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LIFT SLING CONSTRUCTION

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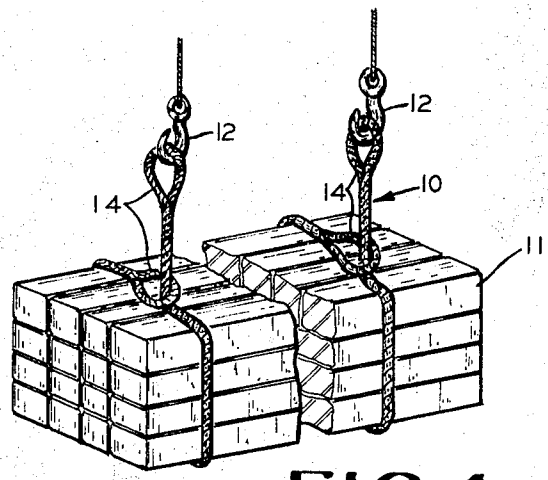


FIG. 1

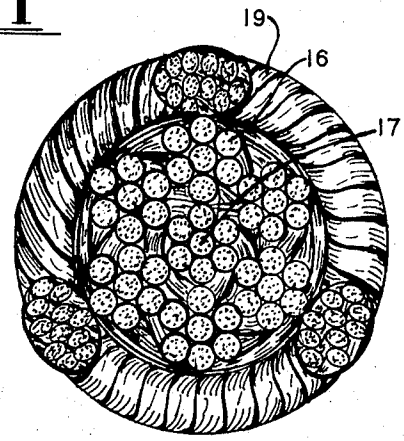


FIG. 2

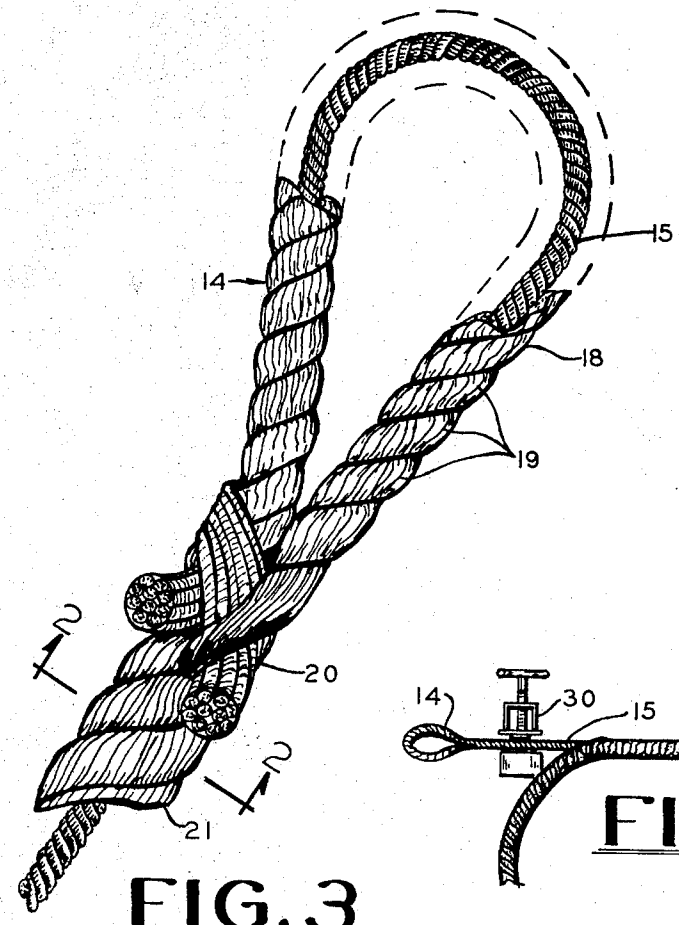


FIG. 3

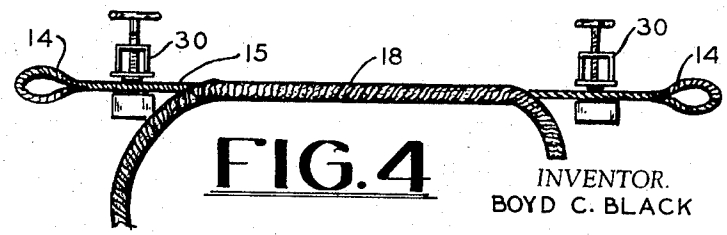


FIG. 4

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LIFT SLING CONSTRUCTION

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ABSTRACT OF THE DISCLOSURE

A composite sling construction for lifting heavy, easily damageable loads, such construction being two slings in one, namely; a high strength metal wire rope sling which is completely enclosed within an outer sling of softer fiber rope.

