A molded polymer cap generally including a hollow body defining a central channel, a closed cap end, an open receiving end, and a plurality of resilient internal fins. A first portion of each internal fin runs longitudinally down the body from the closed cap end toward the open receiving end, extending laterally inward from the body into the central channel, and deflecting toward the cap body to contact to the side surfaces of an inserted object. A second portion of each internal fin runs partially longitudinally and partially laterally down the body from the end of the first portion toward the receiving end of the device, extending laterally inward from the body into the central channel, and exposing a broad side of each fin to the advancing end of an inserted object. The first and second portions of each internal fin are connected to each other, so that a deflection will propagate ahead of the advancing end of an inserted object.
MOLDED POLYMER CAP WITH CONFORMABLE INTERNAL STRUCTURE

BACKGROUND

[0001] This application is directed to a cap for reinforcement members and reinforcement placement accessories used in concrete construction and, more particularly, to molded polymer caps for attachment to rebar, metal slab bolsters, and other reinforcement-related items, where the cap includes a conformable internal structure for frictionally engaging an end or leg of the item.

[0002] During the construction of buildings, bridges, and other structures using reinforced concrete it is common to place a plurality of metal slab bolsters on grade or within forming molds to position steel reinforcement bars (a.k.a. “rebar”) within the mold cavity prior to the pouring of wet concrete. Such slab bolsters become embedded within the cured concrete but include support legs that intersect the lower surface of the cured concrete element. The exposed support leg ends may corrode due to exposure to the environment, creating an expanded, porous oxide that fractures the concrete and permits the infiltration water, oxygen, salts, and the like, potentially leading to corrosion of the embedded rebar and compromise of the design strength of the concrete element. Molded polymer caps may be placed over the ends of such support legs to minimize the potential for corrosion and infiltration. Such caps typically include an internal cavity sized to match the end of the slab bolster support leg and frictionally engage that leg through an interference-type fit. However, such caps are vulnerable to cracking, splitting, and retention failure due to the means of attachment as well as differential expansion/contraction between the polymer cap and metal support leg end during temperature swings at the construction site. The interference fit between the cap and the metal support leg generates substantial hoop stresses that are magnified by the dynamic heating and cooling of the connected materials during the day/night cycle and during changes in the weather.

[0003] During the intermediate stages of construction, portions of the rebar emplaced in an earlier-constructed structural element, such as a footing or a slab, may project outward or upwards from the element to leave a free end for interconnection with rebar in other structural elements. The projecting rebar may be spliced or otherwise connected to rebar that will be emplaced within a later-constructed structural element, such as a load bearing wall. However until construction commences on the later-constructed element, the free end of the rebar presents a hazard to workers who may fall onto it or otherwise contact it while performing other construction activities. To prevent worker injuries various rebar protective caps or rebar safety caps having large, sometimes flexible or collapsible heads may be placed over the free end of the rebar to alter impact forces and prevent impalement. Such rebar protective caps may include conformable internal fins permitting the caps to be used on a range of rebar sizes, however these designs require a worker to simultaneously twist and press the cap onto the rebar end in order to deflect the fins and bring them into contact with the side surfaces of the rebar. An example of a rebar protective cap is illustrated in U.S. Pat. No. 6,857,235, the entire contents of which are incorporated herein by reference.

[0004] There is a need for a molded polymer cap for slab bolsters and other reinforced concrete construction accessories which does not rely upon an internal cavity creating an interference-type fit with as a means for retention upon the accessory, and which reduces the hoop stresses within the cap to reduce the incidence of cracking, splitting, and retention failure in such caps. There is a further need for a molded polymer cap that may be applied by workers or automated machinery while preserving the simple, linear application method used with the above-described prior art molded polymer caps. There is also a need for a rebar protective cap or rebar safety cap having conformable internal structure that does not require a twisting motion for proper application of the cap over rebar.

