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System and method for pulling a stake from a surface

Abstract

A stake removal tool configured for removing in-ground stakes, the stake removal tool comprising an elongated member defining a proximal end and a distal end, a carriage, and a lift system configured to drive the carriage along a longitudinal direction of the elongated member. The carriage comprises a chassis and a pivoting member configured to pivot about a fulcrum and defining first and second engagement members. As the lift system engages the carriage to displace it downwardly in a longitudinal direction of the elongate member, the first and second pivot members may be forced to pivot thereby engaging and dislodging a stake.

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References Cited

U.S. PATENT DOCUMENTS

Patent No.	Issued Date	Patentee Name	U.S. Cl.	CPC
2681789	12/1953	Nichols	N/A	N/A
7017962	12/2005	Toensing	N/A	N/A
8282077	12/2011	Bonney	414/23	B66F 3/24
8356799	12/2012	Cheslock	N/A	N/A
2017/0159323	12/2016	Graves	N/A	E04H 17/265
2020/0157841	12/2019	Blank	N/A	E04H 17/265
2023/0220700	12/2022	Davis	254/30	E04H 17/265

OTHER PUBLICATIONS

APG Australia. “Post puller Demo”. YouTube [Online] [Video]. Aug. 15, 2016 [retrieved on Aug. 25, 2023]. Retrieved from https://youtube.com/watch?v=mPZOClusXFc. cited by applicant
Operating manual of the RHINOTM PL-3 Hydraulic Post Puller (not dated)—https://rhinotool.com/wp-content/uploads/2021/11/PL-3_WEB.pdf. cited by applicant

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS (1) The present patent application claims the benefits of priority of U.S. Provisional Patent Application No. 63/174,869, entitled “SYSTEM AND METHOD FOR REMOVING A STAKE”, and filed at the United States Patent Office on Apr. 14, 2021, the content of which is incorporated herein by reference.

FIELD OF THE INVENTION
(1) The present invention generally relates to the field of mechanical tools and methods thereof and, more particularly, to tools for removing in-ground stakes and associated methods of use.
BACKGROUND OF THE INVENTION
(2) Commonly used in construction projects, stakes serve multiple purposes from surveying to securing concrete. In particular, they provide a temporary marker or support in various construction projects. The stakes are commonly made of metal, wood or plastic and comprise a pointed end allowing them to be driven deep into the soil or concrete using a sledgehammer thereby increasing their stability.
(3) Stakes are often manually removed once a project is complete or if they are no longer required. Depending on the depth at which the stakes are buried or the material they are buried in, their removal can prove challenging and time consuming. Moreover, the large number of stakes commonly used in construction projects can often be physically exhausting for workers while

extending the construction time.
(4) Various stake removal tools have been proposed for the easy removal of stakes. For example, U.S. Pat. No. 7,017,962 discloses a stake removal tool having two handles linked by a link bar, wherein the limits of the handles define gripper surfaces being opposite to one another. The gripper surfaces are spaced apart to allow a stake to be positioned therebetween which can be engaged by the gripper surfaces for removal.
(5) U.S. Pat. No. 8,356,799 discloses a stake removal tool comprising two loops disposed on opposite ends of the device. A first loop is configured to receive a top end of a stake while the second loop is configured to receive a user's forearm. As the user engages the device, the first loop tightens around the stake thereby facilitating its removal.
(6) The use of the aforementioned removal tools presents certain drawbacks, namely the continued physical effort required by the users. There is therefore a need for a manual or powered stake removal tool.

