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Smith et al.

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(54) **SWIVEL HOOK**

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(52) **U.S. Cl.** **24/599.1**; 24/598.4; 24/598.7

(58) **Field of Search** ..... 24/298–302, 68 CT, 24/68 TT, 165, 265 H, 369–376, 378.1, 598.4, 598.7, 905, 599.1–600.2, 600.4–601.2, 907; 59/84–87; 294/82.17, 82.21, 82.23, 82.24, 82.27, 82.31, 82.33, 82.34

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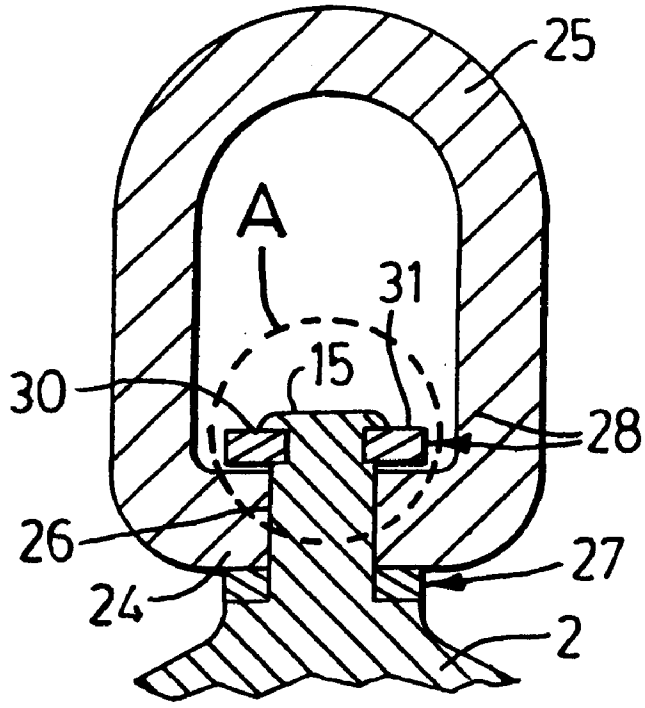
(57) **ABSTRACT**

A swivel hook is described that is comprised of a hook body and a swivel connector. The hook body has a generally uniform thickness and is stamped from a sheet of material. A hook member formed at a first end and a longitudinally oriented stem, having a generally rectangular cross-section, formed at a second opposite end of the hook body. The swivel connector is pivotally securable over the stem and formed from a forged metal. The swivel connector has a generally circular bore of a size exceeding the rectangular cross-section of the stem such that the stem may be received through the bore to secure the swivel connector to the hook body while permitting rotational movement of the swivel connector about the stem. Also described is a method of constructing a swivel hook.

