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Goodrich

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[54] **ADJUSTABLE MULTI-LEG LOAD-CARRYING SLING APPARATUS**

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[52] **U.S. Cl.** ..... **294/74,** 294/78 A

[51] **Int. Cl.** **B66c 1/12**

[58] **Field of Search** ..... 294/74, 78 R, 78 A, 86 LS; 24/115 G, 115 H, 116 A, 126 C, 126 K, 126 L, 132 AS, 132 HL; 188/64; 254/192

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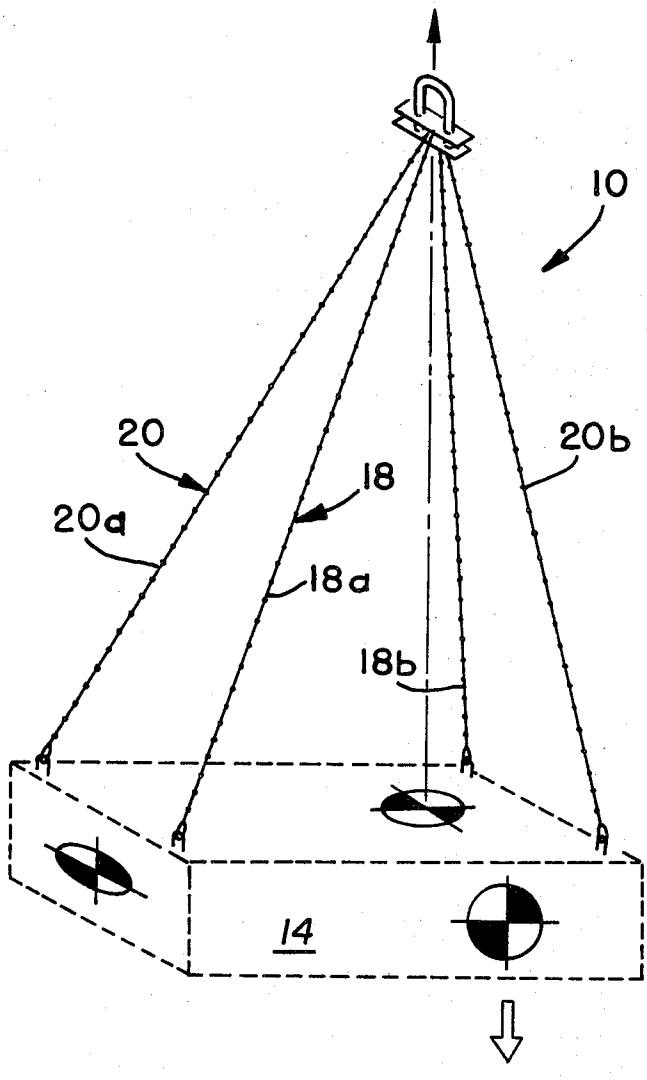
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Attorney, Agent, or Firm—R. S. Sciascia; G. J. Rubens

[57] **ABSTRACT**

A multi-leg sling apparatus is presented for lifting loads having individual sling legs adjustable in length in a simple, and highly reliable manner to enable balanced and unbalanced loads to be supported in a variety of different orientations.