SUMMARY OF THE INVENTION

(7) The shortcomings of the prior art are generally mitigated by a stake removal tool configured for removing in-ground stakes, the stake removal tool comprising an elongated member defining a proximal end and a distal end, a carriage, a lift system configured to drive the carriage along a longitudinal direction of the elongated member, and a fulcrum, wherein the carriage comprises a chassis and a pivoting member configured to pivot about the fulcrum and defining first and second engagement members, the engagement members being configured to engage the stake and grasp the stake when the pivoting member is pivoted.
(8) The pivoting member may further define a passage between the first and second engagement members, wherein the passage has a dimension along an axis normal to a longitudinal axis of the stake being smaller than a width of the stake when the pivoting member is suspended, and wherein the dimension along the axis normal to the longitudinal axis of the stake of the opening is greater than the width of the stake when the pivoting member is pivoted about the fulcrum. A rotation of the pivoting member may be limited by the width of the stake when said stake is in the opening and the pivoting member is pivoted.
(9) The pivoting member may be configured to remove the stake from the ground when the engagement members grasp the stake and the carriage is driven upwardly, and the pivoting member may loosely pivot about a pivot point of the carriage. The pivoting member may pivot about an elongated aperture of the carriage and the lift system may comprise an endless gear configured to threadingly engage the carriage.
(10) The stake removal tool may further comprise a resilient member adapted to dampen a displacement of the carriage at the distal end of the elongated member, and the lifting system may comprise an elongated rod, the elongated rod comprising a threaded portion threadingly engaging the carriage, an axle portion for receiving the resilient member, and a drive connector.
(11) The stake removal tool may further comprise a bearing adapted to receive and rotate the elongated rod, the lifting system may be unitary, and at least one of the first and second engagement members may comprise serrations.
(12) The shortcomings of the prior art are further mitigated by a method for removing a stake from a surface, the method comprising driving a carriage toward the stake along an elongated member, inserting the stake into an opening of a pivoting attachment member, and driving the carriage to suspend the pivoting member and to grasp the stake with the attachment member.
(13) The method may further comprise pivoting the attachment member to a position being substantially normal to a longitudinal axis of the stake prior to inserting the stake into the opening, wherein grasping the stake may comprise pressing serrations of first and second engagement members of the attachment member against a surface of the stake.
(14) The method may further comprise dampening a displacement of the driving carriage and/or aligning an axle of a drive system with a rotational axis of the endless screw, wherein driving the

carriage may comprise rotating an endless screw configured to threadingly engage the carriage.
(15) In yet another aspect of the present invention, a stake removal tool configured for removing in-ground stakes is provided. The stake removal tool comprises an elongated member defining a proximal end and a distal end, a carriage comprising a stake engagement assembly configured to engage and grasp the stake, a lift system configured to drive the carriage along a longitudinal direction of the elongated member, wherein the carriage is disengageable yet engageable to the lift system.
(16) The stake removal tool may further comprise a fulcrum and the carriage may further comprise a pivoting member configured to pivot about the fulcrum to engage the stake. The engagement assembly may comprise first and second engagement members, the first and second engagement members being configured to engage the stake and grasp the stake when the pivoting member is pivoted. The pivoting member may further define a passage between the first and second engagement members. The passage may have a dimension along an axis normal to a longitudinal axis of the stake being smaller than a width of the stake when the pivoting member is suspended. The dimension along the axis normal to the longitudinal axis of the stake of the opening may be greater than the width of the stake when the pivoting member is pivoted about the fulcrum. A rotation of the pivoting member may be limited by the width of the stake when said stake is in the opening and the pivoting member is pivoted.
(17) The pivoting member may be configured to remove the stake from the ground when the engagement members grasp the stake and the carriage is driven upwardly. The pivoting member may loosely pivot about a pivot point of the carriage. The pivoting member may pivot about an elongated aperture of the carriage.
(18) The stake removal tool may further comprise a resilient member for engaging the carriage to the lift system. The resilient member may be a spring pushing the disengaged carriage to be engaged by the lift system. The lifting system may comprise an elongated rod rotatably attached to the stake removable tool, the elongated rod comprising a threaded portion for threadingly engaging the carriage and a non-threaded axle portion for receiving the resilient member and for disengaging the carriage.
(19) The at least one of the first and second engagement members may comprise serrations.
(20) In yet another aspect of the invention, a method for removing a stake from a surface is provided. The method comprises driving a carriage downward toward the stake along an elongated member, disengaging the carriage from the elongated member, inserting the stake into an opening of an attachment member, engaging the disengaged carriage to the elongated member and driving the carriage upward to grasp the stake with the attachment member.
(21) The method may further comprise pivoting the attachment member to a position being substantially normal to a longitudinal axis of the stake prior to inserting the stake into the opening.
(22) The grasping of the stake may comprise pressing serrations of first and second engagement members of the attachment member against a surface of the stake. The disengagement of the carriage further may comprise driving the carriage to a threadless portion of the elongated member.
(23) The engagement of the carriage may further comprise pushing the carriage from the threadless portion of the elongated member to a threaded portion of the elongated member. The method may further comprise using a resilient member pushing the carriage from the threadless portion of the elongated member to a threaded portion of the elongated member. The driving of the carriage may further comprise using a drive system to rotate the elongated member to drive the carriage.
(24) The method may further comprise pivoting the attachment member to insert the stake in the opening and suspending the pivoted attachment member to grasp the stake with the attachment member.
(25) In another aspect of the invention, a stake removal tool configured for removing in-ground stakes is provided. The stake removal tool comprises an elongated member defining a proximal end and a distal end, a carriage comprising a stake engagement assembly configured to engage and