This invention is related to a new rope sling having a spliced metal wire loop within an outer spliced loop of softer rope material of natural or synthetic fibers.

Wire rope or cable slings, because of their high tensile strength, lend themselves admirably to handling of heavy apparatus and component parts in the order of 15 pounds or more. In addition, the adaptability of such slings to handling a wide range of loads both heavy and light, as well as both hot and cold, place them in the category approximating an all purpose sling. Such metallic slings have one important failing, however, in that when utilized in handling delicate loads, for example, perishable materials, or precision machine parts, or highly polished parts, their biting and abrasive character frequently requires that a substitute lift means be sought. Under such circumstances, less abrasive fiber ropes such as hemp or manila fiber ropes, or nylon or dacron fiber ropes are resorted to where possible because of their softer, less damaging nature when in stressed communication with the object to be lifted.

Such fiber ropes, however, also have limitations not only in their maximum stress capabilities, but also in their temperature characteristics when hot loads such as heated aluminum or heated steel in the order of 400° F. to 800° F. and above are to be lifted. The coarser metal wire ropes or cables in communication with metals at such temperatures often scratch the load materials, while natural fiber ropes smolder or burn progressively to a weakened condition with use, while ropes of synthetic materials such as nylon melt.

Still further fiber ropes, such as of manila or hemp, are subject to deterioration with age and the strength of ropes can, even without use, be weakened beyond use due to rot in a mere matter of thirty days.

In view of the foregoing it is an object of the present invention to provide a looped sling construction having not only both the high tensile strength and high temperature properties of wire cable slings, but also the softer non-abrasive characteristics of natural and synthetic fiber ropes, and at the same time providing a sling capable of widening the range of uses of the combination construction beyond the capabilities of looped slings made solely of either of such materials.

Another object of the present invention is to provide a looped sling structure which not only has the high tensile strength of metal slings, but also the softer cushioning and conformability without abrasion of synthetic or natural fiber slings.

Still another object of the present invention is to provide a sling having the non-abrasive character of soft rope constructions but also the high temperature, high strength characteristics of metallic sling constructions.

A still further object of the present invention is to

provide a composite sling construction spliced of both a wire cable and a softer outer rope over the wire cable, the latter of which, even though subject to deterioration will not weaken the overall structure and can be replaced over the wire cable when deteriorated beyond practical use.

A sling meeting the above objectives is produced according to the present invention by providing a composite construction incorporating both a loop of metal wire cable and a loop of softer rope fiber material, the spliced metal loop being fully enclosed within the exposed spliced softer fiber loop.

Features of the present invention lie in the mutually self-protective character of both the harder, stiffer sling which is resistant to damage due to deformation, and the outer sling of more cushionable material which is protective of the inner cable against crushing damage under sharp impact blows.

Another feature of the invention lies in recoverability of the inner cable sling after burning or wearing out, or deterioration in strength of the outer softer rope sling.

Still another, but no less important feature of the invention exists in the fact that the inner cable sling can be inspected for damage merely by temporarily untwisting the softer outer rope when outer indications suggest a possibility of interior damage.

Other objects and features which I believe characteristic of my invention are set forth with particularity in the appended claims. My invention, however, both in organization and manner of construction, together with further objects and features thereof, may be best understood by reference to the following description taken in connection with the accompanying drawings.

In the drawings:

FIG. 1 illustrates a pair of slings of the present invention used in carrying a load of metal bars shown in broken away form.

FIG. 2 is an enlarged view of a sling embodying the concepts of the present invention with sections of the exterior removed to show the interior high strength portion of the structure.

FIG. 3 is an enlarged cross sectional view of the sling structure of FIG. 2 as taken on line 3—3.

FIG. 4 illustrates, in general, the manner in which the sling construction of the present invention can be fabricated.

Referring to the drawings in greater detail, FIG. 1 illustrates a pair of clutch slings **10** of the present invention supporting a load of rectangular bars such as hot aluminum bars **11** such as are frequently handled at temperatures up to 600° F. or more and which accordingly are relatively soft and easily subject to deformation upon application of localized cable pressures such as are experienced during lifting. The bars **11** are stacked upon each other in side-by-side rows. To hold the bars in this stacked relation during lifting, the two slings **10** are wrapped around opposite ends of the stack, one eye **14** of each sling being passed through the eye at its opposite end and held by a crane hook **12**.

