MAGNETIZED REINFORCING BAR PROTECTIVE CAP

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 ABSTRACT

A protective cap for covering an exposed end of any sized reinforcing bar (rebar or reinforced steel) is provided. The protective cap is configured to be affixed to an exposed end of the reinforcing bar and protect falling objects from being punctured by the reinforcing bar. The protective cap includes a magnet embedded and secured within the protective cap to secure the protective cap to the reinforcing bar.
MAGNETIZED REINFORCING BAR PROTECTIVE CAP

CROSS-REFERENCE TO RELATED APPLICATION(S)

[0001] This application claims priority to, and the benefit of, co-pending U.S. Provisional Application No. 62/328,359, filed Apr. 27, 2016, for all subject matter common to both applications. The disclosure of said provisional application is hereby incorporated by reference in its entirety.

FIELD OF THE INVENTION

[0002] This present invention relates to the field of workplace and personal safety. The invention relates to protection of individuals from impalement hazards, and other injuries that exist from exposed ends of reinforcing steel bars (otherwise known as “rebar”) onto and into which individuals could fall. More specifically, the invention relates to a protection cap configured for placement on exposed ends of reinforcing bar and having a magnetic field aiding in the coupling of the protection cap with the reinforcing bar by action of the attractive magnetic force between the protection cap and the reinforcing bar.

BACKGROUND

[0003] Generally, the Occupational Safety and Health Administration (OSHA) requires that all protruding reinforcing steel, onto and into which employees could fall, be guarded to eliminate the hazard of impalement. OSHA considers devices (covers or wooden troughs) that are capable of withstanding at least two-hundred and fifty pounds dropped from a height of ten feet to be adequate to meet the §1926.701(b) rebar requirements. There are devices known for protecting against impalement hazards created by exposed ends of reinforcing steel that meet OSHA’s guidelines. These devices include impact resistant troughs or caps made of, or a combination of, metal, plastic, or wood. The trough or cap is placed over the impalement hazard(s) and secured in place by mechanically gripping the reinforcing steel. Unfortunately, protection systems that utilize a gripping mechanism are prone to frequent dislodging and/or falling off due to accidental contact from individuals and/or vibration of the reinforcing steel or other environmental factors. When these systems become dislodged or fall off, individuals are no longer protected from the impalement hazard, and the worksite is in violation of the OSHA requirements.

[0004] Existing protection systems rely on the individual installing the system to properly install, physically monitor, and re-install the system when it becomes dislodged or falls off. A shortcoming with these types of systems is that there is no automated monitoring system integrated that can provide alerts if the system is no longer secured to the impalement hazard. As such, these systems rely on constant post-installation inspection to identify if impalement hazards exist. The, delay or absence of a post installation inspection can mean the existence of a life threatening hazard that goes unnoticed for long periods of time. Additionally, the failure of these caps to stay secure on reinforcing bar can result in safety citations (fines) and/or temporary shutdown of worksites.

SUMMARY

[0005] There is a need for improved reinforcing bar capping technology to avoid the above-noted shortcomings and issues related to conventional capping systems and devices. The present invention is directed toward further solutions to address this need, in addition to having other desirable characteristics. Specifically, the present invention includes a protective cap with collar designed to be affixed to exposed ends of reinforcing bar (e.g., reinforcing steel or rebar) and not experience the dislodging characteristics of conventional rebar caps. The present invention provides a protective cap structure comprised of two half caps mechanically coupled together, assembled with a magnetic field generating element positioned to magnetically couple the protective cap with the reinforcing bar, thus improving the coupling of the protective cap with the reinforcing bar over conventional systems. Additionally, the inventive protective cap includes a structural crumple zone in an upper portion of the cap that can absorb a force of a maximum of two-hundred and fifty pounds dropped from a maximum height of ten feet onto the cap positioned on the reinforcing bar without the reinforcing bar poking through the protective cap. As noted, the cap of the present invention includes a magnetic field generating element, which can be implemented as, e.g., a magnetized steel plate, magnet, and/or magnet injected plastic mold, to secure the cap to exposed reinforcing bar. As a result, the magnetized cap is less susceptible to becoming dislodged or displaced through physical contact, vibration, weather, or traditional wear and tear, than conventional protection caps. The cap can be reused and maintain its effectiveness to affix to reinforcing steel and is equally effective in the vertical or horizontal position.

