upward movement of the adjuster **324** compresses the biasing means **314** between the adjuster **324** and the hydraulic piston **326**. The tension applied by the tensioning device **170** must overcome the expansion force of the biasing means **314** by an amount sufficient for the cylindrical surface **356** to move upward past the collet finger ends **338**.

[0045] Moreover, the rate at which the adjuster **324** is able to move upward and compress the biasing means **314** is dependent upon the flow of hydraulic fluid out of the annulus **304** containing the biasing means **314**. That is, the hydraulic piston **326** is an annular feature having seals (e.g., O-rings) **327** against the inner surface of the housing **302** and the outer surface of the tubular feature **310** that prevent the passage of fluid from the annulus **304**. Consequently, axial contraction of the annulus **304** forces fluid in the annulus **304** to flow (see arrows **441**) through various passages **440** in the adjuster toward a hydraulic manifold **328**.

[0046] The hydraulic piston **326** may carry one or more check valves preventing fluid flow from the annulus **304** through one or more passages **461** that connect the annulus **304** to an annulus **311** at least partially defined between an inner profile of the outer latch portion **350** and an outer profile of the tubular feature **310**. For example, the one or more check valves may comprise one or more flapper check valves **462**, ball check valves **463**, and/or other types of check valves permitting quick reset of the impact jar apparatus **300** without drawing fluid back through the flow restrictors **412**, **422** described below.

[0047] FIG. **9** is a schematic sectional view of another portion of the impact jar apparatus **300**, namely a portion of the hydraulic manifold **328**. The hydraulic manifold **328** is an example implementation of the hydraulic manifold **228** shown in FIGS. **2** and **4** according to one or more aspects introduced by the present disclosure.

[0048] The hydraulic manifold **328** includes configurable means for optionally restricting the flow of fluid from the annulus **304**. For example, the hydraulic manifold **328** includes first and second valves **410**, **420** that are each set (at the wellsite surface) to an open or closed position to control fluid flow to first and second flow restrictors **412**, **422**. The first and second valves **410**, **420** and the first and second flow restrictors **412**, **422** control how quickly hydraulic fluid flows from the annulus **304** and into a fluid reservoir **430** and, thus, whether and how long activation of the impact jar apparatus **300** is delayed.

[0049] The first valve **410** receives fluid from a passage **442** that is in fluid communication with the fluid passages **440** of the adjuster **324**. The second valve **420** is in fluid communication with a passage **444** (including a portion **445** that partially extends around the tubular feature **310** within the hydraulic manifold **328**) that is in fluid communication with the passage **442**. In the configuration depicted in FIG. **9**, the first valve **410** is closed and the second valve **420** is open, such that fluid from the passage **444** flows through the second valve **420** to the second flow restrictor **422** and through additional passages **446** (including a passage **447**

that partially extends around the tubular feature **310** within the hydraulic manifold **328**) to the first flow restrictor **412**. Accordingly, activation of the impact jar apparatus **300** is delayed by a first amount of time sufficient to permit enough hydraulic fluid to pass through the first and second flow restrictors **412**, **422** and thereby permit the outer latch portion **350** to move upward by an amount sufficient to permit the inner latch portion **330** to disengage the tubular feature **310**.

[0050] However, when the first and second valves **410**, **420** are both closed, as depicted in FIG. **10**, fluid flows through just the first flow restrictor **412**. Accordingly, activation of the impact jar apparatus **300** is delayed by a second amount of time, greater than the first amount of time (e.g., twice as long), sufficient to permit enough hydraulic fluid to pass through just the first flow restrictor **412** and thereby permit the outer latch portion **350** to move upward enough to permit disengagement of the inner latch portion **330** from the tubular feature **310**.

[0051] In the configuration depicted in FIG. **11**, the first valve **410** is open, such that fluid from the passage **444** flows through just the first valve **410** to a passage **448**, thus bypassing the first and second flow restrictors **412**, **422**. That is, the flow rate possible through the first valve **410** and the passage **448** is substantially greater (e.g., by an order of magnitude) than the combined flow rate possible through the first and second flow restrictors **412**, **422**, such that **90**% or more of fluid received by the passage **444** flows through the first valve **410**. Accordingly, activation of the impact jar apparatus **300** is delayed by a third amount of time sufficient to permit enough hydraulic fluid to pass through various passages **440**, **442**, **448** and the first valve **410** and thereby permit enough relative upward movement of the outer latch portion **350** to permit disengagement of the inner latch portion **330** from the tubular feature **310**. The third amount of time may be minimal, such as less than 20% (e.g., perhaps less than 5%) of the first amount of time.