grasp the stake, a lift system configured to drive the carriage along a longitudinal direction of the elongated member, a carriage disengagement member adapted to disengage the driven carriage from the lift system and a carriage engagement member adapted to engage the disengaged carriage to the lift system.

(26) In a further aspect of the invention, a method for removing a stake from a surface is provided. The method comprises driving a carriage downward toward the stake along an elongated member, disengaging the carriage from the elongated member upon reaching an end portion of the elongated member, inserting the stake into an opening of an attachment member of the carriage, moving the disengaged carriage to be engaged to the elongated member and driving the engaged carriage upward to grasp the stake with the attachment member.

(27) Other and further aspects and advantages of the present invention will be obvious upon an understanding of the illustrative embodiments about to be described or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) The above and other aspects, features and advantages of the invention will become more readily apparent from the following description, reference being made to the accompanying drawings in which:

(2) FIG. **1** is a right side elevation view of an embodiment of a stake removal tool in accordance with the principles of the present invention.

(3) FIG. **2** is a front elevation view of the stake removal tool of FIG. **1**.

(4) FIG. **3** is a top plan view of the stake removal tool of FIG. **1**.

(5) FIG. **4** is a bottom plan view of the stake removal tool of FIG. **1**.

(6) FIG. **5** is a right side elevation view of an exemplary lift system used in the stake removal tool of FIG. **1**.

(7) FIG. **6** is a right side elevation view of an exemplary attaching system used in the stake removal tool of FIG. **1** shown when receiving a stake.

(8) FIG. **7** is a right side elevation view of the attaching system of FIG. **6** shown when engaging a stake.

(9) FIG. **8** is an isometric view of another embodiment of a stake removal tool in accordance with the principles of the present invention.

(10) FIG. **9** is a right side elevation view of the stake removal tool of FIG. **8**.

(11) FIG. **10** is front elevation view of the stake removal tool of FIG. **8**.

(12) FIG. **11** is an exploded isometric view of the stake removal tool of FIG. **8**.

(13) FIG. **12** is a right side cross-sectional view of a distal end of the stake removal tool of FIG. **8**.

DETAILED DESCRIPTION OF THE INVENTION

(14) A novel system and method for removing a stake will be described hereinafter. Although the invention is described in terms of specific illustrative embodiments, it is to be understood that the embodiments described herein are by way of example only and that the scope of the invention is not intended to be limited thereby.

(15) Referring to FIGS. **1** and **2**, an embodiment of a tool **100** for the removal of an in-ground stake **5** out of the ground **7** (shown in FIG. **7**) is illustrated. The stake removal tool **100** typically comprises a carriage **10**, an attaching system **20**, a base **30**, an elongated member **40** and a lifting system **50**.