[0006] In accordance with example embodiments of the present invention, reinforced cap is provided. The protective cap includes a cap top end and a cap bottom end opposite the top end and a crumple zone structure located within the protective cap proximal the cap top end. The crumple zone structure is configured to withstand a force resulting from a maximum weight of two-hundred and fifty pounds dropped from a maximum height of ten feet above the protective cap. The protective cap also includes a collar structure located at the cap bottom end. The collar structure is sized and dimensioned to fit over and receive an end section of reinforcing bar in such a way that the protective cap surrounds and removably couples with the end section of reinforcing bar. The protective cap further includes a magnetic field located internally within the protective cap at a top end of the collar structure. Additionally, the protective cap is constructed from two halves that are mechanically coupled together to form the protective cap.

[0007] In accordance with aspects of the present invention, the two halves include a first cap half having a first cap half top end and a first cap half bottom end. The first cap half includes a first half of the crumple zone structure located at the first cap half top end, a first half of the collar structure located at the first cap half bottom end, and a first plurality of mechanically interconnecting features configured for mechanical coupling with a second plurality of mechanically interconnecting features. The two halves also includes a second cap half having a second cap half top end and a second cap half bottom end. The second cap half includes a second half of the crumple zone structure located at the second cap half top end, the second half of the collar structure located at the second cap half bottom end, and the
second plurality of mechanically interconnecting features configured for mechanical coupling with the first plurality of mechanically interconnecting features. The first cap half mechanically couples with the second cap half by the first plurality of mechanically interconnecting features interconnecting with the second plurality of interconnecting features to form the protective cap.

[0008] In accordance with aspects of the invention, the magnetic field can be generated from a plurality of magnetic particles integrated into the protective cap structure. The magnetic field can be generated from a magnet or magnetized component located in an internal chamber of the protective cap at a top end of the collar structure. The magnetic field can be generated from neodymium, ferrite, or other similar openable magnet. When the protective cap is removably coupled with an end section of reinforcing bar, the magnetic field interacts with the reinforcing bar to magnetically pull the protective cap against the reinforcing bar, contributing to holding the protective cap in place.

[0009] In accordance with aspects of the invention, the crumple zone structure comprises a plurality of crumple zones. The force resulting from the weight of two-hundred and fifty pounds dropped from the height of up to ten feet above the protective cap matches a level required to withstand OSHA mandated load conditions without failure.

[0010] In accordance with aspects of the invention, the protective cap is manufactured of injection molded High Density Polyethylene (HDPE), or other similar openable material.

[0011] In accordance with aspects of the invention, the collar structure sized and dimensioned to fit over and receive an end section of reinforcing bar in such a way that the protective cap removably couples with the end section of reinforcing bar comprised of different sizes.

BRIEF DESCRIPTION OF THE FIGURES

[0012] These and other characteristics of the present invention will be more fully understood by reference to the following detailed description in conjunction with the attached drawings, in which:

[0013] FIG. 1 is an illustrative perspective view of the protective cap in accordance with the present invention;

[0014] FIG. 2 is an illustrative perspective view of the protective cap in accordance with the present invention;

[0015] FIG. 3 is an illustrative cross-sectional view of the protective cap, in accordance with the present invention; and

[0016] FIGS. 4A, 4B, and 4C are illustrative perspective views of cap halves that form the protective cap, in accordance with the present invention.

