Abstract
A releasing mechanism for releasing a hydraulically actuated setting tool from a downhole tool is provided. Preferably, the downhole tool to be released is a wellbore sealing tool such as a bridge plug, packer or inflatable packer. The releasing mechanism comprises an adapter having a body, a connector above the body connected to the setting tool, and a lower portion. The releasing mechanism further comprises a releasable connection which releasably connects the lower portion of the adapter to a mandrel within the bridge plug or other sealing tool. In one embodiment, the releasable connection defines a frangible body disposed within the plane of the circumferential bore of the bridge plug mandrel. In another arrangement, the releasable connection defines both a frangible body and threaded collet fingers which releasably engage matching threads on the outer surface of the mandrel of the bridge plug or other wellbore sealing tool.
RELEASING MECHANISM FOR DOWNHOLE SEALING TOOL

NATURE OF THE INVENTION

[0001] The present invention pertains to downhole tools for a hydrocarbon wellbore. More specifically, the present invention pertains to downhole tools useful in conjunction with the sealing of an opening within a wellbore. More specifically still, the present invention pertains to a releasing mechanism for releasing a bridge plug or other sealing tool into a wellbore after the sealing tool has been set.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] Hydrocarbon and other wells are completed by forming a borehole in the earth and then lining the borehole with steel pipe or casing to form a wellbore. After a section of wellbore is formed by drilling, a section of casing is lowered into the wellbore and temporarily hung therein from the surface of the well. Using apparatus known in the art, the casing is cemented into the wellbore by circulating cement into the annular area defined between the outer wall of the casing and the borehole. The combination of cement and casing strengthens the wellbore and facilitates the isolation of certain areas of the formation behind the casing for the production of hydrocarbons.

[0003] It is sometimes desirable to seal or plug the wellbore at a selected depth downhole. Various tools are used to accomplish a sealing of the wellbore. These tools include a bridge plug, a mechanical packer, and an inflatable packer. In some instances, a sealing tool may be used to permanently plug a well after production operations have ceased. In other instances, a wellbore may be temporarily plugged so that formation treatment operations may be conducted. For example, a bridge plug may be set at a depth below a production zone in a wellbore. A formation fracturing operation can then be conducted above the bridge plug by injecting gel and sand, under pressure, into the formation. Other uses for sealing tools are also known.

[0004] Traditionally, sealing tools such as bridge plugs and packers have been fabricated from alloys of metal. Metallic plugs are considered most durable in high temperature, high pressure environments. Recently, sealing tools have been fabricated from composite materials. Such composite materials include plastics and ceramics. Advantages exist in the use of nonmetallic sealing plugs, such as lower manufacturing costs. Also, composite tools are more easily milled in the hole in the event it is desired to set the downhole plugging tool only temporarily.

[0005] One disadvantage which has been encountered with the use of nonmetallic plugs pertains to the process of releasing the plug from a working string downhole. In the typical plugging operation, the composite bridge plug is run into the wellbore at the end of a working string, e.g., drill string, coiled tubing, wireline, etc. A separate releasing tool is disposed between the bridge plug and the working string. The releasing tool is used to release the bridge plug from the working string once the bridge plug or other sealing tool is set. To accomplish this, the releasing tool includes a tubular lower portion which concentrically encompasses an upper end of an inner mandrel of the bridge plug. A plurality of set screws temporarily fasten the lower portion of the tubular releasing tool and the inner mandrel of the bridge plug. The bridge plug is set by application of differential pressure between the mandrel and outer setting portions of the bridge plug. Differential pressure is typically applied by either a charge deployed at the lower end of a wireline, or through the injection of fluid under pressure into a hydraulic setting tool. Application of additional pressure after the bridge plug has been set causes the shear screws to shear, allowing the setting tool to be released from the composite inner mandrel.

[0006] The use of metallic shear screws in a nonmetallic mandrel creates an unpredictable and, sometimes, unreliable arrangement for shearingly releasing a setting tool from a bridge plug. This is because the physical properties of nonmetallic materials can be dissimilar and not typically as uniform in nature as metallic materials. Thus, a need exists for an alternate apparatus for releasing a hydraulic setting tool from a bridge plug after the bridge plug has been set in a wellbore.

[0007] An apparatus is also needed which will permit a hydraulic setting tool to be consistently released or disconnected from a nonmetallic bridge plug after the bridge plug has been set through application of a predictable force or pressure. Further, a need exists for a releasing mechanism which does not require a metal-to-composite interface between a shear screw and the inner mandrel of the bridge plug or other sealing tool.

SUMMARY OF THE INVENTION

[0008] A releasing mechanism for releasing a hydraulic (or other) setting tool from a bridge plug within a wellbore is provided. For purposes of this application, the term “bridge plug” includes any tool used for sealing an opening in a wellbore, including bridge plugs, hydro-mechanically set packers, and inflatable packers. Further, the term “bridge plug” includes bridge plugs of any material, whether metallic or nonmetallic.

[0009] The releasing mechanisms of the present invention are designed to release a bridge plug from a setting tool after the bridge plug has been set. To this end, the releasing mechanisms of the present invention first comprise an adapter. The adapter includes an upper portion which is connected to a lower end of a hydraulic setting tool. The adapter is configured to receive an upward force generated by hydraulic pressure injected into the hydraulic setting tool for the bridge plug. The releasing mechanisms of the present invention further comprise a frangible member which releasably secures the adapter to the mandrel of the bridge plug until a releasing pressure has been reached. For each embodiment of the present inventions, the releasing pressure is a pressure greater than the pressure or force required to set the bridge plug itself within the wellbore.

[0010] Various embodiments for a releasing mechanism are provided in accordance with the present inventions. The various embodiments present different means for releasing the adapter from the inner mandrel of the bridge plug. In accordance with the various releasing means, different frangible members are employed. Preferably, the frangible member is disposed within the longitudinal plane of the circumference of the inner mandrel. This affords greater clearance for running the bridge plug into the surrounding casing of the wellbore.
BRIEF DESCRIPTION OF THE DRAWINGS

[0011] So that the manner in which the above recited features of the present invention are attained and can be understood in detail, a more particular description of the invention, briefly summarized above, may be had by reference to the embodiments thereof which are illustrated in the appended drawings. It is to be noted, however, that the appended drawings illustrate exemplary embodiments of this invention and are, therefore, not to be considered limiting of its scope, for the invention may admit to other legally equivalent embodiments.

[0012] FIG. 1 presents a wellbore containing a releasing mechanism of the present invention in one embodiment. The releasing mechanism is being run into the wellbore on a working string intermediate a hydraulic setting tool and bridge plug.