(16) The elongated member **40** typically defines a proximal end **41** adapted to be manipulated by a user and a distal end **44** adapted to engage a stake.

(17) The base **30** is typically affixed at a distal end **44** of the elongated member **40** and is generally adapted to support the stake removal tool **100** when in use. Still referring to FIGS. **1** and **2**, the stake removal tool **100** comprises a substantially flat base **30** which is adapted to be disposed substantially parallel to the ground **7**.
(18) The base **30** may be affixed to the elongated member **40** using a fastener, an adhesive or any other suitable method. In other embodiments, the base **30** may be detachably affixed to the elongated member **40** and selectively affixed when required. In yet other embodiments, the base **30** may be pivotally attached to the distal end **44** of the elongated member **40**, generally aiming at conforming with an uneven ground **7**.
(19) The stake removal tool **100** may further comprise a carriage **10** configured to be moved longitudinally in relation with the elongated member **40**. To that end, the carriage **10** may be slidably attached to the elongated member **40** using any suitable means. The carriage **10** generally comprises an attachment portion **12** (shown in FIG. **5**). The attachment portion **12** may comprise upper and lower threaded ends **13**, **14**. The carriage **10** may further comprise a pivot point **15** adapted to pivotally receive the attaching system **20**.
(20) In certain embodiments, the stake removal tool **100** further comprises a lift system **50**. The lift system **50** may extend along the elongated member **40** and is adapted to displace the carriage **10** along the said elongated member **40**. The lift system **50** may comprise any suitable mechanism for generating a displacement of the carriage along the elongated member **40**, such as but not limited to, an endless screw, a screw jack, a belt system, a magnetic system or any combination thereof. Referring again to FIGS. **1** and **2**, the lift system **50** of the present embodiment comprises a screw jack or endless screw **52** disposed along the length of the elongated member **40**. In a preferred embodiment, the endless screw **52** is within an inner cavity **42** of the elongated member **40**. The endless screw **52** may have any length suitable to displace the carriage **10** along a desired length of the elongated member **40**. It may be appreciated that, in other embodiments, the lift system **50** may be disposed externally to the elongated member **40**.
(21) In order to displace the carriage **10**, the lift system **50** may engage or may be attached to the attachment portion **12** of the carriage **10**. Referring now to FIG. **5**, the attachment portion **12** may additionally form part of a chassis of the carriage **10**. In accordance with the present embodiment, the attachment portion **12** may be embodied as a threaded portion configured to receive the endless screw **52**. As shown in FIGS. **1** and **5**, the attachment portion **12** may comprise upper and lower threaded ends **13**, **14**. The threaded ends **13**, **14** may be configured to engage the endless screw **52**. To that end, a rotation of the endless screw **52** engages the threaded portion **12** of the chassis to drive the carriage **10** along the longitudinal axis of the elongated member **40**.
(22) The gripping or attaching system **20** may be attached to or unitary with the carriage **10**. Broadly, the attaching system **20** is adapted to grip or firmly retain the stake **5** when the carriage **10** is moved upwardly. The attaching system **20** may additionally comprise one or more aperture or openings **22** allowing the passage of the stake **5**.
(23) Referring now to FIGS. **1** to **4**, in some embodiments, the stake removal tool **100** may comprise a substantially flat attaching system **20** comprising the opening **22**. The opening **22** may be large enough to receive a portion of the stake **5** positioned above the ground **7** but without being affixed thereto. In a preferred embodiment, the attaching system **20** and the opening **22** define a substantially U-shaped holder allowing the stake to be inserted either by downwardly moving the tool toward the ground **7** above the stake **5** or by sliding the stake **5** within the opening **22** to allow later engagement. In said embodiment, the ends of the opening **22** may define first and second gripping members **26**, **28** with the first gripping member **26** being positioned distally from the elongated member **40** relative to the second gripping member **28**.
(24) In the illustrated embodiment, the attaching system **20** comprises a supporting member or link **24** for pivotally attaching the attaching system **20** to the carriage **10**. The attaching system **20** may therefore be pivotally attached to the carriage **10** at the pivot point **15** of the carriage **10**. The