DETAILED DESCRIPTION

[0017] An illustrative embodiment of the present invention relates to a magnetized protective cap for placement on exposed ends of any sized reinforcing bar to protect workers from potential injury caused by falling on exposed reinforcing bar. In particular, the present invention provides a protective cap made up of two mechanically fitting half caps coupled together, forming the protective cap and encasing a magnetic field or magnetic field generating material. The protective cap is designed to removably slide over an end of exposed reinforcing bar with the magnetic field or magnetic field generating material being adjacent to the end of the reinforcing bar, sufficiently close to enable magnetic attractive forces to additionally hold the protective cap onto the reinforcing bar. The configuration and inclusion of the magnetic field or magnetic field generating material within the protective cap provides a mechanism to firmly secure the protective cap to the reinforcing bar through a combination of friction fit and magnetic attraction forces (e.g., the magnetism from the cap attracting to the metal properties of the reinforcing bar).

[0018] The protective cap also includes a crumple zone structure designed to withstand Occupational Safety and Health Administration (OSHA) mandated load conditions. Specifically, the crumple zones provide by the protective cap are designed to withstand a force generated by a maximum of two-hundred and fifty pound object falling from a maximum height of ten feet without the reinforcing protective cap failing and the reinforcing bar poking through the cap. It will be appreciated that the invention is equally applicable to any steel protrusion, or similar structure, that requires impalement protection pursuant to the Occupational Safety and Health Administration (OSHA) requirement that all protruding reinforcing steel, onto and into which employees could fall, be guarded by the protective cap of the present invention to eliminate the hazard of impalement.

[0019] Referring to the figures, wherein like numerals indicate like or corresponding parts throughout the several views, a magnetically affixed protective cap is generally shown. For purposes of illustration and not to be in any way limiting, the following description will make reference to the magnetically affixed protective cap on reinforcing bar. As would be appreciated by one skilled in the art, the protective cap can include alternative options for magnetizing including a magnet, magnetized steel plate, and/or magnet injected plastic mold. In accordance with an example embodiment of the present invention,

[0020] FIGS. 1 through 4C, wherein like parts are designated by like reference numerals throughout, illustrate an example embodiment or embodiments of an improved protective cap for placement on exposed reinforcing bar, according to the present invention. Although the present invention will be described with reference to the example embodiment or embodiments illustrated in the figures, it should be understood that many alternative forms can embody the present invention. One of skill in the art will additionally appreciate different ways to alter the parameters of the embodiment(s) disclosed, such as the size, shape, or type of elements or materials, in a manner still in keeping with the spirit and scope of the present invention.

[0021] FIGS. 1-4C depict example embodiments of a protective cap 100. The overall structure of the protective cap 100 includes a cap top end 102 and a cap bottom end 104 positioned opposite the cap top end 102. The protective cap 100 also includes a combination of features created by the cap top end 102, the cap bottom end 104 and the area in between the cap ends 102, 104. For example, the cap top end 102 can be a rectangular design, as depicted in FIGS. 1, 3, and 4A-4C, or a circular design, as depicted in FIG. 2, while maintaining the required functional features of the protective cap 100 as described throughout herein. Accordingly, regardless of shape and dimension, the protective cap 100 includes a combination of features to provide the utility of the protective cap 100. An exemplary utility feature of the protective cap 100 includes the protective cap 100 fitting on an end of a reinforcing bar to provide a protective structure for objects that may fall on the otherwise exposed reinforcing-
The protective cap 100 of the present invention provides a combination of structural elements that enable the protective properties. In particular, the protective cap 100 includes magnetic field to more effectively secure the protective cap 100 on an end of the reinforcing bar and a crumple zone structure 106 designed to absorb impact of objects dropped on the reinforcing bar end.