[0013] FIGS. 1A-1D provide an enlarged view for the tools within FIG. 1. FIG. 1A depicts a working string being lowered into a surrounding casing string within a wellbore. FIG. 1B shows a hydraulic setting tool as might be used to set a bridge plug. FIG. 1C presents the releasing mechanism of FIG. 1. FIG. 1D presents one arrangement for a bridge plug, attached to the lower end of the releasing mechanism of FIG. 1C.

[0014] FIGS. 1C-R presents a cross-sectional view of the releasing mechanism of FIG. 1C released from the mandrel of the bridge plug.

[0015] FIG. 2C presents a second embodiment of a releasing mechanism in accordance with the present invention. In this view, the releasing mechanism is in its run-in position such that it remains connected to the mandrel of a bridge plug.

[0016] FIGS. 2C-R presents the releasing mechanism of FIG. 2C being released from the mandrel of the bridge plug.

[0017] FIG. 3C presents a third embodiment of a releasing mechanism in accordance with the present invention. In this cross-sectional view, the releasing mechanism is in its run-in position such that it remains connected to the mandrel of a bridge plug.

[0018] FIGS. 3C-R presents the releasing mechanism of FIG. 3C being released from the mandrel of the bridge plug.

[0019] FIG. 4C presents a fourth embodiment of a releasing mechanism in accordance with the present invention. In this cross-sectional view, the releasing mechanism is in its run-in position such that it remains connected to the mandrel of a bridge plug.

[0020] FIGS. 4C-R presents the releasing mechanism of FIG. 4C being released from the mandrel of the bridge plug.

[0021] FIG. 5C presents a fifth embodiment of a releasing mechanism in accordance with the present invention. In this cross-sectional view, the releasing mechanism is in its run-in position such that it remains connected to the mandrel of a bridge plug.

[0022] FIGS. 5C-R presents the releasing mechanism of FIG. 5C being released from the mandrel of the bridge plug.

[0023] FIG. 6C presents a sixth embodiment of a releasing mechanism in accordance with the present invention. In this cross-sectional view, the releasing mechanism is in its run-in position such that it remains connected to the mandrel of a bridge plug.

[0024] FIGS. 6C-R presents the releasing mechanism of FIG. 6C being released from the mandrel of the bridge plug.

[0025] FIG. 7C presents a seventh embodiment of a releasing mechanism in accordance with the present invention. In this cross-sectional view, the releasing mechanism is in its run-in position such that it remains connected to the mandrel of a bridge plug.

[0026] FIGS. 7C-R presents the releasing mechanism of FIG. 7C being released from the mandrel of the bridge plug.

[0027] FIG. 8C presents an eighth embodiment of a releasing mechanism in accordance with the present invention. In this cross-sectional view, the releasing mechanism is in its run-in position such that it remains connected to the mandrel of a bridge plug.

[0028] FIGS. 8C-R presents the releasing mechanism of FIG. 8C being released from the mandrel of the bridge plug.

[0029] FIG. 9C presents a ninth embodiment of a releasing mechanism in accordance with the present invention. In this cross-sectional view, the releasing mechanism is in its run-in position such that it remains connected to the mandrel of a bridge plug.

[0030] FIGS. 9C-R presents the releasing mechanism of FIG. 9C being released from the mandrel of the bridge plug.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0031] FIG. 1 presents a releasing mechanism 100 of the present invention, in one embodiment. The releasing mechanism 100 is shown disposed in a wellbore 10. The wellbore 10 is cased with a string of casing 15. The casing is resides within a surrounding formation 18.

[0032] In the view of FIG. 1, the releasing mechanism 100 is being run into the wellbore 10 on a working string 20. The working string 20 may be any tubular string, including but not limited to drill pipe and coiled tubing. At the lower end of the working string 20 are various tools, including a hydraulic setting tool 30, a bridge plug 50, and a bridge plug releasing mechanism 100. The releasing mechanism 100 is used to release the bridge plug 50 from the end of the hydraulic setting tool 30. Exemplary arrangements of a hydraulic setting tool 30 and a bridge plug 50 are shown in FIG. 1.

[0033] FIGS. 1A-1D provide enlarged views of the tools 30,50,100 of FIG. 1. FIG. 1A presents a cross-sectional view of a wellbore, with the working string 20 being lowered into the surrounding casing 15 within the wellbore 10. An upper portion of the setting tool 30 is shown attached to a lower end of the working string 20. FIG. 1B shows the hydraulic setting tool 30 as might be used to set a bridge plug 50. FIG. 1C presents a first embodiment of a releasing mechanism 100 of the present invention. The releasing mechanism 100 is disposed intermediate the setting tool 30 and a bridge plug 50. Finally, FIG. 1D presents an exemplary arrangement for a bridge plug 50.

DESIGN 1

[0034] Turning to FIG. 1C, a releasing mechanism 100 in one arrangement is presented. Visible in FIG. 1C is a setting
sleeve 32 of the setting tool 30 circumferentially encompassing the releasing mechanism 100. The setting sleeve 32 defines a tubular body which is used by the setting tool 30 of FIG. 1B in order to exert downward pressure against the bridge plug 50 of FIG. 1D. In this regard, the setting sleeve 32 includes a lower shoulder 34 which butts downward against a setting ring 58 of the bridge plug 50. The setting sleeve 32 has an upper threaded connector 36 for connecting to an inner adapter 38 of the setting tool 30.

[0035] An upper portion of the bridge plug 50 is visible in FIG. 1C. The upper portion of the bridge plug 50 defines a mandrel 51 having a bore 52 therethrough. Also disposed on the bridge plug 50 is a support ring 56. The support ring is threadedly connected to the mandrel 51 near the top end 54. Thus, the support ring 56 defines a tubular body concentrically placed around the mandrel 51. Immediately below the support ring 56 and also disposed circumferentially around the mandrel 51 is the setting ring 58. The setting ring 58 has a larger outer diameter than the support ring 56. As noted, the setting ring 58 serves as a shoulder against which the setting sleeve 32 of the setting tool 30 acts. Thus, downward force applied by the setting sleeve 32 of the setting tool 30 provides the actuating force for setting the bridge plug 50.

[0036] Those of ordinary skill in the art will understand that the typical bridge plug 50 is set when upper 57 and lower 57" slips and an intermediate elastomeric packing element 59 engage the surrounding string of casing 15 in order to seal the wellbore 10. These features are seen in the exemplary bridge plug 50 of FIG. 1D. The slips are shown in 57, 57" while the packing element is shown at 59.

