US 20100136495A1

(19) **United States**

(12) **Patent Application Publication**

Weston et al.

(10) **Pub. No.: US 2010/0136495 A1**

(43) **Pub. Date: Jun. 3, 2010**

(54) **ONE-HANDED FIRE STARTER**

(75) Inventors: **Nancie Lynn Weston**, Camano Island, WA (US); **Keri Susan Kliemann**, Duvall, WA (US); **Robert Franklin Jordan**, Brier, WA (US); **Chris Patrick Venti**, Redmond, WA (US)

Correspondence Address:
CHARLES J RUPNICK
PO BOX 46752
SEATTLE, WA 98146 (US)

(73) Assignee: **Ultimate Survival Technologies, LLC**

(21) Appl. No.: **12/583,463**

(22) Filed: **Aug. 21, 2009**

Related U.S. Application Data

(60) Provisional application No. 61/191,064, filed on Sep. 4, 2008.

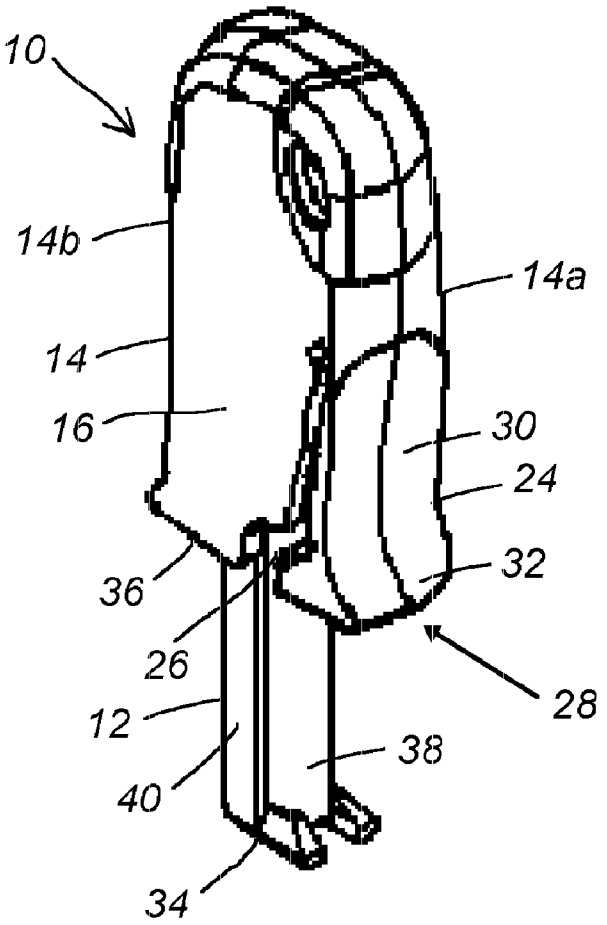
Publication Classification

(51) **Int. Cl.**
F23Q 1/02 (2006.01)

(52) **U.S. Cl.** **431/274**

(57) **ABSTRACT**

A novel mechanical spark generating device for one-handed operation. The novel mechanical spark generating device includes a case having a case body and a relatively moveable striker arm extended therefrom, the case body includes a channel having an opening thereinto. A pyrophoric rod assembly is moveably carried in the channel of the case body, the pyrophoric rod assembly having a support surface adjacent to one end thereof, and a pyrophoric rod carried therein. A striker bar is fixed to the striker arm in a position for interacting with the pyrophoric rod of the pyrophoric rod assembly when the pyrophoric rod assembly is in a deployed configuration extended from the case body and the striker arm is moved there toward.



