Disclosed is a robust selective fire switch. One exemplary selective fire switch includes a switch housing, a plunger having a head and a body extending longitudinally from the head, the head extending at least partially into an opening defined in the switch housing, a first post and a second post arranged on opposing sides of the switch housing, and a filament wire coupled to and extending between both the first and second posts, the filament wire being in contact with the plunger and thereby securing the plunger in a seated configuration within the switch housing.
SUPPORT BRACKET FOR SELECTIVE FIRE SWITCHES

BACKGROUND

[0001] The present disclosure relates generally to wellbore casing perforation operations and, more particularly, to a more robust selective fire switch used in casing perforating guns.

[0002] After drilling the various sections of a subterranean wellbore that traverses a hydrocarbon-bearing formation, individual lengths of relatively large diameter metal tubulars are typically secured together to form a casing string that is positioned within the wellbore. This casing string increases the integrity of the wellbore and provides a path for producing fluids extracted from producing intervals in the formation to the surface. Conventionally, the casing string is cemented within the wellbore. To produce fluids into the casing string, hydraulic openings or perforations must be made through the casing string and the cement, and extend a short distance into the surrounding subterranean formation.

[0003] Typically, these perforations are created by detonating a series of shaped charges that are disposed within the casing string and are positioned adjacent to the formation. Specifically, one or more perforating guns are loaded with shaped charges that are connected with a detonator via a detonating cord. The perforating guns are then connected within a tool string that is lowered into the casing wellbore at the end of a tubing string, wireline, slickline, coiled tubing or other type of downhole conveyance. Once the perforating guns are properly positioned in the wellbore such that the shaped charges are adjacent the formation to be perforated, the shaped charges are detonated, thereby creating the desired hydraulic openings in to the casing string.

[0004] To detonate a particular shaped charge, a voltage is commonly sent to a corresponding selective fire switch that includes a filament wire configured to be burned or otherwise disintegrate upon being subjected to a predetermined amount of voltage. The filament wire also typically supports a plunger used to switch the fire switch into detonation mode. Once the filament wire is burned, the plunger is able to switch positions, thereby placing the fire switch in detonation mode. In traditional selective fire switches, the filament wire is usually supported with a pliable terminal or turret and may be susceptible to tensile stresses and environmental vibrations. Upon experiencing extreme vibrations, for example, especially vibrations stemming from adjacent detonations or explosions, the filament wire can fail or may otherwise be rendered inoperative before its intended operation can be carried out.

SUMMARY OF THE DISCLOSURE

[0005] The present disclosure relates generally to wellbore casing perforation operations and, more particularly, to a more robust selective fire switch used in casing perforating guns.

[0006] In some embodiments, a selective fire switch is disclosed and may include a switch housing, a plunger having a head and a body, the body extending longitudinally from the head and at least partially into an opening defined in the switch housing, a first post and a second post arranged on opposing sides of the switch housing, and a filament wire coupled to and extending between both the first and second posts across the switch housing, the filament wire being in contact with the plunger and thereby securing the plunger in a seated configuration within the switch housing.

[0007] In some embodiments, a method of operating a selective fire switch is disclosed. The method may include securing a plunger in a seated configuration within a switch housing with a filament wire that engages the plunger, the filament wire being coupled to and extending between a first post and a second post arranged on opposing sides of the switch housing and extending across the switch housing, applying a voltage across the filament wire, burning the filament wire with the voltage, and moving the plunger from the seated configuration to an extended configuration with respect to the switch housing.

[0008] In some embodiments, another selective fire switch is disclosed and may include a switch housing, a plunger extending at least partially into an opening defined in the switch housing, an input stanchion and an output stanchion arranged on a side of the switch housing, the input and output stanchions being electrically conductive and structurally offset from each other, a post arranged on a second side of the switch housing opposite the first side of the switch housing, and a filament wire having a first portion coupled to the input stanchion and extending to the post across the switch housing, and a second portion extending from the post across the switch housing and to the output stanchion, the filament wire being in contact with the plunger and thereby maintaining the plunger in a seated configuration within the switch housing.

[0009] The features of the present disclosure will be readily apparent to those skilled in the art upon a reading of the description of the embodiments that follows.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The following figures are included to illustrate certain aspects of the present disclosure, and should not be viewed as exclusive embodiments. The subject matter disclosed is capable of considerable modifications, alterations, combinations, and equivalents in form and function, as will occur to those skilled in the art and having the benefit of this disclosure.