[0037] It is the purpose of the releasing mechanism 100 to release the setting tool 30 from the bridge plug 50. To accomplish this, an adapter 110 is first provided for the releasing mechanism 100. The adapter 110 includes a threaded upper connector 114 for sealingly connecting with the setting tool 30. In the arrangement of FIG. 1C, the adapter 110 further comprises a lower tubular portion 116 having a bore 112 therein. The lower tubular portion 116 butts downward against the end 54 of the inner mandrel 51.

[0038] Disposed partially within the lower portion 116 of the adapter 110 is a threaded rod 120. The threaded rod 120 defines a tubular body having an inner bore 112 running therethrough. The inner rod 120 is configured to fit within the inner bore 112 of the lower tubular portion 116 of the adapter 110. The inner rod 120 is threadedly connected to the lower portion 116 of the adapter 110 within the inner bore 112.

[0039] The rod 120 includes a lower portion 127 having an enlarged wall thickness. It can be seen in FIG. 1C that the enlarged wall portion 127 of rod 120 has both a slightly enlarged outer diameter to form an outer shoulder 124, and a significantly reduced inner diameter to form an inner shoulder 129.

[0040] In the arrangement of FIG. 1C, the releasing mechanism 100 also comprises a collet ring 130. The collet ring 130 defines a plurality of fingers 132 which are radially disposed between the threaded rod 120 and the mandrel 51 of the bridge plug 50. Each of the collet fingers 130 includes a shoulder portion 134 which butts against the outer shoulder 124 of the threaded rod 120. Each collet finger 132 includes gripping teeth on the outer diameter for gripping the surrounding mandrel 51.

[0041] Disposed within the lower portion of the threaded rod 120 is a shear nose 140. The shear nose includes a shear plane 145 formed normal to the plane of the longitudinal bore 52 in the mandrel 51. The shear plane 145 creates an area of structural weakness within the shear nose 140. As will be described below, upon application of tensile force, the shear nose 140 will fail along the shear plane 145. To aid in the application of tensile force, the shear nose 140 includes a severable lower portion 140L having a generally conical cross section. In the run-in position of FIG. 1C, the lower ends of the collet fingers 130 engage the lower portion 140L of the shear nose 140 in a friction fit between the lower nose portion 140L and the mandrel 51.

[0042] Finally, the releasing mechanism 100 in FIG. 1C includes a catch rod 150. The catch rod 150 defines an elongated rod having an upper end and a lower end. The lower end is threadedly connected to the lower portion 140L of the shear nose 140. The upper portion includes a shoulder 154 which resides within the inner bore 122 of the threaded rod 120 above the enlarged lower portion 127. As will be discussed, the inner shoulder 129 of the threaded rod 120 catches the shoulder 154 of the catch rod 150 when the releasing mechanism 100 releases from the bridge plug 50.

[0043] In operation, actuation of the hydraulic setting tool 30 creates a simultaneous downward force against the setting ring 58 of the bridge plug 50 and an upward force against the adapter 110 of the releasing mechanism 100. The threaded rod 120 is threadedly connected to the lower tubular portion 116 of the adapter 110. Therefore, an upward force against the adapter 110 serves to also pull the threaded rod 120 upward. As noted, the collet fingers 130 include a shoulder portion 134. An upward force of the threaded rod 120 causes the outer shoulder 124 to engage the shoulder 134 of the collet fingers 130. Thus, upward force against the adapter 110 also pulls the collet 130 upward within the wellbore.

[0044] A threaded connection is provided between the shear nose 140 and the lower portion of the threaded rod 120. Eventually, upward force against the adapter 110 pulls the threaded rod 120, the base of the shear nose 140, and the collet fingers 130 upward together. The shear nose 140 shears along the shear plane 145, leaving the lower portion 140L of the shear nose 140 within the mandrel 51.

[0045] Referring now to the cross-sectional view of FIGS. 1C-R, the releasing mechanism 100 is shown being released from the inner mandrel 51 of the bridge plug 50. It is to be noted that removal of the releasing mechanism 100 from the wellbore 10 brings with it the entire shear nose 140, including the sheared lower portion 140L. To accomplish this, the lower end of the catch rod 150 is threadedly connected to the lower portion 140L of the shear nose 140. Further, as the threaded rod 120 moves upward in the wellbore 10, the inner shoulder 129 catches the shoulder 154 of the catch rod 150. The sheared portion 140L of the shear nose 140 is then pulled from the wellbore 10 upon raising of the working string 20.

[0046] It can be seen from FIGS. 1C-R that the releasing mechanism 100 is simple to install, and leaves no metal parts within the bridge plug mandrel 51 after the bridge plug 50 has been released from the setting tool and the releasing mechanism 100. The releasing mechanism 100 of FIG. 1C can function properly with nonmetallic materials, and with-
out concern as to the collapse of a nonmetallic mandrel. No metal components or parts are left in the wellbore 10 after the bridge plug 50 is released, and all parts of the releasing mechanism 100 are reusable, except for the shear nose 140. Further, the mechanism 100 does not rely on metal-to-composite shearing.

[0047] Various other arrangements for a releasing mechanism 100 are provided in this application. These are listed below.

DESIGN 2

[0048] FIG. 2C presents an alternate arrangement for a releasing mechanism 200 of the present invention. Releasing mechanism 200 includes all of the same features as releasing mechanism 100 described in connection with FIG. 1C. However, releasing mechanism 200 further includes a metal sleeve 260 disposed along the inner diameter of the mandrel 51 proximate to the top end 54. In the arrangement of FIG. 2C, the metal sleeve 260 also wraps over the top end 54 of the mandrel 51. Thus, in one aspect, the inner metal sleeve 260 covers the inner diameter, the top end 54, and the outer diameter of the top of the mandrel 51.

[0049] The metallic sleeve 260 is machined to include a slotted profile in the inner diameter for the teeth of the collet rings 130 to locate. This helps secure the collet 130 to the mandrel 51 during run-in without applying undue burst pressure to the mandrel 51. Preferably, the sleeve 260 is fabricated from a softer metal, such as aluminum. The sleeve 260 helps control any possible ballooning or swelling of the mandrel 50 material when a severe load is applied during the bridge plug 50 releasing operation.

[0050] FIGS. 2C-R presents the releasing mechanism 20 of FIG. 2C being released from the mandrel 51 of the bridge plug 50. Operation of the releasing mechanism 200 in FIGS. 2C-R is the same as the operation of the releasing mechanism 100 in FIGS. 1C-R. It can be seen from FIGS. 2C-R that the releasing mechanism 200 enjoys the advantage of preventing the composite layers of the non-metallic mandrel from shearing. In this respect, the metal insert sleeve assist in spreading the load over the outer diameter and inner diameter of the mandrel when the bridge plug is set.

