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DESCRIPTION

Field of the Invention:

[0001] The present disclosure is generally in the field of grounding clamps used for grounding high voltage conductors. More particularly, the present disclosure relates to grounding clamps which have locks that are actuable through the use of an insulated line tool or hot-stick.

Background:

[0002] Electrical workers use grounding cables on an almost daily basis in the industry to help manage dangerous voltages and currents in de-energized power lines and electrical equipment. Grounds are designed to be installed and removed using an insulating tool, for example an insulating tool called a Grip-All stick or Shotgun, to keep the worker at a safe distance from the hazard.

[0003] When installing grounds, the first connection is always made to a ground point. Workers will normally make this connection by hand instead of with the insulating tool, as there is no hazardous energy when making this connection. IT MI20120517 discloses a device for earthing and short-circuiting conductors. FR2719422 discloses a short-circuit device for earth connection of overhead power line. CN 201611697 discloses ground wire action bars for electrical safety. US 4846725 discloses a self-latching power line clamp.

[0004] Any time a connection is made to a conductor or apparatus that could be at a different electrical potential from ground, this connection must be made using an insulating tool. This is especially true in a high voltage environment (for example, over 69 Kv). Due to the design of conventional ground clamps, they can be installed and removed by hand instead of being installed using an insulating tool. It is not uncommon in applicant's experience for workers to make the mistake of installing a ground clamp on a conductor, or removing one from a conductor by hand instead of with an insulating tool. This potentially exposes the worker to a voltage potential and consequently may result in electrocution of the worker. To applicant's knowledge, this has accounted for fatalities and electrocution incidents in the industry.

[0005] Consequently, there is a need in the industry for a locking ground clamp that operates in combination with an insulating tool so as to prevent the worker or lineman from being able to operate the ground clamp without the use of the insulating tool. This is to inhibit workers or linemen from attempting to install the ground clamp by hand. To accomplish this a locking mechanism is described below which prevents manual operation of the ground clamp as the ground clamp can only be actuated or un-locked with or in the presence of the insulating tool.

Summary:

[0006] According to an aspect of the present invention, there is provided a grounding clamp as claimed in claim 1. According to another aspect of the present invention, there is provided a method as claimed in claim 11. In one embodiment, a grounding clamp includes a safety lock-out which locks the operation of the clamp in the absence of a hot-stick. The clamp includes a frame and a first clamping member defining a capture cavity and an opening. The opening provides access into the cavity for a conductor to be captured in the cavity. The first clamping member cooperates with the frame, and is selectively biasable by a user between an unclamped position wherein the clamping member is retracted and a clamped position wherein by translation of the first clamping member relative to the frame the conductor is clamped between the first clamping member and an arm or second clamping member on the frame when the conductor is positioned in the cavity. The lock-out has first and second positions and cooperates with the first clamping member to prevent the selective biasing of the first clamping member from the unclamped position to the clamped position when the lock-out is in the first position. The lock-out is normally biased into the first position. In the second position, the selective biasing of the first clamping member to the clamped position is enabled. A hot-stick head is mountable onto, or mounted on, an end of the hot-stick or other insulating tool (collectively referred to herein as a hot-stick). The hot-stick head is adapted to couple onto the frame and to cooperate with the lock-out to bias the lock-out into the second position when the head is coupled with the frame.

[0007] In an embodiment of the present disclosure, the second clamping member is in opposed facing relation to the first clamping member, and located at an opposite end of the frame from the first clamping member. The first clamping member includes a threaded bore. A correspondingly threaded shaft is rotatably journaled in the threaded bore, whereby rotation of the shaft in the bore translates the first clamping member relative to; that is away from or towards, the second clamping member. The frame includes a first couple. The hot-stick head includes a second couple couplable with the first couple on the frame whereby the head of the hot-stick is selectively and detachably coupled onto the frame.

[0008] In an embodiment of the present disclosure, the lock-out includes a ferrous member resiliently biased into a first position and the hot-stick head includes a magnet cooperating with the ferrous member to magnetically bias the ferrous member, and thereby the lock-out, into the second position when the head is coupled with the frame.

[0009] In an embodiment of the present disclosure, the ferrous member is resiliently biased by a resilient biasing force into a locking position when the lock-out is in the first position to thereby prevent rotation of the threaded shaft in the threaded bore, and wherein a magnetic attractive force of the magnet is greater than the resilient biasing force whereby the lock-out is magnetically biased into the second position against a return biasing of the resilient biasing force.