[0011] FIG. 1 is a well system that may embody or otherwise employ one or more principles of the present disclosure, according to one or more embodiments.

[0012] FIGS. 2A-2D are various views of an exemplary selective fire switch, according to one or more embodiments.

[0013] FIGS. 3A and 3B are isometric views of another exemplary selective fire switch, according to one or more embodiments.

[0014] FIGS. 4A-4D illustrate various exemplary embodiments of a plunger that can be used with the selective fire switches of FIGS. 2A-2D or 3A-3B, according to one or more embodiments.

DETAILED DESCRIPTION

[0015] The present disclosure relates generally to wellbore casing perforation operations and, more particularly, to a more robust selective fire switch used in casing perforating guns.

[0016] The present disclosure describes a selective fire switch that has structural stanchions or posts configured to reliably support a filament wire that is to be burned or otherwise disintegrated in the process of setting a detonator. The posts provide additional structural strength to the switch and
the filament wire such that the filament wire is able to sustain heavy shock loads and vibrations, such as vibrations that are sustained through detonations of adjacent perforation charges. Moreover, the posts may include lateral extensions that bend over or extend across the switch a short distance in order to decrease the deflection potential of the filament wire, thereby reducing the potential for tensile fatigue in the filament wire before its intended operation can be undertaken.

[0017] Referring to FIG. 1, illustrated is a well system 100 that may embody or otherwise employ one or more principles of the present disclosure. The well system 100 may include an offshore oil and gas platform 102 centered over a submerged oil and gas formation 104 located below a sea floor 106. Even though FIG. 1 depicts an offshore oil and gas platform 102, it will be appreciated by those skilled in the art that the various embodiments discussed herein are equally well suited for use in conjunction with other types of oil and gas rigs, such as land-based oil and gas rigs or rigs located at any other geographical site. A subsurface conduit 108 extends from a deck 110 of the platform 102 to a wellhead installation 112 including one or more subsurface blow-out preventers 114. The platform 102 has a hoisting apparatus 116 and a derrick 118 for raising and lowering pipe strings, such as work string 120, within the subsurface conduit 108.

[0018] As depicted, a wellbore 122 extends through the various earth strata including a hydrocarbon-bearing formation 104. A casing string 124 is cemented within the wellbore 122 using cement 126. The work string 120 includes various tools such as a plurality of perforating gun assemblies 134 arranged at or near its distal end. When it is desired to perforate the casing string 124 and cement 126 in order to provide fluid communication to the formation 104, the work string 120 is lowered through the casing string 124 until the perforating guns 134 are properly positioned relative to the formation 104. Thereafter, one or more shaped charges within the string of perforating guns are sequentially fired, either in an uphole to downhole or a downhole to uphole direction. Upon detonation, the liners of the shaped charges form jets that create a spaced series of perforations extending outwardly through the casing string 124, the cement 126, and into surrounding portions of the formation 104, thereby allowing fluid communication between the formation 104 and the wellbore 122.

[0019] In the illustrated embodiment, the wellbore 122 has an initial, generally vertical portion 128 and a lower, generally deviated or horizontal portion 130. The work string 120 may include a retrievable packer 132 which may be sealingly engaged with the casing string 124 in the vertical portion 128 of the wellbore 122. The perforating guns 134 may have a ported nipple 136 arranged at their upper or proximal end, below which is a time domain firer 138. The time domain firer 138 may be arranged at the upper end of a tandem gun set 140 including first and second guns 142 and 144. In the illustrated embodiment, a plurality of such gun sets 140 are utilized, each including a first gun 142 and a second gun 144.

[0020] Positioned between each gun set 140 may be a blank pipe section 146 used to control and optimize the pressure conditions in the wellbore 122 immediately after detonation of the shaped charges. In other embodiments, the blank pipe sections 146 may serve as secondary pressure generators. It should be understood by those skilled in the art that any arrangement of perforating guns may be utilized in conjunction with the present disclosure, including both more and less sections of blank pipe 146 as well as no sections of blank pipe 146, without departing from the scope of the disclosure. It will also be appreciated by those skilled in the art that even though FIG. 1 depicts the perforating guns 134 and its associated components as being arranged to perforate a horizontal section of the wellbore 122, the embodiments described herein are equally applicable for use in portions of the wellbore 122 that are vertical, deviated, slanted or otherwise.