In accordance with an example embodiment of the present invention, the crumple zone structure 106 is located within the protective cap 100 proximal the cap top end 102. In particular, the protective cap 100 includes one or more cavities or crumple zones within the cap top end 102, as depicted in FIGS. 3 and 4A, designed to absorb an impact of an object falling on top of the protective cap 100. In accordance with an example embodiment of the present invention, the crumple zone structure 106 is configured to withstand a force resulting from a maximum weight of two-hundred and fifty pounds dropped from a maximum height of up to ten feet above the protective cap 100 (e.g., a level required to withstand Occupational Safety and Health Administration (OSHA) mandated load conditions without failure. As would be appreciated by one skilled in the art, the crumple zone structure 106 can include a single crumple zone or a plurality of crumple zones configured to handle such an impact. For example, the crumple zone structure 106 can include a plurality of rectangular crumple zones as depicted in FIGS. 3 and 4A. Additionally, although FIGS. 3 and 4A depict a plurality of rectangular crumple zones, the present invention is not intended to be limited to this implementation, such that the crumple zone structure 106 can be constructed from any combination crumple zones of different shapes and dimensions without departing from the scope of the present invention.

In accordance with an example embodiment of the present invention, the protective cap 100 further includes a collar structure 108 located at the cap bottom end 104. The collar structure 108 is sized and dimensioned to fit over and receive an end section of reinforcing bar 110 in such a way that the protective cap 100 fits over, surrounds, and removably couples with the end section of reinforcing bar 110, as depicted in FIGS. 2 and 3. For example, the collar structure 108 can include a cylindrical cavity 108c designed to slide over and form a friction fit around an end section of reinforcing bar 110. As would be appreciated by one skilled in the art, different sized and dimensioned protective caps 100, and included collar structure 108, can be created for different sized and shaped reinforced bar or other exposed building materials.

In addition to the crumple zone structure 106, the protective cap 100 can include other structural features designed to improve strength and force absorption of the protective cap 100. For example, the protective cap 100 can include a plurality of trusses 112 connecting the cap top end 102 and the cap bottom end 104 to improve the strength of the overall protective cap 100 structure. In an example embodiment, the trusses 112 are attached to an underside of the cap top end 102 and the external sides of the collar structure 108. The trusses 112 can contribute to the structural integrity of the protective cap 100 required to resist impact without failure.

Additionally, in accordance with an example embodiment of the present invention, the protective cap 100 includes a magnetic field or magnetic field generating material 114 located internally within the protective cap 100 to increase a level of security of the protective cap 100 to the end section of reinforcing bar 110. The magnetic field generating material 114 is positioned at a top end of the collar structure 108, as depicted in FIGS. 2, 3, and 4A, adjacent to the location of where an end section of reinforcing bar 110 ends up when the protective cap 100 is placed thereon, as depicted in FIGS. 2 and 3. In accordance with an example embodiment of the present invention, the magnetic field is generated from a plurality of magnetic particles integrated into the protective cap 100 structure or a magnetic field generating material 114 (e.g., a magnetic plate) located in an internal chamber of the protective cap 100. For example, the magnetic field generating material 114 can include ferrite, neodymium, or other magnetic material known in the art integrated within the protective cap 100. With the magnetic field generating material 114 included within the protective cap 100, when the protective cap 100 is removably coupled with an end section of reinforcing bar 110 the magnetic field interacts with the reinforcing bar 110 to magnetically pull the protective cap 100 toward the reinforcing bar 110, contributing to the additional available forces (e.g., gravity, friction, magnetism, etc.) holding the protective cap 100 in place on the end section of reinforcing bar 110. As would be appreciated by one skilled in the art, the magnetic field generating material 114 can include any combination of substances capable of generating a magnetic force to attract the protective cap 100 to an end section of reinforcing bar 110, including but not limited to a magnet, magnetic particles, magnetized metal, or the like.