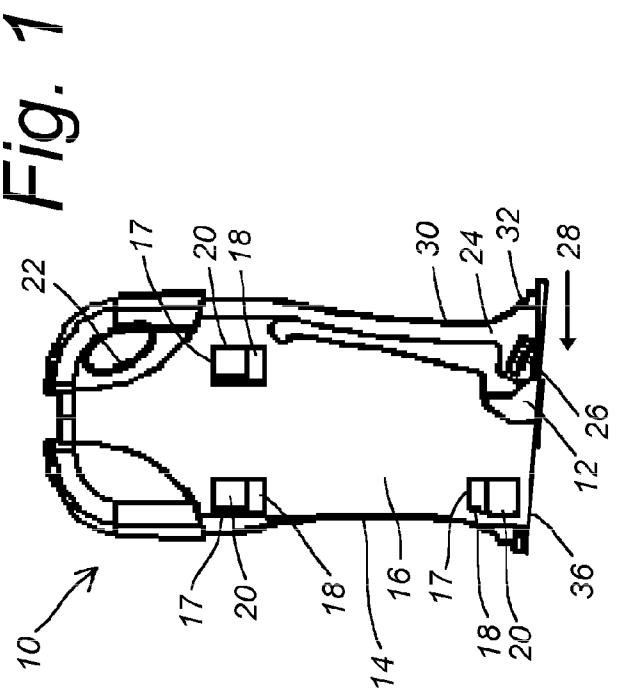


Fig. 1

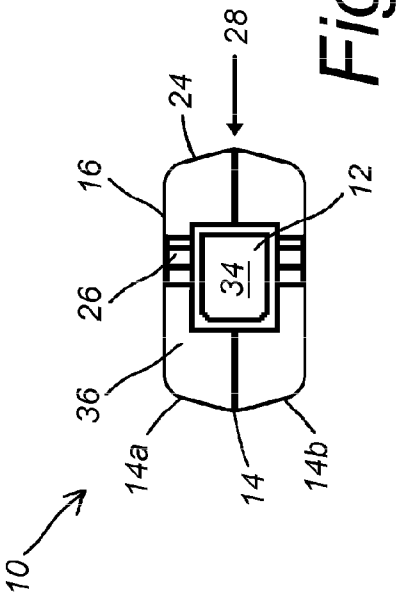


Fig. 2

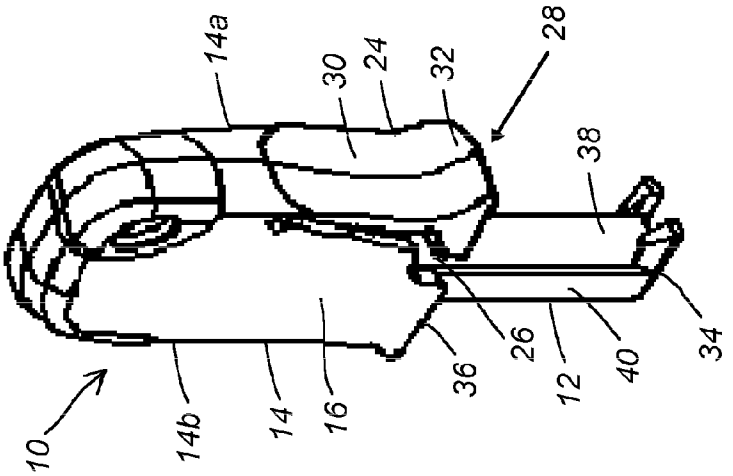


Fig. 3

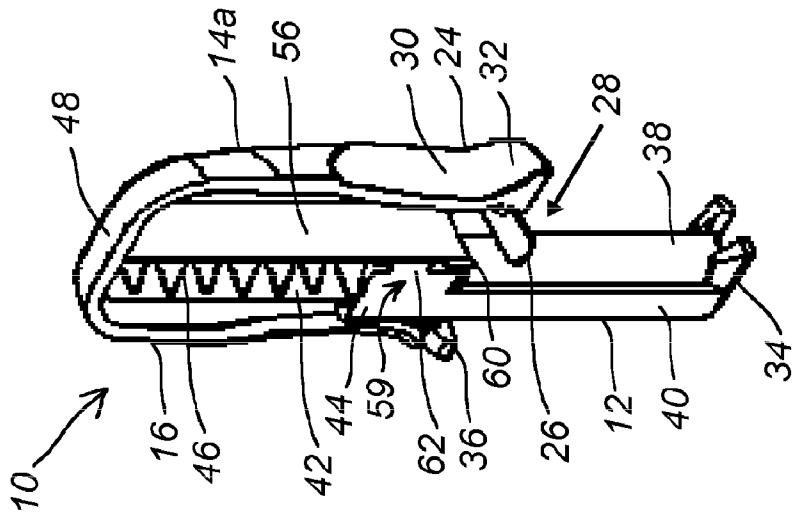


Fig. 6

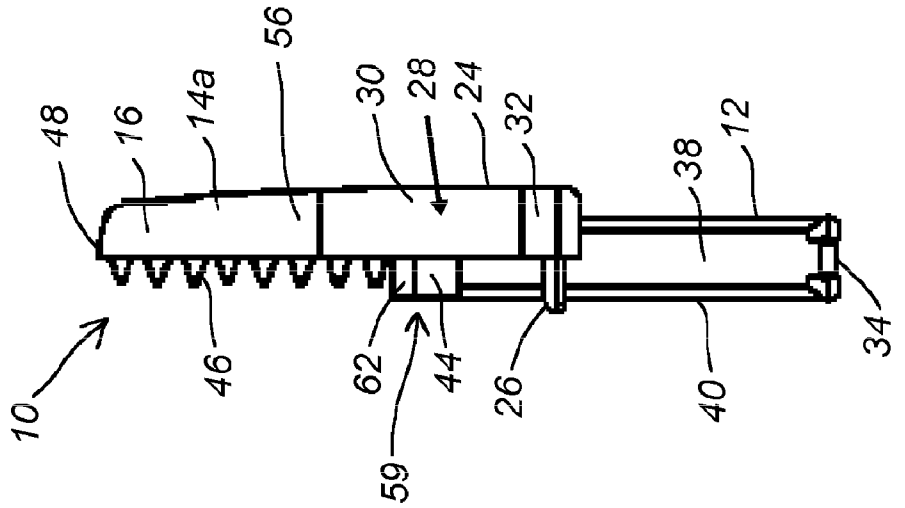


Fig. 5

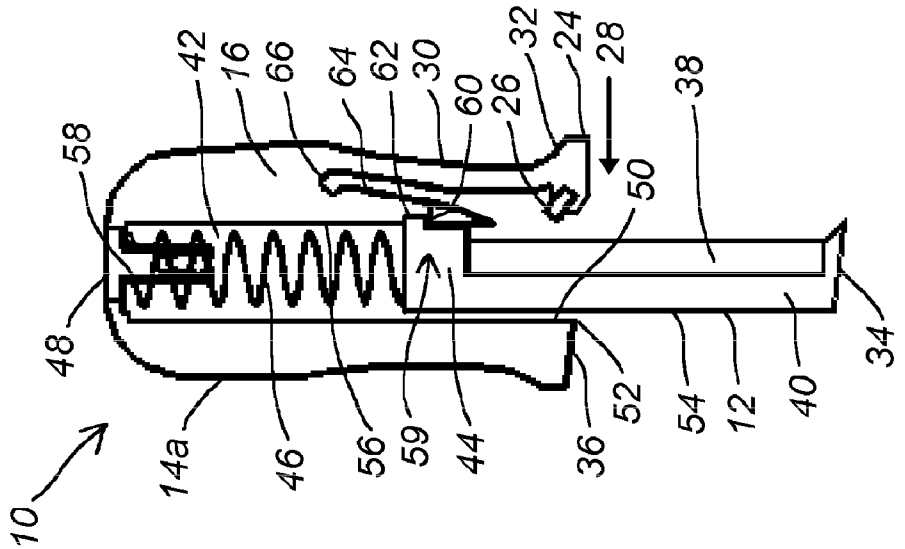


Fig. 4

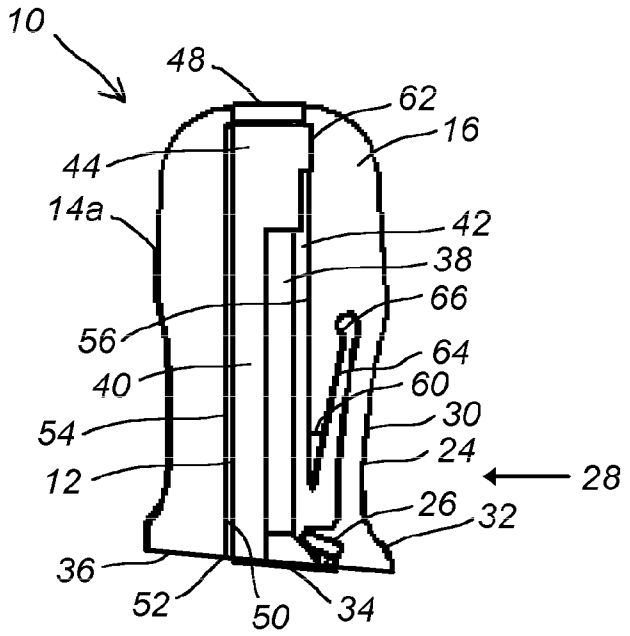


Fig. 7

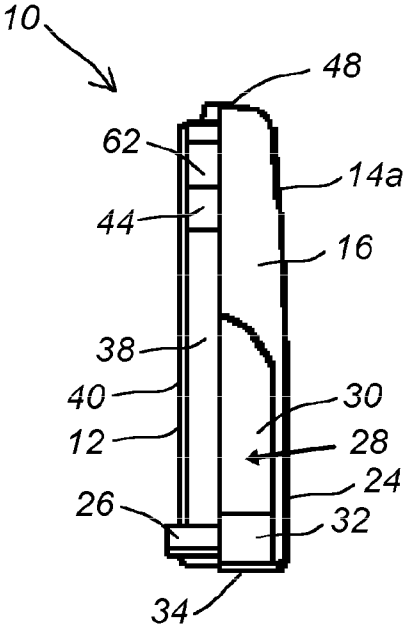
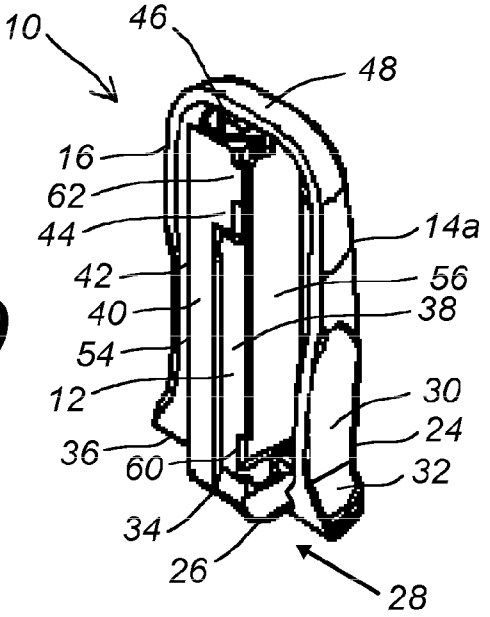


Fig. 8

Fig. 9



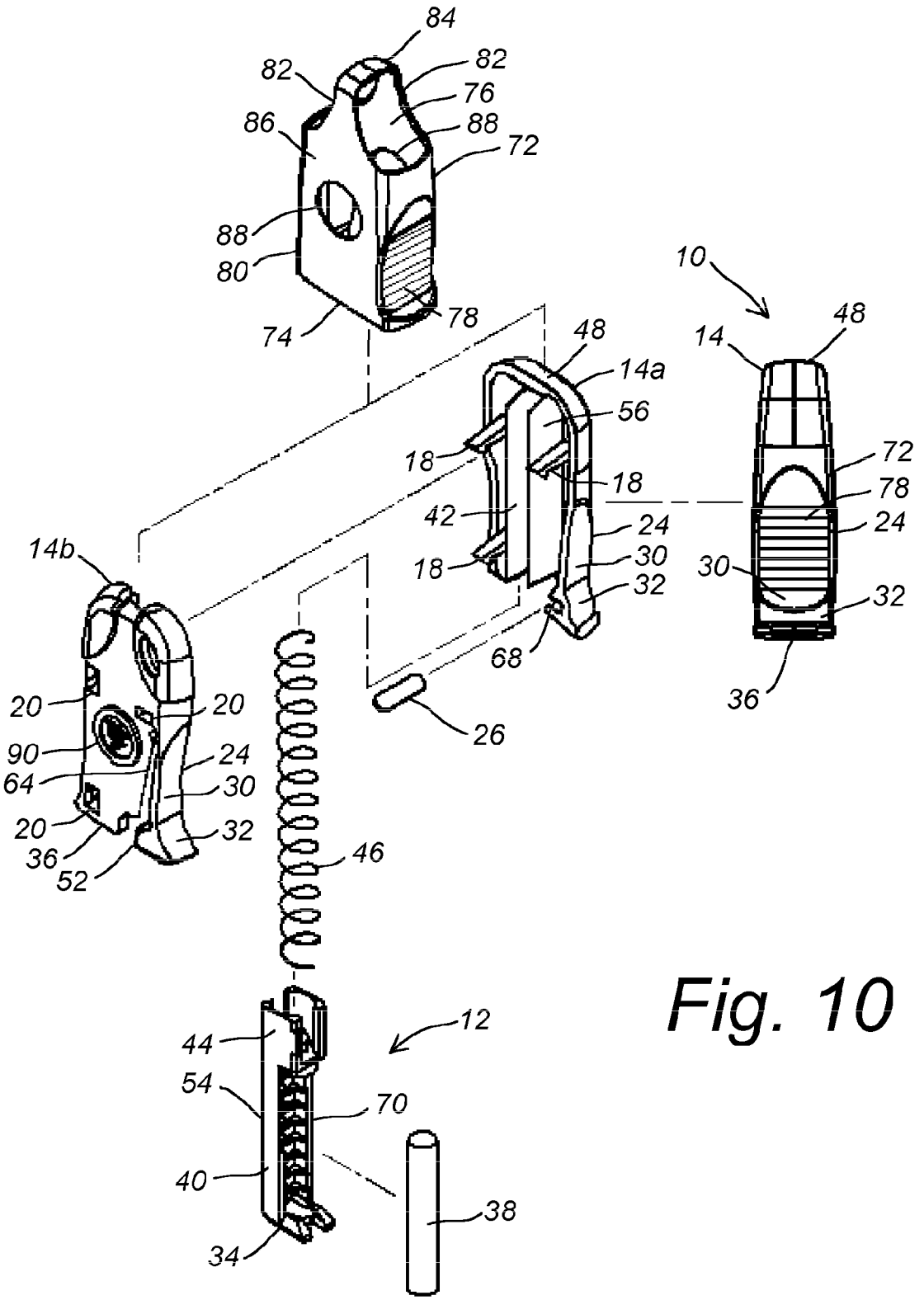

84
82
82
76
86
88
72
88
80
74
78
10
48
14
14a
56
18
18
72
78
42
24
24
14b
18
30
30
32
32
68
36
20
20
26
90
24
64
30
20
32
36
52
46
12
44
54
70
40
38
34