[0021] Referring now to FIGS. 2A-2D, illustrated are various views of an exemplary selective fire switch 200 (hereinafter “switch”) that may be used in conjunction with one or more of the perforating guns 134 of FIG. 1, according to one or more embodiments. In particular, FIGS. 2A and 2B illustrate isometric and end views of the switch 200, respectively, in a secured configuration (i.e., a position opposing a load), and FIGS. 2C and 2D illustrate isometric and end views of the switch 200, respectively, in an actuated configuration (i.e., a position after functioning). Those skilled in the art, will readily recognize that the embodiments disclosed herein may equally be applied to other technology fields besides the oil and gas industry. Indeed, the various embodiments of selective fire switches disclosed herein may be used in any field where it may prove advantageous to have a robust and reliable firing switch. For example, the exemplary selective fire switches may be used in any device requiring a mechanism capable of enabling/disabling or engaging/releasing something.

[0022] The switch 200 depicted in FIGS. 2A-2D may include a switch housing 202 coupled to or otherwise supported by a circuit board 204, such as a printed circuit board or the like. The switch housing 202 may be made of one or more non-conductive or insulative materials such as, but not limited to, plastics, polymers, ceramics, glasses, composites, combinations thereof, and the like. The switch 200 may include a plunger 206 at least partially arranged within the housing 202 and movable between a seated configuration, as depicted in FIGS. 2A and 2B, and an extended configuration, as depicted in FIGS. 2C and 2D. The plunger 206 may also be made of one or more non-conductive or insulative materials such as, but not limited to, plastics, polymers, ceramics, glasses, composites, nylon, combinations thereof, and the like.

[0023] The plunger 206 may have a head 208 and a body 210 (FIG. 2B) that extends longitudinally from the head 208. As depicted in FIG. 2B, the body 210 may be configured to extend within an opening 212 defined or otherwise formed within the housing 202. The head 208 may exhibit a diameter that is greater than the diameter of the opening 212 such that the head 208 is prevented from extending into the opening 212 and otherwise generally rests on the exterior of the housing 202 when the plunger 206 is in its seated configuration.

[0024] The switch 200 may further include a filament wire 214 that may extend across at least a portion of the housing 202 and may be supported across the housing 202 by at least a first post 216a and a second post 216b. The filament wire 214, also known as a fuse wire or heater wire, may also be configured to at least partially maintain or otherwise secure the plunger 206 in its seated configuration within the housing 202. In some embodiments, for example, the plunger 206 may define or otherwise include at least one groove 218 configured to receive or engage the filament wire 214. In the embodiment of FIGS. 2A-2D, for instance, the at least one groove 218 may include a first groove 218a and a second groove 218b defined on opposing sides of the head 208 and portions of the filament
wire 214 may rest on or otherwise be received in each of the first and second grooves 218a,b.

[0025] The filament wire 214 is shown in FIGS. 2A-2D as extending from the first post 216a to the second post 216b, extending around the second post 216a and returning to the first post 216a. Those skilled in the art will readily appreciate, however, that the filament wire 214 may extend between the first and second posts 216a,b in various other configurations, without departing from the scope of the disclosure. In some embodiments, for example, the filament wire 214 may include only a single wire strand extension that extends between or otherwise connects the first post 216a to the second post 216b. As a result, and as will be described in greater detail below, the at least one groove 218 may take on several different configurations to accommodate the differing configurations of the filament wire 214, without departing from the scope of the disclosure.

[0026] In its seated configuration, as shown in FIG. 2B, the distal end of the body 210 of the plunger 206 may engage or otherwise bias a toggle mechanism 220. In some embodiments, the toggle mechanism 220 may be a single-throw, single-pole switch, as generally known by those skilled in the art. In other embodiments, the toggle mechanism 220 may encompass any other type of toggling or switching device capable of generally performing the actions of the toggle mechanism 220 described herein, such as relays, contactors, actuators, spring devices, valves, inflatable or expandable apparatus (whether inflating speed control or not), and the like. In at least one embodiment, the toggle mechanism 220 may be similar to or otherwise related to the switches described in co-owned U.S. patent application Ser. No. 13/494,075, filed on Jun. 12, 2012, the contents of which are hereby incorporated by reference in their entirety. Accordingly, the toggle mechanism 220 depicted in FIGS. 2B and 2D is shown and described merely for illustrative purposes and should not be considered limiting to the scope of the disclosure.