12 Claims, 5 Drawing Sheets



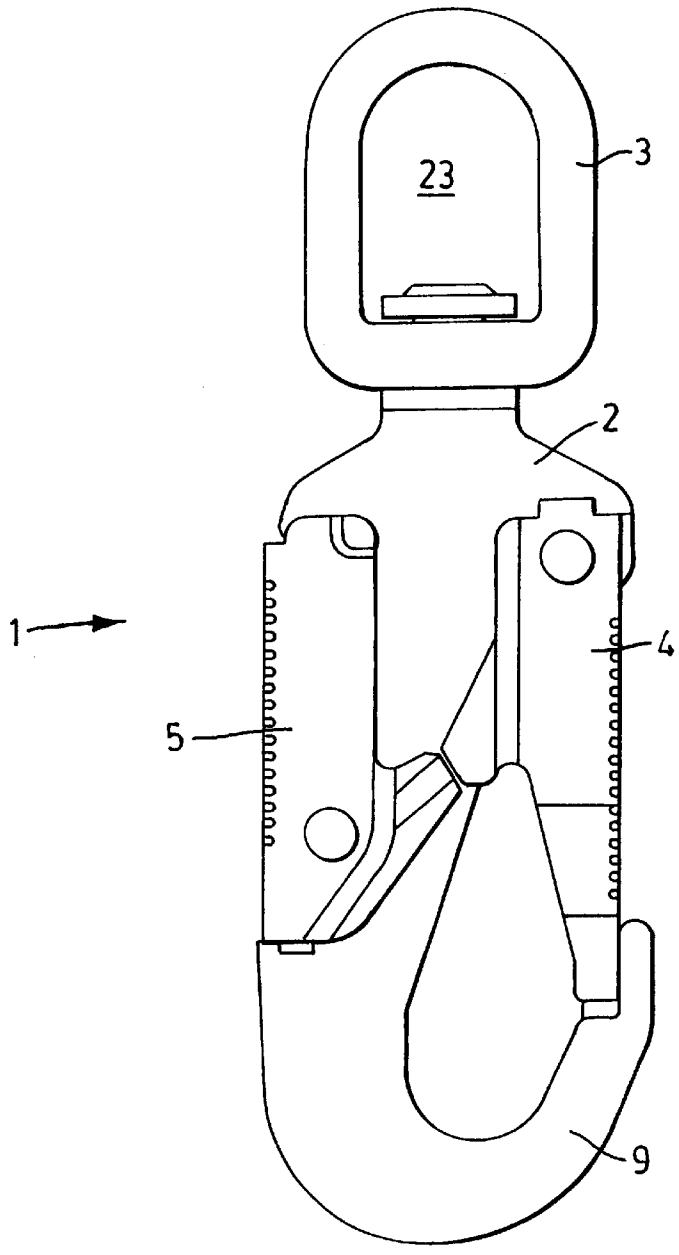


FIG. 1

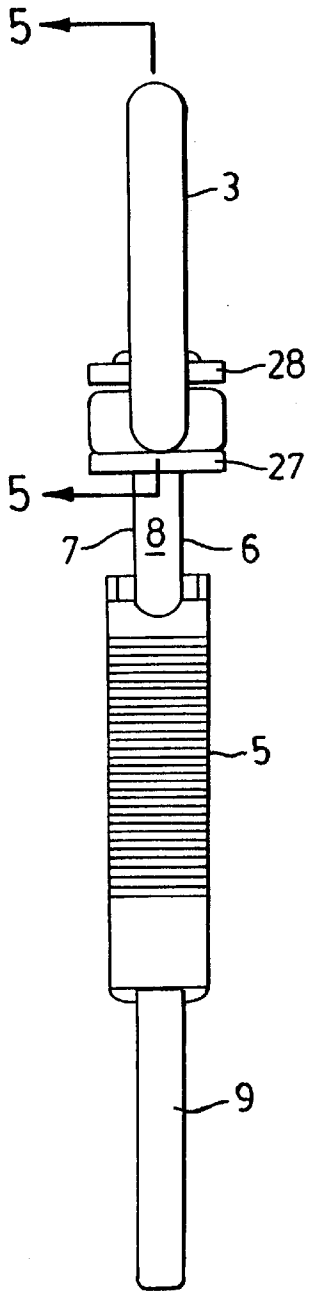


FIG. 2

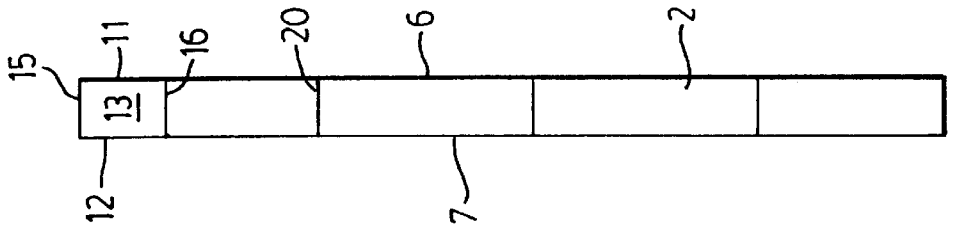


FIG.4

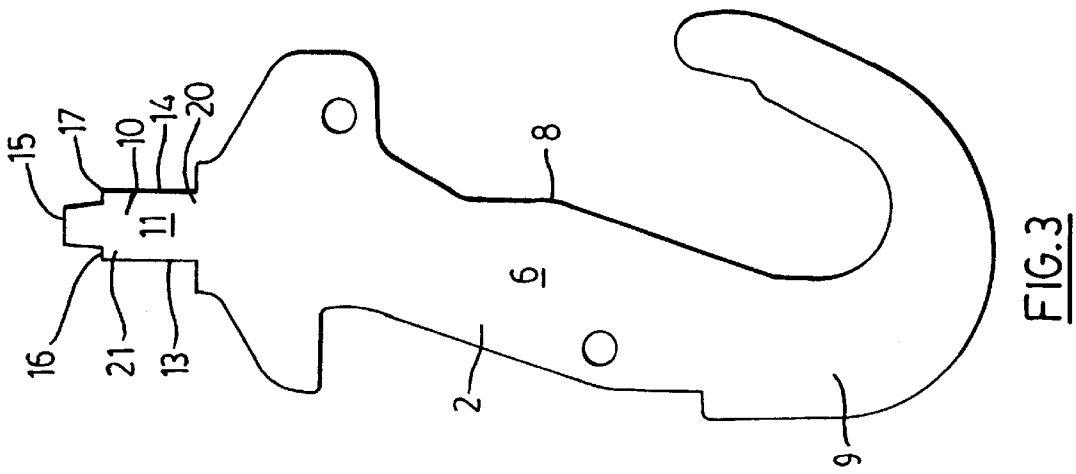


FIG.3

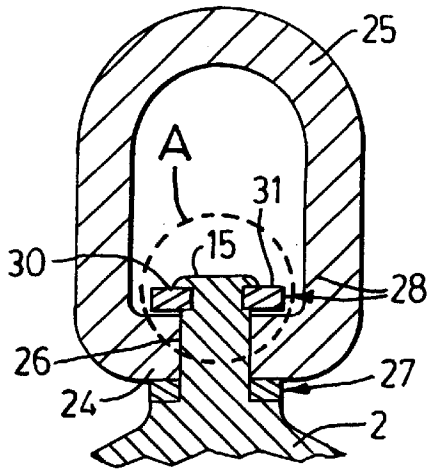


FIG.5

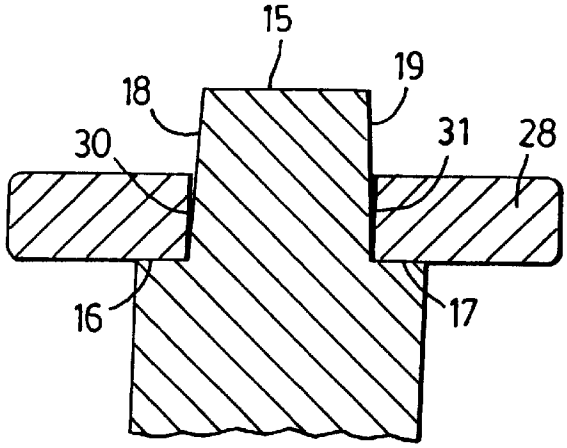


FIG.10

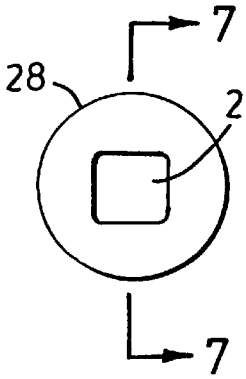


FIG.6

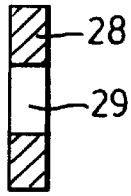


FIG.7

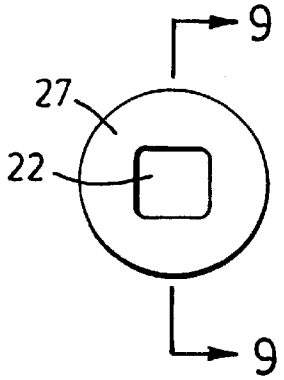


FIG.8

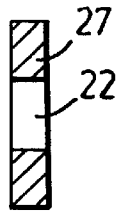


FIG.9

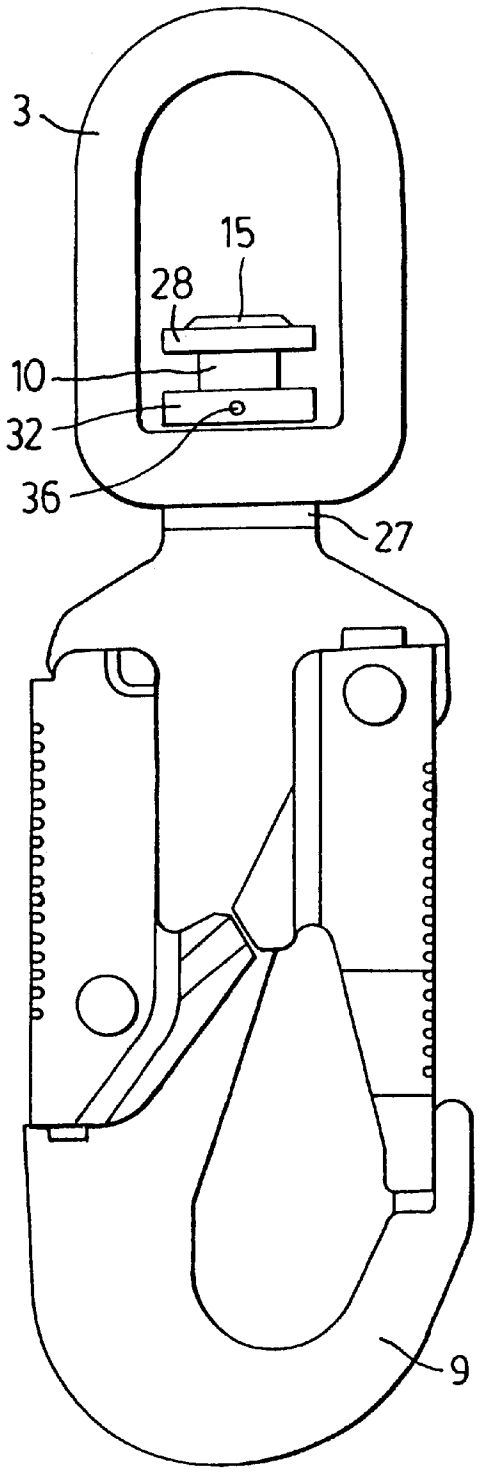


FIG. 11

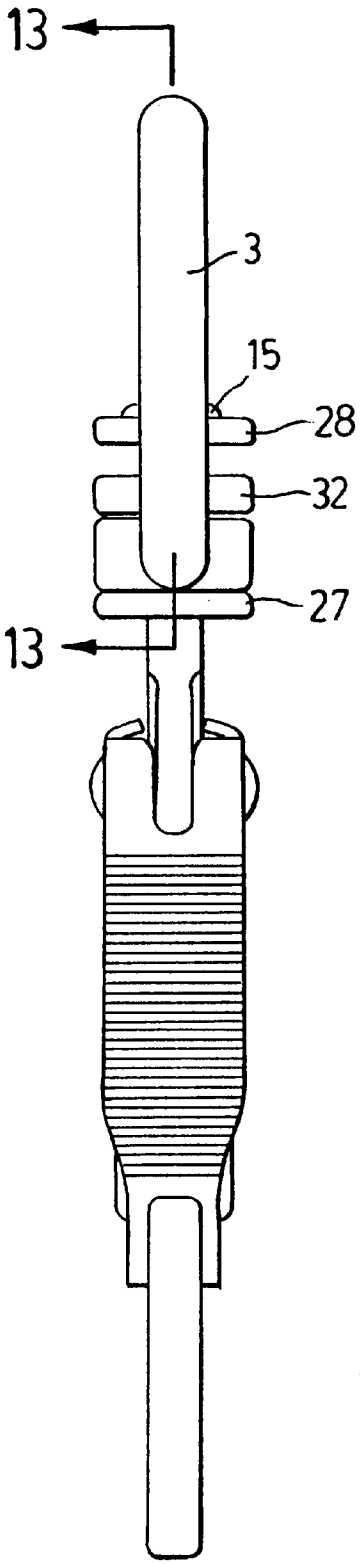


FIG. 12

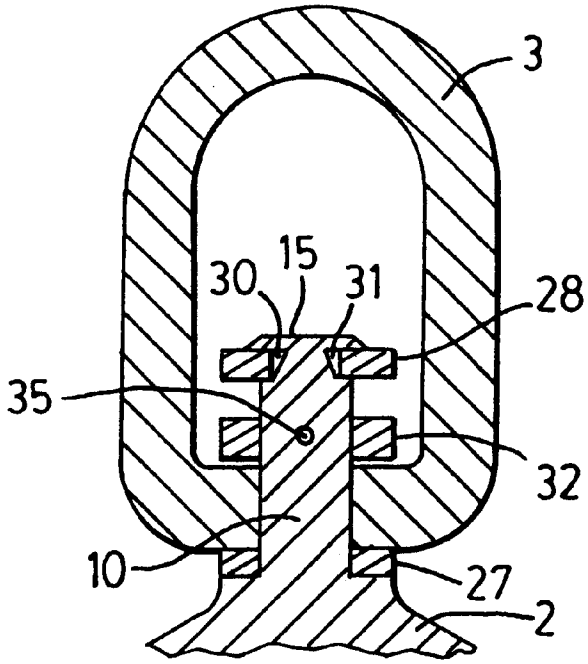


FIG. 13

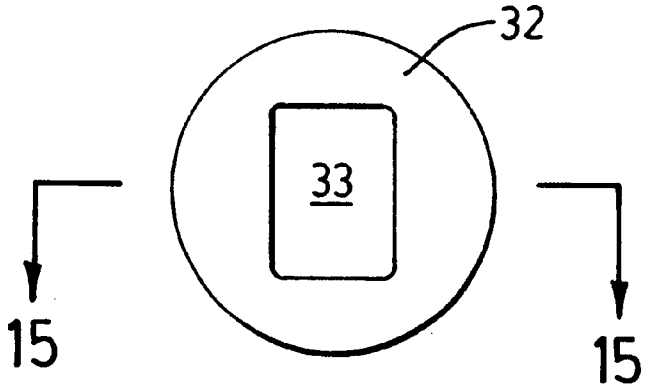


FIG. 14

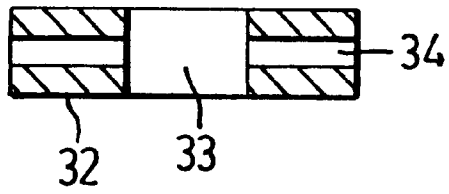


FIG. 15

SWIVEL HOOK

FIELD OF THE INVENTION

This invention relates generally to swivel hooks, and more particularly a new and improved swivel hook and its method of manufacture.