Fig. 10

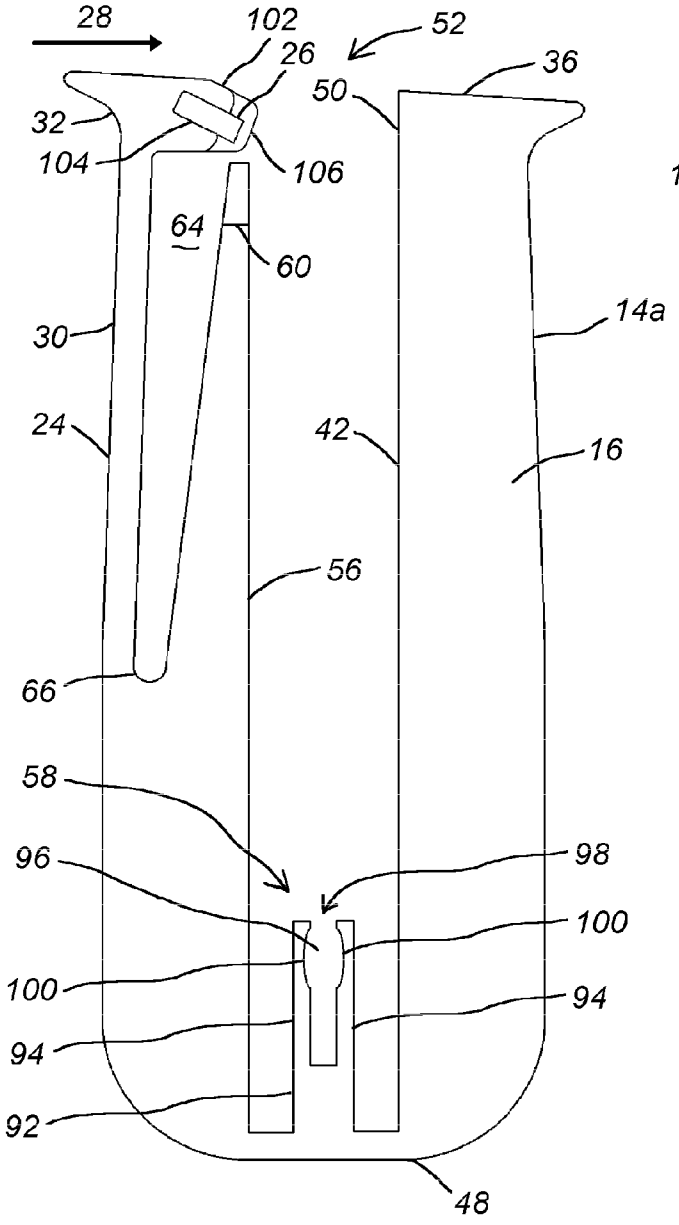

28
102
26
52
36
50
32
104
106
64
60
30
14a
24
42
16
56
66
58
96
98
100
100
94
94
92
48

Fig. 11

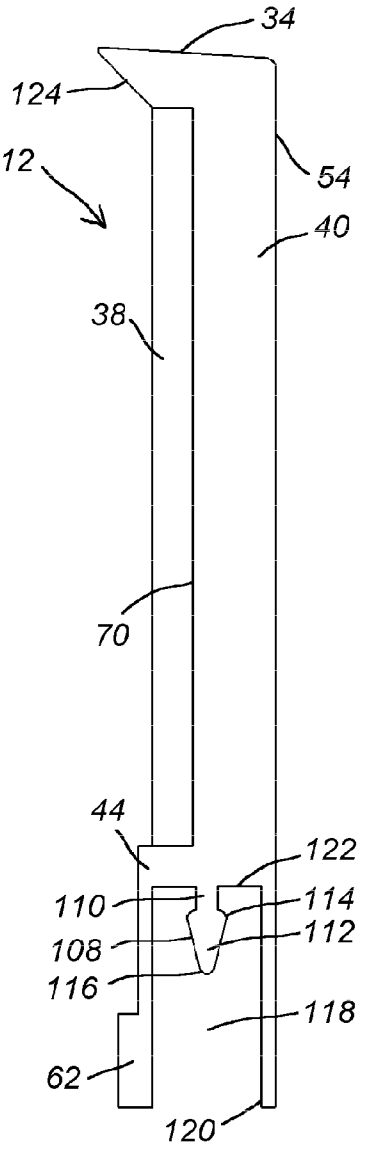

34
124
12
54
40
38
70
44
122
110
114
108
112
116
118
62
120

Fig. 12

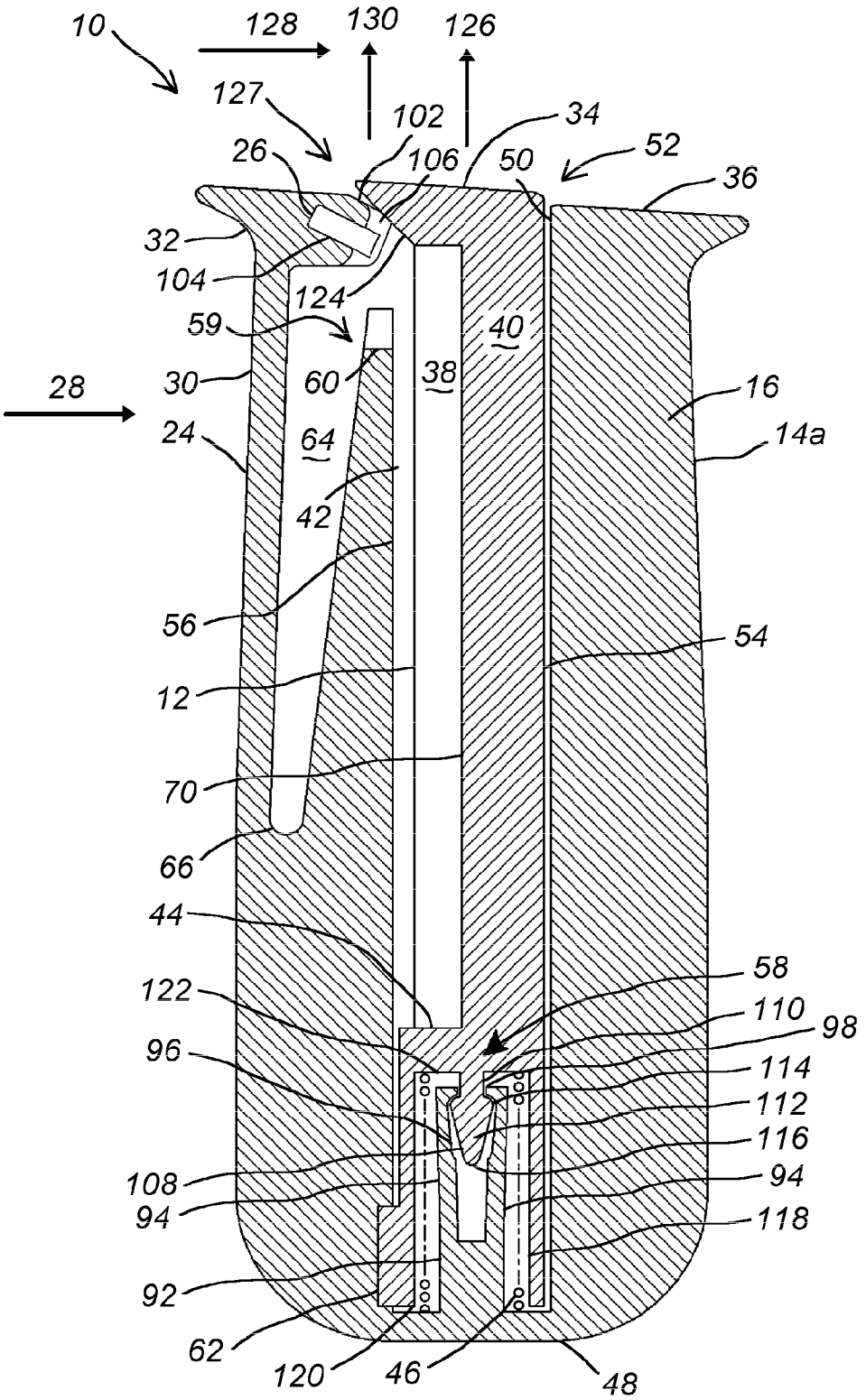

10
128
130
126
127
102
34
26
106
50
52
36
32
104
124
59
40
28
30
60
38
16
24
64
14a
42
56
54
12
70
66
44
58
122
110
98
96
114
112
116
108
94
94
118
92
62
120
46
48

Fig. 13

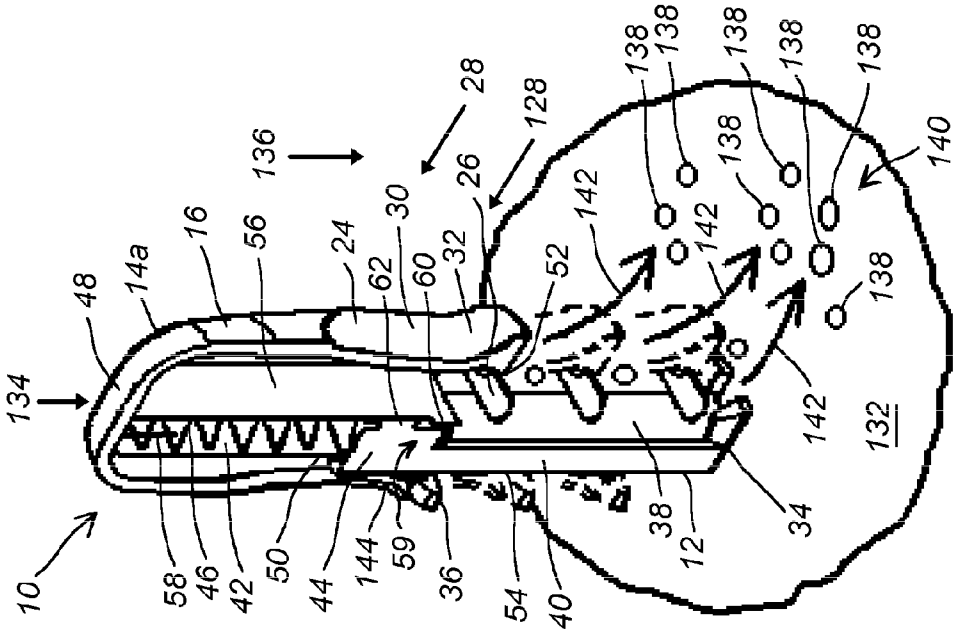

10
134
48
14a
16
56
24
62
60
32
30
26
28
128
136
52
142
138
140
132
34
12
38
54
40
36
144
59
44
50
42
46
58