As illustrated, the exemplary toggle mechanism 220 may include a wiper 222 that may be movable between a first position, as shown in FIG. 2B, where the wiper 222 makes contact with a first contact 224a, and a second position, as shown in FIG. 2D, where the wiper 222 makes contact with a second contact 224b. The wiper 222 may be spring biased or otherwise naturally tened towards contact with the second contact 224b. The wiper 222 may be made of an electrically conductive material, such as copper or bronze. In at least one embodiment, the wiper 222 may be a wire or the like.

[0028] In order to maintain the wiper 222 in the first position or otherwise in contact with the first contact 224a, the body 210 of the plunger 206 may be extended through the opening 212 such that it engages the wiper 222 and overcomes its spring force until the wiper 222 makes contact with the first contact 224a. In such a configuration, the plunger 206 is in its seated configuration and may be maintained therein with the filament wire 214 biased against a portion of the head 208, such as at least one groove 218. In the event the filament wire 214 is severed or otherwise fails, such as is depicted in FIGS. 2C-2D, the plunger 206 may be moved or otherwise forced in the upward direction as the wiper 222 moves to its second position and makes contact with the second contact 224b.

[0029] The filament wire 214 may be coupled to or otherwise attached to the first and second posts 216a,b which generally serve as stanchions that support the filament wire 214 across the housing 202 and hold the filament wire 214 in a substantially tangential relationship with the head 208 of the plunger 206. As illustrated, the first and second posts 216a,b may be arranged on opposing sides of the housing 202 such that the filament wire 214 generally extends across the top of the housing 202. In some embodiments, the filament wire 214 may be soldered, welded, or brazed to one or both of the first and second posts 216a,b, or otherwise attached thereto using a glue or any chemical adhesive known to those skilled in the art. In other embodiments, the filament wire 214 may be fastened to one or both of the first and second posts 216a,b using one or more mechanical fasteners such as, but not limited to, screws, clamps, wedges, rivets, clips, heat shrink tubing, combinations thereof, and the like. In yet other embodiments, the filament wire 214 may form an integral part of one or both of the first and second posts 216a,b, without departing from the scope of the disclosure.

[0030] At their respective bases, the first and second posts 216a,b may be soldered to, mechanically fastened to, or otherwise form an integral part of the circuit board 204. In some embodiments, both the first and second posts 216a,b may be electrically conductive or otherwise made of a material that is able to conduct an electrical current therethrough. In other embodiments, however, one of the first or second posts 216a,b may be non-conductive or otherwise made of an insulative material, without departing from the scope of the disclosure. In the illustrated embodiment, both the first and second posts 216a,b are electrically conductive, as will be described below.

[0031] In one or more embodiments, at least one of the first and second posts 216a,b may include or otherwise define a lateral extension that extends or otherwise reaches a short distance across or over the housing 202. In FIGS. 2A-2D, each of the first and second posts 216a,b are depicted as having a lateral extension, labeled as a first lateral extension 226a and a second lateral extension 226b. The first and second lateral extensions 226a,b may prove advantageous in providing additional support to the filament wire 214 such that the filament wire 214 may be less susceptible to wire fatigue or mechanical vibrations. The distance that each lateral extension 226a,b extends across or over the housing 202 may vary, depending on the application. In at least one embodiment, for example, one or both of the lateral extensions 226a,b may extend to but not obstruct movement of the plunger 206 such that the plunger 206 is nonetheless able to move to its extended configuration.

[0032] According to one or more embodiments of the disclosure, the switch 200 may be used to set or otherwise arm an igniter or detonator (not shown) used to detonate a corresponding perforating charge (not shown), such as is used in casing perforating operations briefly described above. With the switch 200 and the plunger 206 in their secured and seated configurations, respectively, as depicted in FIGS. 2A and 2B, exemplary operation of the switch 200 is now provided.

[0033] A first voltage 227 may be sent to the toggle mechanism 220 via a power line 228. The power line 228 may be communicably or otherwise electrically coupled to a power source (not shown) either arranged adjacent the switch 200 (e.g., downhole) or at a remote location (e.g., via wireline, slickline, c-line, etc.), such as the platform 102 of FIG. 1. The first voltage 227 may be a positive or a negative voltage, depending on the perforating application and how many switches 200 are to be activated. Those skilled in the art will readily appreciate that the power line 228 may receive the first
voltage 227 via several different methods or devices, without departing from the scope of the disclosure.