BACKGROUND OF THE INVENTION

Lifting and safety hooks have a wide range of applications in a vast array of industries and recreational pursuits. While there are many different types of hooks that have been designed for many different applications, one particular commonly used hook is known as a swivel hook. In general, a swivel hook comprises a primary body having a hook member at one end and a rotatable or pivotal swivel eye, connector or clevis at the opposite end. Use of the hook enables a load that is secured to the hook portion to be rotated independently of the rope, cable, strap or other tethering apparatus attached to the hook by way of the swivel eye. The ability of its hook portion to rotate independently of its connecting eye makes a swivel hook highly desirable where there is need to prevent rotational movement and/or forces from being transferred from the hook body through to the rope, cable or tether to which the hook is attached. Swivel hooks allow for the accommodation of rotational forces that may be applied to the hook body without the necessity of using intervening devises or swivel connectors. Depending upon the application, the hook may also be equipped with a gatekeeper and one or more of a variety of locking mechanisms to prevent accidental opening of the gatekeeper.

Typically the primary components of a hook are formed from parts that are made by way of either a forging or a stamping process. Traditionally, where a high strength product is required the primary components would have been forged. Forging generally results in a high strength product capable of withstanding significant tensile and/or compressive loading. In contrast, hooks formed from components manufactured through stamping processes are generally limited to loads significantly less than those that may be borne by forged hooks. However, stamped hooks have the advantage of often being lighter and less costly to manufacture.