Slings of the general type herein disclosed are also used to lift machine parts such as by wrapping the sling in intimate contact with the machine part surfaces and supporting the load on a crane hook. Whether the slings are used to lift bars or delicate machine parts, slippage of conventional wire rope slings over the surfaces of the load often results in damage to the load, and after many such instances the sling itself becomes worn. In order to reduce such potential damage to loads and wearing of the sling, fiber rope slings are often used. Danger exists in the use of natural fiber rope slings, however, since mere aging of such slings results in a

reduction of strength and correspondingly results in danger of the load dropping during lifting. Where slings made of ropes of synthetic resin fibers are utilized in place of natural fiber rope slings, danger exists in that the resin fibers are not capable of standing up and even melt under the high temperatures of a hot load such as are represented by FIG. 1. Thus, both wire rope slings and natural or synthetic fiber rope slings have their disadvantages in lifting such loads.

According to the present invention, however, the composite sling **10** shown in greater detail in FIGS. 2 and 3 uses an assembly of both a wire rope sling and a fiber rope sling, thus gaining the advantages of both the strength of the wire rope sling and the protective cushioning character of the fiber rope slings in one structure.

FIG. 2 shows the internal wire rope **15** spliced back on itself to form the eye **14** of the sling and fiber rope **18** covering the wire rope which is also spliced back on itself resulting in complete enclosure of the wire rope sling and thereby providing the soft resilient and conformable surfaces of the fiber rope, while at the same time embodying the high strength of the interior wire rope.

The fiber rope sling is spliced in the zone **20** over the enclosed wire rope splice. Since the fiber rope splice is made back onto the longitudinal portion **21** of the body of the fiber rope, the portion of the fiber rope extending about the eye **14** of the sling is held in relatively fixed relation over the portion of the wire rope **15** forming the core of the eye **14**. This provides the feature that both the wire and fiber rope sections of both the eye **14** and the longitudinal body portion of the sling are held in relatively locked relation with limited likelihood of internal friction developing due to shifting which otherwise would promote deterioration of strength of the fiber rope portion of the sling.

Materials adaptable to use in the fiber rope component of slings of the present invention are natural fiber materials such as sisal, hemp, or manila, or syntheic fiber materials such as nylon, Dacron, or polyethylene. The wire rope or cable may be of metal such as improved plough steel or, where the sling is to be used for high temperature loads such as illustrated in FIG. 1, can be of stainless steel. The softer rope materials usually stretch but the splice of the exterior sling, as indicated above, helps the outer sling from slipping or otherwise changing position on the inner more stablely dimensioned metal sling. Also as pointed out, assurance of continued strength of the stretchable sling material is not reliable, but the stability of dimension of the wire cable on the interior imparts corresponding stability to the overall assemblage.

Fiber ropes are usually made with three, and sometimes, but less frequently, four side-by-side helically twisted strands, such as the strands **19** of FIG. 3. The wire cables are usually of six strands **16** each made up of a bundle of continuous wires with a core **17** of natural fiber material such as hemp as an inner filler. At times, the inner core **17** is also a wire strand which will provide, in general, a 7% increase in overall tensile strength to the wire cable. The wire center, however, sacrifices flexibility and correspondingly sacrifices conformability of the sling making it less adaptable and conformable to small radius bends.

By way of example, the inner sling of the present invention may be a wire have a ⅜" diameter while the exterior fiber rope sling has a 1½" diameter. As another example, the inner sling may have a 3/16" diameter with an exterior fiber rope sling having a ¾" diameter.

The direction of the twist of the cable strands **16** and the fiber rope strands **19** can be opposite to each other to impart a greater balance to the overall sling construction.

In assembling the sling construction, the outer rope can be provided over the cable by winding a single rope strand helically about the cable over its full length back and forth three or four times to cover the spliced cable base.

Preferably as shown in FIG. 4, however, the sling of the present invention may be made by holding the cable **15** in tightly extended relation between clamps **30** and splicing the cable ends to form eyes **14**. Thereafter the cable **15** may be pressed in the groove between a pair of strands **19** of the fiber rope **18** until the rope extends in fully surrounding relation over the full length of the body portion of the wire cable **15**. The ends of the fiber rope may then be correspondingly pressed into surrounding relation about the wire cable eyes **14** to provide the correspondingly soft fiber exterior for the eyes **14**. The fiber rope ends can then be spliced to the body **21** in the splice zone **20** over the wire cable splice, thus completing the composite construction.