[0034] With the plunger 206 in its seated configuration, the wiper 222 is held in its first position and therefore in contact with the first contact 224a. Accordingly, the first voltage 227 is conveyed to the first contact 224a which may be configured to convey the first voltage 227 to a first conductor line 230a. In some embodiments, the first conductor line 230a may be communicably or otherwise electrically coupled to the first post 216a, such that the first voltage 227 is conveyed to the first post 216a via the first conductor line 230a. As shown in FIG. 2A, the first conductor line 230a is shown as extending to the first post 216a as part of the design of the circuit board 204. At least one diode 232 (FIG. 2A) may be arranged in the first conductor line 230a and otherwise configured to determine the polarity of the first voltage 227 such that the correct voltage polarity is provided to the first post 216a for proper operation.

[0035] With continued reference to FIG. 2A, in some embodiments the first voltage 227 may be applied across the first post 216a and to the filament wire 214 which conveys the first voltage 227 to the second post 216b. In some embodiments, the filament wire 214 may extend at least partially down the first post 216 toward the circuit board 204. The second post 216b may then convey the first voltage 227 downstream to ground, for example. The filament wire 214 may be manufactured or otherwise configured to exhibit a predetermined resistance per unit length. The first voltage 227 may be a predetermined voltage used to overcome the predetermined resistance of the filament wire 214 such that as the first voltage 227 is applied across the filament wire 214, the filament wire 214 may be configured to burn, disintegrate, or otherwise fail.

[0036] Those skilled in the art will readily recognize the several advantages of the first and second posts 216a,b. For example, the first and second posts 216a,b may reliably secure the filament wire 214 across the top of the housing 202 while holding the plunger 206 in its seated configuration. Moreover, the first and second posts 216a,b provide additional structural strength to the switch 200 and the filament wire 214 such that the filament wire 214 may be able to sustain heavy shock loads and vibrations. The lateral extensions 226a,b of each post 216a,b, respectively, may serve to decrease the length and deflection of the filament wire 214, thereby reducing the potential for tensile fatigue, commonly referred to as "support post fatigue." As a result, the switch 200 provides a more robust and reliable means of setting a detonator.

[0037] Referring to FIGS. 2C-2D, the filament wire 214 is depicted as burned or otherwise disintegrated after having been subjected to the first voltage 227. Without the filament wire 214 securing or maintaining the plunger 206 in its seated configuration, the spring force of the wiper 222 may overcome the weight of the plunger 206, thereby moving the plunger 206 to its extended configuration as the wiper 222 moves to its second position. With the wiper 222 in its second position, contact is made between the wiper 222 and the second contact 224b and the power source (not shown) is thereby placed in electrical communication with the igniter or detonator (not shown). Specifically, the power line 228 may be electrically coupled through the wiper 222 and the second contact 224b to a second conductor line 230b which may be coupled to the detonator.

[0038] To activate the detonator, and thereby detonate a corresponding perforating charge, a second voltage 234 may be applied across the power line 228 and conveyed through the wiper 222, the second contact 224b, and the second conductor line 230b which applies the second voltage 234 to the detonator. Similar to the first voltage 227, the second voltage 234 may be a positive or a negative voltage, depending on the perforating application and how many switches 200 are to be activated.

[0039] Referring now to FIGS. 3A and 3B, illustrated are isometric views of another exemplary selective fire switch 300 (hereinafter "switch"), according to one or more embodiments. The switch 300 may be similar in some respects to the switch 200 of FIGS. 2A-2D and therefore may be best understood with reference thereto, where like numerals indicate like elements that will not be described again in detail. Similar to the switch 200 of FIGS. 2A-2D, the switch 300 includes the switch housing 202 coupled to or otherwise supported by the circuit board 204. The switch 300 may also include the plunger 206 at least partially arranged within the housing 202 and movable between seated and extended configurations, as depicted in FIG. 3A and FIG. 3B, respectively.

[0040] Unlike the switch 200 of FIGS. 2A-2D, however, the first post 216a of the switch 300 may include or otherwise encompass an input stanchion 302a and an output stanchion 302b. As illustrated, the input stanchion 302a may be communicably or otherwise electrically coupled to the first conductor line 230a. The output stanchion 302b may be structurally offset from the input stanchion 302a and otherwise insulated from contact with the input stanchion 302a except for through the filament wire 214, as will be described below. Both the input and output stanchions 302a,b may be electrically conductive or otherwise made of a material that is able to conduct an electrical current. The second post 216b may or may not be electrically conductive. In embodiments where the second post 216b is electrically conductive, any voltages applied across the second post 216b may be prevented from passing through and into the circuit board 204.