Fig. 15

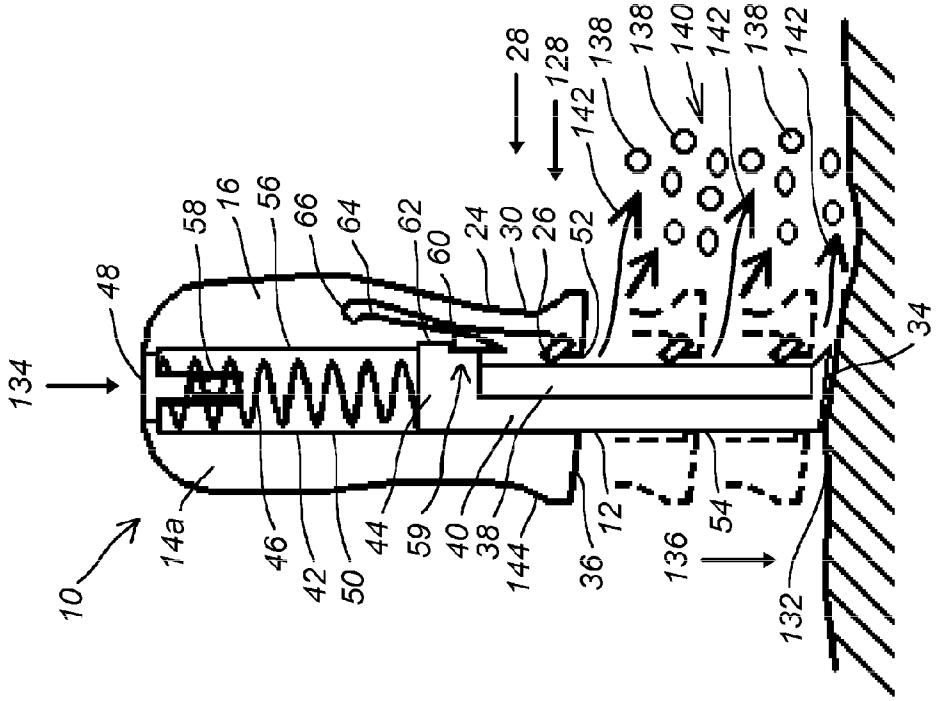

10
134
48
14a
58
16
56
66
64
62
60
24
30
26
52
28
128
142
138
140
34
12
54
136
132
144
38
40
59
44
50
42
46

Fig. 14

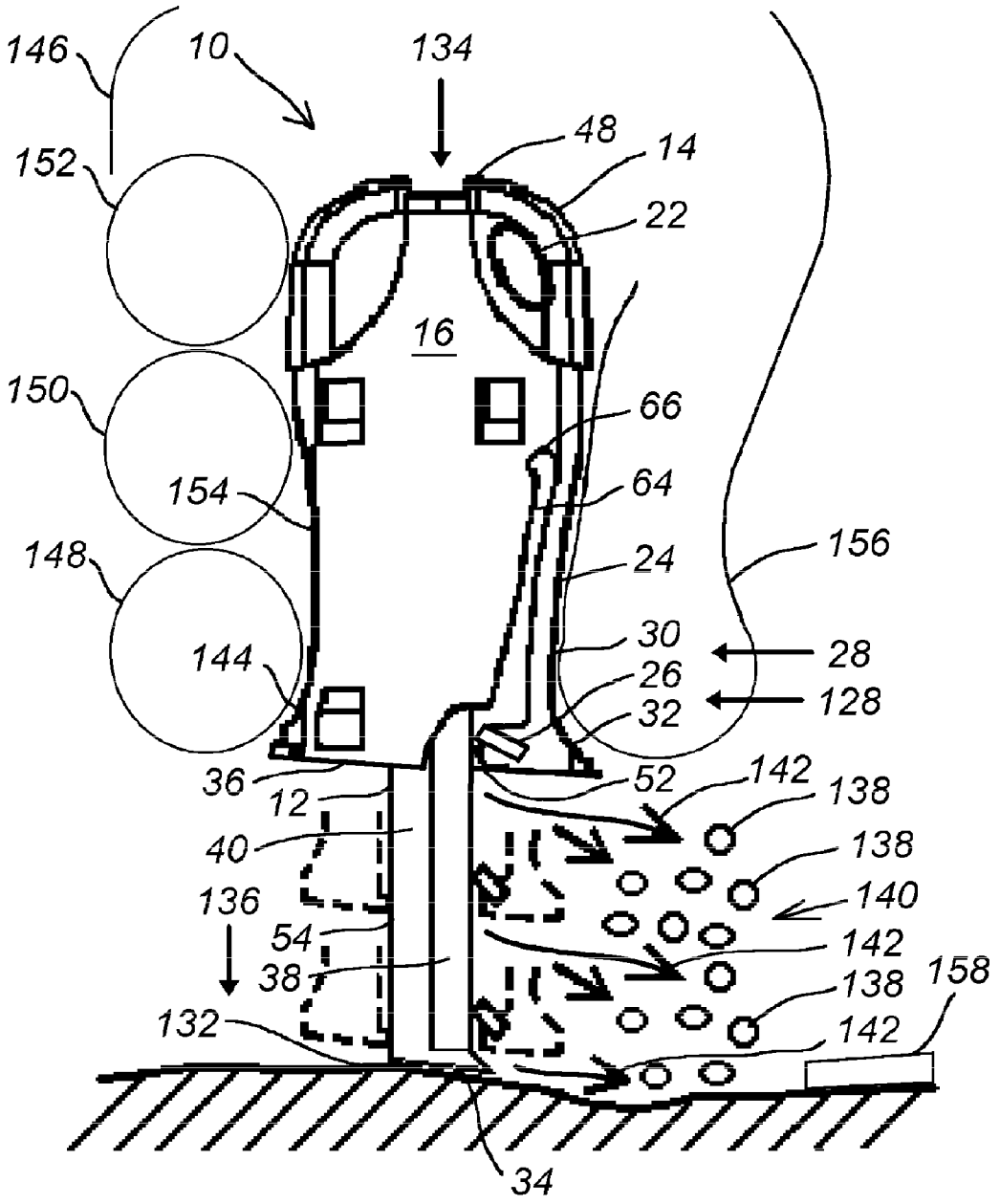

146
10
134
48
14
152
22
16
150
66
154
64
156
148
24
30
28
144
26
128
32
36
52
142
138
12
40
138
136
140
54
142
38
158
138
132
142
34

Fig. 16

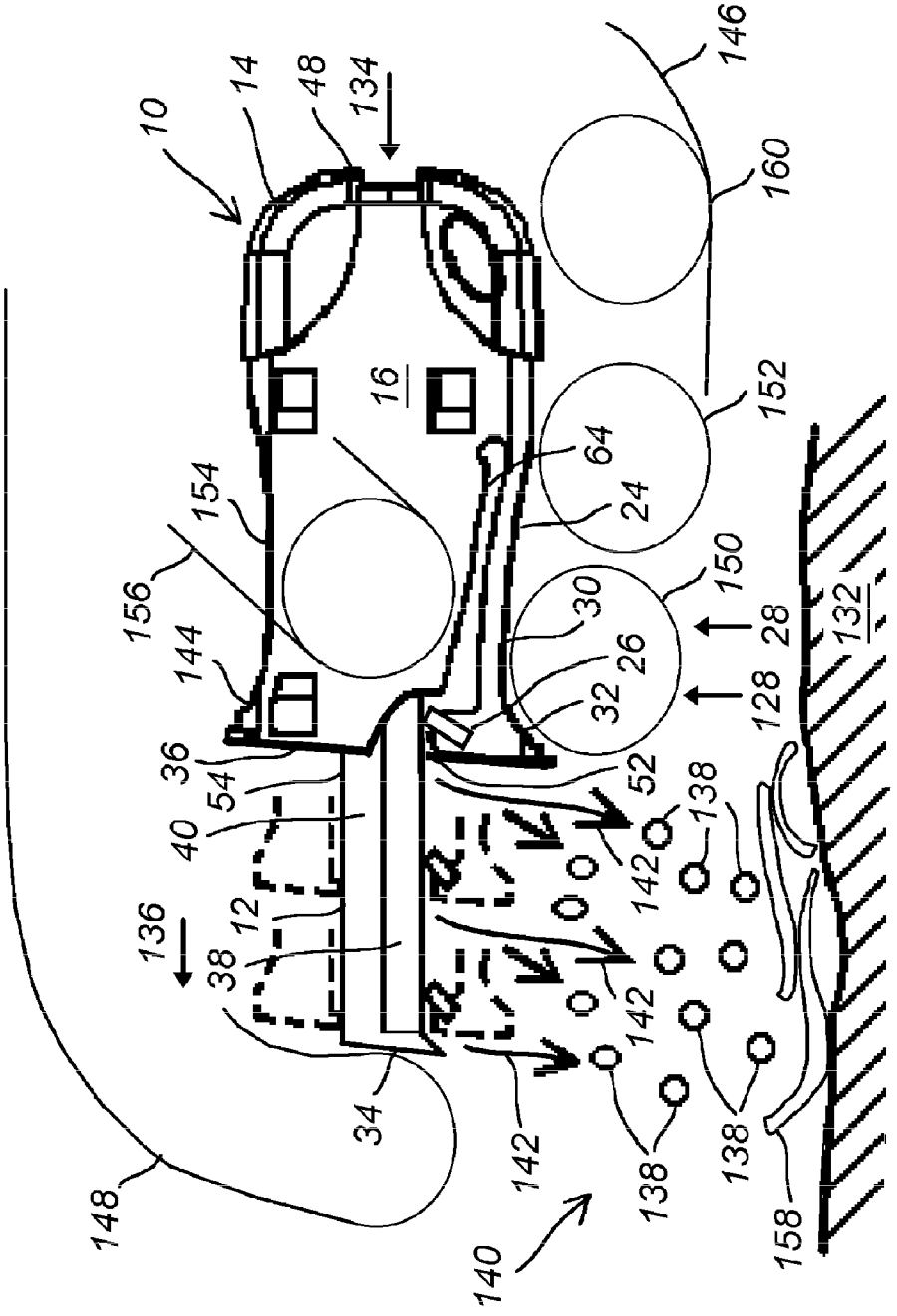

10
14
48
134
146
160
16
152
64
24
154
156
144
150
30
28
132
26
32
128
36
54
52
138
40
142
136
12
38
142
34
142
138
138
158
148
140

Fig. 17

ONE-HANDED FIRE STARTER

[0001] This application claims priority benefit of copending U.S. Provisional Patent Application Ser. No. 61/191,064 filed in the names of the above captioned inventors, the common inventors hereof, on Sep. 4, 2008, the complete disclosure of which is incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The present invention relates generally to spark generating devices having a shavable pyrophoric element, and in particular to manually operated mechanical spark generating devices.