[0052] Referring also to FIG. **1**, if the impact jar apparatus **150** includes activation delay means (such as the delay means described above and/or other delay means), the impact jar apparatus **150** may be triggered at almost any value above the predetermined activation tension. This permits the operator to start a jarring operation with an initial activation of the impact jar apparatus **150** that results in a low impact force and then, as needed, causing subsequent activations that may gradually increase the impact force. For example, the impact force of an initial activation may be about 5,000 pounds (lbs) and subsequent activations may increase the impact force in increments of about 250 lbs. Such approach of gradually increasing an initially low impact force may avoid damaging the impact jar apparatus **150**, other components **130**, **140** of the tool string **105**, the conveyance means **160**, the tensioning device **170**, and/or other surface equipment **175**.

[0053] Moreover, if the impact jar apparatus **150** does not include activation delay means (such as the delay means described above and/or other delay means), the impact jar apparatus **150** may be susceptible to inadvertent activation when, for example, tension applied to the tool string **105** unintentionally exceeds the trigger tension. Such occurrence is often not detectable quickly enough to reduce the tension via operation of the tensioning device **170** (e.g., due to angular momentum of a spool and/or other rotating feature (s) of the tensioning device **170** and/or linear momentum of the conveyance means **160** and upper tool string portion **130**), such that the impact jar apparatus **150** is inadvertently activated. Such inadvertent activation can increase the time and cost of downhole operations. Moreover, each individual activation of the impact jar apparatus **150** can potentially damage other components **130**, **140** of the tool string **105**, the conveyance means **160**, the tensioning device **170**, other surface equipment **175**, and potentially even the impact jar apparatus **150**, which further increases operational and maintenance costs. However, by configuring the impact jar apparatus **150** to include a delay between the attainment of the trigger tension and activation (i.e., jarring), such as by utilizing the implementation of the impact jar apparatus **300** depicted in FIGS. **5-11**, inadvertent tension spikes can be identified and rectified prior to such inadvertent jarring.

[0054] Thus, by introducing an activation delay according to one or more aspects introduced in the present disclosure, such as by utilizing the example configurations depicted in FIGS. **9** and **10**, operational and maintenance time and costs can be reduced. The activation delay, for example, may be 30-60 seconds for the configuration depicted in FIG. **9** or 60-120 seconds for the configuration depicted in FIG. **10**.

[0055] However, an activation delay may not be critical in some operations, such as when the predetermined trigger tension exceeds (e.g., by 25% and/or some other predetermined safety factor) a maximum conceivable tension to be applied to the tool string **105** during operations. In such scenarios, the impact jar apparatus **150** may be an instance of the impact jar apparatus **300** configured as depicted in FIG. **11**, such that activation of the impact jar apparatus **300** occurs within a few seconds (e.g., less than 10 seconds) after the trigger tension is attained via operation of the tensioning device **170**.

[0056] Although the flow restrictors **412**, **422** are schematically depicted in FIGS. **9-11** as being integral to the hydraulic manifold **328**, the flow restrictors **412**, **422** may be discrete devices assembled with the hydraulic manifold **328**. For example, the flow restrictors **412**, **422** may be interchangeable with other, differently sized flow restrictors, so as to adjust the length of the activation delay. This permits adjustment of the activation delay without disassembly of the tool string **110**. Accordingly, the length of the activation delay can even be adjusted at the wellsite by including job-specific flow restrictors **412**, **422** and setting the open/closed positions of the valves **410**, **420**. Moreover, a malfunctioning flow restrictor **412**, **422** can be replaced without disassembly of the tool string **110** (perhaps even at the wellsite), or at least without significant disassembly of the impact jar apparatus **300**. Additionally, implementations within the scope of the present disclosure may also include more than the two flow restrictors **412**, **422**, such as to provide additional lengths of activation delays.