[0041] In some embodiments, the filament wire 214 may be soldered, welded, or brazed to one or both of the input and output stanchions 302a,b. In other embodiments, the filament wire 214 may be fastened to one or both of the input and output stanchions 302a,b using one or more mechanical fasteners such as, but not limited to, screws, clamps, wedges, rivets, clips, combinations thereof, and the like. In yet other embodiments, the filament wire 214 may form an integral part of one or both of the input and output stanchions 302a,b. Moreover, one or both of the input and output stanchions 302a,b may include or otherwise define a portion of the first lateral extension 226a. In the illustrated embodiment, each of the input and output stanchions 302a,b are shown as defining corresponding portions of the first lateral extension 226a.

[0042] In the illustrated embodiment, the first voltage 227 may be conveyed to the input stanchion 302a via the first conductor line 230a. The input stanchion 302a may apply the first voltage 227 across the filament wire 214 and, more particularly, to a first portion 304a of the filament wire 214 that extends from the input stanchion 302a, across the housing 202, and to the second post 216b. The filament wire 214 may then loop around the second post 216 such that the first voltage 227 is conveyed back to the first post 216a or, more particularly, to the output stanchion 302b via a second portion 304b of the filament wire 214. More particularly, the second portion 304b may be configured to extend from the second
post 216b, across the housing 202, and to the output stanchion 302b. The output stanchion 302b may convey the first voltage 227 downstream, such as to ground, for example. [0043] As briefly discussed above, the filament wire 214 may be manufactured or otherwise configured to exhibit a predetermined resistance per unit length, and the first voltage 227 may be a predetermined voltage used to overcome the predetermined resistance of the filament wire 214. As a result, as the first voltage 227 is conducted through the filament wire 214, the filament wire 214 may be configured to burn, disintegrate, or otherwise fail, thereby freeing the plunger 206 to move into its extended configuration, as depicted in FIG. 3B. [0044] Those skilled in the art will readily appreciate that looping the filament wire 214 around the second post 216 via the first and second portions 304a, b of the filament wire 214 requires the first voltage 227 to traverse a greater effective length of the filament wire 214. Increasing the effective length of the filament wire 214 may increase its resistance such that a reduced amount of voltage would be required to burn or otherwise disintegrate the filament wire 214. [0045] Moreover, looping the filament wire 214 around the second post 216 via the first and second portions 304a, b also offers an increased amount of strength for the filament wire 214 such that the filament wire 214 may be better able to sustain vibrations and other shock loading that may be encountered in a downhole environment. [0046] Referring now to FIGS. 4A-4D, with continued reference to the prior figures, illustrated are exemplary embodiments of the plunger 206, according to one or more embodiments. Each of the variations of the plunger 206 in FIGS. 4A-4D may be used in conjunction with any of the embodiments of the switches 200, 300 described above. As illustrated, in some embodiments of the plunger 206, the filament wire 214 may include two lengths of wire, each of which may be configured to apply voltage in either the same or opposing directions across the plunger 206. Accordingly, in at least one embodiment, the filament wire 214 depicted in FIGS. 4A-4D may be the first and second portions 304a, b of the filament wire 214, as described above with reference to FIGS. 3A and 3B. In other embodiments, such as is shown in FIG. 4D, the filament wire 214 may encompass a single wire strand that extends across the plunger 206. [0047] In FIG. 4A, the at least one groove 218 may be centrally defined or otherwise formed on the head 208 of the plunger 206. The filament wire 214 may rest within or otherwise be restrained within the groove 218 until burned or disintegrated, as described above. As depicted, the groove 218 may be in the general shape of a rectangular cut or slot defined in the head 208. In other embodiments, however, the groove 218 may be arcuate in shape (i.e., “U” shaped), such that the filament wire 214 rests in a trough-like structure. In yet other embodiments, the groove 218 may be “V” shaped or assume any other polygonal shape capable of receiving or otherwise containing the filament wire 214. [0048] In FIG. 4C, the groove 218 may be entirely omitted from the plunger 206, and the filament wire 214 may instead rest or otherwise extend across the top of the head 208. In FIG. 4C, the at least one groove 218 may be characterized as one or more perforations or conduits defined in and otherwise extending through the head 208 of the plunger 206. As illustrated in FIG. 4C, first and second conduits 402a and 402b may each be configured to receive a separate strand of the filament wire 214 therethrough. As will be appreciated, more or less than two conduits 402a, b may be used, without departing from the scope of the disclosure. For instance, in FIG. 4D, a single perforation or conduit 404 may be defined in and otherwise extended through the head 208 of the plunger 206. As illustrated, the conduit 404 may be configured to receive the filament wire 214 therein. [0049] Those skilled in the art will readily recognize several other variations that the plunger 206 may assume while remaining within the scope of the present disclosure. The embodiments depicted in FIGS. 4A-4D are shown and described for illustrative purposes only and therefore should not be considered as limiting the disclosure to only those illustrated embodiments. Indeed, other configurations of the plunger 206, not necessarily depicted or otherwise described herein, but nonetheless configured to generally interact with the filament wire 214 as discussed herein, are also contemplated as being within the scope of the disclosure. [0050] Therefore, the disclosed systems and methods are well adapted to attain the ends and advantages mentioned as well as those that are inherent therein. The particular embodiments disclosed above are illustrative only, as the teachings of the present disclosure may be modified and practiced in different but equivalent manners apparent to those skilled in the art having the benefit of the teachings herein. Furthermore, no limitations are intended to the details of construction or design herein shown, other than as described in the claims below. It is therefore evident that the particular illustrative embodiments disclosed above may be altered, combined, or modified and all such variations are considered within the scope and spirit of the present disclosure. The systems and methods illustratively disclosed herein may suitably be practiced in the absence of any element that is not specifically disclosed herein and/or any optional element disclosed herein. While compositions and methods are described in terms of “comprising,” “containing,” or “including” various components or steps, the compositions and methods can also “consist essentially of” or “consist of” the various components and steps. All numbers and ranges disclosed above may vary by some amount. Whenever a numerical range with a lower limit and an upper limit is disclosed, any number and any included range falling within the range is specifically disclosed. In particular, every range of values of (of the form, “from a to b” “or,” equivalently, “from approximately a to b,” or, equivalently, “from approximately a to b”) disclosed herein is to be understood to set forth every number and range encompassed within the broader range of values. Also, the terms in the claims have their plain, ordinary meaning unless otherwise explicitly and clearly defined by the patentee. Moreover, the indefinite articles “a” or “an,” as used in the claims, are defined herein to mean one or more than one of the elements that it introduces. If there is any conflict in the usages of a word or term in this specification and one or more patent or other documents that may be incorporated herein by reference, the definitions that are consistent with this specification should be adopted. The invention claimed is: 1. A selective fire switch, comprising: a switch housing; a plunger having a head and a body, the body extending longitudinally from the head and at least partially into an opening defined in the switch housing; a first post and a second post arranged on opposing sides of the switch housing; and a filament wire coupled to and extending between both the first and second posts across the switch housing, the
filament wire being in contact with the plunger and thereby securing the plunger in a seated configuration within the switch housing.