3 Claims, 7 Drawing Figures



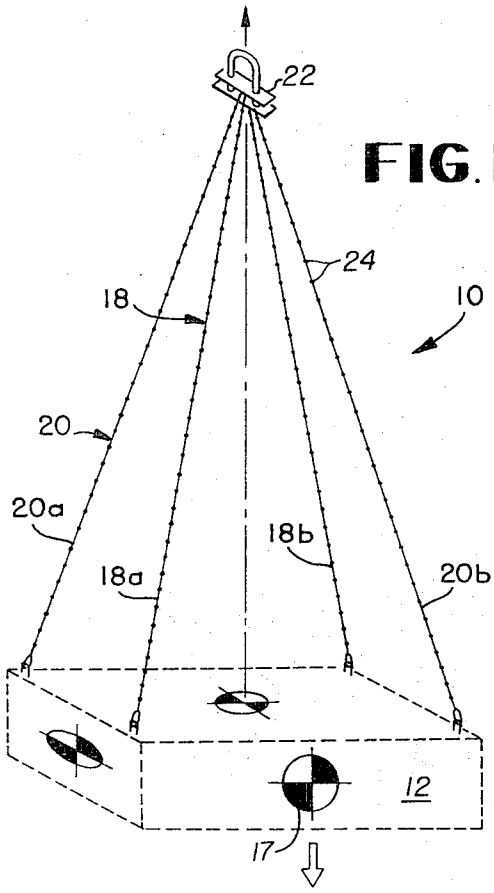


FIG. 1

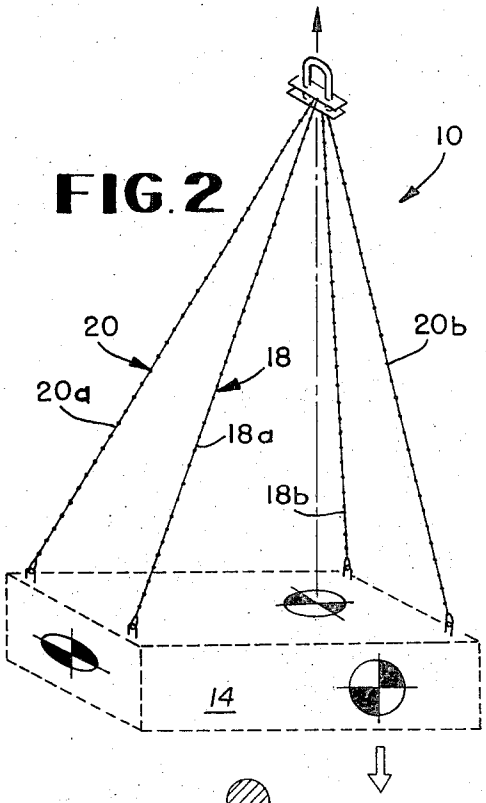


FIG. 2

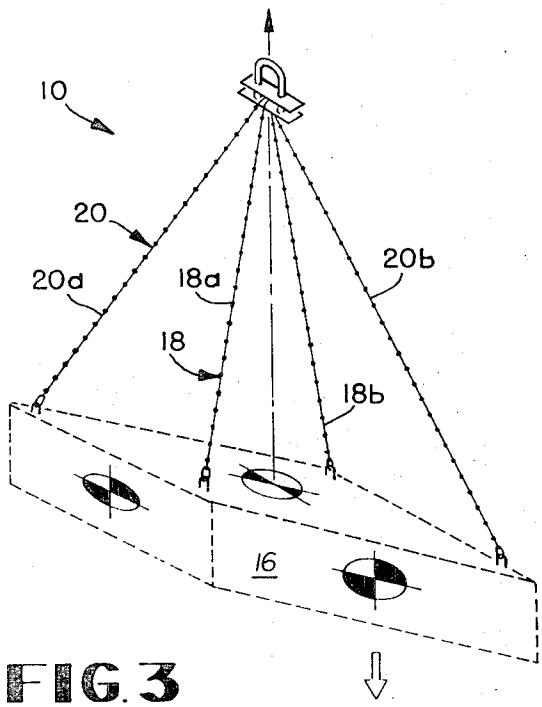


FIG. 3

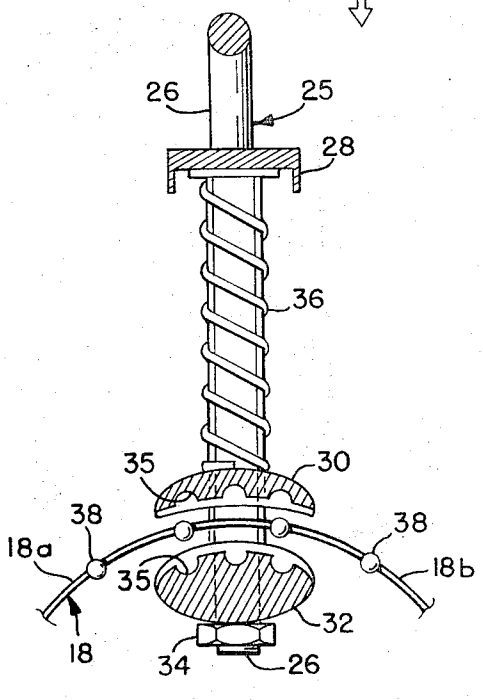


FIG. 4

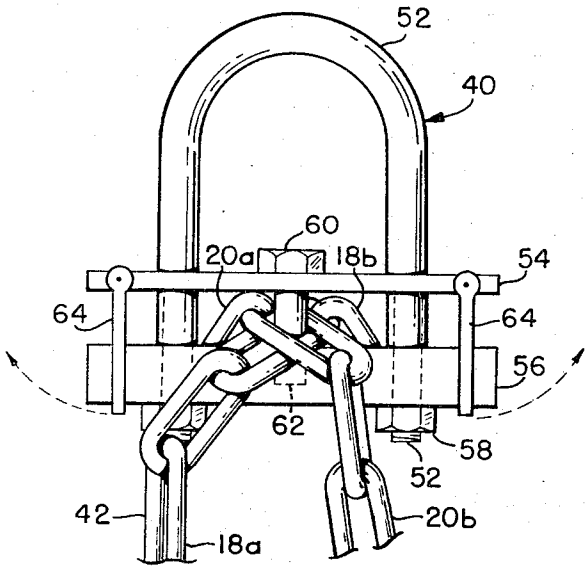


FIG. 5

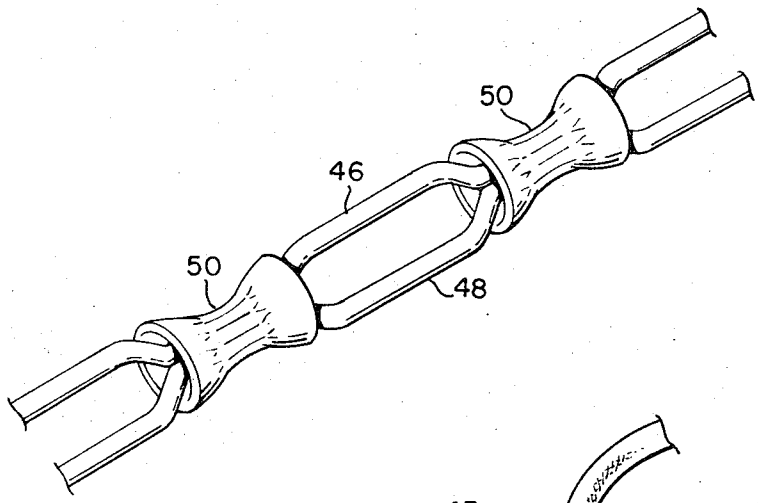


FIG. 6

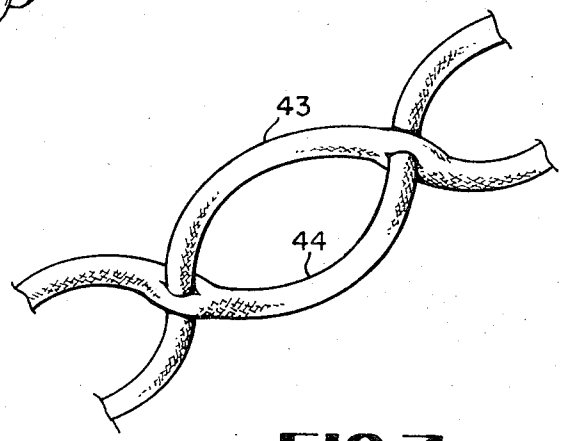


FIG. 7

ADJUSTABLE MULTI-LEG LOAD-CARRYING SLING APPARATUS

STATEMENT OF GOVERNMENT INTEREST

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

BACKGROUND OF THE INVENTION

This invention relates to lifting apparatus, and more particularly to a multi-leg sling apparatus in which each leg can be individually adjusted.

Various types of sling apparatuses have been proposed to accommodate different loads under a wide variety of operational conditions. However, most of the prior art slings are limited in scope of application, and many were designed to handle special load lifting situations. Self equalizing slings have been advanced in which a single line is reeved around a pulley or the like whereby either leg of the pair can be adjusted in length. Such slings adjust in only one plane, and since the entire load is assumed by only two legs a heavy steel cable or chain is required for many applications.

Multi-leg slings have been available wherein the individual lengths are adjusted by adding or subtracting a finite length to the leg segments, but such an arrangement is accident prone, and most important it is too time consuming for military operations, such as by helicopter hoisting or conventional crane operations.