supporting member **24** may comprise a pin, a bolt or any other suitable component.
(25) Referring now to FIG. **1**, the stake removal tool **100** may comprise a protrusion or fulcrum **36** providing a support for a pivoting of the attaching system **20** about the pivot point **15**. In certain embodiments, the fulcrum **36** may be affixed to the base **30** using any suitable means. In other embodiments, the fulcrum **36** may be affixed to the elongated member **40**, or the fulcrum **36** and the base **30** may form a single unitary piece. The base **30**, the fulcrum **36** and the elongated member **40** may additionally define a recess **38** disposed therebetween.
(26) In certain embodiments, the attaching system **20** may be loose about the pivot point **15** to be impacted by gravitational forces and to allow a free rotation thereabout. Accordingly, the attaching system **20** may tilt downwardly when unsupported with the first gripping member **26** being lower than the second gripping member **28** due to gravitational forces acting upon the attaching system **20**. In preferred embodiments, the pivoting range of motion of the attaching system **20** is limited due to the geometry of the attaching system **20**, the carriage **10**, a stopper (not shown) or any other suitable means.
(27) Referring to FIG. **1**, the fulcrum **36** may be configured to support the attaching system **20** about the second gripping member **28** when the carriage **10** is moved downwardly towards the distal end of the elongated member **40**. In this manner, the vertical displacement of the attaching system **20** may be limited as the carriage **10** continues to move downwardly towards and/or into the recess **38**. Due to the geometry of the carriage **10**, of the attaching member **20** and of the fulcrum **36**, the attaching member **20** may begin to pivot about the pivot point **15** to reach a substantially horizontal position when or after the attaching member **20** is in contact with the fulcrum **36** with the first gripping member **26** being at a similar height to the second gripping member **28**.
(28) In other embodiments, the fulcrum **36** may be replaced by a resilient member or any pivoting system allowing the attaching member **20** to be pivoted when engaging with the stake **5** as to be substantially parallel with the ground (or substantially perpendicular with the stake **5**).
(29) Referring now to FIG. **6**, it may be appreciated that the lateral distance A between the two engagement members **26** and **28** may reach a maximum distance when the attaching member **20** is in a substantially horizontal position thereby facilitating the reception of the stake **5** within the opening **22**.
(30) Referring now to FIG. **7**, the lateral distance A between the two engagement members **26** and **28** may decreases as the link **24** is driven upwardly thereby forcing the attaching member **20** to pivot due to gravitational forces. In such conditions, the first gripping member **26** is typically lower relative to the second gripping member **28**. The first and second engagement members **26**, **28** may be configured to conjointly engage the stake **5** positioned within the opening **22** as the lateral distance A is decreased.
(31) In a preferred embodiment, the stake removal tool **100** may be configured to force the stake **5** upwardly and to dislodge it from the ground **7** as the attaching member **20** pivots when it is raised. Once the stake **5** has been dislodged, the carriage **10** may continue to be driven upwardly by the lift system **50**. As carriage **10** is driven upward, the gravitational forces still force the attaching member **20** into its pivoted state, thus allowing the engagement members **26**, **28** to maintain their grip on the stake **5**. To that end, the stake **5** may be removed from the ground **7** as the carriage **10** continues to be driven upwardly.
(32) Understandably, any other methods to grip or attach the stake by moving the carriage **10** up and down may be used within the scope of the present invention. As such, in some embodiments, a roller may be pushed against the stake to maintain pressure against a gripping member.
(33) The lifting system **50** typically comprises a drive system (not shown) configured to drive the lift system **50**. The drive system may comprise any suitable system to operate and control the lift system such as, for example, an engine, a motor or more preferably a power tool such as a drill configured to engage and rotate the endless screw **52**. The stake removal tool **100** may further comprise a drive bracket **54** adapted to align the axle of the drive system with the rotational axis of