[0057] In FIGS. **9-11**, arrow sizes and directions generally indicate fluid flow rates and directions, including fluid discharged from the flow restrictors **412**, **422** and the passage **448** into the fluid reservoir **430**. In some implementations, fluid entering the passage **442** may first flow through a filter **460** so that fluid entering the flow restrictors **412**, **422** is free of particulate that could otherwise clog the flow restrictors **412**, **422**.

[0058] As also depicted in FIGS. **9-11**, the housing **302** may include slots or other openings **470** by which the first and second valves **410**, **420** may be accessed at the wellsite, so that the valves **410**, **420** may be opened or closed to adjust the above-described activation delay. Although not depicted in FIGS. **9-11**, the impact jar apparatus **300** may also comprise one or more covers that may be temporarily moved or removed to access the valves **410**, **420** at the wellsite and then returned to a position that protects the valves **410**, **420** from the downhole environment.

[0059] FIG. **12** is a schematic sectional view of another portion of the impact jar apparatus **300** comprising an activation indicator **530** that is an example implementation of the activation indicator **230** shown in FIGS. **2** and **4**, according to one or more aspects of the present disclosure. The example activation indicator **530** includes a wire coil **500** disposed within an exterior groove and/or other recess **504** of the tubular feature **310**. Electrical connections **508** connect the wire coil **500** to a wire harness (not shown) of the impact jar apparatus **300**. An internal chassis or other member **512** is threadedly and/or otherwise fixed relative to the outer housing **302**. The axial positioning of the chassis **512** relative to the housing **302** may be set by contact between an internal, uphole-facing shoulder **516** of the housing **302** and an external, downhole-facing shoulder **520** of the chassis **512**.

[0060] The chassis **512** includes a plurality of embedded magnets **524** extending circumferentially around the tubular feature **310**, thus creating a predetermined magnetic field **526** depicted in FIG. **12** by dashed magnetic field lines. When the impact jar apparatus **300** activates, such that the housing **302** and the chassis **502** attached thereto collectively move upward relative to the tubular feature **310**, the movement of the wire coil **500** through the magnetic field **526** generates a voltage pulse in the wire coil **500**. This signal may be sent directly to the surface and read via a user interface (e.g., voltage panel) of a casing collar locator (CCL) and/or other surface equipment **175**. Alternatively, or additionally, the signal from the wire coil **500** may be digitized in a telemetry cartridge (e.g., of the tool string module **130** depicted in FIG. **1**) and sent to the surface equipment **175** via telemetry. Additional means for transmitting to the surface equipment **175** data based on the voltage pulse and/or other signal generated by the wire coil **500** are also within the scope of the present disclosure.

[0061] Surface availability of the signal from the wire coil **500** (or data based thereon) permits real-time confirmation that the impact jar apparatus **300** has activated. Such real-time confirmation that the impact jar apparatus **300** has activated can be vital during operations to dislodge a stuck portion of the tool string, especially if the impact jar apparatus **300** is configured for activating after the elapse of the above-described delay.

[0062] For example, with additional reference to FIG. **1**, if the impact jar apparatus **150** is not configured to include the above-described delay, it is reasonable to assume that the impact jar apparatus **150** will activate within a few seconds (e.g., less than 2-3 seconds) after the trigger tension is applied to the tool string **105** via the conveyance means **160**. However, by configuring the impact jar apparatus **150** to include a delay between attainment of the trigger tension and activation (i.e., jarring), such as in the implementation of the impact jar apparatus **300** depicted in FIGS. **5-11**, inadvertent tension spikes can be identified and rectified prior to inadvertent jarring, and the signal generated by the wire coil **500** can be utilized to confirm that the impact jar apparatus **300** has been activated. Moreover, when the impact jar apparatus **300** relatches (as described below), the wire coil **500** again passes through the magnetic field **526**, thus creating another voltage pulse indicative of relatch.

[0063] The speed at which the magnetic field **526** passes by the wire coil **500** is proportional to the voltage in the pulse. Such speed information may be utilized to estimate the actual jarring force generated by activation of the impact jar apparatus **300**. Moreover, because the activation indicator **530** is a passive device, it may be implemented without the provision of additional power and associated electronics. It is also noted that other types of motion sensors, such as a Hall effect sensor or linear potentiometer, may also or instead be used to detect activation and/or relatch.