Brief Description of the Drawings:

[0010]

Figure 1 is a partially cut away view, illustrating an embodiment of the present disclosure in a locked position; and

Figure 2 is a partially cut away view, illustrating an embodiment of the present disclosure in an unlocked position.

Figure 3 is an alternative embodiment of the grounding clamp of Figure 1, in the locked position.

Figure 4 is the grounding clamp of Figure 3 and a hot-stick ready for mounting to the grounding clamp.

Figure 5 is the grounding clamp and hot-stick of Figure 4 with the grounding clamp mounted to the hot-stick and the grounding clamp in the locked position.

Figure 6 is the grounding clamp and hot-stick of Figure 5 with the grounding clamp unlocked by actuation of the hot-stick.

Detailed Description

[0011] In an embodiment of the present disclosure, a locking grounding clamp 30 comprises a frame 36 supporting a clamping member 34. The frame includes a clamping member 32 at opposite-ends of the frame. The clamping member and frame define a capture cavity 31 therebetween having an opening 31A. The capture cavity 31 is sized to receive conductor 20, shown in cross section in Figure 2, via opening 31A. Advantageously capture cavity 31 conforms in shape, and so as to encircle, conductor 20.

[0012] Square shaft 42 is supported on or within the frame 36 and disposed alongside clamping member 34. Square shaft 42 (which is square in cross section) is inserted through opening 26 at the upper end 36A of frame 36, through a channel or cut-out 27 running along frame 36, and through an opening 28 located in the locking portion 37 of frame 36. Ferrous lock-out ring 50 is mounted adjacent portion 37. The square shaft 42 is journaled through a square opening (not shown) in the center of ring 50. A coupling eye 44 is mounted or formed at the end of square shaft 42 adjacent ring 50, opposite portion 37 within spring housing 46A. The square shaft 42 is also inserted through the hollow centre of a threaded shaft 39. Threaded shaft 39 is provided with a square shaped bore sized so as to slidably snugly couple with the square shaft 42 whereby rotating the square shaft 42 in direction C about a rotational axis α extending through the centre of the square shaft 42 results in rotating the threaded shaft 39 in the same rotational direction as rotation of shaft 42. Square shaft 42 is free to rotate

within openings 26, 28 and within channel 27. For example, openings 26, 28 may be round.

[0013] A threaded bore is formed in collar 38. Collar 38 is coupled to clamping member 34. The threading of the threaded bore in collar 38 rotatably mates with the threading on the external surface of the threaded shaft 39. Thus, an insulating tool grasping the coupling eyelet 44 and rotating the coupling eyelet 44 and the square shaft 42 in direction C about the axis of rotation α results in rotation of both the square shaft 42 and the threaded shaft 39. Rotation in a first direction about axis α , urges clamping member 34 in direction A towards clamping arm 32. Rotating the coupling eyelet 44 in an opposite direction translates clamping member 34 in direction B, away from clamping arm 32.

[0014] As stated above, lock-out ring 50 is disposed adjacent the locking portion 37 of the frame 36, and has a square channel through its centre. Advantageously, lock-out ring 50 is ferrous. The square channel in ring 50 is sized so as to snugly slidably receive the square shaft 42. Ring 50 thus also rotates in direction C along with the rotation of square shaft 42 about the rotational axis α . Ring 50 includes a plurality of teeth 52. Locking portion 37 similarly comprises a plurality of teeth 33. The teeth 33 on locking portion 37 are in opposed facing relation so as to complement the teeth 52 on ring 50 such that when ring 50 is urged towards the locking portion 37 of frame 36, teeth 33 releasably lock with teeth 52. In particular, teeth 33 interleave between teeth 52, thereby preventing rotation of ring 50 relative to locking portion 37 and frame 36.

[0015] Ring 50 and spring 46 are located in spring housing 46A in the end 37 of frame 36 corresponding to eyelet 44. Spring 46 is disposed between the base 46B of spring housing 46A and ring 50. Spring 46 surrounds the square shaft 42. The spring 46 resiliently biases ring 50 against the locking portion 37 of the frame 36, causing the plurality of teeth 33 on locking portion 37 to couple with the plurality of teeth 52 on ring 50. Thus, when ring 50 is biased against locking portion 37, the coupling of the plurality of teeth 33 with the plurality of teeth 52 prevents rotation of ring 50 relative to the frame 36 and locking portion 37, thereby also preventing rotation square shaft 42 about rotational axis α . This prevents linear translation of clamping member 34 relative to frame 36.