SUMMARY

[0005] An aspect of the disclosure relates to a molded polymer cap generally including a hollow body defining a central channel, a closed cap end, an open receiving end, and a plurality of resilient internal fins. A first portion of each internal fin runs longitudinally down the body from the closed cap end toward the open receiving end, extending laterally inward from the body into the central channel. These first portions resiliently deflect toward the body to contact to the side surfaces of an inserted object, with the broad sides of the fins frictionally engaging the side surfaces of the object to retain the cap on the object. A second portion of each internal fin runs partially longitudinally and partially laterally down the body from the end of the first portion toward the receiving end of the device, extending laterally inward from the body into the central channel. The configuration of the second portion exposes a broad side of each fin to the advancing end of an inserted object, enabling the forward motion of the object to deflect the fins toward the body for engagement with the sides of the object. The first and second portions of each internal fin are connected to each other, so that the deflection will propagate ahead of the advancing end of the object, eliminating the potential for a blocking interference between an end of a fin and the end of the object.

[0006] A further aspect of the disclosure relates to a slab bolster incorporating the molded polymer cap.

[0007] A further aspect of the disclosure relates to a rebar protective cap generally including a collar defining a central channel, a protective cap end, an open receiving end, and a plurality of resilient internal fins. A first portion of each internal fin runs longitudinally down the collar from the closed cap end toward the open receiving end, extending laterally inward from the collar into the central channel. These first portions resiliently deflect toward the collar to contact to the side surfaces of inserted rebar, with the broad sides of the fins frictionally engaging the side surfaces of the rebar to retain the cap on the end of the rebar. A second portion of each internal fin runs partially longitudinally and partially laterally down the collar from the end of the first portion toward the receiving end of the device, extending laterally inward from the collar into the central channel. The configuration of the second portion exposes a broad side of each fin to the advancing end of an inserted object, enabling the forward motion of the rebar to deflect the fins toward the body for engagement with the sides of the rebar. The first and second portions of each internal fin are connected to each other, so that the deflection will propagate ahead of the rebar, eliminating the potential for a blocking interference between an end of a fin and the end of the rebar.
BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. 1 is an entry view of a molded polymer cap illustrating internal fins having a partially helical configuration;

[0009] FIG. 2 is a cross-sectional view of the molded polymer cap of FIG. 1 illustrating internal fins first running longitudinally down the cap and second running helically down the cap toward the receiving end;

[0010] FIG. 3 is an entry view of a rebar protective cap illustrating internal fins having a partially helical configuration;

[0011] FIG. 4 is a cross-sectional view of the rebar protective cap of FIG. 3 illustrating internal fins first running longitudinally down the cap and second running helically down the cap toward the receiving end; and

[0012] FIG. 5 is a perspective view of a slab bolster combinable with the molded polymer cap of FIGS. 1 and 2.

DETAILED DESCRIPTION

[0013] A first aspect of a molded polymer cap, generally designated 50, is shown in FIGS. 1 and 2. The molded polymer cap 50 includes a hollow body 52 defining a central channel 60, the closed cap end 54, an open receiving end 56, and a plurality of resilient internal fins 58 each having at least two different alignments for releasably engaging the sides of an inserted object such as a slab bolster leg end or a rebar end.

[0014] The plurality of resilient internal fins 58 comprises a first portion 62 running longitudinally down the body 52 from the cap end 54 toward the receiving end 56 and extending laterally inward from the body 52 into the central channel 60 and a second portion 64 running partially longitudinally and partially laterally down the body 52 from the first portion 62 toward the receiving end 56 and extending laterally inward from the body 52 into the central channel 60. The second portion 64 may be said to have a helical configuration. The first portion 62 preferably, but not necessarily, extends laterally but not radially inward into the central channel 60 to maximize the useful range of distortion of the fins 58 while accommodating a predetermined range of sizes and shapes of inserted material. The body may preferably, but not necessarily, define a frusto-conical entry 68 at the receiving end to ease the automated application of the cap on an object such as a slab bolster leg end when a single size or narrow range of sizes of inserted material will be capped by the device.