DESIGN 3

[0051] An alternate design for a releasing mechanism 300 of the present invention is depicted in FIG. 3C. As seen in FIG. 3C, the alternate releasing mechanism 300 first comprises an adapter 310. The adapter 310 is configured in accordance with the adapter 110 of Design 1 (shown in FIG. 1C) for the releasing mechanism 100. In this regard, the adapter 310 includes an upper connecting end 314, a lower tubular portion 316, and a bore 312 within the lower tubular portion 316.

[0052] The releasing mechanism 300 further comprises an inner tubular body 320 having an inner bore 322. The tubular body defines a shear rod 320. In this respect, the shear rod 320 includes a shear plane 345 which is normal to the longitudinal plane of the circumferential bore 52 within the mandrel 51 of the bridge plug 50. To aid in the failure of the shear rod 320 along the shear plane 345, a reduced wall thickness can be seen at the point of the shear plane 345.

[0053] The upper portion of the shear rod 320 is threadedly connected to the inner diameter of the tubular portion 316 of the adapter 310. By this arrangement, an upward force against the adapter 310 acts to create an upward force against the shear rod 320. The lower portion of the shear rod 320 is connected to the inner diameter of the mandrel 51. The lower portion of the shear rod 320 is shown at 320L.

[0054] The connection between the lower portion 320L of the shear rod 320 and the mandrel 51 may be of any number of means. Preferably, the lower portion 320L of the shear rod 320 is directly fabricated into the mandrel 51. The fabrication may include winding, molding, inserting, bonding, or gluing in to the mandrel 51. The connection may also be through a threaded connection.

[0055] In operation, actuation of the hydraulic setting tool causes an upward force against the adapter 310 and the shear rod 320. At the same time, the setting sleeve 32 acts downwardly against the setting ring 58 of the bridge plug 50. Ultimately, a releasing pressure is obtained within the hydraulic setting tool 30 which causes a failure of the shear rod 320 along the shear plane 345. Failure is due to tensile forces applied within the shear rod 320.

[0056] FIGS. 3C-R depicts the releasing mechanism 300 of FIG. 3C being removed from the wellbore 10. In this arrangement, the lower portion 320L of the shear rod 320 remains connected to and becomes a part of the mandrel 51 of the bridge plug 50 along an inner surface.

[0057] As can be seen, the releasing mechanism 300 is relatively inexpensive, and is simple to install. The releasing mechanism 300 further enjoys the advantage that it can be applied to bridge plugs having a small inner diameter within the mandrel. The releasing mechanism functions properly with both metallic and nonmetallic materials. A ball (not shown) may also be incorporated into the design. Further, the mechanism 300 does not rely on metal-to-composite shearing for tool 50 release.

DESIGN 4

[0058] Turning now to FIG. 4C, yet an additional alternate embodiment 400 for a releasing mechanism is disclosed. The releasing mechanism 400 first comprises an adapter member 410. The adapter 410 includes an upper portion 414 which serves as a threaded connector for connecting with the hydraulic setting tool 30 (not shown) in FIG. 4C. The adapter 410 also includes a middle portion 412 having an enlarged outer diameter. The base of the middle portion 412 defines a shoulder 418. Finally, the adapter 410 includes a lower male portion 416. The male portion 416 of the adapter 410 extends into the bore 52 of the mandrel 51.

[0059] The releasing mechanism 400 in FIG. 4C also comprises an insert sleeve 460. The insert sleeve 460 defines a tubular body disposed within the mandrel 51, and includes a bore 462 therein. The insert sleeve 460 is disposed concentrically within the bore 52 of the mandrel 51, and proximate to the upper end 54 of the mandrel 51. The insert sleeve 460 preferably is fabricated from a metallic material.

[0060] The insert sleeve 460 is releasably connected to the inner mandrel 51. In one aspect, a releasable connection is provided in the form of a plurality of shear pins 425. The shear pins 425 are inserted through holes 426 aligned through the mandrel 51, the insert sleeve 460 and the male portion 416 of the adapter 410. In one aspect, the shear pins 425 are threaded into drilled holes within the male portion 416.
In one aspect, the outer surface of the insert sleeve 460 includes a plurality of barbs 428. The barbs 428 are pressed into the inner surface of the mandrel 51 in order to further hold the insert sleeve 460 within the mandrel 51. In this arrangement, the inner sleeve 460 becomes a permanent part of the bridge plug 50.

In operation, the hydraulic setting tool 30 is actuated so as to provide opposing forces between the mandrel 51 and the setting ring 58 of the bridge plug 50. A setting pressure is ultimately reached by the hydraulic setting tool 30 in order to seat the bridge plug 50 within the wellbore 10. Pressure continues to be applied through the working string 20 and into the setting tool 30 so as to release the releasing mechanism 400. In this respect, an upward force applied by the setting tool 30 against the adapter 410 causes the shear pins 425 to shear. The use of a metal-to-metal contact between the shear pins 425 and the insert sleeve 460 serves to provide dependability and predictability as to the release pressure.

FIGS. 4C-R depicts the releasing mechanism 400 being pulled from the wellbore. In this arrangement, the shear pins 425 have been sheared from the connection with the male portion 416 of the adapter 410. The adapter 410 is now being pulled from the wellbore 10. However, the insert sleeve 460 remains a permanent fixture within the mandrel 51 of the bridge plug 50.

As can be seen from this disclosure in FIGS. 4C-R, the releasing mechanism 400 is relatively inexpensive, and is simple to install. The releasing mechanism 400 further enjoys the advantage that it can be applied to bridge plugs having a small inner diameter within the mandrel 51. A simple shear screw 425 can be used to achieve the desired load. A ball and seat (not shown) can be incorporated into the design.

An additional alternate design for a releasing mechanism 500 of the present invention is shown in FIG. 5C. The alternate arrangement 500 first comprises an adapter 510. The adapter 510 includes an upper threaded portion 514 for connection with the setting tool 30 (not shown). The adapter 510 also includes a middle portion 512 having an enlarged outer diameter. The base of the middle portion 512 defines a shoulder 518. Finally, the adapter 510 includes a lower male portion 516. The male portion 516 of the adapter 510 extends into the bore 52 of the mandrel 51.

The male portion 540 of the adapter 510 includes a shear plane 545 which is designed to fail upon application of tensile forces within the adapter 510. The shear plane 545 is oriented essentially normal to the plane of the circumferential bore 52 of the mandrel 51. A lower portion 540L of the male portion 540 extends below the shear plane 545.