[0016] As illustrated in Figure 2, hot-stick 10 includes an insulated body 12, a head 14, a coupling clamp 16 and a plurality of magnets 18 (shown in dotted outline). The plurality of magnets 18 and the coupling clamp hook 16A (seen in Figure 4) are disposed within the head 14.

[0017] In operation, as illustrated in Figure 2, a lineman seeking to operate the grounding clamp 30 will grasp the insulated body 12 of a hot-stick 10 and manipulate the coupling clamp 16 so as to couple the coupling clamp hook 16A to the coupling eyelet 44. Upon coupling the coupling clamp 16 to the coupling eyelet 44, the plurality of magnets 18 disposed within the head 14 attract ring 50 in direction B, causing the plurality of teeth 33 on locking portion 37 to uncouple from the plurality of teeth 52 on ring 50. Once ring 50 becomes uncoupled from the locking portion 37 of frame 36, the square shaft 42 may be freely rotated. By rotating, using a

twisting motion in direction D about the length (or longitudinal axis) of hot-stick 10, the lineman may then rotate square shaft 42 in direction C. This results in a corresponding rotation of the threaded shaft 39, thereby causing clamping member 34 to translate linearly in either direction A or direction B, depending on the direction of rotation of square shaft 42. In this manner, the capture cavity 31 may only be opened to receive a conductor 20 via opening 31A or closed to enclose a conductor 20 within cavity 31 when the coupling clamp 16 of the hot-stick 10 is coupled with the coupling eyelet 44 so as to disengage the lock-out ring.

[0018] Once the grounding clamp 30 has either been engaged around or disengaged from a conductor 20, the lineman may unhook the coupling clamp 16 from the coupling eyelet 44 and remove the hot-stick 10 from the locking ground clamp 30. By removing the hot-stick 10 from the grounding clamp 30, and therefore removing the magnetic field caused by the plurality of magnets 18 disposed within the head 14, the magnetic force causing the ferrous member 50 to move in direction B is removed and therefore the spring force applied in direction A by spring 46 against ring 50 will once again resiliently urge ring 50 in direction A towards locking portion 37, whereby the plurality of teeth 33 once again engage with the plurality of teeth 52 and bring the grounding clamp 30 into the locking position, as shown in Figure 1.

[0019] Additional embodiments of the locking grounding clamp are seen in Figures 3-6. In Figure 3, the grounding clamp is similar to the above described embodiment of Figures 1 and 2 which uses magnets, but the lock-out ring 50 is connected directly to the locking mechanism so that pulling ring 50 down in direction E retracts teeth 52 from interlocking between teeth 33. As before, shaft 42 is journaled in hollow shaft 39 and provides a movable connection, for example a telescopic coupling, to the threaded shaft 39. The spring 46 is a very stiff spring to keep the lock-out in the locked position, and to discourage manual unlocking of the lock-out ring 50.

[0020] As seen in Figure 4, the insulating hot-stick 10 may incorporate a lever 54 to overcome the very stiff spring tension and to release the lock-out mechanism by uncoupling the lock-out ring 50, allowing the ground clamp eye 44 to be turned in direction C to rotate the shaft 42 to thereby open or close the clamp member 34 onto the conductor 20.

[0021] A bearing within bearing interface 56 may be incorporated into the end of the insulating hot-stick 10 or into the ground clamp interface with the hot-stick, for example into the base of spring housing 46A, to allow twisting rotation of the hot-stick when under the spring tension.

[0022] In another embodiment a universal joint (not shown) may be incorporated into the end of the insulating hot-stick to allow operation when the stick and ground clamp are not in alignment; that is, not aligned longitudinally.

[0023] As seen in Figure 5 the hot-stick is mounted to the clamp 30 when the lever 54 is partially actuated in direction F to capture the clamp 30 by engaging hook 16A on the hot-stick 10 with the eye 44. The locking mechanism is still engaged as the lock-out ring 50 remains in its locked position.

[0024] As seen in Figure 6, to unlock the grounding clamp, so as to allow its use by the lineman, the lever 54 is fully actuated by pulling the lever fully down in direction F. This retracts the actuating rod 56 connected to the hook 16A on the upper end of the hot-stick 10 along the hot-stick thereby pulling down on the eye 44 on the base of the grounding clamp. Pulling down on eye 44 also pulls down ring 50 onto the spring 46 which releases the teeth 52 on ring 50 in the locking mechanism. The bearing 56 allows the hot-stick to be twisted in direction D while under tension from the compressed spring 46.