[0015] The first portion 62 of each internal fin 58 resiliently deflects toward the body 52 to conform to sides of an inserted object, with the broad sides of the fins of the first portion 62 frictionally engaging the side surfaces of the object. This means for retention enables the cap 50 to be placed over various sizes and shapes of inserted material, e.g., slab bolsters constructed from different sizes of metal rod, and also causes the stresses caused by thermal expansion/contraction in the cap material and inserted material to be distributed primarily as elastic deformation stress within the internal fins 58 rather than as hoop stress within the body 52 of the cap.

[0016] The helical configuration of the second portion 64 of each internal fin 58 exposes a broad side of each fin to the advancing end of an inserted object, thereby allowing the forward motion of the object to deflect the second portion 64 toward the body 52. The second portion 64 and first portion 62 of each internal fin 58 are connected to each other so that the deflection of the second portion 64 will cause a deflection of the first portion 62, enabling the deflection to propagate ahead of the advancing object, thereby eliminating the potential for a blocking interference between an end of a fin 58 and the end of object. This configuration permits a molded polymer cap to be placed over the end of an object such as a slab bolster support leg using automated, linearly reciprocating machinery like that used with molded polymer caps lacking an internal fin structure. In molded polymer caps lacking fins with a helical configuration, such automated machinery would need to simultaneously twist and press the cap onto the slab bolster support leg end to create an initial deflection of the fins 58, or risk crushing, tearing, or otherwise damaging the fins, thereby increasing the risk of retention failure and the time spent by construction workers in assuring that a molded polymer cap is still in place at various stages in the construction process.

[0017] A second aspect of a molded polymer cap, generally designated 150, is shown in FIGS. 3 and 4. The molded polymer cap 150 includes a hollow collar 152 defining a central channel 160, a protective cap end 154, an open receiving end 156, and a plurality of resilient internal fins 158 each having at least two different alignments for releasably engaging the sides of projecting end of rebar.

[0018] The plurality of resilient internal fins 158 comprises a first portion 162 running longitudinally down the collar 152 from the protective cap end 154 toward the receiving end 156 and extending laterally inward from the collar 152 into the central channel 160, and a second portion 164 running partially longitudinally and partially laterally down the collar 152 from the first portion 162 toward the receiving end 156 and extending laterally inward from the collar 152 into the central channel 160. The second portion 164 may be said to have a helical configuration. The first portion 162 preferably, but not necessarily, extends laterally but not radially inward into the central channel 160 to maximize the useful range of distortion of the fins 158 while accommodating a predetermined range of sizes of rebar.

[0019] The first portion 162 of each internal fin 158 resiliently deflects toward the collar 152 to conform to sides of inserted rebar, with the sides of the fins of the first portion 162 frictionally engaging the side surfaces of the rebar. This means for retention enables the cap 150 to be placed over various sizes of rebar, e.g., #4 to #9 rebar.

[0020] The helical configuration of the second portion 164 of each internal fin 158 exposes a broad side of each fin to the inserted rebar, thereby allowing the forward motion of the rebar to deflect the second portion 164 toward the collar 152. The second portion 164 and first portion 162 of each internal fin 158 are connected to each other so that the deflection of the second portion 164 will cause a deflection of the first portion 162, enabling the deflection to propagate ahead of the rebar end, thereby eliminating the potential for a blocking interference between an end of a fin 158 and the rebar end. This configuration permits a rebar protective cap to be placed over the end of rebar using a single-handed, generally linear pushing motion, rather than a single-handed, combined twisting and pushing motion or a two-handed, combined twisting and pushing motion that may be disfavored as being significantly slower than a single-handed placement technique.

[0021] The protective cap end 154 of the device may include any of a number of rebar protective cap or rebar safety cap top constructions known in the art. Such protective caps most typically include cap portion 170 oriented substantially perpendicularly to the collar structure and extending laterally beyond the collar structure, preferably defining a top surface having an area of at least 16 square inches, and a barrier 172
embedded within or coupled to the cap portion 170 to prevent rebar from penetrating the protective cap end 154 and impaling a falling worker.

[0022] These molded polymer caps 50, 150 described herein may be made from a wide variety of injection moldable polymer materials, including materials containing colorants, UV inhibitors, and various non-polymer additives, depending on the specific physical, chemical, and electrical properties desired for a particular application.