In accordance with an example embodiment of the present invention, the protective cap 100 is constructed from two cap halves 100a, 100b that are mechanically coupled together to form the protective cap 100. The two cap halves 100a, 100b include a first cap half 100a having a first cap half top end 102a and a first cap half bottom end 104a. The first cap half 100a also includes a first half of the crumple zone structure 106a located at the first cap half top end 102a and a first half of the collar structure 108a located at the first cap half bottom end 104a. The first cap half 100a further includes placement for the magnetic field generating material 114. For example, the first cap half 100a can include a first cavity portion 114a for insertion of a magnet or a first magnetically embedded portion 114b including magnetic particles. Additionally, in accordance with an example embodiment of the present invention, the first cap half 100a includes a first plurality of mechanically interconnecting features 116a configured for mechanical coupling with a second plurality of mechanically interconnecting features 116b.

The protective cap 100 also includes a second cap half 100b. Similar to the first cap half 100a, the second cap half 100b has a second cap half top end 102b and a second cap half bottom end 104b. The second cap half 100b also includes a second half of the crumple zone structure 106b located at the second cap half top end 102b and a second half of the collar structure 108b located at the second cap half bottom end 104b. The second cap half 100b further includes placement for the magnetic field generating material 114. For example, the second cap half 100b can include a second cavity portion 114b for insertion of a magnet or a second magnetically embedded portion 114b including magnetic particles. Additionally, in accordance with an example embodiment of the present invention, the second cap half 100b includes the second plurality of mechanically inter-
To form the protective cap 100, the first cap half 100a mechanically couples with the second cap half 100b by the first plurality of mechanically interconnecting features 116a interconnecting with the second plurality of interconnecting features 116b. As would be appreciated by one skilled in the art, the mechanically interconnecting features 116a, 116b can include any mechanical arrangement configured to form the two cap halves 100a, 100b into a single protective cap 100. For example, the mechanically interconnecting features 116a, 116b can include a plurality of tabs configured for inserting into a plurality of slots to form a friction fit, or a snap fit, between the first cap half 100a and the second cap half 100b. Additionally, although the discussion of the two cap halves 100a, 100b provide examples of mechanical coupling with mechanically interconnecting features 116a, 116b, that can be undone (e.g., are removably coupled together) as would be appreciated by one skilled in the art, the two cap halves 100a, 100b could be joined utilizing any method known in the art. For example, in an alternative embodiment, the two cap halves 100a, 100b could be joined together by plastic welding or other technique without the reliance on mechanically tabs or slots.

In accordance with an example embodiment of the present invention, when the two cap halves 100a, 100b are joined to form the protective cap 100 they combine to form the features of the protective cap 100 as discussed herein. In particular, the joined two cap halves 100a, 100b will form the cap top end 102 (e.g., formed from the first cap half top end 102a and the second cap half top end 102b) the cap bottom end 104 (e.g., formed from the first cap half bottom end 104a and the second cap half bottom end 104b), the crumple zone structure 106 (e.g., formed from the first crumple zone structure 106a and the second crumple zone structure 106b), the collar structure (e.g., formed from the first collar structure 108a and the second collar structure 108b), and the magnetic field generating material 114 (e.g., via a cavity portion for insertion of a magnet or embedded magnetic portion).

In accordance with an example embodiment of the present invention, the protective cap 100 is manufactured of injection molded High Density Polyethylene (HDPE). As would be appreciated by one skilled in the art, the protective cap 100 can be constructed from any combination of materials utilizing any combination of manufacturing techniques. For example, the protective cap 100 can be printed utilizing three-dimensional printing techniques or any other technique known in the art.