BACKGROUND OF THE INVENTION

[0003] Spark generating or "fire starter" devices are generally well-known. However, known spark generating devices tend to be complex devices having multiple components. For example, most known spark generating devices include at least two separate components that must be operated together for generating sparks. Furthermore, the multiple components of known spark generating devices require the use to two hands.

[0004] Accordingly, known spark generating devices are limited in their ability to provide ease of use in challenging circumstances.

SUMMARY OF THE INVENTION

[0005] The present invention is a novel mechanical spark generating device structured for one-handed use.

[0006] According to one aspect of the invention the novel mechanical spark generating device includes a case having a case body, and a flexibly resilient striker arm extended from one surface of the case body. The case body includes a linear channel having an opening thereinto adjacent to an impact surface of the case body, and the striker arm includes a distal end thereof opposite from its attachment to the case body and positioned adjacent to the opening into the channel of the case body. A pyrophoric rod assembly is slidably carried in the channel of the case body. The pyrophoric rod assembly includes a rod carrier that is formed with a rod receiver cavity and with a support surface adjacent to one end, and a pyrophoric rod that is replaceably received into the rod receiver cavity. A striker bar is formed of a substantially hard material, such as a hardened stainless steel or carbide material, that will cooperate with pyrophoric rod **38** to generate sparks. The striker bar is positioned adjacent to the distal end of the striker arm in a position adjacent to the opening into the channel of the case body so that it is positioned for interacting with at least a portion of the pyrophoric rod of the pyrophoric rod assembly when the pyrophoric rod assembly is configured in a deployed configuration extended from the impact surface of the case body, and the striker arm is resiliently deflected inwardly there toward.

[0007] According to another aspect of the novel mechanical spark generating device, the novel mechanical spark generating device further includes a decoupleable latching mechanism that is operable between the rod carrier of the pyrophoric rod assembly and the channel of the case body for retaining the pyrophoric rod assembly substantially completely enclosed within the channel in an undeployed configuration.

[0008] According to another aspect of the novel mechanical spark generating device, with the striker arm deflected inwardly toward the case body, the striker bar is further positioned for interacting with at least a portion of the pyrophoric rod of the pyrophoric rod assembly during travel of the pyrophoric rod assembly between the deployed configuration and the undeployed configuration.

[0009] According to another aspect of the novel mechanical spark generating device, the novel mechanical spark generating device further includes a spring or other biasing member that is positioned between the pyrophoric rod assembly and the case body, such that the biasing member is deflected in a potential energy state when the pyrophoric rod assembly is in the undeployed configuration, and the biasing member is undeflected in a substantially expended energy state when the pyrophoric rod assembly is in the deployed configuration.

[0010] According to another aspect of the novel mechanical spark generating device, the novel mechanical spark generating device further includes an activation mechanism that is operable between the distal end of the striker arm and the rod carrier of the pyrophoric rod assembly for decoupling the decoupleable latching mechanism.

[0011] According to another aspect of the novel mechanical spark generating device, the novel mechanical spark generating device further includes a brake mechanism that is operable between the pyrophoric rod assembly and the case body for stopping progression of the pyrophoric rod assembly during travel toward the deployed configuration, and retaining the pyrophoric rod assembly partially within the case body when the pyrophoric rod assembly is in the deployed configuration.

[0012] According to another aspect of the novel mechanical spark generating device, the pyrophoric rod assembly is further substantially completely retracted within the channel of the case body when it is configured in the undeployed configuration.

[0013] According to another aspect of the novel mechanical spark generating device, a novel one-handed method of mechanically generating sparks is disclosed in detail.

[0014] Other aspects of the invention are detailed herein.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The foregoing aspects and many of the attendant advantages of this invention will become more readily appreciated as the same becomes better understood by reference to the following detailed description, when taken in conjunction with the accompanying drawings, wherein:

[0016] FIG. **1** is a perspective view showing an example of the novel mechanical spark generating device that is manually operable for generating a spark for starting a fire;

[0017] FIG. **2** is an end view of the novel spark generating device showing a support surface thereof adjacent to one end of a pyrophoric rod assembly and an impact surface of the case for impacting an external reaction surface, e.g., earth, and stopping progression of the case relative to the pyrophoric rod assembly;

[0018] FIG. **3** illustrates the novel spark generating device having the pyrophoric rod assembly extended from the case's impact surface, whereby the pyrophoric rod assembly is deployed in an initial operative position prior to striking a spark;

[0019] FIGS. **4**, **5** and **6** each illustrate an internal portion of the novel spark generating device, wherein one half of the two-part case is removed for clarity, and the pyrophoric rod

assembly is illustrated as being deployed from the impact surface of the case in the initial operational configuration prior to striking a spark;

[0020] FIGS. **7**, **8** and **9** illustrate an internal portion of the novel spark generating device, wherein one case half is removed for clarity, and the pyrophoric rod assembly is stored within the case and substantially completely retracted into the case body in an undeployed configuration;

[0021] FIG. **10** is an exploded assembly view of the novel spark generating device that illustrates one exemplary order of assembly;

[0022] FIG. **11** is a view of one half of the case that illustrates details of a latching mechanism for retaining the pyrophoric rod assembly stored within the case in an undeployed configuration;

[0023] FIG. **12** illustrates details of the pyrophoric rod assembly, wherein the rod carrier carrying the rod of pyrophoric material is formed with a shoulder portion that is structured to cooperate with a receiver portion of the case positioned adjacent to a base portion of the case body for forming the latching mechanism which retains the pyrophoric rod assembly in a channel within the case body until the novel spark generating device is activated;

[0024] FIG. **13** illustrates the novel mechanical spark generating device configured in a cocked state, having the pyrophoric rod assembly retracted into the case with a spring biasing member compressed between the shoulder of the rod carrier and the base portion of the channel for popping the pyrophoric rod assembly outwardly of the case like a jack-in-the-box when triggered;

[0025] FIGS. **14** and **15** illustrate operation of the novel mechanical spark generating device for generating sparks in a repeatable spark generation sequence; and

[0026] FIGS. **16** and **17** demonstrate alternative one-handed methods of operation for utilizing the novel mechanical spark generating device for generating hot sparks by shaving ignited shavings from the pyrophoric alloy rod of the pyrophoric rod assembly.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

[0027] In the Figures, like numerals indicate like elements.

[0028] The Figures illustrate a novel mechanical spark generating device **10** that is manually operable for generating a spark, e.g., causing ignition of fuel for starting a fire. FIG. **1** is a side view of spark generating device **10** configured in a safe storage and carrying condition wherein a pyrophoric rod assembly **12** is safely retained substantially completely within a two-piece case **14** sized to fit in the palm of a user's hand. As more clearly illustrated in FIGS. **2** and **3**, case **14** is formed of two case halves **14***a* and **14***b* of injection molded plastic. Case halves **14***a*, **14***b* are coupled together to form case **14** substantially enclosing pyrophoric rod assembly **12** within a case body **16**. Case halves **14***a*, **14***b* are formed with one or more interlocks **17** that operate to hold them together. By example and without limitation, case halves **14***a*, **14***b* are snapped together with a plurality of flexibly resilient teeth **18** in one case half **14***a* interlockably received into mating receiver notches **20** in mating case half **14***b*. Case **14** is optionally formed with an open loop **22**, e.g., for a lanyard.

[0029] Case halves **14***a*, **14***b* combine to form a flexibly resilient striker arm **24** along one side of case **14**. Striker arm **20** holds a metallic striker bar **26** in a position for interacting with pyrophoric rod assembly **12** when striker arm **24** is resiliently deflected inwardly there toward (arrow **28**) during operation, as disclosed herein. Mated case halves **14***a*, **14***b* form a striker control pad **30** on a surface of striker arm **24** external of case **14**. Striker control pad **30** is operated for resiliently deflecting striker arm **24** against case body **16** and thereby compressing striker bar **26** into operative contact with pyrophoric rod assembly **12**. Mated case halves **14***a*, **14***b* also optionally form a protective spur **32** on an external surface of striker arm **24** at distal end of striker control pad **30** adjacent to striker bar **26**. Protective spur **32** is useful for protecting the users thumb on striker control pad **30** from experiencing hot particles of pyrophoric alloy generated during operation of spark generating device **10**.

[0030] FIG. **2** is an end view of spark generating device **10** showing a support surface **34** adjacent to one end of pyrophoric rod assembly **12**. An impact surface **36** of case **14** surrounds pyrophoric rod assembly **12** for impacting an external reaction surface, e.g., earth, and stopping progression of case **14** relative to pyrophoric rod assembly **12**.

[0031] FIG. **3** illustrates spark generating device **10** having pyrophoric rod assembly **12** extended from impact surface **36**, whereby pyrophoric rod assembly **12** is deployed in an initial operative position relative to case **14** prior to striking sparks. As illustrated, pyrophoric rod assembly **12** includes a pyrophoric rod **38** in a rod carrier **40** that is retractable relative to case **14** into a position substantially enclosed by case body **16**. See, e.g., FIG. **1**. Rod carrier **40** is, for example, of injection molded plastic.

[0032] FIGS. **4**, **5** and **6** each illustrate an internal portion of spark generating device **10**, wherein one case half **14***b* is removed for clarity. Pyrophoric rod assembly **12** is illustrated as having pyrophoric rod **38** in rod carrier **40** deployed from impact surface **36** of case **14** in an initial operational configuration relative to striker bar **26** on striker arm **24**. According to one embodiment, rod carrier **40** is slidably carried in a channel **42** fashioned within body **16** of case **14**. For example, channel **42** is substantially straight and extends substantially the entire length of case body **16**, and rod carrier **40** is substantially straight with a shoulder **44** formed adjacent to one end thereof and is sized to be a sliding fit in channel **42**. A spring or other biasing member **46** is positioned in channel **42** between shoulder **44** and a base portion **48** of channel **42** for urging rod carrier **40** out of case body **16** along channel **42**. A guide **50** is positioned within a mouth **52** of channel **42** adjacent to impact surface **36** of case **14**. For example, guide **50** is an interior wall surface of channel **42**. Guide **50** operates along a back surface **54** of rod carrier **40** for controlling alignment of pyrophoric rod assembly **12** in channel **42**.