the endless screw to increase mechanical efficiency and generally to avoid side forces on the pivoting shaft, which may create breakages.
(34) The drive bracket **54** may be adapted to be securely attached to the drive motor and to the elongated member **40**. In one embodiment, the drive motor may be dismantled, the bracket **55** may be inserted within the two or more dismantled parts and be secured within the drive motor, offering a rigid connection to the drive motor.
(35) In certain embodiments, the endless screw **52** may be axially connected to a socket **56**, such as a standard socket for drilling. The drive system may be engaged with the socket **56** to turn the endless screw **52** in any direction. A first direction of rotation drives the carriage **10** down while the opposite direction moves the carriage **10** upwards.
(36) To further ease the operation of the stake removal tool, the stake removal tool **100** may comprise one or more handles **60** to be engaged by the user during the operation of the stake removal tool **100**, as shown in FIG. **2**.
(37) In use, the tool **100** is placed on the ground, typically against the base **30**. The tool **100** is positioned to align the elongated member **40** or the attaching member **20** with the stake **5** in the ground **7**. The drive system **50** is activated to move the carriage **10** down, such as rotating the endless screw **52** in a first direction. When the attaching system **20** has made contact with the fulcrum **36** and pivoted sufficiently to engage and dislodge the stake **5** from the ground **7**, the drive system **50** is stopped and/or reversed to move the carriage **10** upwards (the endless screw **52** turns in a second direction, opposite to the first direction). By moving up, gravitational forces pivot the attaching system **20** in an opposite direction once again engaging the stake **5**. As the carriage **10** moves up, the stake **5** is solidly gripped between the first and second gripping members **26** and **28**.
(38) Referring now to FIGS. **8** to **12**, another embodiment of a stake removal tool **200** is illustrated. The stake removal tool **200** similarly comprises a carriage **210**, an attaching system **220**, a base **230**, an elongated member **240** and a lifting system **250**.
(39) Referring to FIGS. **11** and **12**, the stake removal tool **200** may further comprise a resilient member **270** positioned at a distal end **244** of the elongated member **240**. The resilient member **270** may be positioned within an inner cavity **242** of the elongated member **240**. The resilient member **270** may comprise a spring, a rubber shock absorber, or any other suitable component for storing mechanical energy. The resilient member **270** may be configured to dampen the displacement or limit the force of impact of the carriage **210** as it is displaced towards its lowest position. In certain embodiments, the resilient member **270** may further limit a displacement of the carriage **210** along the elongated member **240**. In the illustrated embodiment, the resilient member **270** is embodied as a spring surrounding the lifting system **250** which allows the carriage **210** to move upwardly and downwardly.
(40) Referring now to FIG. **8**, the attaching system **220** is pivotally attached too the carriage **210** and is adapted to generally surround the outer surface of a stake to be pulled. When the carriage **210** moves up, the attaching system **220** grips the outer surface of a stake (as shown at FIG. **7**). In some embodiments, the attaching system **220** may comprise first and second gripping members **226**, **228**. In such embodiments, the first and second gripping members **226**, **228** generally form a U shape allowing the outer surface of the stake to be inserted within the opening of the U shape gripping members **226**, **228**.
(41) The attachment system **220** generally comprises a supporting member **224** pivotally attached to the carriage **210**. In the illustrated embodiment, the supporting member **224** is kingpin insertable in the pivot point **215** of the carriage. As such, the attachment system **220** may comprise one or more annular members **222** (shown in FIG. **11**) adapted to receive the supporting member **224**, such as a kingpin.
(42) In certain embodiments, the first and second gripping members **226**, **228** may comprise serrations **229** configured to increase the points of contact between the first and second gripping members **226**, **228** and the stake **5** while additionally increasing the applied pressure at each contact

point. Understandably, the serrations **229** may allow the first and second gripping members **226**, **228** to securely grip the stake **5** while additionally preventing a rotation of said stake **5** about its longitudinal axis.