In making the present sling, the outer softer fiber rope must be longer than the wire cable. For example, dependent upon the diameter of the inner cable, the outer rope might be in the order of 20% greater in initial length than the wire cable to make it correspond to the final length of the sling after assemblage. More specifically, if the wire inner cable is ten feet long, a sling might require an outer rope length of 12 feet before assemblage in the sling.

As an alternative sequence of steps of assembly, if the extended wire cable length is ten feet, the fiber rope coverage of the wire rope cable might be started back about two feet from the end of the fully extended unspliced wire cable. The wire cable is then progressively inserted as the core of the fiber rope over the full length of the body of the wire cable by revolving the rope thereover to within two feet of the opposite end. The wire cable ends might then be spliced to form the eyes of the sling at both ends. The cable splice may be a machine splice or can be a hand splice. The fiber rope then can be pushed over the remainder of the wire rope to cover both the remaining body portions of the sling and the eye portions. The fiber rope ends are spliced over the wire cable splices by interweaving the rope strand ends thereover.

As an example of durability, a sling constructed according to the present invention, made with a stainless steel wire cable interior and a manila rope exterior has been used in industrial production for lifting high temperature loads at temperatures in the order of 600° F. on a 24-hour basis for periods longer than 30 days on end, with no noticeable loss in cable strength and no damage to the overall construction, even though the outer manila rope portion appeared scorched.

While I have shown a certain particular form of my invention, it will be understood that I do not wish to be limited specifically thereto since many modifications may be made within the broader concepts of the invention. I therefore contemplate by the appended claims to cover all modifications as fall within the true spirit of my invention.

I claim as my invention:

1. A looped sling for lifting damageable loads such as hot metal members, precision machine parts and the like, comprising a length of wire, rope, a loop formed at least at one end of said sling by a splice of such end back onto itself over a body portion of said rope extending from said loop, a relatively soft fiber rope covering said wire rope over its full length and having a loop formed therein by being spliced back on itself over a body portion of said fiber rope extending from said fiber rope loop and through which said wire rope projects in forming said metal loop.

2. A sling for lifting easily damageable loads such as hot metal members, precision machine parts and the like comprising a wire rope, a loop formed of said rope by splicing one end of said rope back on itself, a relatively soft fiber rope comprising at least three strands oriented helically in side-by-side relation along and about the

linear axis of said wire rope, said fiber rope covering said wire rope over its full length and having a loop formed thereof by splicing one end back on itself over said wire rope loop whereby forming a complete metal core loop within said spliced fiber rope loop of softer character.

3. A sling as defined by claim 2, wherein the wire rope is of stainless steel.

4. A sling as defined by claim 3, wherein the wire rope has a metal central core.

5. A sling for lifting damageable loads such as hot metal bars, precision machine parts and the like comprising a wire cable, a pair of loops formed at opposite ends of said sling by having each end of said cable spliced back on its linear body portion, a relatively soft fiber rope comprising at least three strands helically oriented in close side-by-side relation about the linear body portion of said wire cable and completely covering said cable, said fiber rope having loops formed therein at opposite ends of said sling by having said fiber rope helically oriented about each of said wire cable loops and each end of said fiber rope spliced back on itself in a zone over the splice of its corresponding interior wire cable splice whereby the softer fiber rope sling thus extending over and enclosing said wire cable body portion and each of said wire cable loops is positively held in non-sliding relation on said wire cable sling.

6. A sling according to claim 5 wherein the twist strands of the wire cable and softer fiber rope are opposite to each other.

7. A sling according to claim 5 wherein the rope sling is a natural fiber rope.

8. A sling according to claim 5 wherein the rope sling is a synthetic fiber rope sling.

9. A sling according to claim 5 wherein the wire cable is of stainless steel.

10. A sling according to claim 9 wherein the wire cable has a metal core strand of stainless steel.

11. A method of fabricating a composite lift sling comprising holding a wire cable in longitudinal extending relation, splicing an end of said wire cable back on itself to form a loop therein, covering the linear body portion and loop of said wire cable with an initially longer fiber rope helically distributed thereover, and splicing the end of said fiber rope back on the body portion of said fiber rope over the splice of said wire cable loop.

12. The method of claim 11 wherein the initially longer fiber rope is assembled in covered relation on said wire cable by progressively pressing the fiber rope over the wire cable in inserted relation between a pair of adjacent strands as the rope is revolved about said cable.

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57—142; 87—8