[0033] When pyrophoric rod assembly **12** is urged out of case body **16** by spring force of biasing member **46**, pressure applied to striker control pad **30** compresses (arrow **28**) striker bar **26** into operative contact with pyrophoric rod **38**. In turn, pressure of striker bar **26** against pyrophoric rod **38** forces back surface **54** of rod carrier **40** into contact with guide **50** in mouth **52** of channel **42**. Compression of pyrophoric rod **38** and rod carrier **40** between striker bar **26** and channel guide **50**, respectively, cooperates with shoulder **44** of rod carrier **40** against an interior wall **56** of channel **42** opposite from guide wall **50** to effectively stabilize pyrophoric rod assembly **12** in channel **42**, even when pyrophoric rod assembly **12** is mostly extended from mouth **52** of channel **42**.

[0034] A decoupleable latching mechanism **58** is provided between pyrophoric rod assembly **12** and channel **42** to retain

pyrophoric rod assembly **12** in channel **42** until activated. For example, latching mechanism **58** is provided between base portion **48** of channel **42** and shoulder **44** of rod carrier **40**, as disclosed herein.

[0035] A brake mechanism **59** is provided between pyrophoric rod assembly **12** and channel **42** for preventing pyrophoric rod assembly **12** from completely exiting mouth **52** of channel **42**. For example, channel **42** is formed with a stop **60** adjacent to mouth **52** and rod carrier **40** includes a brake member **62** that cooperates with stop **60** to arrest progress of pyrophoric rod assembly **12** from mouth **52** of channel **42**. Other brake mechanisms **59** are also contemplated and may be substituted without deviating from the scope and intent of the present invention.

[0036] Striker arm **24** is resiliently deflectable toward (arrow **28**) pyrophoric rod assembly **12** for causing striker bar **26** to interact with pyrophoric rod **38** during operation of spark generating device **10**. For example, case **14** is formed with a gap **64** between striker arm **24** and body **16** for normally spacing striker bar **26** away from pyrophoric rod **38**, except during operation. Case halves **14***a*, **14***b* are formed of a substantially rigid but resilient material, such as injection molded plastic, whereby when assembled in case **14**, striker arm **24** is flexibly spaced away from case body **16** by gap **64**. A stress relief notch **66** is optionally formed at root of gap **64** between striker arm **24** and case body **16** to ensure longevity of case **14**.

[0037] FIGS. **7**, **8** and **9** illustrate an internal portion of spark generating device **10**, wherein case half **14***b* is removed for clarity. Pyrophoric rod assembly **12** is stored in case **14** in an undeployed configuration having rod carrier **40** and pyrophoric rod **38** therein substantially completely retracted into case body **16**. In this undeployed configuration of spark generating device **10**, rod carrier **40** is slidably received into channel **42** with spring biasing member **46** compressed between shoulder **44** thereof and base portion **48** of channel **42**. See, e.g., FIG. **9**. Pressure applied to striker control pad **30** deflects striker arm **24** toward (arrow **28**) case body **16** for releasing pyrophoric rod assembly **12** and extending pyrophoric rod **38** in rod carrier **40** into the initial operational position relative to striker bar **26**. See, e.g., FIGS. **4**, **5**, **6**.

[0038] FIG. **10** is an exploded assembly view that illustrates spark generating device **10**. Order of assembly is provided for illustrative purposes only and is not the only effective assembly order possible. Accordingly, other assembly orders are also contemplated and may be substituted without deviating from the scope and intent of the present invention. As illustrated, both striker arm **24** of case halves **14***a*, **14***b* are each formed with a striker receiver slot **68** sized to snuggly receive striker bar **26** thereinto. Striker bar **26** is formed of a very hard material, for example, a hardened stainless steel or carbide material, that will cooperate with pyrophoric rod **38** to generate sparks. When case halves **14***a*, **14***b* are assembled into case **14**, striker bar **26** is effectively captured within striker arm **24**.

[0039] Case halves **14***a*, **14***b* are assembled into case **14** by fitting the plurality of flexibly resilient teeth **18** in one case half **14***a* interlockably into mating receiver notches **20** in mating case half **14***b*. Accordingly, case halves **14***a*, **14***b* are snapped together for ease of assembly. Assembled case halves **14***a*, **14***b* form case body **16** and flexible striker arm **24** of case **14**.

[0040] As illustrated, pyrophoric rod assembly **12** is formed of pyrophoric rod **38** installed into rod carrier **40**. For example, pyrophoric rod **38** is sized slightly longer than a rod receiver cavity **70** of rod carrier **40**, such that pyrophoric rod **38** is a lengthwise snap fit into rod carrier **40**. Accordingly, pyrophoric rod **38** is easily changed after extended use has ended its useful life. However, pyrophoric rod **38** is substantially cylindrical in shape such that it can be turned within rod receiver cavity **70** to expose a different, unworn surface to striker bar **26** after one surface becomes worn from use. As disclosed herein, pyrophoric rod **38** is a pyrophoric alloy, such as ferrocerium which is a man-made metallic material having a high coefficient of pyrophoricity such that it has the ability to give off a large number of hot sparks when scraped against a rough surface such as ridged steel.

[0041] Spring biasing member **46** is a conventional compression spring installed into cavity **42** formed between assembled case halves **14***a*, **14***b*. Pyrophoric rod assembly **12** is installed into cavity **42** with pyrophoric rod **38** facing toward striker bar **24** in striker arm **24**. Pyrophoric rod assembly **12** is pushed down into cavity **42** of case **14** to compress spring biasing member **46** between shoulder **44** of rod carrier **40** and base portion **48** of channel **42**. Spring biasing member **46** is positioned for urging rod carrier **40** out of case body **16** along channel **42**.

[0042] An optional cover **72** may be fitted over case **14**. For example, optional cover **72** is formed of an elastic material, such as a synthetic rubber material having a higher coefficient of friction than the injection molded plastic or other material of case **14**. Optional cover **72**, if present, thus provides added grip to spark generating device **10**. According to one embodiment, optional cover **72**, if present, includes an opening **74** for receiving assembled case **14** into an internal cavity **76**. Optional cover **72** is optionally formed with a knurled or ribbed panel **78** in a position to fit over striker control pad **30** on striker arm **24**. Optional ribbed panel **78** maximizes user's grip on striker control pad **30**. A second ribbed panel **78** is optionally provided on a surface **80** opposite from striker arm **24** for added gripping capability. When lanyard loop **22** is present in case **14**, optional cover **72** may include a corner cutout **82** positioned to expose lanyard loop **22**. A opposing corner cutout **82** may be provided for aesthetics. Corner cutouts **82** are joined by a strap **84** of the elastic material to maintain integrity of cover **72** and act as a stop when fitted over case **14**. Optionally, side surfaces **86** of cover **72** include a company or product logo. Else, cover **72** may include side cutouts **88** for exposing optional logos **90** embossed on case halves **14***a*, **14***b*.

[0043] FIG. **11** is a view of one case half **14***a* that illustrates details of latching mechanism **58** for retaining pyrophoric rod assembly **12** within case **14** in an undeployed configuration. Latching mechanism **58** is illustrated by example and without limitation as having a receiver portion **92** within channel **42** adjacent to base portion **48**. For example, receiver portion **92** is bifurcated into a pair of arms **94** projected upright from base portion **48** of channel **42** and forming an enlarged cavity **96** therebetween with a narrow mouth **98** thereinto. For example, arms **94** are formed with opposing reliefs **100** therebetween, and arms **97** may be spaced apart to form mouth **98**.

[0044] Striker arm **24** is illustrated as being formed with an ejector head **102** on the distal end thereof opposite from external protective spur **32**. Ejector head **102** is positioned adjacent to impact surface **36** of case **14** within mouth **52** of channel **42** opposite from guide wall **50** thereof. Ejector head **102** is thus positioned for being deflected toward (arrow **28**) channel **42** in body **16** of case **14**. Accordingly, ejector head

102 is positioned for ejecting pyrophoric rod assembly **12** when striker arm **24** is resiliently deflected there toward (arrow **28**) during operation, as disclosed herein. Ejector head **102** carries striker bar **26**. For example, ejector head **102** includes a retention slot **104** for holding striker bar **26** in a position for interacting with pyrophoric rod assembly **12** during operation of striker arm **24**, as disclosed herein. For example, retention slot **104** is positioned on the ejector head **102** adjacent to mouth **50** of channel **42** and impact surface **36** of case **14**. Retention slot **104** may extend into wings **106** of striker arm **24** that extend outside of ejector head **102**, and thus outside of channel **42** to avoid interference with operation of pyrophoric rod assembly **12**. Retention slot **104** and wings **106** are symmetrically formed in striker arm **24** within each half **14***a*, **14***b* of case **14**. Striker bar **26** is thus nested in retention slot **104** of ejector head **102** opposite from external protective spur **32** and between wings **106**.

[0045] FIG. **12** illustrates details of pyrophoric rod assembly **12**. Shoulder portion **44** of rod carrier **40** is structured to cooperate with receiver portion **92** adjacent to base portion **48** of case body **16** for forming latching mechanism **58** which retains pyrophoric rod assembly **12** in channel **42** until spark generating device **10** is activated. By example and without limitation, shoulder portion **44** of rod carrier **40** is formed with an anchor **108** structured to be received into a releasably interlocking relationship with receiver portion **92** when pyrophoric rod assembly **12** is received into channel **42**. According to one embodiment, anchor **108** is barbed for being retained in cavity **96** of receiver portion **92**. For example, barbed anchor **108** has a downwardly projected shank **110** suspending a head portion **112** which includes a wide shoulder portion **114** adjacent to shank **110** and sized to fit inside enlarged cavity **96** of receiver portion **94** and be retained therein by narrow mouth thereof. Head portion **112** terminates in a pointed nose portion **116** distal from shank **110** and sized to fit between lips of narrow mouth **98** into cavity **96**. Shank **110** is sized to permit mouth **98** of cavity **96** to substantially close there about over shoulders **114** of head portion **112**. Engagement of barbed anchor **108** with receiver portion **92** thus retains pyrophoric rod assembly **12** within channel **42** of case **14** against spring force of biasing member **46**.