[0064] The magnets **524** may be comprised of samarium cobalt, neodymium, and/or other permanently magnetic materials. One or more retainers **528** may be utilized to retain the magnets **524** embedded within the chassis **512**. In the example implementation depicted in FIG. **12**, the retainers **528** are opposing portions of a clam-shell design that close around/within an external groove **532** of the chassis **512**. However, other implementations are also within the scope of the present disclosure. For example, the external groove **532** may instead be a plurality of external recesses azimuthally spaced around the chassis **512**, and each retainer **528** may be one of a plurality of discrete members each threadedly and/or otherwise retained within a corresponding one of the external recesses, thereby retaining a corresponding one of the magnets **524** within the chassis **512**.

[0065] The following description refers to FIGS. **1**, **2**, and **12**, collectively. Friction between the upper tool string portion **140** and the sidewall of the wellbore **110** (especially when the casing **180** is not extant) may restrict the ability of the impact jar apparatus **300** to relatch under the weight of the dynamic (unstuck) portion, the upper tool string portion **140**, and the conveyance means **160**, especially in non-vertical sections of the wellbore **110**. Thus, as depicted in FIG. **12**, the impact jar apparatus **300** may include a relatch assist **632**, which is an example implementation of the relatch assist **232** shown in FIG. **2**.

[0066] For example, the relatch assist **632** may comprise one or more compression springs (and/or other biasing members) **600** that, when compressed, generate an uphole-directed biasing force **604** and an opposing downhole-directed biasing force **608**. In the example implementation depicted in FIG. **12**, the uphole-directed biasing force **604** is applied against a downhole-facing shoulder and/or other feature **612** of the tubular feature **310** and the downhole-directed biasing force **608** is applied against an uphole-facing should and/or other feature **614** of the chassis **512**. Thus, the biasing forces **604**, **608** generated by the compression spring(s) **600** may be collectively operable to move the chassis **512** (and, thus, the housing **302**) downward relative to the tubular feature **310** until returning to the latched position shown in FIG. **12**.

[0067] That is, referring also to FIGS. **1** and **5**, the tensioning device **170** is operated to reduce (or remove) the tension applied via the conveyance means **160** to the tool string **105**. Consequently, the collective weight of the conveyance means **160**, the upper tool string portion **130**, and the dynamic portion of the impact jar apparatus **300**, together with the biasing forces **604**, **608**, urge the dynamic portion of the impact jar apparatus **300** downward relative to the wellbore **110** and the tubular feature **310**. Such movement brings the surface **342** downward into contact with the protrusion **370**, which then deflects the collet finger ends **338**

into the recess formed by the surfaces **351**, **353**, **358** such that the collet finger ends **338** can move downward past the protrusion **370**. Further downward movement of the dynamic portion of the impact jar apparatus **300** brings the surface **342** downward into contact with the surface **372** such that the cylindrical surface **356** of the outer latch portion **350** move downward past the collet finger ends **338** until the inner and outer latch portions **330**, **350** return to the latched configuration depicted in FIG. **5**.

[0068] As described above, the combined weight of the conveyance means **160**, the upper tool string portion **130**, and the dynamic portion of the impact jar apparatus **300** may not be sufficient to overcome friction between such components and the wellbore **110** so as to successfully return the impact jar apparatus **300** to the latched configuration depicted in FIG. **5**, especially in portions **112** of the wellbore **110** not having the casing **180**. The additional biasing forces **604**, **608** generated by the relatch assist **632** and urging the dynamic portion of the impact jar apparatus **300** downward relative to the tubular feature **310** may aid in overcoming such friction to successfully relatch the impact jar apparatus **300**. While the example implementation of FIG. **12** depicts the relatch assist **632** comprising one or more compressions springs and/or other biasing means **600** between the chassis **512** and the tubular feature **310**, the relatch assist **632** in other implementations within the scope of the present disclosure may be located in other and/or additional locations within the impact jar apparatus **300**, and may comprise biasing means other than or in addition to the compression spring(s) **600** depicted in FIG. **12**.