(43) In such embodiment, the carriage **210** comprises a threaded aperture **212** adapted to receive the threaded portion **252** of the lifting system **250**. As the threaded portion **252** rotates, the carriage **210** moves upwardly or downwardly following the direction of rotation of the threaded portion **252**. In the illustrated embodiment, the threaded aperture **212** is solidly fixed to the body **214** of the carriage **210**. In such embodiment, the body **214** of the carriage **210** extends downwardly from the threaded aperture **212** to position the attachment system **220** at the base of the stake **5** to be pulled or removed.

(44) In certain embodiments and referring again to FIGS. **11** and **12**, the carriage comprises a pivot point **215** configured to pivotally retain the attaching system **220**. In some embodiments, the pivot point **215** may comprise a vertically elongated opening **216**. The elongated opening **216** is configured to receive a supporting member **224** of the attaching system **220** while allowing a vertical displacement of said supporting member **224** relative to the carriage **210**. By allowing a relative displacement between the supporting member **224** and the carriage **210**, the attaching system **220** may remain substantially horizontal while the carriage **210** is in a broader range of positions along the elongated member **240**.

(45) Referring now to FIGS. **10** and **11**, the stake removal tool **200** may further comprise a lifting system **250** extending along the elongated member **240** and adapted to displace the carriage **210** upwardly and downwardly. In the illustrated embodiment, the lifting system **250** is embodied as an elongated threaded rod **251**. The elongated threaded rod may comprise a threaded portion **252**, an axle portion **254** configured to rotate within a support **290**, such as a bearing (shown in FIG. **12**), and a drive connector **256** configured to engage the drive system. In a preferred embodiment, the lifting system **250** is unitary. In the illustrated embodiment, the threaded portion **252** is between the drive connector **256** and the axle portion **254**. The threaded portion **252** is long enough to allow sufficient vertical movement of the carriage **210** to remove the stake from a surface, such as the ground. In the illustrated embodiment, the axle portion **254** is adapted to receive the resilient member **270** and thus has a smooth external surface, such as a non threaded surface. The support **290** may be unitary with the base **240** of the removal tool **200**.

(46) The stake removal tool **200** may further comprise a rotating member **280** adapted to receive and facilitate the rotation of the lifting system **250**. The rotating member **280** may be a bearing receiving a portion of the elongate rod. In the illustrated embodiment, the drive connector **256** extends above the rotating member **280** to allow a drive system to engage with the lifting system **250**. Understandably, any type of bearing, such as standard bearings may be used to embody the rotating member **280**.

(47) Referring now to FIG. **11**, the stake removal tool **200** may comprise a handle **260**. The handle **260** typically extends from the side of the elongated member **240**. In some embodiments, the handle **260** may comprise a friction cover **262**. The friction cover **262** generally improves gripping of the tool by a hand of a user.

(48) Referring back to FIGS. **11** and **12**, the lifting system **250** may allow disengaging the carriage **210** when moved at the axle portion **254**. In the illustrated embodiment, the axle portion **254** is threadless. As such, the carriage **210** is disengaged when moved over the axle portion **254**. As such, when disengaged, the carriage **210** is prevented from pushing downwardly on the base **230**, therefore avoiding long-term wear of the stake removal tool **200**. When the carriage **210** reaches the lower end of threaded part **252**, it continues to move downwards over the axle portion **254** until disengaged from the threaded portion **252**. When completely disengaged, the carriage **210** stops moving downwards. The support **290** may be unitary with the base **240** of the removal tool **200**.

(49) In the illustrated embodiment, when the carriage **210** is disengaged from the lifting system **250**, the resilient member **270** pushes the carriage **210** upwardly over the threadless axle portion

254. When the lifting system **250** is rotated to move the carriage **210** upwardly, the carriage **210** engages with the threaded portion **252** and can be moved upwardly towards the upper portion of the lifting system **250**.