The fact that stamped hooks are generally less costly to manufacture, together with the realization that although not having the strength of a forged product they nevertheless have more than sufficient strength for a wide variety of applications, has made stamped hooks a desirable alternative to more traditional forged products. Unfortunately an inherent limitation within the stamping process that is carried through to the end product resides in the fact that stamping involves stamping or punching a particular shape from a blank sheet of material. Accordingly, the punched or stamped product is planer in nature, of a relatively constant thickness, and has square side walls that are generally perpendicular to the upper and lower surfaces. Forming rounded edges, posts, or other 3-dimensional features typically requires subsequent machining, which can add significantly to the overall manufacturing costs. Furthermore, while stamped products often exhibit relatively good strength characteristics in compression and tension, their planer nature and uniform thickness often presents a significant limitation with respect to their ability to withstand torsional stress. On the other hand forging permits a wide variety of 3-dimensional design features to be incorporated into the hook, including design features that enhance torsional loading characteristics.

SUMMARY OF THE INVENTION

The invention therefore provides a hook that addresses a number of the limitations associated with existing hooks through providing a hook body that may be formed from a stamping process and that is capable of receiving a swivel, connector or clevis thereon without the need for subsequent machining.

Accordingly, in one of its aspects the invention provides A swivel hook comprising a hook body having a generally uniform thickness and stamped from a sheet of material, said hook body having a hook member formed at a first end and a longitudinally oriented stem formed at a second opposite end, said stem having a generally rectangular cross-section; and, a swivel connector pivotally securable over said stem and formed from a forged metal, said swivel connector having a generally circular bore of a size exceeding the rectangular cross-section of said stem such that said stem may be received through said bore to secure said swivel connector to said hook body while permitting rotational movement of said swivel connector about said stem.

In a further aspect the invention provides swivel hook comprising a hook body having a generally uniform thickness and formed by way of a stamping operation, said hook body having a hook member formed at a first end and a generally rectangular, longitudinally oriented, stem formed at a second opposite end, a connector securable over said rectangular stem, said connector having a bore therethrough for receiving said rectangular stem and for securing said connector to said hook body, said connector permitting said hook body to be attached to a rope, cable or tether; and, first and second washers, said first washer received over said rectangular stem between said hook body and said connector and said second washer received over said rectangular stem between said connector and the end of said stem with a portion of the end of said stem extending through said second washer, said second washer secured to said stem and retaining said connector and said first washer in place about said stem, said first and second washers assisting in the transference of torsional loading between said hook body and said connector and tending to maintain said hook body and said connector in a co-planer relationship.

In yet a further embodiment the invention provides a method of constructing a swivel hook, the method comprising: forming a hook body by way of a stamping process wherein the hook body is stamped from material having a generally uniform thickness, said hook body formed with a hook member at a first end and a generally rectangular, longitudinally oriented, stem at a second opposite end, said rectangular stem having a base portion connecting said stem to said hook body and an end portion that terminates in an outwardly disposed tip; forming a swivel connector by means of a forging process, said swivel connector having a first end securable over said rectangular stem of said hook body and a second end adapted to secure said swivel connector to a rope, cable, tether or object, said first end of said swivel connector having a generally circular bore therethrough for receiving said rectangular stem of said hook body, said bore dimensioned so as to permit rotational movement of said swivel connector about said rectangular stem when received thereon; placing a first washer having a rectangular shaped right angled bore over said stem; inserting said rectangular stem through said circular bore in said first end of said swivel connector; placing a second washer

having a generally rectangular shaped right angled bore over said rectangular stem and into abutment with said swivel connector with the end of said stem extending through said second washer; and, thereafter, peening said tip of said rectangular stem extending through said second washer to secure said second washer in place over said rectangular stem.

Further aspects and advantages of the invention will become apparent from the following description taken together with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the present invention, and to show more clearly how it may be carried into effect, reference will now be made, by way of example, to the accompanying drawings which show the preferred embodiments of the present invention in which:

FIG. **1** is a front view of a swivel hook according to one embodiment of the present invention;

FIG. **2** is a left side view of the hook shown in FIG. **1**;

FIG. **3** is a front view of the hook body of the hook shown in FIG. **1**;

FIG. **4** is a left side view of the hook body shown in FIG. **3**;

FIG. **5** is a longitudinal sectional view taken along the line **5**—**5** of FIG. **2**;

FIG. **6** is a top plan view of the upper or second washer of the hook shown in FIG. **1**;

FIG. **7** is a sectional view taken along the line **7**—**7** of FIG. **6**;

FIG. **8** is a top plan view of the lower or first washer of the hook shown in FIG. **1**;

FIG. **9** is a sectional view taken along the line **9**—**9** of FIG. **8**;

FIG. **10** is a detail view of area "A" of the stem portion of the hook body shown in FIG. **3** having the upper or second washer received thereover;

FIG. **11** is a front view of an alternate embodiment of the hook shown in FIG. **1**;

FIG. **12** is a right side view of the hook shown in FIG. **11**;

FIG. **13** is a longitudinal sectional view taken along the line **13**—**13** of FIG. **12**;

FIG. **14** is a top plan view of the strain gauge of the hook shown in FIG. **11**; and,

FIG. **15** is a sectional view taken along the line **15**—**15** of FIG. **14**.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention may be embodied in a number of different forms. However, the specification and drawings that follow describe and disclose only some of the specific forms of the invention and are not intended to limit the scope of the invention as defined in the claims that follow herein.