FIGS. 1-4C depict various illustrative views of the protective cap 100 and the various components that make up the protective cap 100. FIG. 1 depicts an example illustrative view of the completely assembled protective cap 100. In particular, FIG. 1 depicts the protective cap 100 as a single piece, or as provided in an example embodiment, two cap halves 100a, 100b joined together to form a single piece. The protective cap 100, as depicted in FIG. 1, includes the cap top end 102 including the crumple zone structure 106, the cap bottom end 104 including the collar structure 108 with cap top end 102 fixedly attached to the cap bottom end 104. FIG. 1 also depicts the plurality of trusses 112 connected to the cap top end 102 and the cap bottom end 104, providing additional structural integrity to the protective cap 100. The collar structure 108 includes the cylindrical cavity 108c configured to receive an end section of a reinforcing bar 110. A magnetic field generating material 114 is included at the end of the collar structure 108 proximate to a bottom portion of the cap top end 102. The placement of the magnetic field generating material 114 enables interaction with an end section of a reinforcing bar 110 inserted into the cylindrical cavity 108c. Although the cap top end 102 of protective cap 100 is rectangular and the collar structure 108 is cylindrical, as depicted in FIG. 1, as would be appreciated by one skilled in the art, the cap top end 102 and the collar structure 108 can be any combination of shapes and sizes configured to receive reinforcing bars. For example, FIG. 2 depicts the protective cap 100 with a circular cap top end 102 and a cylindrical cap bottom end 104.

FIG. 2 depicts another example illustrative view of the protective cap 100. In particular, FIG. 2 depicts the protective cap 100 as a single piece, or as provided in an example embodiment, two cap halves 100a, 100b joined together to form a single piece. The protective cap 100, as depicted in FIG. 2, includes the cap top end 102 including the crumple zone structure 106 (not depicted), the cap bottom end 104 including the collar structure 108 with cap top end 102 fixedly attached to the cap bottom end 104. FIG. 2 also depicts the plurality of trusses 112 connected to the cap top end 102 and the cap bottom end 104, providing additional structural integrity to the protective cap 100. FIG. 2 further depicts the magnetic field generating material 114 embedded within a cavity of the cap top end 102. As disclosed herein, the magnetic field generating material 114 can include any combination of a magnetic material within a cavity or a plurality of particles embedded material formed within the cap top end 102. Additionally, FIG. 2 depicts the end section of reinforcing bar 110 inserted in the cylindrical cavity 108c of the collar structure 108, positioned for interaction with the magnetic field generating material 114.

FIG. 3 depicts an example illustrative cross-sectional view of the protective cap 100. Additionally, the cross-sectional view depicted in FIG. 3, represents one half of the two cap halves 100a, 100b combined to form the single protective cap 100. In particular, FIG. 3 depicts an internal cross-sectional view of the protective cap 100 (or on cap half 100a or 100b) including the cap top end 102 with the crumple zone structure 106 and the cap bottom end 104 including the collar structure 108 with cap top end 102 fixedly attached to the cap bottom end 104. The crumple zone structure 106, as depicted in FIG. 3, is made up of a plurality of rectangular crumple zones or cavities configured to absorb the impact of a falling object. FIG. 3 also depicts the plurality of trusses 112 connected to the cap top end 102 and the cap bottom end 104, providing additional structural integrity to the protective cap 100. FIG. 3 further depicts the magnetic field generating material 114 included within a cavity 114a of the cap top end 102. As would be appreciated by one skilled in the art, the magnetic field generating material 114 and the cavity 114a could be replaced with magnetic particles injected/formed within this portion of the cap top end 102. Additionally, FIG. 3 depicts the end section of reinforcing bar 110 inserted in the cylindrical cavity 108c of the collar structure 108 with the end of the inserted reinforcing bar proximate to the magnetic field generating material 114. A magnetic field 114f is generated by the
magnetic field generating material 114 and interacts with the reinforcing bar 110. In accordance with an example embodiment of the present invention, the protective cap 100 of FIG. 3 further includes a plurality of mechanically interconnecting features 116 configured for join two cap half pieces (e.g., 100a, 100b) together to form a single protective cap 100 structure.