[0025] As will be appreciated by one skilled in the art, various other mechanisms may be employed to actuate a lock-out locking mechanism disabling the grounding clamp so that the lock-out will lock the operation of the clamp unless in the presence of an insulating tool such as a hot-stick. For example, the lockout does not necessarily have to employ mating sets of teeth as other braking mechanisms, including those relying on friction or adhesion, between mating components may also work. Further, the spring and magnet arrangement in the lock-out described above may be reversed. Also the proximity or presence of the hot-stick, so as to unlock the lock-out, may be detected by the lock-out other than by the use of a magnetic field, and operate other than by a magnet field overcoming a resilient biasing of one locking component against another. For example, the mating of the hot-stick with the clamp may mechanically disengage a spring-loaded latch mechanism, wherein for example, a pushing of the hot-stick against a plunger within a coupling housing on the clamp will disengage the latch mechanism in the lock-out.

[0026] As will be apparent to those skilled in the art in the light of the foregoing disclosure, many alterations and modifications are possible in the practice of this invention without departing from the scope thereof. Accordingly, the scope of the invention is to be construed in accordance with the substance defined by the following claims.

REFERENCES CITED IN THE DESCRIPTION

Cited references

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- ITMI20120517 [0003]
- FR2719422 [0003]
- CN201611697 [0003]
- US4846725A [0003]

PATENTKRAV

1. Jordklemme, som under brug kan monteres på en hot-stick (10), hvilken jordklemme har en sikkerhedslåsning (37), som samvirker med hot-sticken (10), og omfattende:

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en ramme (36) og et klemement (34), som definerer et gribehulrum (31) og en åbning (31A), hvilken åbning (31A) tilvejebringer adgang ind i hulrummet (31) for en leder (20), som skal gribes i hulrummet (31),

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hvilket klemmeelement (34) samvirker med rammen (36) og selektivt kan forspændes af en bruger imellem en ikke-klemt position, hvor klemementet (34) er tilbagetrukket for at åbne hulrummet (31) og åbningen (31A), og en klemt position, hvor hulrummet (31) og åbningen (31A) er lukkede, således at lederen (20) er klemt imod rammen (36) af klemementet (34), når lederen (20) er placeret i hulrummet (31),

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kendetegnet ved:

en låsning (37) monteret på rammen (36), hvilken låsning (37) er indrettet til låsebevægelse af klemementet (34) under fraværet af hot-sticken (10), for at forhindre bevægelse af klemementet (34) i forhold til rammen (36), og til at oplåse klemementet (34) for at tillade bevægelse af klemementet (34) i forhold til rammen (36), når den er forbundet med hot-sticken (10), hvorved, når rammen (36) er monteret på hot-sticken (10), klemementet (34) kan bevæges til at klemme en leder (20) placeret i hulrummet (31).

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2. Klemme ifølge krav 1, hvor låsningen (37) har første og anden position og samvirker med klemementet (34) for at forhindre den selektive forspænding af klemementet (34) imellem den ikke-klemte position og den klemte position, når låsningen (37) er i den første position, og hvor låsningen (37) er normalt forspændt til den første position, og hvor, i den anden position, den selektive forspænding af klemementet (34) imellem den ikke-klemte position og den klemte position muliggøres, og hvor et hot-stickhoved (14) er indrettet til at koble ind i rammen (36) og til at samvirke med låsningen (37) for at forspænde låsningen (37) til den anden position, når den er koblet med rammen (36), hvor hot-stickhovedet (14) er indrettet til at blive eller er monteret på én ende af hot-sticken (10).

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3. Klemme ifølge krav 2, hvor klemmelementet (34) har første og anden modstående ender, og omfatter en gevindboring forbundet med den anden ende, og hvor rammen (36) omfatter et tilsvarende gevindskæft (39), hvilket gevindskæft (39) er drejeligt lejret i gevindboringen.

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4. Klemme ifølge krav 3, hvor den anden ende af rammen (36) omfatter en første kobling (33, 52), og hvor hot-stickhovedet (14) omfatter en anden kobling (16, 16A), som kan kobles med den første kobling (33, 52), når hovedet (14) er koblet med rammen (36).

10 5. Klemme ifølge krav 4, hvor låsningen (37) omfatter en låsningsring (50) som er elastisk forspændt til den første position og hot-stickhovedet (14) omfatter en aktuator (54, 56), som samvirker med ringen (50) for at forspænde ringen (50) og derved låsningen (37) til den anden position, når hovedet (14) er koblet med rammen (36).