2. The selective fire switch of claim 1, wherein the filament wire extends from the first post to the second post and back to first post from the second post.

3. The selective fire switch of claim 1, wherein the first and second posts support the filament wire across the switch housing in a substantially tangential relationship with respect to the head of the plunger.

4. The selective fire switch of claim 1, wherein at least one of the first and second posts define a lateral extension that extends a short distance over the switch housing.

5. The selective fire switch of claim 1, wherein the filament wire is coupled to one or both of the first and second posts by at least one of soldering, welding, brazing, or mechanical fasteners.

6. The selective fire switch of claim 1, wherein at least one of the first and second posts is electrically conductive and configured to apply a voltage across the filament wire.

7. The selective fire switch of claim 1 or 6, wherein the filament wire is configured to fail upon being subjected to the voltage, and wherein, when the filament wire fails, the plunger is able to move from the seated configuration to an extended configuration.

8. The selective fire switch of claim 1, wherein the first post comprises an input stanchion and an output stanchion, the input and output stanchions being electrically conductive and structurally offset from each other on a first side of the switch housing.

9. The selective fire switch of claim 1 or 8, wherein the filament wire comprises a first portion coupled to the input stanchion and extending to the second post arranged on a second side of the switch housing, and a second portion extending from the second post and coupled to the output stanchion.

10. The selective fire switch of claim 1, further comprising at least one groove defined in the head of the plunger and being configured to receive or engage the filament wire as it extends across the switch housing.