[0069] FIG. **13** is a schematic sectional view of another portion of the impact jar apparatus **300**, including at least a portion of a shock absorber **734** that is an example implementation of the shock absorber **234** shown in FIGS. **2** and **4**, according to one or more aspects introduced by the present disclosure. The following description refers to FIGS. **1**, **2**, **4**, and **13**, collectively, in which the impact jar apparatus **150** of FIG. **1** may be an instance of the impact jar apparatus **200** shown in FIGS. **2** and **4** which, in turn, may be an instance of the above-described impact jar apparatus **300**.

[0070] The shock absorber **734** may reduce the force placed on sensitive components of the upper tool string portion **130** located above the impact jar apparatus **300**, such as a cable head, telemetry cartridge, gamma ray module, and the like. The shock absorber **334** may comprise a plurality of elastomeric (e.g., VITON) bumper rings that absorb axial shock generated by activation of the impact jar apparatus **300**, such that the axial shock is not transmitted (or is at least dampened) along mechanical load paths **700** to the upper tool string portion **130**.

[0071] For example, the housing **302** may have an internal flange and/or other feature having an upward facing shoulder **704** and a downward facing shoulder **708**, and the tubular feature **310** may comprise a first member **712** and a second member **716** that threadedly or otherwise fixedly receives an upper end of the first member **712**. A first elastomeric bumper ring **720** may interposingly contact and thereby absorb axial shock between the downward facing shoulder **708** of the housing **302** and an upward facing shoulder **724** of the first tubular feature member **716**. A second elastomeric bumper ring **728** may interposingly contact and thereby absorb axial shock between a bottom surface **732** of the second member **720** and the upward facing shoulder **704** of the housing **302**. As depicted in FIG. **13**, the first and second elastomeric bumper rings **720**, **728** may be sized and positioned such that the mechanical load paths **700** between the dynamic and static portions of the impact jar apparatus **300** pass through the bumper rings **720**, **728**. Accordingly, the bumper rings **720**, **728** may aid in reducing or preventing axial shock from being transmitted to the upper tool string portion **130** during activation of the impact jar apparatus **300**.

[0072] The shock absorber **734** may also comprise a plurality of elastomeric (e.g., VITON) O-rings **738**, **740** that aid in preventing hydraulic fluid from leaking out of the impact jar apparatus **300**, and also provide stiffening when the impact jar apparatus **300** is subjected to bending forces. For example, as depicted in FIG. **13**, the O-rings **738**, **740** may be carried in external recesses **742** of the second tubular feature member **716** at multiple axial locations, perhaps including at least two O-rings **738** positioned axially above the bumper rings **720**, **728** and at least two O-rings **740** positioned axially below the bumper rings **720**, **728**. The O-rings **738**, **740** may also aid in preventing metal-to-metal contact and/or reduce shock transmission between the dynamic and static portions of the impact jar apparatus **300**.

[0073] In view of the entirety of the present disclosure, including the figures and the claims, a person having ordinary skill in the art will readily recognize that the present disclosure introduces an impact jar apparatus comprising: a dynamic portion having a first connector for connection to an upper portion of a downhole tool string for conveyance within a wellbore penetrating a subterranean formation; a static portion having a second connector for connection to a lower portion of the tool string; and a hydraulic manifold in fluid communication with an annulus defined between the dynamic and static portions, wherein the hydraulic manifold is configurable to adjust a delay between application of a trigger tension to the tool string and consequent activation of the impact jar apparatus.

[0074] The hydraulic manifold may comprise: a first flow restrictor; a second flow restrictor; and first and second valves configurable to collectively control fluid flow from the annulus to the first and second flow restrictors and thereby adjust the delay. The first and second valves may be configurable to select the delay from one of a plurality of delays comprising: a first delay resulting from the first valve being closed and the second valve being open such that fluid from the annulus flows to the first and second flow restrictors; and a second delay resulting from the first and second valves being closed such that fluid from the annulus flows to the first flow restrictor and not the second flow restrictor. The second delay may be longer than the first delay. The second delay may be at least twice as long as the first delay. The plurality of delays may further comprise a third delay resulting from the first valve being open such that fluid from the annulus substantially bypasses the first and second flow restrictors. The plurality of delays may consist of just the first, second, and third delays.

[0075] The first and second flow restrictors may be interchangeable with other, differently sized flow restrictors so as to adjust the length of the activation delay.

[0076] The first and second valves may be configurable without disassembling the impact jar apparatus from the tool string.