[0034] FIGS. 4A-4C depict illustrative perspective views of two cap halves 100a, 100b that are combinable to form a single protective cap 100 structure. The two cap halves 100a, 100b, as depicted in FIGS. 4A-4C, include the cap half top ends 102a, 102b including the crumple zone structures 106a, 106b (including crumple zones/cavities), the cap half bottom ends 104a, 104b including the collar structures 108a, 108b with cap half top ends 102a, 102b fixedly attached to the respective cap half bottom ends 104a, 104b. FIGS. 4A-4C also depict the plurality of braces 112 connected to the cap half top ends 102a, 102b and the cap half bottom ends 104a, 104b, providing additional structural integrity to the overall protective cap 100. In accordance with an example embodiment of the present invention, the protective cap 100 of FIGS. 4A-4C further includes a plurality of mechanically interconnecting features 116a, 116b configured for join two cap half pieces (e.g., 100a, 100b) together to form a single protective cap 100 structure (e.g., inserting the tabs from one half into respective slots on the other half).

[0035] FIG. 4A is an example illustration showing a partially rotated side perspective view of the two cap halves 100a, 100b. In particular, FIG. 4A depicts an alternate view all the elements that make up the protective cap 100, as discussed herein. From the partially rotated side view, an inside portion of the first cap half 100a and reverse portion of the second cap half 100b is depicted. The inside portion of the first cap half 100a shows the internal of the crumple zone structure 106a including a plurality of crumple zones/cavities. The two cap halves 100a, 100b are configured to join together via the plurality of mechanically interconnecting features 116a, 116b to form the protective cap 100. FIG. 4B further depicts the magnetic field generating material 114 embedded/included within a cavity of the first cap half top end 102a.

[0036] FIG. 4B is an example illustration showing a partially rotated bottom view of the two cap halves 100a, 100b. In particular, FIG. 4B depicts an alternate view all the elements that make up the protective cap 100, as discussed herein. The partially rotated bottom view of the two cap halves 100a, 100b shows the internal cylindrical cavity portion 108c of the first collar structure 108a. Additionally, FIG. 4B further depicts the magnetic field generating material 114 embedded/included within a cavity of the first cap half top end 102a.

[0037] FIG. 4C is an example illustration showing a side view of the two cap halves 100a, 100b. In particular, FIG. 4C depicts an alternate view all the elements that make up the protective cap 100, as discussed herein. Additionally, FIG. 4C depicts how the two cap halves 100a, 100b are configured to join together via the plurality of mechanically interconnecting features 116a, 116b to form the protective cap 100.

[0038] In operation, the protective cap 100 is inserted onto exposed ends of any sized reinforcing bars, or other construction materials, to provide a protective barrier between objects and exposed ends of reinforcing bars. In particular, a reinforcing bar is inserted into the cylindrical cavity 108c of the collar structure 108, as depicted in FIGS. 2 and 3. The end section of the reinforcing bar 110 extends into the collar structure 108 and makes contact with a bottom portion of the cap top end 102 of the reinforcing cap 100. In accordance with an example embodiment of the present invention, the end section of the reinforcing bar 110 is secured to the protective cap 100 by the magnetic pull provided by the magnetic field generating material 114 located inside the cap top end 102 of the protective cap 100. The magnetically secured connection will prevent the protective cap 100 from dislodging and/or falling off of the reinforcing bar, due to accidental contact from individuals, vibration of the reinforcing bar, etc. Additionally, the structural benefits of the combination of the crumple zone structure 106 and the plurality of braces will protect an object falling on the protected end (e.g., by the protective cap 100). Specifically, the protective cap 100 installed on an end section of the reinforcing bar 110 will protect an object weighing two-hundred and fifty pounds falling from a height up to 10 feet without failure of the protective cap 100. This level protection provided by the cap meets the requirements of the OSHA mandated drop test.