15 6. Klemme ifølge krav 5, hvor ringen (50) er forspændt af en elastisk forspændingskraft til en låseposition, når låsningen (37) er i den første position, for derved at forhindre den nævnte rotation af gevindskæftet (39) i gevindboringen, og hvor aktuatoren (54, 56) omfatter i det mindste én magnet (18), hvor en magnetisk tiltrækningskraft for den i det mindste ene magnet (18) er større end den elastiske forspændingskraft, hvorved låsningen (37) magnetisk forspændes til den anden position imod en returforspænding fra
20 den elastiske forspændingskraft.

7. Klemme ifølge krav 6, hvor den elastiske forspændingskraft tilvejebringes af en fjeder (46), og hvor rammen (36) omfatter et fjederhus (46A), som indeholder fjederen (46).

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8. Klemme ifølge krav 7, hvor gevindskæftet (39) har modstående første og anden ende, og hvor den anden ende strækker sig fra rammen (36) til at strække sig fra den første kobling (33, 52), hvilken anden ende af gevindskæftet (39) er indrettet til at indgribe med hot-stickhovedet (14), hvorved en drejebevægelse af hot-stickhovedet (14), forårsaget af en tilsvarende drejning af hot-sticken (10) omkring dennes længde, forårsager
30 rotation af gevindskæftet (39) i boringen for derved at forskyde klemmelementet (34) i forhold til rammen (36).

9. Klemme ifølge krav 8, hvor skæftet (39) omfatter et øje (44) ved den anden ende af skæftet (39), og hovedet (14) er indrettet til udløseligt at koble til øjet (44).
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10. Klemme ifølge krav 9, hvor rammen (36) omfatter en klemarm (32) som modstående vender imod klemelementet (34) ved modstående ender af rammen (36).

11. Jordingsfremgangsmåde, under anvendelse af en jordklemme ifølge ethvert af de
5 foregående krav monteret på en hot-stick (10), hvilken fremgangsmåde omfatter:

a) tilvejebringelse af en ramme (36) og et klemelement (34), som definerer et gribehulrum (31) og en åbning (31A), hvilken åbning (31A) tilvejebringer adgang til hulrummet (31) for en leder (20), som skal gribes i hulrummet (31), hvilket
10 klemelement (34) samvirker med rammen (36) og selektivt kan forspændes af en bruger imellem en ikke-klemte position, hvor klemelementet (34) er tilbage-trukket for at åbne hulrummet (31) og åbningen (31A), og en klemte position, hvor hulrummet (31) og åbningen (31A) er lukkede, således at lederen (20) er klemte imod rammen (36) af klemelementet (34), når lederen (20) er placeret i hul-
15 rummet (31),

kendetegnet ved:

b) tilvejebringelse af en låsning (37) monteret på rammen (36), hvilken låsning (37) er indrettet til at låse klemelementet (34) under fraværet af hot-sticken (10), for at forhindre bevægelse af klemelementet (34) i forhold til rammen (36), og til
20 at oplåse klemelementet (34) for at tillade bevægelse af klemelementet (34), når den er forbundet med hot-sticken (10),

c) montering af rammen (36) på hot-sticken (10), for at oplåse låsningen (37), hvorved klemelementet (34) kan bevæges til at klemme en leder (20) placeret i hulrummet (31),

25 d) placering af lederen (20) i hulrummet (31); og

e) drejning af hot-sticken (10) med en drejebewægelse omkring dennes længde for at forskyde det første klemelement (34) til dets klemte position for derved at klemme lederen (20).

30 12. Fremgangsmåde ifølge krav 11, hvor låsningen (37) har første og anden position og samvirker med klemelementet (34) til at forhindre den selektive forspænding af klemelementet (34) imellem den ikke-klemte position og den klemte position, når låsningen (37) er i den nævnte første position, og hvor låsningen (37) er normalt forspændt til den første position, og hvor, i den anden position, den selektive forspænding af klem-
35 elementet (34) imellem den ikke-klemte position og den klemte position muliggøres,

og hvor et hot-stickhoved (14) er indrettet til at koble til rammen (36) og til at samvirke med låsningen (37) til at forspænde låsningen (37) til den anden position, når den er koblet til rammen (36), hvor hot-stickhovedet (14) er indrettet til at blive eller er monteret på en ende af hot-sticken (10).