(50) While illustrative and presently preferred embodiments of the invention have been described in detail hereinabove, it is to be understood that the inventive concepts may be otherwise variously embodied and employed and that the appended claims are intended to be construed to include such variations except insofar as limited by the prior art.

Claims

1. A stake removal tool configured for removing in-ground stakes, the stake removal tool comprising: an elongated member defining a first end portion and a second end portion; a carriage comprising a stake engagement assembly configured to engage and grasp the stake; a lift system configured to drive the carriage along a longitudinal direction of the elongated member; a carriage disengagement member comprising a non-threaded axle portion for disengaging the driven carriage from the lift system before the carriage reaches the first end portion of the elongated member; and a carriage engagement member comprising: a resilient member for moving the disengaged carriage toward the lift system; a threaded portion for threadingly engaging the carriage.

2. The stake removal tool of claim 1, the stake removal tool further comprising a fulcrum, the stake engagement assembly further comprising a pivoting member abutting the fulcrum and configured to pivot about the fulcrum to engage the stake.

3. The stake removal tool of claim 2, the pivoting member further comprising an opening that defines a passage between the first and second engagement members.

4. The stake removal tool of claim 2, wherein the passage is larger than a width of the stake when the opening extends in a plane substantially normal to the longitudinal axis of the stake.

5. The stake removal tool of claim 4, wherein the passage is smaller than the width of the stake when the pivoting member and the opening are pivoted relative to the longitudinal axis of the stake.

6. The stake removal tool of claim 5, wherein a rotation of the pivoting member is limited by the width of the stake when said stake is in the opening and the pivoting member is pivoted.

7. The stake removal tool of claim 2, the pivoting member being configured to remove the stake from the ground when the engagement members grasp the stake and the carriage is driven upwardly.

8. The stake removal tool of claim 2, wherein the pivoting member loosely pivots about a pivot point of the carriage.

9. The stake removal tool of claim 2, wherein the pivoting member pivots about an elongated aperture of the carriage.

10. The stake removal tool of claim 2, the stake engagement assembly comprising defining first and second engagement members, the first and second engagement members being configured to engage the stake and grasp the stake when the pivoting member is pivoted.

11. The stake removal tool of claim 10, wherein at least one of the first and second engagement members comprises serrations.

12. The stake removal tool of claim 2 further comprising an abutment member being attached to a base of the tool, when contacting the abutment member, the fulcrum allowing the stake to be inserted.

13. The stake removal tool of claim 1, wherein the lifting system comprises an elongated rod rotatably attached to the stake removal tool, the elongated rod comprising: the threaded portion for threadingly engaging the carriage; the non-threaded axle portion for receiving the resilient member and for disengaging the carriage.

14. The stake removal tool of claim 1, the resilient member being a spring pushing the disengaged carriage towards the carriage engagement member.

15. The stake removal tool of claim 1, the stake removal tool being a handheld tool.
16. A method for removing a stake from a surface, the method comprising: driving a carriage downward toward the stake along an elongated member; disengaging the carriage from the elongated member upon reaching a non-threaded end portion of the elongated member; inserting the stake into an opening of an attachment member of the carriage; moving the disengaged carriage to be engaged to a threaded portion of the elongated member; and driving the engaged carriage upward to grasp the stake with the attachment member.
17. The method of claim 16 further comprising pivoting the attachment member to a position being substantially normal to a longitudinal axis of the stake prior to inserting the stake into the opening.
18. The method of claim 16, the driving of the carriage further comprising using a drive system to rotate the elongated member to drive the carriage.
19. The method of claim 16, the disengagement of the carriage further comprising driving the carriage from the threaded portion to the threadless portion of the elongated member.
20. The method of claim 16, the engagement of the carriage further comprising pushing the carriage from the threadless portion of the elongated member to a threaded portion of the elongated member.
21. The method of claim 16 further comprising pivoting the attachment member to insert the stake in the opening and suspending the pivoted attachment member to grasp the stake with the attachment member.