In the attached drawings the swivel hook according to one embodiment of the invention is noted generally by reference numeral **1**. Hook **1** is comprised primarily of a hook body **2** and a swivel connector **3**. Swivel connector **3** may take the general form of a swivel eye (as shown). However, in alternate embodiments of the invention the connector could be in the form of a clevis or other form of mechanism allowing hook **1** to be secured to a rope, chain, cable, tether strap, or other object or device. In the version of the hook shown in the drawings there is included a gatekeeper **4** and a locking member **5**. The existence or absence of a gatekeeper and/or one or more locking members is not an essential feature of the invention and it will be appreciated that any variety of commonly used gatekeepers and/or locking devices could be utilized without affecting the scope of the invention. Alternatively, hook body **2** could be assembled without any gatekeepers or locking members if such mechanisms are not necessary for the desired end use of the hook

According to the present invention hook body **1** is formed through a stamping process by which the hook body is stamped or punched from a sheet of stock material. Preferably such material is comprised of a relatively high strength metallic alloy in order to provide the stamped product with a sufficient degree of tensile and compressive strength for the application for which it is intended. The formation of the hook body may be accomplished through the use of any one of a variety of commonly used stamping processes, including through the use of a specifically designed set of dies and a traditional stamping press. Through the formation of hook body **1** in such a manner it will be understood by those skilled in the art that the hook body will be of a generally constant thickness having a relatively planer upper surface **6** and lower surface **7**, with side surfaces **8** extending therebetween at generally right angles.

During the formation of hook body **1**, a hook member **9** is created at a first end and a generally rectangular, longitudinally oriented, stem **10** is formed at an opposite second end. As shown in FIGS. **3** and **4**, stem **10** is generally rectangular in cross-section with flat, planer, upper and lower surfaces **11** and **12**. Due to the nature of the stamping process, stem **10** also has relatively flat, planer, side surfaces **13** and **14** that intersect surfaces **11** and **12** at generally right angles. It is expected that in most applications the width of the upper and lower surfaces of stem **10** will exceed the height of the respective side surfaces such that the major axis of the rectangular cross-section of stem **10** will be parallel to the upper and lower surfaces of the hook body.

Referring to FIG. **3**, stem **10** has a base portion **20** at its point of intersection with hook body **2**, and an outer end portion **21** that terminates in a tip **15**. End portion **21** includes a necked down section of reduced width that forms a pair of inwardly disposed shoulders **16** and **17** on each side of the stem. In one preferred embodiment the portion of stem **10** extending beyond shoulders **17** and **16** has inwardly tapered side surfaces **18** and **19** that terminate in tip **15**. The tapering of side surface **18** and **19** provide tip **15** with a generally square cross-sectional configuration. It will be appreciated that the relative length of stem **10** may vary depending upon the size and nature of the swivel connector to be attached to hook body **2**. That is, stem **10** could be relatively longer or shorter than the embodiment shown in the attached drawings.

In FIGS. **1**, **2** and **5**, swivel connector **3** is shown as comprising a swivel eye that is pivotally securable over rectangular stem **10** to provide a means to attach the hook to a cable, rope, strap, etc. Preferably swivel connector **3** is formed from a forged high strength metal having a generally smooth and round exterior surface. As will be appreciated, if swivel connector **3** were formed by way of a stamping process it would contain relatively sharp, right angled surfaces that could cause uneven loading and accelerated wear upon a rope, cable or strap attached thereto. For that reason where swivel connectors or swivel eyes are formed through stamping, typically they must undergo further machining to smooth out such sharp right angled surfaces, thereby adding to the cost of manufacturing such a product.

A forged swivel connector has the further advantage of providing a component having generally superior tensile and compressive loading capabilities, exceeding those of standard stamped or punched products. Since to a large extent the central portion **23** of the swivel connector will be open to allow for the accommodation of a cable, rope etc., the lack of a substantially solid body structure favours a stronger forged product over that that as may be formed by stamping or punching.

In the embodiment shown in the attached drawings, swivel connector **3** has a generally square first end **24** and a rounded or looped second or outer end **25**. Rounded end **25** is adapted to receive a rope, cable, or strap thereon, whereas square end **24** preferably includes a generally circular bore **26** of a size that exceeds the rectangular crosssectional dimensions of stem **10** such that the rectangular stem may be received through the circular bore. The diameter of bore **26** relative to the rectangular dimension of stem **10** permits rotational movement of swivel connector **3** about the stem. Preferably circular bore **10** is centrally located along square end **24** of swivel connector **3** to prevent wobbling of the swivel connector as it rotates about stem **10**.

Hook **1** further includes first and second washers **27** and **28** respectively. Washers **27** and **28** are preferably formed from a high strength metallic compound and have centrally located, generally rectangular shaped, right angled bores **22** and **29**, respectively, extending therethrough. Bores **22** and **29** are dimensioned so as to permit washers **27** and **28** to be received over rectangular stem **10** while preventing rotational movement of the washers relative to the stem.