11. The selective fire switch of claim 1 or 10, wherein the filament wire comprises a first portion and a second portion and the at least one groove comprises a first groove and a second groove defined on opposing sides of the head, the first groove being configured to engage the first portion and the second groove being configured to engage the second portion.

12. The selective fire switch of claim 1 or 10, wherein the at least one groove is centrally defined on the head and the filament wire rests within the at least one groove.

13. The selective fire switch of claim 1 or 10, wherein the at least one groove comprises one or more conduits defined through the head and configured to receive the filament wire therethrough.

14. A method of operating a selective fire switch, comprising:

sealing a plunger in a seated configuration within a switch housing with a filament wire that engages the plunger, the filament wire being coupled to and extending between a first post and a second post arranged on opposing sides of the switch housing and extending across the switch housing;

applying a voltage across the filament wire;

burning the filament wire with the voltage; and

moving the plunger from the seated configuration to an extended configuration with respect to the switch housing.

15. The method of claim 14, wherein the plunger has a head and a body extending longitudinally from the head and at least partially into an opening defined in the switch housing, and wherein securing the plunger in the seated configuration further comprises supporting the filament wire with the first and second posts in a substantially tangential relationship with respect to the head.

16. The method of claim 14 or 15, wherein supporting the filament wire with the first and second posts further comprises supporting the filament wire with a lateral extension defined on at least one of the first and second posts, the lateral extension extending a short distance over the switch housing.

17. The method of claim 14 or 15, further comprising engaging the filament wire in or on at least one groove defined in the head of the plunger.

18. The method of claim 14 or 15, wherein moving the plunger from the seated configuration to the extended configuration further comprises:

engaging the body of the plunger on a toggle mechanism arranged within the switch housing, the toggle mechanism being spring loaded; and

moving the plunger into the extended configuration with the toggle mechanism once the filament wire is burned.

19. The method of claim 14, wherein applying the voltage across the filament wire comprises:

supplying a current to the first post, the first post being electrically conductive; and

conducting the current from the first post to the filament wire.

20. The method of claim 14, wherein the first post comprises an input stanchion and an output stanchion, the input and output stanchions being electrically conductive and structurally offset from each other, and wherein applying the voltage across the filament wire comprises:

supplying a current to the input stanchion;

conducting the current from the input stanchion to a first portion of the filament wire which extends to the second post; and

conducting the current to the output stanchion via a second portion of the filament wire that extends from the second post.

21. A selective fire switch, comprising:

a switch housing;

a plunger extending at least partially into an opening defined in the switch housing;

an input stanchion and an output stanchion arranged on a first side of the switch housing, the input and output stanchions being electrically conductive and structurally offset from each other;

a post arranged on a second side of the switch housing opposite the first side of the switch housing; and

a filament wire having a first portion coupled to the input stanchion and extending to the post across the switch housing, and a second portion extending from the post across the switch housing and to the output stanchion, the filament wire being in contact with the plunger and thereby maintaining the plunger in a seated configuration within the switch housing.

22. The selective fire switch of claim 21, wherein the filament wire is supported across the switch housing between the
input and output stanchions and the post in a substantially tangential relationship with respect to the plunger.

23. The selective fire switch of claim 21, wherein at least one of the input and output stanchions and the post defines a lateral extension that extends a short distance over the switch housing.

24. The selective fire switch of claim 21, wherein the filament wire is coupled to at least one of the input and output stanchions and the post by at least one of soldering, welding, brazing, or mechanical fasteners.

25. The selective fire switch of claim 21, wherein the input and output stanchions are electrically conductive and configured to route a voltage through the filament wire and around the post.

26. The selective fire switch of claim 21 or 25, wherein the filament wire is configured to fail upon being subjected to the voltage, and wherein, when the filament wire fails, the plunger is able to move from the seated configuration to an extended configuration.

27. The selective fire switch of claim 21, wherein the plunger has a head and at least one groove defined in the head, the at least one groove being configured to receive or engage the filament wire as it extends across the switch housing.

28. The selective fire switch of claim 21 or 27, wherein the at least groove comprises a first groove and a second groove defined on opposing sides of the head, the first groove being configured to engage the first portion of the filament wire and the second groove being configured to engage the second portion of the filament wire.

29. The selective fire switch of claim 21 or 27, wherein the at least one groove comprises first and second conduits defined through the head and configured to receive the first and second portions of the filament wire, respectively, there-through.