[0046] Alternatively, details of latching mechanism **58** are reversed between channel **42** of body **14** and shoulder **44** of rod carrier **40** without deviating from the scope and intent of the present invention. In other words, anchor portion **108** of latching mechanism **58** is optionally formed in base portion **48** of channel **42**, while receiver portion **92** is formed in base of rod carrier **40**. Additionally, alternative embodiments of latching mechanism **58** are also contemplated and may be substituted without deviating from the scope and intent of the present invention.

[0047] Shoulder portion **44** of rod carrier **40** is further structured to retain biasing member **46** in an operative position between pyrophoric rod assembly **12** and channel **42**. According to one embodiment, shoulder portion **44** is optionally formed with a cavity **118** having an opening **120** in a bottom surface of rod carrier **40**. Cavity **118** is sized to fit loosely about arms **94** of receiver portion **92** with spring biasing member **46** nested in between, as disclosed herein. Cavity **118** is further deep enough to compress spring biasing member **46** between a base surface **122** thereof and base portion **48** of channel **42**.

[0048] Rod carrier **40** is formed with an ejector head reaction surface **124** positioned adjacent to support surface **34** adjacent to one end of pyrophoric rod assembly **12** and opposite from pyrophoric rod carrier back surface **54**. Ejector head reaction surface **108** is thus positioned to cooperate with ejector head **102** on the distal end of striker arm **24** when pyrophoric rod assembly **12** is installed in channel **42**. Ejector head reaction surface **124** is inclined for more effectively interacting with ejector head **102** of striker arm **24**. As disclosed herein, reaction surface **124** is responsive to force from ejector head **102** when pressure is applied to striker control pad **30** of striker arm **24** for releasing latching mechanism **58** between pyrophoric rod assembly **12** and case **14**.

[0049] FIG. **13** illustrates novel mechanical spark generating device **10** configured in a cocked state, having pyrophoric rod assembly **12** retracted into case **14** with spring biasing member **46** compressed between shoulder **44** of rod carrier **40** and base portion **48** of channel **42**. In this cocked state, spring biasing member **46** is compressed within cavity **118** of shoulder portion **44** between its base surface **122** and base portion **48** of channel **42**. In this position, spring biasing member **46** is expandable through opening **120** of cavity **118** for forcing rod carrier **40** along channel **42** outwardly (arrow **126**) from base portion **48** thereof. Spark generating device **10** is thus operated for shooting pyrophoric rod assembly **12** outwardly (arrow **126**) of impact surface **36** of case **14** using the spring energy stored in compressed biasing member **46** like a jack-in-the-box.

[0050] Operation of spark generating device **10** is initiated or "triggered" by an activation or "trigger" mechanism **127** operable between striker arm **24** and pyrophoric rod assembly **12** for decoupling latching mechanism **58** and releasing pyrophoric rod assembly **12** for moving within channel **42**. By example and without limitation, activation mechanism **127** is provide by ejector head **102** of striker arm **24** interacting with inclined ejector head reaction surface **124** of rod carrier member **40** of pyrophoric rod assembly **12**.

[0051] Accordingly, operation of spark generating device **10** is triggered by application of compressive activation force (arrow **128**) to striker control pad **30** on exterior surface of striker arm **24**. Compressive activation force **128** on striker control pad **30** forcibly deflects ejector head **102** inwardly toward (arrow **28**) channel **42** in body **16** of case **14** and into contact with inclined ejector head reaction surface **124** of rod carrier **40** adjacent to one end of pyrophoric rod assembly **12**. Forceful contact of ejector head **102** with inclined ejector head reaction surface **124** laterally forces back surface **54** of rod carrier **40** into contact with channel guide **50**, which arrests lateral movement of pyrophoric rod carrier within channel **42**. Continued application of compressive activation force **128** redirects loading of ejector head **102** on inclined ejector head reaction surface **124** into an ejection force (arrow **130**) directed substantially longitudinally of channel **42** for forcing rod carrier **40** along channel **42** outwardly (arrow **126**) of case impact surface **36**.

[0052] Redirection of loading of ejector head **102** on inclined ejector head reaction surface **124** longitudinally of channel **42** in turn loads latching mechanism **58** with longitudinal ejection force **130**. Firing of pyrophoric rod assembly **12** occurs when longitudinal ejection force **130** overloads retention strength of latching mechanism **58**, which decouples latching mechanism **58**. For example, shoulder portion **114** of anchor head **112** forcibly spreads arms **94** of bifurcated receiver portion **92** in base **48** of channel **42**, and anchor head **112** is forced outwardly (arrow **126**) from cavity **96**. Barbed anchor **108** is thus released from receiver portion

92 of latching mechanism 58. After this decoupling of latching mechanism 58, compressed spring biasing member 46 expands between opposing bases 48, 122 of case channel 42 and shoulder 44 of rod carrier 40. Spring force of expanding biasing member 46 operates for urging pyrophoric rod assembly 12 along channel 42 outwardly (arrow 126) of case 14 like a jack-in-the-box.

[0053] Ejection motion of pyrophoric rod assembly 12 along channel 42 outwardly (arrow 126) of case 14 is arrested by operation of brake mechanism between pyrophoric rod assembly 12 and channel 42. For example, contact of brake member 62 with stop 60 adjacent to mouth 52 of channel 42 overcomes force of expanding biasing member 46 and forcibly arrests motion of pyrophoric rod assembly 12 along channel 42 outwardly (arrow 126) of case 14.

[0054] Other decoupleable latching mechanism 58 are also contemplated and may be substituted without deviating from the scope and intent of the present invention.

[0055] Other activation mechanisms 127 are also contemplated and may be substituted without deviating from the scope and intent of the present invention.

[0056] FIGS. 14 and 15 illustrate operation of novel mechanical spark generating device 10 for generating sparks in a repeatable spark generation sequence. Here, pyrophoric rod assembly 12 is initially deployed in the initial operative position relative to case 14 with rod carrier 40 extended from impact surface 36 of case 14 under pressure of expanded spring biasing member 46. Support surface 34 of rod carrier 40 is nested against a solid surface 132, such as earth, which holds pyrophoric rod assembly 12 substantially stationary.

[0057] Metallic striker bar 26 and pyrophoric alloy rod 38 function similarly to traditional flint-and-steel. In traditional flint-and-steel fire-starting systems, using actual flint, tiny shavings of the steel that are removed in the striking process are what burn, rather than the flint. Here, metallic striker bar 26 functions as the flint, and pyrophoric alloy rod 38 functions as the steel in generating burning sparks for starting a fire.

[0058] As disclosed herein, striker bar 26 provides means for shaving pyrophoric particles from the pyrophoric rod 38 and simultaneously igniting them. Compressive activation force 128 is applied to striker control pad 30 for forcibly deflecting striker bar 26 into operative contact with pyrophoric rod 38, as shown. While striker bar 26 remains forcibly deflected into operative contact with pyrophoric rod 38, striking force (arrow 134) is rapidly applied to case 14 in a striking direction (arrow 136) toward surface 132. As case 14 is forced to travel rapidly toward surface 132, compressive activation force 128 causes striker bar 26 to scrape along pyrophoric rod 38, which in turn scrapes small shavings 138 of the pyrophoric alloy. When small shavings 138 of the pyrophoric alloy are removed quickly enough, heat generated by friction is enough to ignite shavings 138 into a shower 140 of hot sparks. The basis for easy sparking of pyrophoric alloys, such as ferrocerium, is their low temperature pyrophoricity. The ignition temperature of ferrocerium is between 150 and 180 degrees Celsius.

[0059] The angular configuration of striker bar 26 relative to pyrophoric rod 38 is unnecessary for practicing the invention. However, inclination of striker bar 26 relative to pyrophoric rod 38 forces ignited shavings 138 generated during travel of case 14 over pyrophoric rod assembly 12 to be ejected outwardly (arrows 142) of mouth 52 of channel 42 and away from impact surface 36 and case 14. When it is desired to ignite wood or the like for a fire, support surface 34 of pyrophoric rod assembly 12 is positioned within or adjacent to paper, wood shavings or other kindling. With striker bar 26 forcibly deflected (arrow 28) into operative contact with pyrophoric rod 38, as shown, case 14 is forced rapidly in striking direction (arrow 136) toward surface 132, which causes striker bar 26 to scrape along pyrophoric rod 38, which in turn, produces small shavings 138 of the pyrophoric alloy rod 38 that are ignited into sparks by friction. The temperature of the sparks thus generated tends to ignite the kindling to form a flame.

[0060] Striking force (arrow 134) is arrested when impact surface 36 of case 14 approaches and impacts solid surface 132. Rod assembly 12 is automatically fully restored in channel 42 of case 14 when impact surface 36 impacts solid surface 132. Simultaneously, rod assembly 12 is re-cocked into the cocked state, having pyrophoric rod assembly 12 fully retracted into case 14 with spring biasing member 46 compressed between shoulder 44 of rod carrier 40 and base portion 48 of channel 42. Accordingly, user may redeploy pyrophoric rod assembly 12, as disclosed herein, for repeating spark generation sequence, or store spark generating device 10 if sufficient sparks have been generated for satisfactorily igniting the kindling.

[0061] As illustrated here, case 14 is further formed with a protective spur 144 on its external surface opposite from striker arm 24 for protecting the user's digits from impacts with solid surface 132 during the spark generation sequence.