In the arrangement of FIG. 5C, the mandrel 51 includes threads 56 machined into the outer diameter. Preferably, the threads are a tapered, acme-style thread. Where a nonmetal mandrel 51 is employed, the tapered threads assist in applying a load over different ceramic or composite layers through the nonmetallic material. This is especially useful when using a wrapped rolling composite or a filament winding composite. A matching tapered acme buttress box 536 is machined into a collet 530 for intermeshing with the threads 56 of the mandrel 51. The buttress-style threads 536 allow the setting tool 30 to release properly, as will be described further below. The threaded collet 530 includes a shoulder portion 534 which butts against the upper end 54 of the mandrel 51. Further, an upper portion 538 of the collet 530 includes an upper shoulder 538U and a lower shoulder 538L.

Disposed circumferentially around the collet 530 is a retaining sleeve 560. The retaining sleeve 560 defines a tubular member which has an upper end threadedly connected to the adapter 510. The upper end of the retaining sleeve 560 butts against the shoulder 518 of the adapter. The retaining sleeve 560 also has a shoulder 544 which butts against the upper shoulder 538U of the collet 530. Finally, at least one dog 565 is positioned through the retaining sleeve 540, as shown in FIG. 5C.

In operation, the releasing mechanism 500 is releasably connected to the mandrel 51 of the bridge plug 50. Injection of fluid under pressure into the hydraulic setting tool 30 above the releasing tool 500 creates opposing forces between the releasing mechanism 500 and the bridge plug 50. As noted previously, a downward force is applied by the setting sleeve 32 against the setting ring 58 of the bridge plug 50, and associated floating members such as the packing element 59 (shown in FIG. 1D). Simultaneously, an upward force is applied against the adapter 510. In the arrangement 500 of FIG. 5C, the adapter 510 is threadedly connected to the upper portion of the retaining sleeve 560. At the same time, a threaded connection is also maintained between the lower end 540L of the male portion 540 of the adapter 510 and the collet 530. Thus, an upward force applied against the adapter 510 pulls the retaining sleeve 560 upward, while the threaded collet 530 holds the lower portion 540L of the adapter 540 in place. Ultimately, upon application of the releasing pressure, the male portion 540 of the adapter 510 fails along the shear plane 545 due to the tensile forces described above.

FIGS. 5C-R presents a cross-sectional view of the releasing mechanism 500 being removed from the wellbore 10. In this arrangement, it can be seen that the adapter 510 and the threadedly connected retaining sleeve 560 are being moved upward through the casing 15 within the wellbore 10. As the retaining sleeve 560 moves upward, the threaded collet 530 is released from the outward-facing threads 56 of the mandrel 51. In this regard, the collet 530 is pre-stressed to cause the fingers 532 to be biased to move outwardly away from the threads 56 of the mandrel 51. As the retaining sleeve 560 further moves up the wellbore 10, the dogs 565 of the retaining sleeve 560 shoulder against the lower shoulder 538L of the collet 530. In this way, the collet 530 is removed from the wellbore 10 along with the adapter 510.

As can be seen from this disclosure and from FIGS. 5C-R, the releasing mechanism 500 leaves no metal components within the bore of the mandrel after the bridge plug or other wellbore sealing tool has been set. The releasing mechanism 500 further enjoys the advantage that it can be applied to bridge plugs having a small inner diameter within the mandrel. All releasing mechanism 500 components are tripped out of the wellbore 10 after the bridge plug 50 is set and released.
DESIGN 6

[0072] Still further, an alternate arrangement 600 for a releasing mechanism of the present invention is depicted in FIG. 6C. As shown in FIG. 6C, the releasing mechanism 600 first comprises an adapter 610. The adapter 610 includes an upper threaded portion 614 for connecting to the lower end of the setting tool 30. The adapter 610 also comprises a lower tubular portion 616. The lower tubular portion 616 creates an inner bore 622 partially into the adapter 610. A shoulder 618 is fabricated onto the outer surface of the lower tubular portion 616 of the adapter 610.

[0073] The releasing mechanism 600 also comprises a retaining sleeve 660. The top of the retaining sleeve 660 butts against the shoulder 618 of the adapter 610. The retaining sleeve 660 defines an elongated tubular body which extends downward from a shoulder 664. A plurality of dogs 665 are disposed within the elongated portion 646 of the retaining sleeve 660 in order to serve as a shoulder.

[0074] As with the mandrel 51 of FIG. 5C, the mandrel 51 of FIG. 6C includes threads 56 along the outer surface of the mandrel 51. A tapered acme-style thread is machined into the outer diameter of the mandrel 51 proximate to the upper end 54. The threads 56 of the mandrel 51 are configured to mate with matching tapered acme buttress box threads 626 on the inner surface of a collet 630. To this end, a collet 630 is disposed below the tubular portion 616 of the adapter 610, and is disposed upward from the upper portion of the mandrel 51. The collet 630 includes a plurality of collet fingers 632 which include the threads 636 for intermeshing with the outer threads 56 of the mandrel 51. This mating arrangement serves as the support mechanism for supporting the bridge plug 50 during run-in.

[0075] Above the fingers 632 of the collet 630 is one or more dog members 634. The dog members 634 protrude inwardly within the collet 630. As will be described below, the dogs 634 will catch against the bottom end of the tubular portion 616 of the adapter 610 when the releasing mechanism 600 is pulled from the wellbore 10.

[0076] The collet 630 generally resides within the retaining sleeve 660 below the adapter 610. The retaining sleeve 660 and the collet 630 are initially held together through a releasable connection 645. Preferably, the releasable connection defines a shear screw 645. The shear screw 645 is sheared upon upward force applied to the retaining sleeve 660 by the threaded connection with the adapter 610.

[0077] The releasing mechanism 600 finally comprises a support rod 620. The support rod 620 defines an elongated body having a top end and a bottom end. The top end of the support rod 620 is threaded connection within a bore 622 of the tubular portion 616 of the adapter 610. A lower portion 624 of the support rod 620 has an enlarged diameter. The enlarged outer diameter portion 624 is configured to move within the bore 52 of the mandrel 51, but to catch the dogs 634 of the collet 630 when the releasing mechanism 600 is raised within the wellbore 10.

[0078] In operation, the releasing mechanism 600 holds the mandrel 51 in place when the hydraulic setting tool 30 is actuated. Connection is accomplished through the threads 56 of the mandrel 51 and the threads 636 of the collet 630. The threads 56, 636 continue to support the mandrel 51 when the setting sleeve 32 of the setting tool 30 presses downward on the setting ring 58 and associated floating tools, e.g., element 59, of the bridge plug 50.