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13. Fremgangsmåde ifølge krav 12, hvor klemelementet (34) har første og anden modstående ender, og omfatter en gevindboring forbundet med den anden ende og hvor rammen (36) omfatter et tilsvarende gevindskaf (39), hvilket gevindskaf (39) er drejeligt lejret i gevindboringen.

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14. Fremgangsmåde ifølge krav 13, hvor den anden ende af rammen (36) omfatter en første kobling (33, 52) og hvor hot-stickhovedet (14) omfatter en anden kobling (16, 16A), som kan kobles med den første kobling (33, 52), når hovedet (14) er koblet til rammen (36).

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15. Fremgangsmåde ifølge krav 14, hvor låsningen (37) omfatter en låsningsring (50), som er elastisk forspændt til den første position og hot-stickhovedet (14) omfatter en aktuator (54, 56), som samvirker med ringen (50) til at forspænde ringen (50) og derved låsningen (37) til den anden position, når hovedet (14) er koblet til rammen (36).

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DRAWINGS

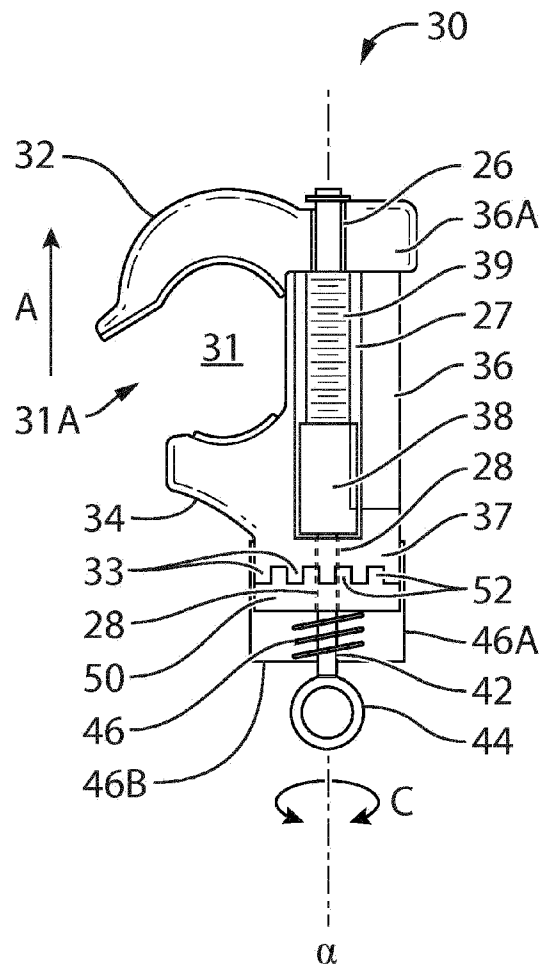


FIG. 1

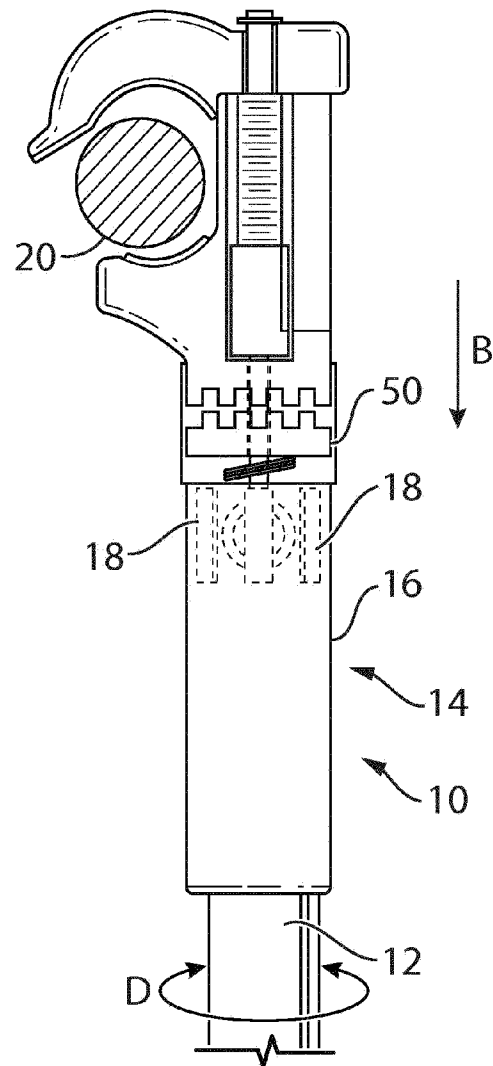


FIG. 2

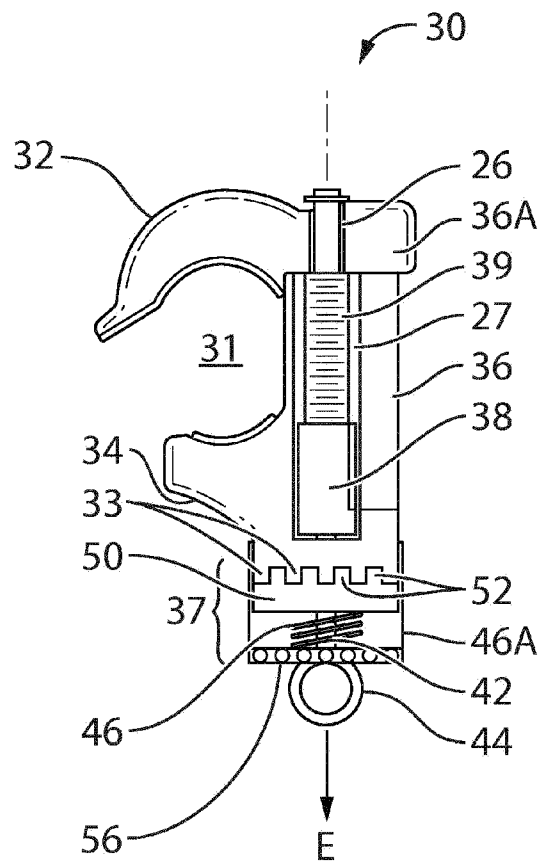


FIG. 3

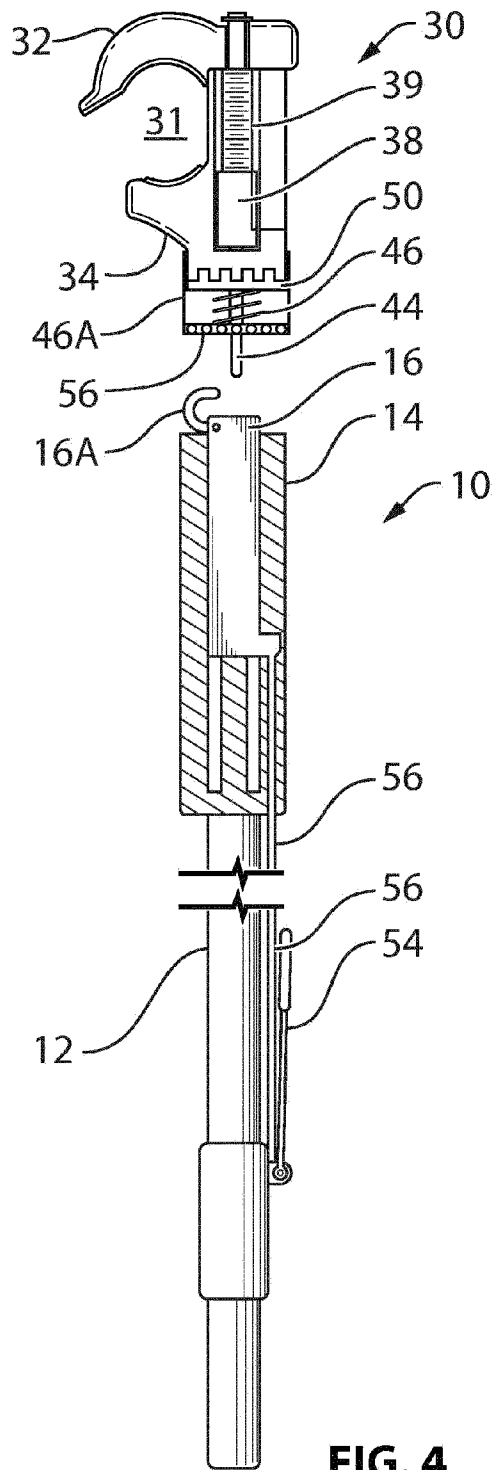
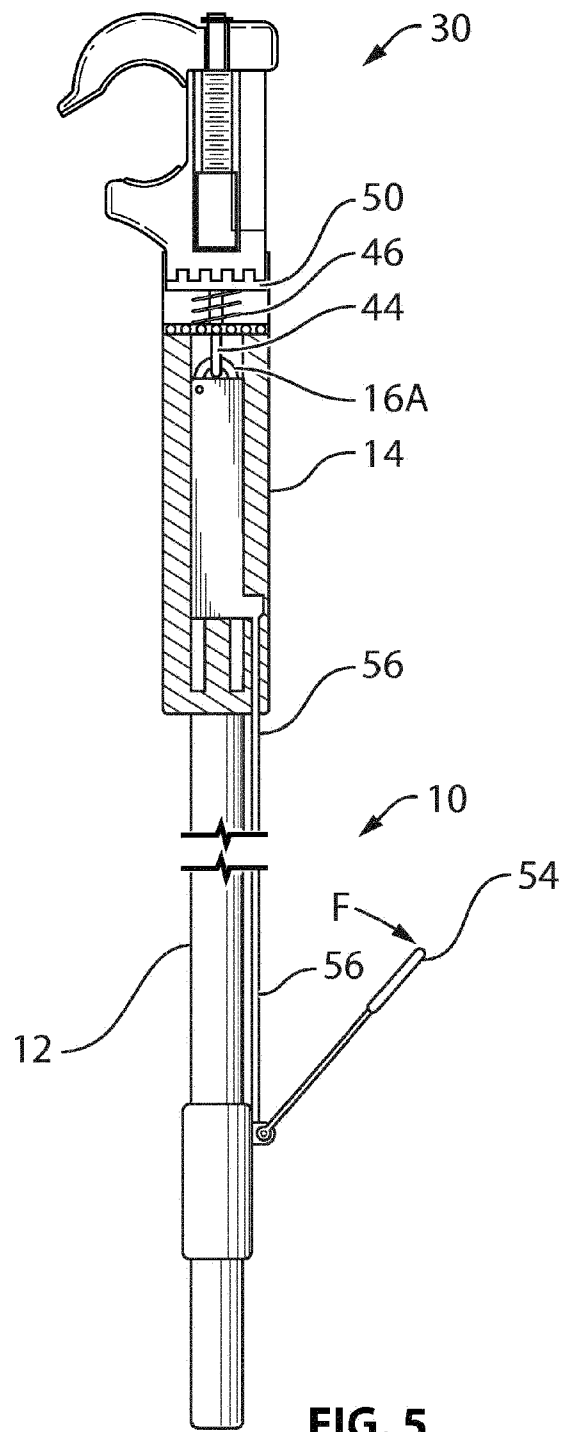