[0077] The impact jar apparatus may comprise an activation indicator providing real-time confirmation, at a wellsite surface whence the wellbore extends, that the impact jar apparatus has activated.

[0078] The impact jar apparatus may comprise a relatch assist urging the dynamic and static portions toward a latched position.

[0079] The impact jar apparatus may comprise a shock absorber configured to absorb axial shock generated by activation of the impact jar apparatus.

[0080] The present disclosure also introduces an impact jar apparatus comprising: a dynamic portion having a first connector for connection to an upper portion of a downhole tool string for conveyance within a wellbore penetrating a subterranean formation; a static portion having a second connector for connection to a lower portion of the tool string; and an activation indicator providing real-time surface confirmation that the impact jar apparatus has activated. The activation indicator comprises: a wire coil disposed within an external recess of the static portion; and a plurality of magnets carried by the dynamic portion and generating a magnetic field such that a voltage pulse is generated in the wire coil in response to the magnetic field passing by the wire coil upon activation of the impact jar apparatus.

[0081] The activation indicator may provide real-time information indicative of a speed at which the magnetic field passes by the wire coil.

[0082] The activation indicator may provide real-time surface confirmation that the impact jar apparatus has relatched after activation.

[0083] The impact jar apparatus may comprise a hydraulic manifold in fluid communication with an annulus defined between the dynamic and static portions, wherein the hydraulic manifold is configurable to adjust a delay between application of a trigger tension to the tool string and consequent activation of the impact jar apparatus.

[0084] The impact jar apparatus may comprise a relatch assist urging the dynamic and static portions toward a latched position.

[0085] The impact jar apparatus may comprise a shock absorber configured to absorb axial shock generated by activation of the impact jar apparatus.

[0086] The present disclosure also introduces an impact jar apparatus comprising: a dynamic portion having a first connector for connection to an upper portion of a downhole tool string for conveyance within a wellbore penetrating a subterranean formation; a static portion having a second connector for connection to a lower portion of the tool string; and a relatch assist urging the dynamic and static portions toward a latched position.

[0087] The relatch assist may comprise a biasing member applying: an uphole-directed biasing force against the static portion; and a downhole-directed biasing force against the dynamic portion. The biasing member may be a compression spring applying: the uphole-directed biasing force against a downhole-facing shoulder of the static portion; and the downhole-directed biasing force against an uphole-facing shoulder of the dynamic portion.

[0088] The impact jar apparatus may comprise a hydraulic manifold in fluid communication with an annulus defined between the dynamic and static portions, wherein the hydraulic manifold is configurable to adjust a delay between application of a trigger tension to the tool string and consequent activation of the impact jar apparatus.

[0089] The impact jar apparatus may comprise an activation indicator providing real-time confirmation, at a wellsite surface whence the wellbore extends, that the impact jar apparatus has activated.

[0090] The impact jar apparatus may comprise a shock absorber configured to absorb axial shock generated by activation of the impact jar apparatus.

[0091] The present disclosure also introduces an impact jar apparatus comprising: a dynamic portion having a first connector for connection to an upper portion of a downhole tool string for conveyance within a wellbore penetrating a subterranean formation; a static portion having a second connector for connection to a lower portion of the tool string; and a shock absorber configured to absorb axial shock generated by activation of the impact jar apparatus.

[0092] The shock absorber may comprise a plurality of elastomeric bumper rings.

[0093] A housing of the dynamic portion may comprise an internal flange having a first upward facing shoulder and a downward facing shoulder; the static portion may comprise a first member and a second member that fixedly receives an upper end of the first member, wherein the first static portion member comprises a second upward facing shoulder and the second static portion member comprises a bottom surface; and the shock absorber may comprise first and second elastomeric bumper rings, the first elastomeric ring interposingly contacting the downward facing shoulder of the housing and second upward facing shoulder of the first static portion member, and the second elastomeric bumper ring interposingly contacting the bottom surface of the second static portion member and the first upward facing shoulder of the housing.

[0094] The impact jar apparatus may comprise a hydraulic manifold in fluid communication with an annulus defined between the dynamic and static portions, wherein the hydraulic manifold is configurable to adjust a delay between application of a trigger tension to the tool string and consequent activation of the impact jar apparatus.