[0023] While the present invention has been described in detail and with particular reference to illustrated embodiments, it is to be understood that other variations in the form and details which are within the spirit and scope of the invention are not specifically addressed. Therefore the invention is to be limited only by the appended claims.

What is claimed is:

1. A molded polymer cap for attachment to a reinforcing accessory support leg, the cap comprising:
   a. a hollow body defining a central channel;
   b. a closed cap end;
   c. an open receiving end; and
   d. a plurality of resilient internal fins, wherein a first portion of each internal fin runs longitudinally down the body from the closed cap end toward the open receiving end, and a second portion of each internal fin runs partially longitudinally and partially laterally down the body from the end of the first portion toward the receiving end of the device.

2. The molded polymer cap of claim 1, wherein the first portion of each internal fin extends laterally inward from the body into the central channel and resiliently deflects toward the body, whereby the broad sides of the fins frictionally engage the side surfaces of an inserted object to retain the cap on the object.

3. The molded polymer cap of claim 2, wherein the first portion of each internal fin extends laterally but not merely radially inward from the body into the central channel.

4. The molded polymer cap of claim 1, wherein the second portion of each internal fin extends laterally inward from the body into the central channel, exposing a broad side of each fin to the advancing end of an inserted object, whereby forward motion of the object deflects the fins toward the body for engagement with the side surfaces of the inserted object.

5. The molded polymer cap of claim 1, wherein the first portion of each internal fin is integrally connected to the second portion of the respective fin, whereby a deflection will propagate ahead of an advancing end of an inserted object and cause a deflection of the first portion of the internal fin.

6. The molded polymer cover of claim 1, wherein the second portions of the internal fins have a helical configuration.

7. The molded polymer cover of claim 1, wherein the body defines a frusto-conical entry adjacent the receiving end of the cap.

8. A slab bolster for positioning steel reinforcing bars within a concrete mold, the slab bolster comprising:
   a. a bridge for supporting steel reinforcing bars; at least one supporting leg for elevating the bridge above a surface, the leg including a surface engaging end; and a molded polymer cap placed over the surface engaging end, the molded polymer cap further comprising:
   b. a hollow body defining a central channel;
   c. an open receiving end; and
   d. a plurality of resilient internal fins, wherein a first portion of each internal fin runs longitudinally down the body from the closed cap end toward the open receiving end, and a second portion of each internal fin runs partially longitudinally and partially laterally down the body from the end of the first portion toward the receiving end of the device, at least the first portion of each internal fin frictionally engaging the surface engaging end of the supporting leg.

9. A rebar protective cap for placement over the end of a projecting portion of rebar, the cap comprising:
   a. a collar defining a central channel;
   b. a protective cap end;
   c. an open receiving end; and
   d. a plurality of resilient internal fins, wherein a first portion of each internal fin runs longitudinally down the collar from the closed cap end toward the open receiving end, and a second portion of each internal fin runs partially longitudinally and partially laterally down the collar from the end of the first portion toward the receiving end of the device.

10. The rebar protective cap of claim 9, wherein the first portion of each internal fin extends laterally inward from the collar into the central channel and resiliently deflects toward the collar, whereby the broad sides of the fins frictionally engage the side surfaces of inserted rebar to retain the cap on the end of the rebar.

11. The rebar protective cap of claim 10, wherein the first portion of each internal fin extends laterally but not merely radially inward from the collar into the central channel.

12. The rebar protective cap of claim 9, wherein the second portion of each internal fin extends laterally inward from the collar into the central channel, exposing a broad side of each fin to the advancing end of inserted rebar, whereby forward motion of the rebar deflects the fins toward the collar for engagement with the sides of the rebar.

13. The rebar protective cap of claim 9, wherein the first portion of each internal fin is connected to the second portion of the respective fin, whereby a deflection will propagate ahead of inserted rebar and cause a deflection of the first portion of the internal fin.

14. The rebar protective cap of claim 9, wherein the second portions of the internal fins have a helical configuration.

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