[0039] As utilized herein, the terms “comprises” and “comprising” are intended to be construed as meaning inclusive, not exclusive. As utilized herein, the terms “exemplary”, “example”, and “illustrative”, are intended to mean “serving as an example, instance, or illustration” and should not be construed as indicating, or not indicating, a preferred or advantageous configuration relative to other configurations. As utilized herein, the terms “about” and “approximately” are intended to cover variations that may exist in the upper and lower limits of the ranges of subjective or objective values, such as variations in properties, parameters, sizes, and dimensions. In one non-limiting example, the terms “about” and “approximately” mean at, or plus 10 percent or less, or minus 10 percent or less. In one non-limiting example, the terms “about” and “approximately” mean sufficiently close to be deemed by one skill in the field to be included. As utilized herein, the term “substantially” refers to the complete or nearly complete extend or degree of an action, characteristic, property, state, structure, item, or result, as would be appreciated by one skill in the art. For example, an object that is “substantially” circular would mean that the object is either completely a circle to mathematically determinable limits, or nearly a circle as would be recognized or understood by one skill in the art. The exact allowable degree of deviation from absolute completeness may in some instances depend on the specific context. However, in general, the nearness of completion will be so as to have the same overall result as if absolute and total completion were achieved or obtained. The use of “substantially” is equally applicable when utilized in a negative connotation to refer to the complete or near complete lack of an action, characteristic, property, state, structure, item, or result, as would be appreciated by one skill in the art.

[0040] Numerous modifications and alternative embodiments of the present invention will be apparent to those skilled in the art in view of the foregoing description. Accordingly, this description is to be construed as illustrative only and is for the purpose of teaching those skilled in
the art the best mode for carrying out the present invention. Details of the structure may vary substantially without departing from the spirit of the present invention, and exclusive use of all modifications that come within the scope of the appended claims is reserved. Within this specification embodiments have been described in a way which enables a clear and concise specification to be written, but it is intended and will be appreciated that embodiments may be variously combined or separated without parting from the invention. It is intended that the present invention be limited only to the extent required by the appended claims and the applicable rules of law.

[0041] It is also to be understood that the following claims are to cover all generic and specific features of the invention described herein, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

What is claimed is:

1. A protective cap, comprising:
   a cap top end and a cap bottom end opposite the top end;
   a crumple zone structure located within the protective cap proximal the cap top end, the crumple zone structure configured to withstand a force resulting from a maximum weight of two-hundred and fifty pounds dropped from a maximum height of ten feet above the protective cap;
   a collar structure located at the cap bottom end, the collar structure sized and dimensioned to fit over and receive an end section of reinforcing bar in such a way that the protective cap surrounds and removably couples with the end section of reinforcing bar; and
   a magnetic field located internally within the protective cap at a top end of the collar structure;
   wherein the protective cap is comprised of two halves that are mechanically coupled together to form the protective cap.

2. The protective cap of claim 1, wherein the two halves comprise:
   a first cap half having a first cap half top end and a first cap half bottom end, the first cap half comprising:
   a first half of the crumple zone structure located at the first cap half top end;
   a first half of the collar structure located at the first cap half bottom end; and
   a first plurality of mechanically interconnecting features configured for mechanical coupling with a second plurality of mechanically interconnecting features;

3. The protective cap of claim 1, wherein the magnetic field is generated from a plurality of magnetic particles integrated into the protective cap structure.

4. The protective cap of claim 1, wherein the magnetic field is generated from a magnet or magnetized component located in an internal chamber of the protective cap at a top end of the collar structure.

5. The protective cap of claim 1, wherein the magnetic field is generated from neodymium or ferrite.

6. The protective cap of claim 1, wherein when the protective cap is removably coupled with an end section of reinforcing bar the magnetic field interacts with the reinforcing bar to magnetically pull the protective cap against the reinforcing bar, contributing to holding the protective cap in place.

7. The protective cap of claim 1, wherein the crumple zone structure comprises a plurality of crumple zones.

8. The protective cap of claim 1, wherein the force resulting from the weight of two-hundred and fifty pounds dropped from the height of up to ten feet above the protective cap matches a level required to withstand OSHA mandated load conditions without failure.

9. The protective cap of claim 1, wherein the protective cap is manufactured of injection molded High Density Polyethylene (HDPE).

10. The protective cap of claim 1, wherein the collar structure sized and dimensioned to fit over and receive an end section of reinforcing bar in such a way that the protective cap removably couples with the end section of reinforcing bar comprised of different sizes.