[0095] The impact jar apparatus may comprise an activation indicator providing real-time confirmation, at a wellsite surface whence the wellbore extends, that the impact jar apparatus has activated.

[0096] The impact jar apparatus may comprise a relatch assist urging the dynamic and static portions toward a latched position.

[0097] The foregoing outlines features of several embodiments so that a person having ordinary skill in the art may better understand the aspects of the present disclosure. A person having ordinary skill in the art will appreciate that they may readily use the present disclosure as a basis for designing or modifying other processes and structures for carrying out the same functions and/or achieving the same benefits of the embodiments introduced herein. A person having ordinary skill in the art will also realize that such equivalent constructions do not depart from the scope of the present disclosure, and that they may make various changes, substitutions and alterations herein without departing from the scope of the present disclosure.

[0098] The Abstract at the end of this disclosure is provided to comply with 37 C.F.R. § 1.72 (b) to permit the reader to quickly ascertain the nature of the technical disclosure. It is submitted with the understanding that it will not be used to interpret or limit the scope or meaning of the claims.

1. An impact jar apparatus, comprising:
a dynamic portion having a first connector for connection to an upper portion of a downhole tool string for conveyance within a wellbore penetrating a subterranean formation;
a static portion having a second connector for connection to a lower portion of the tool string; and
a hydraulic manifold in fluid communication with an annulus defined between the dynamic and static portions, wherein the hydraulic manifold is configurable to adjust a delay between application of a trigger tension to the tool string and consequent activation of the impact jar apparatus;
wherein the hydraulic manifold comprises:
a first flow restrictor;
a second flow restrictor; and
first and second valves configurable to collectively control fluid flow from the annulus to the first and second flow restrictors and thereby adjust the delay; and
wherein the first and second valves are configurable to select the delay from one of a plurality of delays comprising:
a first delay resulting from the first valve being closed and the second valve being open such that fluid from the annulus flows to the first and second flow restrictors; and
a second delay resulting from the first and second valves being closed such that fluid from the annulus flows to the first flow restrictor and not the second flow restrictor.
2. (canceled)
3. (canceled)
4. The impact jar apparatus of claim **1** wherein the second delay is longer than the first delay.
5. The impact jar apparatus of claim **1** wherein the second delay is at least twice as long as the first delay.
6. The impact jar apparatus of claim **1** wherein the plurality of delays further comprises a third delay resulting from the first valve being open such that fluid from the annulus substantially bypasses the first and second flow restrictors.
7. The impact jar apparatus of claim **1** wherein the first and second flow restrictors are interchangeable with other, differently sized flow restrictors so as to adjust the length of the activation delay.
8. The impact jar apparatus of claim **1** further comprising an activation indicator providing real-time confirmation, at a wellsite surface whence the wellbore extends, that the impact jar apparatus has activated.
9. The impact jar apparatus of claim **1** further comprising a relatch assist urging the dynamic and static portions toward a latched position.
10. The impact jar apparatus of claim **1** further comprising a shock absorber configured to absorb axial shock generated by activation of the impact jar apparatus.
11. An impact jar apparatus, comprising:
a dynamic portion having a first connector for connection to an upper portion of a downhole tool string for conveyance within a wellbore penetrating a subterranean formation;
a static portion having a second connector for connection to a lower portion of the tool string; and
an activation indicator providing real-time surface confirmation that the impact jar apparatus has activated, wherein the activation indicator comprises:
a wire coil disposed within an external recess of the static portion; and
a plurality of magnets carried by the dynamic portion and generating a magnetic field such that a voltage pulse is generated in the wire coil in response to the magnetic field passing by the wire coil upon activation of the impact jar apparatus.
12. The impact jar apparatus of claim **11** wherein the activation indicator also provides real-time surface confirmation that the impact jar apparatus has relatched after activation.
13. The impact jar apparatus of claim **11** further comprising a hydraulic manifold in fluid communication with an annulus defined between the dynamic and static portions, wherein the hydraulic manifold is configurable to adjust a delay between application of a trigger tension to the tool string and consequent activation of the impact jar apparatus.
14. The impact jar apparatus of claim **11** further comprising a relatch assist urging the dynamic and static portions toward a latched position.
15. The impact jar apparatus of claim **11** further comprising a shock absorber configured to absorb axial shock generated by activation of the impact jar apparatus.
16. An impact jar apparatus, comprising:
a dynamic portion having a first connector for connection to an upper portion of a downhole tool string for conveyance within a wellbore penetrating a subterranean formation;
a static portion having a second connector for connection to a lower portion of the tool string; and
a shock absorber comprising a plurality of elastomeric bumper rings that are collective configured to absorb axial shock generated by activation of the impact jar apparatus.
17. The impact jar apparatus of claim **16** further comprising a relatch assist urging the dynamic and static portions toward a latched position, wherein the relatch assist comprises a biasing member applying:
an uphole-directed biasing force against the static portion; and
a downhole-directed biasing force against the dynamic portion.
18. The impact jar apparatus of claim **16** further comprising a hydraulic manifold in fluid communication with an annulus defined between the dynamic and static portions, wherein the hydraulic manifold is configurable to adjust a delay between application of a trigger tension to the tool string and consequent activation of the impact jar apparatus.
19. The impact jar apparatus of claim **16** further comprising an activation indicator providing real-time confirmation, at a wellsite surface whence the wellbore extends, that the impact jar apparatus has activated.
20. (canceled)
21. The impact jar apparatus of claim **16** wherein:
a housing of the dynamic portion comprises an internal flange having a first upward facing shoulder and a downward facing shoulder;
the static portion comprises:
a first member; and
a second member that fixedly receives an upper end of the first member;