FIG. 4



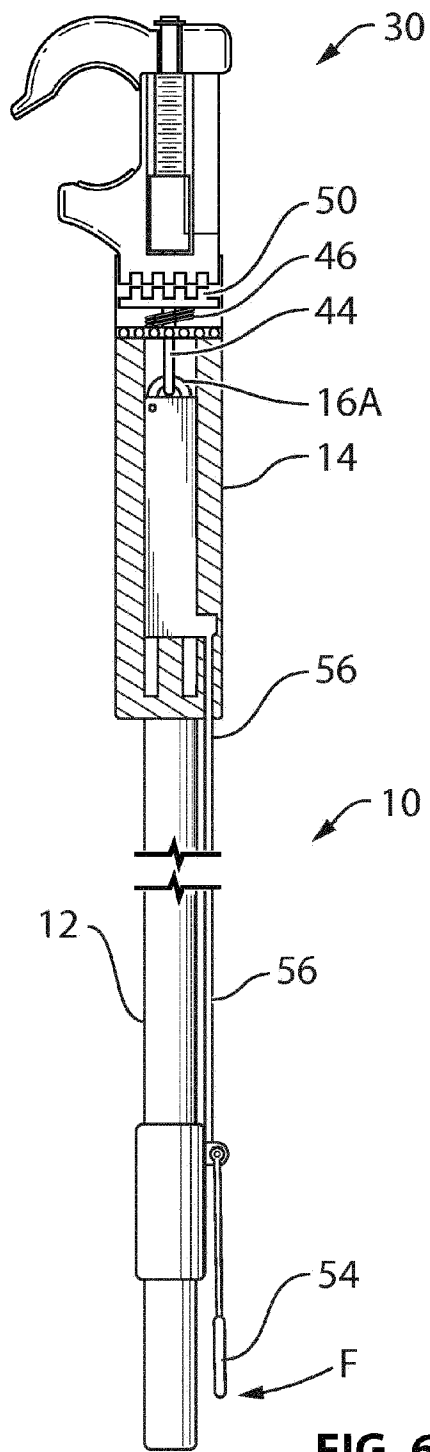


FIG. 6