[0062] FIGS. 16 and 17 demonstrate two one-handed methods of operation for utilizing novel mechanical spark generating device 10 for generating hot sparks by shaving ignited shavings 138 from pyrophoric alloy rod 38. For example, in FIG. 16 spark generating device case 14 is held in the user's palm 146 with digits, e.g., index finger 148, middle finger 150 and ring finger 152, arranged along a spine 154 of case body 16 opposite from striker arm 24, with index finger 148 nested against protective spur 144 and middle and ring fingers 148, 150 trailing along case spine 154. The user's opposing thumb 156 is arranged along striker control pad 30 and nested into protective spur 32. Having device case 14 arranged in user's palm 146 as described, user applies compressive activation pressure (arrow 128) against striker control pad 30 for deflecting striker arm 24 inwardly toward (arrow 28) case body 16. As disclosed herein, deflection of striker arm 24 inwardly toward (arrow 28) case body 16 brings ejector head 102 into forceful contact with reaction surface 124 on the underside of support surface 34 of rod carrier 40. Reaction surface 124 is responsive to force from ejector head 102 for releasing latching mechanism 58 between pyrophoric rod assembly 12 and case 14. For example, force from ejector head 102 against reaction surface 124 forces rod carrier 40 outwardly (arrow 126) along channel 42 away from base portion 48 of case body 16, which in turn, in turn loads latching mechanism 58 with longitudinal ejection force 130. See, e.g., FIG. 13. As disclosed herein, sufficient longitudinal ejection force 130 overloads retention strength of latching mechanism 58, whereupon firing of latching mechanism 58 occurs, and pyrophoric rod assembly 12 is free to pop out (arrow 126) of case 14 under spring force of expanding biasing member 46.

[0063] Ejection of pyrophoric rod assembly 12 is forcibly arrested when brake member 62 contacts stop 60 adjacent to mouth 52 of channel 42, which overcomes force of expanding

biasing member **46** and arrests outwardly (arrow **126**) motion of pyrophoric rod assembly **12** along channel **42** of case **14**.

[0064] Here, support surface **34** of pyrophoric rod assembly **12** is seated against a solid surface **132**, such as earth, which holds pyrophoric rod assembly **12** substantially stationary. Rod assembly **12** is oriented with pyrophoric rod **38** facing generally toward adjacent kindling **158**. With novel mechanical spark generating device **10** held approximately as indicated, user applies additional compressive activation force (arrow **128**) to striker control pad **30** for forcibly deflecting striker arm **24** and engaging striker bar **26** with pyrophoric alloy rod **38**. Thereafter, user rapidly applies striking force (arrow **134**) to case **14** in striking direction (arrow **136**) toward surface **132**. During travel of case **14** toward surface **132**, striker bar **26** is caused to scrape along pyrophoric rod **38**, which produces small shavings **138** of the pyrophoric alloy rod **38** that are ignited into shower **140** of hot sparks by friction.

[0065] The angular configuration of striker bar **26** relative to pyrophoric rod **38** forces ignited shavings **138** to be ejected as shower **140** of sparks outwardly (arrows **142**) of mouth **52** of channel **42** adjacent to impact surface **36** of case **14**. The hot sparks thus generated tend to ignite kindling **158** to form a flame. If initial spark generation is inadequate for igniting kindling **158**, for example in windy conditions, this spark generation sequence may be repeated as often as necessary.

[0066] A final operation of spark generating device **10** through the spark generation sequence leaves pyrophoric rod assembly **12** retracted and interlocked with case **14**, whereupon spark generating device **10** is configured in a condition safe for storage and carrying.

[0067] FIG. **17** illustrates another one-handed method of operating novel mechanical spark generating device **10** without resting pyrophoric rod assembly **12** against solid surface **132**. Here, spark generating device case **14** is held in user's palm **146** secured, for example, by thumb **156** squeezing case body **16**. Some digits, e.g., middle finger **150**, ring finger **152** and, possibly pinky finger **160**, are arranged along striker control pad **30** of striker arm **24** with middle finger **150** nested into protective spur **32**. After latching mechanism **58** is fired and pyrophoric rod assembly **12** is extended from case **14**, as disclosed herein, index finger **148** is arranged under support surface **34** of pyrophoric rod assembly **12**. With assembly **12** oriented with pyrophoric rod **38** facing generally toward adjacent kindling **158**, striking force (arrow **134**) is rapidly applied between user's index finger **148** and palm **146** to move case **14** rapidly in striking direction (arrow **136**) toward support surface **34**. During compression of pyrophoric rod assembly **12** into case body **16**, striker bar **26** scrapes small shavings **138** of the pyrophoric alloy rod **38** that are ignited into shower **140** of hot sparks by friction.

[0068] The angular configuration of striker bar **26** relative to pyrophoric rod **38** forces ignited shavings **138** to be ejected as shower **140** of sparks outwardly (arrows **142**) of mouth **52** of channel **42** adjacent to impact surface **36** of case **14**. Protective spur **32** on external surface of striker arm **24** serves to protect user's digits, i.e., middle finger **150** and ring finger **152**, from shower **140** of hot sparks, while rod carrier **40** protects index finger **148**.

[0069] This initial spark generation sequence leaves pyrophoric rod assembly **12** retracted and interlocked with case **14**, whereupon spark generating device **10** is configured in a condition safe for storage and carrying. However, spark generation sequence may be repeated as often as necessary for igniting kindling **158**, and each repetition of the spark generation sequence leaves pyrophoric rod assembly **12** retracted and interlocked with case **14**.

[0070] While the preferred and additional alternative embodiments of the invention have been illustrated and described, it will be appreciated that various changes can be made therein without departing from the spirit and scope of the invention. Therefore, it will be appreciated that various changes can be made therein without departing from the spirit and scope of the invention.

[0071] Accordingly, the inventor makes the following claims.

What is claimed is:

1. A mechanical spark generating device, comprising:

a case, comprising a case body and a relatively moveable striker arm extended therefrom, the case body further comprising a channel having an opening thereinto;

a pyrophoric rod assembly moveably carried in the channel of the case body, the pyrophoric rod assembly further comprising a support surface adjacent to one end thereof, and a pyrophoric rod; and

a striker bar fixed to the striker arm in a position for interacting with the pyrophoric rod of the pyrophoric rod assembly when the pyrophoric rod assembly is in a deployed configuration extended from the case body and the striker arm is moved there toward.

2. The device of claim **1**, further comprising a latching mechanism operable between the pyrophoric rod assembly and the channel of the case body for retaining the pyrophoric rod assembly in an undeployed configuration within the channel.

3. The device of claim **2**, wherein the pyrophoric rod assembly is further slidably carried in the channel of the case body between the undeployed configuration and the deployed configuration.

4. The device of claim **3**, further comprising a biasing member positioned for urging the slidably moveable pyrophoric rod assembly toward the deployed configuration.

5. The device of claim **4**, further comprising an activation mechanism operable between the striker arm and the pyrophoric rod assembly for decoupling the latching mechanism.

6. The device of claim **1**, wherein the striker arm further comprises a resiliently flexible arm extended from the case body and moveable relative thereto.

7. The device of claim **2**, wherein the pyrophoric rod assembly is further substantially completely retracted within the channel of the case body when configured in the undeployed configuration.

8. A mechanical spark generating device, comprising:

a case, comprising a case body and a flexibly resilient striker arm extended from one surface thereof, the case body further comprising a linear channel having an opening thereinto adjacent to an impact surface of the case body, and the striker arm further comprising a distal end thereof adjacent to the opening into the channel of the case body;

a pyrophoric rod assembly slidably carried in the channel of the case body, the pyrophoric rod assembly further comprising a rod carrier formed with a rod receiver cavity with a support surface adjacent to one end thereof, and a pyrophoric rod replaceably received into the rod receiver cavity; and

a striker bar formed of a substantially hard material positioned adjacent to the distal end of the striker arm in a

position adjacent to the opening into the channel of the case body for interacting with at least a portion of the pyrophoric rod of the pyrophoric rod assembly when the pyrophoric rod assembly is configured in a deployed configuration extended from the impact surface of the case body, and the striker arm is resiliently deflected inwardly there toward.

9. The device of claim **8**, further comprising a decoupleable latching mechanism operable between the rod carrier of the pyrophoric rod assembly and the channel of the case body for retaining the pyrophoric rod assembly in an undeployed configuration substantially completely enclosed within the channel.

10. The device of claim **9**, wherein with the striker arm deflected inwardly toward the case body, the striker bar is further positioned for interacting with at least a portion of the pyrophoric rod of the pyrophoric rod assembly during travel of the pyrophoric rod assembly between the deployed configuration and the undeployed configuration.

11. The device of claim **10**, further comprising a biasing member positioned between the pyrophoric rod assembly and the case body, the biasing member being in a potential energy state when the pyrophoric rod assembly is in the undeployed configuration, and the biasing member being in a substantially expended energy state when the pyrophoric rod assembly is in the deployed configuration.

12. The device of claim **11**, further comprising an activation mechanism operable between the distal end of the striker arm and the rod carrier of the pyrophoric rod assembly for decoupling the decoupleable latching mechanism.

13. The device of claim **8**, further comprising a brake mechanism operable between the pyrophoric rod assembly and the case body for retaining the pyrophoric rod assembly partially within the case body when the pyrophoric rod assembly is in the deployed configuration.

14. The device of claim **9**, wherein the pyrophoric rod assembly is further substantially completely retracted within the channel of the case body when configured in the undeployed configuration.

15. A mechanical spark generating device, comprising:

a case comprising a body portion that is sized for being held in one hand;

a means for carrying a rod of pyrophoric material slidably between a deployed configuration at least partially extended from an opening of the case body, and an undeployed configuration substantially stored within the case body; and

a means for generating sparks from the rod of pyrophoric material when the rod of pyrophoric material is transited between the deployed and undeployed configurations.

16. The device of claim **15**, wherein the means for generating sparks from the rod of pyrophoric material further comprises a means for compressing a bar of a substantially hard material against a surface of the rod of pyrophoric material during a transit of the rod of pyrophoric material between the deployed and undeployed configurations.

17. The device of claim **16**, wherein the means for compressing a bar of a substantially hard material against a surface of the rod of pyrophoric material further comprises flexibly suspending the bar of a substantially hard material relative to the case body, and providing for a force applied thereto in a direction toward the rod of pyrophoric material to move the substantially hard material into contact with the surface of the rod of pyrophoric material.

18. The device of claim **17**, further comprising a means for urging the rod of pyrophoric material to transit between the undeployed and deployed configurations.

19. The device of claim **18**, further comprising a means for releasably retaining the rod of pyrophoric material in the undeployed configuration.

20. The device of claim **19**, further comprising a means for releasing the means for releasably retaining the rod of pyrophoric material in the undeployed configuration.

* * * * *