As is once again illustrated in FIGS. **1**, **2** and **5**, in the preferred embodiment rectangular washers **27** and **28** are received over rectangular stem **10** on opposite sides of swivel connector **3**. Specifically, first washer **27** is received between hook body **2** and swivel connector **3** while second washer **28** is received over stem **10** between the swivel connector and the end of the rectangular stem, with the tip and a portion of the end of the stem extending through second washer **28**. Assembled in this fashion washers **27** and **28** will present a bearing surface against which swivel connector **3** can ride and rotate when under tensile or compressive loading. Rotation of the relatively hard, high strength, forged swivel connector will thus cause minimal wear of hook body **2** or rectangular shaft **10** with the primary rotational movement being and associated friction and wear borne directly by washers **27** and **28**. The washers will also present a smooth surface against which swivel connector **3** may rotate making rotation of the connector easier and smoother than would otherwise be the case if the connector was merely allowed to ride against the side surfaces of the hook body.

First and second washers **27** and **28** also add a **3**-dimensional aspect to rectangular stem **10** that further enhances the ability of the stem to permit rotational movement and to accept torsional loading. That is, since hook body **2** is formed from a stamping process it is of a generally constant thickness. Without subsequent machining the hook body is generally limited to 2-dimensional structural features. The placement of first and second washers **27** and **28** about rectangular stem **10** on either side of swivel connector **3** essentially permits the rectangular stem to function as a 3-dimensional shaft having a generally circular cross-section, particularly where the washers do not rotate. Without the use of washers **27** and **28** any torsion between the hook body and swivel connector would be borne by a smaller aspect of rectangular stem **10**, increasing the likelihood of deformation and failure of the stem. Washers **27** and **28** also help to maintain the hook body and swivel connector in a generally co-planer relationship.

As discussed previously, stem **10** preferably includes a necked down portion of reduced width forming inwardly disposed shoulders **16** and **17** along the side surfaces of its outer end portion. Rectangular stem **10** is preferably of a sufficient length such that shoulders **16** and **17** are formed along the portion of the stem that protrudes through bore **26** of swivel connector **3**. The size of rectangular bore **29** through second washer **28** is such that when the second washer is received over the rectangular stem it abuts against shoulders **16** and **17**, with the tip portion **15** of stem **10** extending through bore **29**.

In the assembly of hook **1**, first washer **27** is placed over rectangular stem **10** after which the stem is fed through circular bore **26** in swivel connector **3**. The swivel connector abuts first washer **27** with shoulders **16** and **17** protruding through the swivel connector **3**. Placement of second washer **28** over the tip of the stem will then enable the second washer to abut against shoulders **16** and **17**. In one preferred embodiment of the invention the space between swivel connector **3** and second washer **28** when the second washer is resting against shoulders **16** and **17** is minimal in order to hold the swivel connector in place and prevent excessive longitudinal movement or travel along the stem.

With second washer **28** abutting shoulders **16** and **17**, the tip of the stem extending through the washer may be peened, pressed or otherwise deformed until it becomes flattened and extends radially beyond the limits of bore **29**. In this fashion it will be appreciated that second washer **28** will be prevented from sliding off the end of rectangular stem **10**, and as such the entire assembly will be held together. It will further be appreciated that sloped side surfaces **18** and **19** of the end portion of stem **10** will effectively extend through bore **29** of second washer **28** when the washer is received over the stem and abuts against shoulders **16** and **17**. In this manner, as shown more specifically in FIG. **10**, laterally positioned and opposed voids **30** and **31** will be formed between bore **29** and the respective tapered side surfaces **18** and **19** of the stem. The peening of tip **15** will thus have the result of deforming and driving material from the tip of the stem into voids **30** and **31**. Such material will effectively wedge second washer **2** against shoulders **16** and **17** and enhance both the attachment of the second washer about stem **10** and increase the maximum non-destructed tensile load to which the hook may be subjected. That is, the formation of voids **30** and **31**, and their filling of material from the tip of the stem after the tip has been peened or pressed against the second washer, acts as a mechanism by which the integrity of the bond between the stem and the second washer may be increased without the use of other more labour intensive or costly fastening devices or mechanisms.

An alternate embodiment of the invention is shown in FIGS. **11** through **15**. In these figures a strain gauge or strain indicator **32** is positioned about rectangular stem **10** in order to present a visual identifier in the event that the hook is subjected to a tensile load that exceeds a predetermined value. In the embodiment shown in the attached drawings the length of stem **10** has been extended with strain gauge **32** positioned between swivel connector **3** and second washer **28**.

Strain gauge **32** would typically comprise a component somewhat similar in overall structure and dimension to first washer **27**. Preferably strain gauge **32** will have a rectangular shaped right angled bore **33** that permits receipt of the

strain gauge over the stem but prevents its rotation. Strain gauge **32** includes a radial bore **34** extending through it that aligns with a correspondingly shaped bore **35** extending through stem **10**.

Bores **34** and **35** present an avenue for the insertion of a sheer pin **36** that secures strain gauge **32** to stem **10** and restricts axial movement or sliding of the strain gauge along the stem.