[0079] As pressure builds within the hydraulic setting tool 30, the bridge plug 50 is sealed within the surrounding casing 15. As additional pressure is injected into the wellbore 10, tensile stress is applied to the shear screws 645 between the collet 630 and the surrounding retaining ring 640. Ultimately, a releasing pressure is reached and the shear screws 645 are sheared, thereby releasing the retaining sleeve 660 from the collet 630. This permits the adapter 610, and the connected retaining sleeve 660 and support rod 620 to move upward within the wellbore 10 relative to the mandrel 51.

[0080] As the retaining sleeve 660 is raised within the wellbore 10, the elongated portion lower portion of the retaining sleeve 660 moves away from the collet fingers 632. The collet fingers 632 are pre-stressed in order to be biased to move away from the mandrel 51. As the retaining sleeve 660 is raised, the collet fingers 632 are freed from the restraining force of the retaining sleeve 660. The collet fingers 632 and associated threads 636 then release from the mandrel 51.

[0081] FIGS. 6C-R presents the releasing mechanism 600 of FIG. 6C being released from the mandrel 51 of the bridge plug 50. Pulling the releasing mechanism 600 from the wellbore 10 moves the support rod 620 upward relative to the collet 630. The releasing mechanism 600 is configured so that the lower enlarged outer diameter portion 624 of the support rod 620 will catch against the dogs 634 of the collet 630 as the adapter 610 is raised. This provides support for removal of the collet 630 from the wellbore 10. Contact with the dogs 634 by the enlarged outer diameter portion 624 of the support rod 620 also assists in releasing the collet fingers 632 from the mandrel 51. In this respect, the enlarged outer diameter portion 624 of the support rod 620 is configured to have a tapered diameter so as to urge the collet fingers 632 away from the mandrel 51.

[0082] As can be seen from FIGS. 6C-R, the releasing mechanism 600 is completely reusable save for the shear screws 645. Removal of the releasing mechanism 600 after the bridge plug 50 of other wellbores sealing tool has been set leaves no metal components within the mandrel. Nothing related to the releasing mechanism 600 other than the external threads 56 of the mandrel 51 remain after the releasing mechanism 600 is removed from the wellbore 10. The releasing mechanism 600 design is adaptable to all mandrel sizes and can function properly with both metallic and nonmetallic materials.

DESIGN 7

[0083] An alternate design for a releasing mechanism 700 of the present invention is depicted in FIG. 7C. As seen in FIG. 7C, the alternate releasing mechanism 700 first comprises an adapter 710. The adapter 710 is configured in accordance with the adapter 110 of the first embodiment 100 for a releasing mechanism. In this regard, the adapter 710 includes an upper end 714 for connection with a setting tool 30, a lower tubular portion 716, and a bore 712 within the lower tubular portion 716.

[0084] A reinforcing insert 740 is fabricated into the mandrel 51. Preferably, the insert 740 is fabricated from a
metallic substance. The insert 740 provides structural support and reinforcement for the mandrel 51. Fabrication of the insert 740 into the mandrel 51 may be through any known means, including gluing, winding, threading or bonding.

[0085] The reinforcing insert 740 is generally tubular in construction. However, the insert 740 is fabricated into the mandrel 51 through matching teeth 746. The teeth 746 in the insert 740, in one embodiment, define castellations in the form of a buttress thread. However, any acme-type thread may be employed. The teeth 746 of the insert 740 mate with the threads 56 in the mandrel 51. Preferably, the threads 56 of the mandrel 51 define a tapered, acme-style thread configured to mate with the teeth 746 of the insert 740.

[0086] In one aspect, the reinforcing insert 740 includes one or more through-openings 743. The insert through-openings 743 are positioned to align with corresponding one or more through-openings 53 in the mandrel 51. The through-openings 53, 743 receive a temporary pin or screwdriver (not shown) or other device which permits the bridge plug 50 and inner rod 720 to be made up to the adapter 710 during assembly of the releasing mechanism 700.

[0087] A threaded rod 720 is also provided for the releasing mechanism 700 of FIG. 7C. The threaded rod 720 in one arrangement defines a tubular body. However, a solid piece may also be used. The upper portion of the threaded rod 720 is designed to threadedly connect into the inner bore 722 of the lower tubular portion 716 of the adapter 710. A lower portion of the rod 720 extends into the bore 52 of the mandrel 51. The outer surface of the lower portion 720L of the rod 720 is generally adjacent to the teeth 746 of the reinforcing insert 740.

[0088] Finally, the releasing mechanism 700 in FIG. 7C comprises a frangible member 745. Preferably, the frangible member 745 defines a shear ring, such as a split ring or “C” ring. The shear ring 745 is disposed along the inner surface of the reinforced mandrel 51 within a profile 748 of the insert 740. The shear ring 745 is positioned above a shoulder portion 724 of the rod 720. The shoulder portion 724 is affixed to the rod 720 along the lower portion 720L of the rod 720.

[0089] In operation, the releasing mechanism 700 holds the mandrel 51 in place when the hydraulic setting tool 30 is actuated. Connection is accomplished through the shear ring 745 and the mandrel 51. As noted, the adapter 710 is threadedly connected to the tubular rod 720. Upward force against the adapter 710 serves to apply a reciprocating upward force upon the rod 720. When the releasing pressure for the releasing mechanism 700 is reached, the shear ring 745 is sheared, thereby releasing the adapter 710 and rod 720 from the mandrel 51. The presence of the metallic reinforcing insert 740 provides reliability and predictability for shearing the shear ring 745 by establishing a metal-to-metal contact between the shear ring 745 and the insert 740. In other words, a consistent shear value is provided for the releasing mechanism 700.

[0090] FIGS. 7C-R depicts the releasing mechanism 700 being raised within the wellbore 10 after release from the bridge plug 50. In this view, the shear ring 745 around the rod 720 has been sheared. It can be seen that the adapter 710 and the rod 720 are being removed from the wellbore 10. However, the reinforcing insert 740 remains attached to the mandrel 51.

DESIGN 8

[0091] Turning now to FIG. 8C, yet another alternate embodiment for a releasing mechanism 800 of the present invention is provided. As seen in FIG. 8C, the alternate releasing mechanism 800 first comprises an adapter 810. The adapter 810 generally is configured in accordance with the adapter 110 of the first embodiment 100 for a releasing mechanism. In this regard, the adapter 800 includes an upper connecting end 814, a lower tubular portion 816, and a bore 812 within the lower tubular portion 816.