the first static portion member comprises a second upward facing shoulder;

the second static portion member comprises a bottom surface;

the plurality of elastomeric bumper rings comprise first and second elastomeric bumper rings;

the first elastomeric ring interposingly contacts the downward facing shoulder of the housing and the second upward facing shoulder of the first static portion member; and

the second elastomeric bumper ring interposingly contacts the bottom surface of the second static portion member and the first upward facing shoulder of the housing.

22. The impact jar apparatus of claim **16** further comprising:

a hydraulic manifold in fluid communication with an annulus defined between the dynamic and static portions, wherein:

the hydraulic manifold is configurable to adjust a delay between application of a trigger tension to the tool string and consequent activation of the impact jar apparatus;

the hydraulic manifold comprises:

a first flow restrictor;

a second flow restrictor; and

first and second valves configurable to collectively control fluid flow from the annulus to the first and second flow restrictors and thereby adjust the delay;

an activation indicator providing real-time confirmation, at a wellsite surface whence the wellbore extends, that the impact jar apparatus has activated, wherein the activation indicator comprises:

a wire coil disposed within an external recess of the static portion; and

a plurality of magnets carried by the dynamic portion and generating a magnetic field such that a voltage pulse is generated in the wire coil in response to the magnetic field passing by the wire coil upon activation of the impact jar apparatus; and

a relatch assist urging the dynamic and static portions toward a latched position.

23. The impact jar apparatus of claim **22** wherein:

the first and second valves are configurable to select the delay from one of a plurality of delays comprising:

a first delay resulting from the first valve being closed and the second valve being open such that fluid from the annulus flows to the first and second flow restrictors;

a second delay resulting from the first and second valves being closed such that fluid from the annulus flows to the first flow restrictor and not the second flow restrictor, wherein the second delay is longer than the first delay; and

a third delay resulting from the first valve being open such that fluid from the annulus substantially bypasses the first and second flow restrictors;

the activation indicator also provides real-time surface confirmation that the impact jar apparatus has relatched after activation;

the relatch assist comprises a biasing member applying:

an uphole-directed biasing force against the static portion; and

a downhole-directed biasing force against the dynamic portion;

a housing of the dynamic portion comprises an internal flange having a first upward facing shoulder and a downward facing shoulder;

the static portion comprises:

a first member; and

a second member that fixedly receives an upper end of the first member;

the first static portion member comprises a second upward facing shoulder;

the second static portion member comprises a bottom surface;

the plurality of elastomeric bumper rings comprise first and second elastomeric bumper rings;

the first elastomeric ring interposingly contacts the downward facing shoulder of the housing and the second upward facing shoulder of the first static portion member; and

the second elastomeric bumper ring interposingly contacts the bottom surface of the second static portion member and the first upward facing shoulder of the housing.

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