In the event that hook **1** is subjected to a tensile load that exceeds the sheer capacity of sheer pin **36**, the pin will fail permitting axial movement of the strain gauge (as well as the swivel connector) along the stem. The axial movement of the strain gauge and swivel connector presents a visual indication that the hook has been subjected to tensile load that either equals or exceeds a predetermined value. Such a visual indication will alert users of the hook that the structural integrity of the hook may have been compromised and that the hook should be replaced. The construction of sheer pin **36** can be altered in order to accommodate different sizes of hooks and the tensile load bearing capabilities of varying metallic alloys from which the hooks and their components may be constructed.

It is to be understood that what has been described are the preferred embodiments of the invention and that it may be possible to make variations to these embodiments while staying within the broad scope of the invention. Some of these variations have been discussed while others will be readily apparent to those skilled in the art.

We claim:

1. A swivel hook comprising:

(i) a hook body having a generally uniform thickness, said hook body having a hook member formed at a first end and a longitudinally oriented stem formed at a second opposite end, said stem having a generally rectangular cross-section;

(ii) a swivel connector pivotally securable over said stem, said swivel connector having a generally circular bore of a size exceeding the rectangular cross-section of said stem such that said stem may be received through said bore to secure said swivel connector to said hook body while permitting rotational movement of said swivel connector about said stem; and,

(iii) first and second washers received over said rectangular stem on opposite sides of said swivel connector, said washers assisting in the transference of torsional loading between said body and said swivel connector and tending to maintain said hook body and said swivel connector in a generally co-planer relationship.

2. The device as claimed in claim **1** wherein said first and second washers have generally rectangular shaped right angle bores therethrough, said bores permitting said washers to be received over said rectangular stem of said hook body but preventing rotational movement of said washers relative to said stem, said washers further presenting a bearing surface against which said swivel connector rides when rotating relative to said hook body.

3. The device as claimed in claim **2** wherein said first washer is received over said rectangular stem between said hook body and said swivel connector, said second washer received over said rectangular stem between said swivel connector and the end of said rectangular stem, a portion of said rectangular stem extending through said second washer.

4. The device as claimed in claim **3** wherein said end of said stem includes a necked down portion of reduced width forming an inwardly disposed shoulder on each side of said end, the length of said stem and the size of said rectangular shaped bore through said second washer dimensioned such that when said first washer, said swivel connector and said second washer are received over said stem said second washer abuts said inwardly disposed shoulders with a portion of said stem extending through said bore in said second washer.

5. The device as claimed in claim **4** wherein the portion of said stem extending through said bore in said second washer includes inwardly tapered side surfaces creating a laterally positioned void between said bore in said second washer and each of said inwardly tapered side surfaces of said portion of said stem extending through said second washer.

6. The device as claimed in claim **5** wherein said portion of said stem extending through said bore in said second washer is peened and deformed to secure said second washer about the end of said stem, said peening of said stem resulting in portions of the end of said stem being deformed and driven into said lateral voids between said second washer and said tapered side surfaces of said stem.

7. The device as claimed in claim **7** wherein the tip of said stem is substantially square in cross-section.

8. The device as claimed in claim **7** including a strain indicator positioned about said rectangular stem, said strain indicator presenting a visual indication in the event that said hook is subjected to a tensile load exceeding a pre-determined value.

9. The device as claimed in claim **8** wherein said strain indicator includes a radial bore therethrough that aligns with a correspondingly shaped bore through said stem when said strain indicator is received over said stem, said bores in said strain indicator and said stem presenting a means for insertion of a sheer pin through said strain indicator and said stem, said sheer pin restricting axial movement of said strain indicator along said stem such that upon the application of a pre-determined tensile load between said hook body and said swivel connector said sheer pin presents a visual indicator that said hook has been subjected to tensile loading that equals or exceeds said pre-determined load.

10. A swivel hook comprising;

(i) a hook body having a generally uniform thickness, said hook body having a hook member formed at a first end and a generally rectangular, longitudinally oriented, stem formed at a second opposite end,

(ii) a connector securable over said rectangular stem, said connector having a bore therethrough for receiving said rectangular stem and for securing said connector to said hook body, said connector permitting said hook body to be attached to a rope, cable or tether; and,

(iii) first and second washers, said first washer received over said rectangular stem between said hook body and said connector and said second washer received over said rectangular stem between said connector and the end of said stem with a portion of the end of said stem extending through said second washer, said second washer secured to said stem and retaining said connector and said first washer in place about said stem, said first and second washers assisting in the transference of torsional loading between said hook body and said connector and tending to maintain said hook body and said connector in a co-planer relationship.

11. The device as claimed in claim **10** wherein the said first and second washers have generally rectangular shaped right angled bores therethrough dimensioned to permit said washers to be received over said rectangular stem but to prevent rotational movement of said washers about said stem.

12. The device as claimed in claim 11 wherein said portion of said stem extending through said second washer has inwardly tapered side surfaces creating a lateral void between each side of said stem and said bore through said second washer, said lateral voids filled with material deformed and driven from said end of said stem upon the peening of said end, said material filling said voids enhancing the attachment of said second washer about said rectangular stem and increasing the maximum non-destructive tensile load to which said hook may be subjected.

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