[0092] A shoulder 818 is fabricated into the adapter 810 along an outer surface. In the arrangement of FIG. 8C, the shoulder 818 is positioned at the level of the lower tubular portion 816.

[0093] The releasing mechanism 800 further comprises a retaining sleeve 820. The retaining sleeve 820 defines a tubular body. A top portion 824 of the retaining sleeve 820 butts up against the shoulder 818 of the adapter 810. In the arrangement of FIG. 8C, the connection between the retaining sleeve 820 and the adapter 810 is by welding. Preferably, the retaining sleeve 820 is fabricated from a metallic substance to facilitate the welding connection. However, other means of connection are within the spirit of the present invention.

[0094] The releasing mechanism 800 further comprises an inner rod 840. An upper portion of the rod 840 is disposed within the bore 812 of the adapter 810. The upper portion of the rod 840 is externally threaded. In one aspect, the rod 840 defines a solid metallic cylindrical body. However, a tubular piece may also be used.

[0095] A shear tube 850 is also disposed within the bore 812 of the adapter 810. An upper portion 852 of the shear tube 850 is internally threaded in order to threadedly connect with the upper portion of the rod 840. At the same time, the upper portion 852 of the shear tube 850 is externally threaded in order to connect with the tubular portion 816 of the adapter 810. Thus, the inner rod 840 and the shear tube 850 are concentrically nested within the tubular portion 816 of the adapter 810.

[0096] Both the threaded rod 840 and the threaded shear tube 850 extend below the bore 812 of the adapter 810. A lower portion 856 of the shear tube 850 extends below the tubular portion 816 of the adapter 810, but does not extend into the bore 52 of the mandrel 51. However, the elongated threaded rod 840 does extend into the bore 52 of the mandrel 51. A lower portion 844 of the rod 840 includes an enlarged outer diameter in order to define a shoulder.

[0097] The releasing mechanism 800 further comprises a collet 830. The collet 830 defines a generally tubular body having an outer surface which is retained within the surrounding retaining sleeve 820. The collet 830 is internally threaded in order to connect to the lower portion 856 of the shear tube 850. The collet 830 has a plurality of radially spaced-apart collet fingers 832 which extend downward in order to overlap with the upper portion of the mandrel 51. The collet fingers include a tapered, acme buttress box thread or other style with constellations or other threads 836. These collet finger threads 836 match threads 56 machined into the outer surface of the mandrel 51.

[0098] A retrieval tube 860 is disposed below the shear tube 850. The retrieval tube 860 defines a tubular body
which encompasses a portion of the threaded rod 840 below the adapter 810. An upper end 866 of the retrieval tube 860 resides proximate to the lower portion 856 of the shear tube 850. The outer surface of the upper end 866 of the retrieval tube 860 is threaded, so as to connect with the inner threads of the collet 830.

[0099] The retrieval tube 860 generally extends downward in the wellbore 10 adjacent to the retainer sleeve 840. The retrieval tube 860 includes an enlarged inner diameter portion which defines a shoulder 864. As will be described, the shoulder 864 of the retrieval tube 860 will catch the shoulder 844 of the inner rod 840 when the retrieval mechanism 800 is removed from the wellbore 10.

[0100] Finally, a shear plane 845 is fabricated into the rod 840. In the arrangement of FIG. 8C, the shear plane 845 is positioned between the adapter 810 and the collet 830. The shear plane 845 is essentially normal to the bore 52 of the mandrel 51.

[0101] In operation, the releasing mechanism 800 holds the mandrel 51 in place when the hydraulic setting tool 30 is actuated. Connection is accomplished through the threads 56 of the mandrel 51 and the threads 836 of the collet 830. Because of the threaded connections between the adapter 810, the rod 840, and the shear tube 850, an upward force on the adapter 810 causes the inner rod 840 and the shear tube 850 to be urged upward in the wellbore 10. Ultimately, releasing pressure is achieved within the hydraulic setting tool 30. The shear tube 850 then fails along shear plane 845 in response to tensile forces created by the hydraulic setting tool 30.

[0102] FIGS. 8C-R presents the releasing mechanism 800 after the shear tube 850 has failed. After the shear tube 850 has failed, the adapter 810, inner rod 840 and retaining sleeve 820 are raised within the wellbore 10. The retaining sleeve 820 then clears the collet fingers 832, allowing the collet fingers 832 to radially expand outward from the fingers 56 of the mandrel 51. In this regard, the collet fingers 832 are preferably pre-stressed in order to be biased away from the mandrel 51. This allows the threads 836 of the collet fingers 832 to be released from the threads 56 of the mandrel 51.

[0103] Once the collet fingers 832 are released from the mandrel 51, the adapter 810 is free to pull the inner rod 840 further in the wellbore. Ultimately, the shoulder 844 of the rod 840 catches the shoulder 864 of the retrieval tube 860. In this way, all parts of the releasing mechanism 800 are retrieved from the wellbore following release from the bridge plug 50. Release of the bridge plug 50 is shown in FIGS. 8C-R.

DESIGN 9

[0104] Finally, a ninth design is provided as an alternative arrangement for a releasing mechanism 900. This arrangement 900 is similar to the releasing mechanism 500 of FIG. 5C. The releasing mechanism 900 shown in FIG. 9C has the same parts as the releasing mechanism 500 of FIG. 5C. However, an additional retrieval body 970 is disposed below the lower portion 910 of the adapter 910. The retrieval body 970 includes an upper connecting portion 972 which threadedly connects within the collet 930. The retrieval body 970 has a lower portion having an enlarged outer diameter in order to define a shoulder 974. The lower portion 974 extends into the bore 52 of the mandrel 51 during run-in.

[0105] FIGS. 9C-R presents the releasing mechanism 900 being removed from the wellbore 10 after reaching a releasing pressure. A dog 965 on the retaining sleeve 960 catches a lower shoulder 938. The collet 930 as the adapter 910 is removed from the wellbore 10. This allows the collet 930 and the connected retrieval body 972 to be removed from the wellbore 10 along with the adapter 910 and the retaining sleeve 960. The retaining sleeve 960 provides reinforcing support for the mandrel 51 during the setting process for the bridge plug 50.

[0106] A releasing mechanism for releasing a downhole tool has been described in the context of releasing a bridge plug. However, it is understood that the releasing mechanism of the present invention has utility in any operation where wellbore fluids are circulated downhole to release a tool. It is also understood that the depictions of the releasing mechanism and other downhole tools are not to scale. Neither the drawings, nor the description of the drawings, are intended to limit the present invention to a particular embodiment. Other and further embodiments of the invention may be devised without departing from the basic scope thereof, and the scope thereof is determined by the claims that follow.

1. A releasing mechanism for releasing a setting tool from a plugging tool within a wellbore, the releasing mechanism supporting a mandrel on the plugging tool while the plugging tool is being set, the mandrel having an essentially circumferential bore therein, the releasing mechanism comprising:
   - an adapter having a top end connected to the setting tool; and
   - a releasable connector connecting the adapter and the mandrel, the releasable connector being disposed within a longitudinal plane of the circumferential bore of the mandrel.

2. The releasing mechanism of claim 1, wherein the releasable connector defines a nose fractionally disposed within the bore of the mandrel, the nose having a shear plane which fails under tensile forces applied by the setting tool.

3. The releasing mechanism of claim 2, wherein the adapter comprises:
   - a body; and
   - a connector above the body for connecting the adapter with the setting tool; and
   - a lower tubular portion having a bore therein, the tubular portion having a bottom end which is landed at a top end of the mandrel.

4. The releasing mechanism of claim 3, wherein the plugging tool is a bridge plug.

5. The releasing mechanism of claim 4, further comprising a tubular rod having a top end and a bottom end, the top end being threadedly connected to the lower tubular portion within the bore of the adapter, and the bottom end being threadedly connected to the shear nose above its shear plane.

6. The releasing mechanism of claim 5, further comprising:
   - a collet disposed circumferentially around the tubular rod and below the tubular portion of the adapter, the collet
having a plurality of radially spaced apart fingers which extend downward towards the nose so as to frictionally reside between the nose below the shear plane, and the inner surface of the mandrel; and

a retrieving rod having a top end and a bottom end, the top end having an enlarged outer diameter portion defining a shoulder, and a lower end threaded connected to a portion of the nose below the shear plane.

7. The releasing mechanism of claim 6, wherein the threaded rod further comprises:

an enlarged wall thickness portion defining an inner shoulder which catches the shoulder of the retrieval rod when the nose has failed due to tensile forces, and when the adapter is being raised within the wellbore; and

an outer shoulder to retrieve the collet from the wellbore when the adapter is being raised within the wellbore.

8. The releasing mechanism of claim 5, further comprising a metallic sleeve disposed along an inner surface of the mandrel proximate to the top end of the mandrel.

9. The releasing mechanism of claim 8, further comprising:

a collet disposed circumferentially around the tubular rod and below the tubular portion of the adapter, the collet having a plurality of radially spaced apart fingers which extend downward towards the nose so as to frictionally reside between the nose below the shear plane, and the inner surface of the mandrel; and

a retrieving rod having a top end and a bottom end, the top end having an enlarged outer diameter portion defining a shoulder, and a lower end threaded connected to a portion of the nose below the shear plane.

10. The releasing mechanism of claim 9, wherein the threaded rod further comprises:

an enlarged wall thickness portion defining an inner shoulder which catches the shoulder of the retrieval rod when the nose has failed due to tensile forces, and when the adapter is being raised within the wellbore; and

an outer shoulder to retrieve the collet from the wellbore when the adapter is being raised within the wellbore.

11. The releasing mechanism of claim 1, wherein the adapter comprises:

a body;

a connector above the body for connecting the adapter with the setting tool; and

a lower tubular portion having a bore therein, the tubular portion having a bottom end which is landed at a top end of the mandrel.

12. The releasing mechanism of claim 11, wherein the plugging tool is a bridge plug.

13. The releasing mechanism of claim 12, further comprising a tubular shear rod, the shear rod having a top end and a bottom end, the top end being threaded connected to the tubular portion of the adapter within the bore, and the lower portion being threaded connected to the inner surface of the mandrel.

14. The releasing mechanism of claim 13, wherein the releasable connection defines a shear plane fabricated between the top end and the bottom end of the tubular shear rod such that the shear rod fails due to tensile forces applied on the shear rod when the hydraulic setting tool is actuated.

15. The releasing mechanism of claim 1, wherein the adapter comprises:

a body;

a connector above the body for connecting the adapter with the setting tool; and

a bottom end defining a male portion which extends into the bore of the mandrel.

16. The releasing mechanism of claim 15, wherein the releasable connection defines a plurality of shear screws releasably connecting the male portion of the adapter with the mandrel.

17. The releasing mechanism of claim 16, further comprising an inner sleeve, the inner sleeve defining a tubular metal body disposed concentrically within the inner surface of the mandrel at the location of the plurality of shear screws.

18. The releasing mechanism of claim 17, wherein the inner sleeve further comprises bars disposed about the outer surface of the metal sleeve which frictionally engages the mandrel.

19. The releasing mechanism of claim 4, wherein the releasable connector comprises an elongated rod having a top end and a bottom end, the top end being threaded connected to the bore of the tubular portion of the adapter, and the lower end being disposed adjacent to the reinforcing insert within the bore of the mandrel.

20. The releasing mechanism of claim 19, further comprising a generally tubular reinforcing insert fabricated into the inner surface of the mandrel proximate to a top end of the mandrel.

21. The releasing mechanism of claim 1, wherein the releasable connector defines a shear ring.

22. The releasing mechanism of claim 21, wherein the shear ring and the reinforcing insert are each fabricated from a metallic substance.

23. The releasing mechanism of claim 22, wherein the plugging tool is a bridge plug.

24. The releasing mechanism of claim 23, wherein the shear ring is disposed intermediate to the lower portion of the elongated rod and the reinforcing insert, and wherein the shear ring includes a shoulder extending into a profile within the reinforcing insert.

25. A releasing mechanism for releasing a hydraulic setting tool from a bridge plug within a wellbore, the releasing mechanism supporting a mandrel on the bridge plug while the bridge plug is being set, the mandrel having an essentially circumferential bore therein, the releasing mechanism comprising:

an adapter having a body, a top end above the body connected to the setting tool, and a shoulder disposed within the body;

a tubular retaining sleeve disposed around a lower portion of the body and connected the shoulder of the adapter at a top end of the retaining sleeve, the retaining sleeve further having a bottom end and a dog intermediate the top end and the bottom end of the retaining sleeve;

a collet defining a tubular member disposed essentially concentrically within the retaining sleeve below the adapter, the collet having a plurality of radially spaced-
apart collet fingers, the collet fingers being held closely to the mandrel by the lower end of the retaining sleeve; and 

a friction body having a top end threadedly connected within the bore of the tubular portion of the adapter, and a lower end threadedly connected to the collet, and 

having a shear plane fabricated between the top end and the lower end, the shear body failing long the shear plane in response to tensile forces when the hydraulic setting tool is actuated.