SUMMARY OF THE INVENTION

The novel multi-leg sling apparatus provides a simple manner of adjusting each leg in an expedient manner to adapt the sling to support balanced and unbalanced loads over a wide range of applications. In the preferred embodiment, the sling comprises at least two pairs of sling legs, each pair being fabricated of a continuous length of flexible line supported intermediately by a saddle device, accordingly, each line provides a continuous and uninterrupted load path. The lines are disposed in a criss-cross relation so that they connect to diagonally opposite attach points on the load. Such an arrangement provides adjustment in two directions simultaneously without the need to dispose of excess line or add to the line. The line is preferably fabricated of flexible material having formed therein a plurality of spaced protuberances, such as links, loops, beads, etc. The lifting saddle supporting the legs at their confluence point has a corresponding recess or the like to receive a selected one of the protuberances in each leg. Depending on the desired adjustment, clamping means are provided in the saddle for maintaining the selected adjustment in the legs.

STATEMENT OF THE OBJECTS

A principal purpose of this invention is to provide an adjustable multi-leg sling that can lift a variety of different payloads having different centers of gravity in a variety of orientations in a simple and expedient manner.

Still another important object is to provide such a sling with a minimum of parts, joints, disconnects thus reducing weight, bulk and cost while possessing a high degree of safety, reliability and endurance.

Still further objects are to provide a sling which can be adjusted in roll and pitch without the need for disconnecting the sling from the payload or the hoist hook; and to enable the sling line to be made of a variety of materials depending on the intended load capacity.

Other objects, advantages and novel features of the invention will become apparent from the following detailed description of the invention when considered in conjuntion with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of the novel sling shown lifting a balanced load in a level orientation achieved by adjusting all of the sling legs to be of equal length.

FIG. **2** is a perspective view of the novel sling shown lifting an unbalanced load in a level orientation, achieved by adjusting the left hand legs to be longer than the right-hand legs.

FIG. **3** is a similar view of FIG. **1** showing a balanced load being raised in an inclined position, achieved by adjusting the right-hand sling legs to be longer than the left hand legs.

FIG. **4** is an enlarged side elevation view of one modification of a lifting saddle, partially in section, in an open position to receive a sling line having a spaced swagged balls to be clamped by the saddle.

FIG. **5** is an enlarged front elevation of another modification of a lifting saddle adapted to receive a sling line having chain links.

FIGS. **6** and **7** are perspective views of modified sling lines that can be employed.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawing where like reference numerals refer to similar parts throughout the drawing, there is showon in FIGS. **1** to **3**, inclusive, a novel multi-leg sling apparatus **10** supporting suspended loads **12**, **14** and **16** of differing characteristics, these being only representative of some of the various types of loads to which the sling may be adapted. In FIG. **1**, load **12** is a balanced load, as indicated by symbol **17**, being suspended in a level condition by adjusting the lengths of sling legs, **18***a*, **18***b*, **20***a*, and **20***b* to be of equal length, four legs being illustrated. In FIG. **2**, load **14** is unbalanced but suspended in a level condition by making sling legs **18***a* and **20***a* of equal length but longer than legs **18***b* and **20***b*. In FIG. **3** balanced load **16** is suspended in a canted position by making legs **18***a* and **20***a* shorter in length than legs **18***b* and **20***b*.

Variable control over the lifting of balanced and unbalanced loads in various orientations is achieved by using at least two pairs of sling legs, **18***a*, **18***b*, and **20***a*, **20***b*, each pair of legs being formed of single flexible line, namely **18** and **20** of identical length. The lines are adjustably supported intermediately their ends by a novel saddle fixture **22**, shown in detail in FIGS. **4** and **5**, which enables the respective legs to be varied in length. In the preferred embodiment, the lines **18** and **20** are arranged in criss-cross orientation with saddle **22** supporting the lines at their confluence point. By such a configuration, a continuous, uninterrupted load path is provided in each line without the use of splices, joints, etc.

The adjustment of the respective lengths of the sling legs in FIGS. **1** to **3** is accomplished by fabricating the line with spaced protuberances or locking elements **24**,

and by providing saddle **22** with compatible means for engaging and locking the respective sling legs at selected locking elements therein to provide the desired length. The entire length of sling lines **18** and **20** need not be provided with locking elements **24** as shown in FIGS. **1** through **3** since only those portions of the legs adjacent both sides of saddle fixture **22** that afford the necessary degree of adjusting may be provided with the protuberances. In the modification illustrated in FIG. **4,** saddle **25** comprises an inverted U-shaped bolt **26** on which is freely threaded three spaced apart plates **28, 30,** and **32** secured thereon by nuts **34.** Plates **30** and **32** serve as upper and lower jaws, respectively, having depressions **35** on their opposing faces to receive the protuberances **24.** Jaws **30** and **32** are biased to an engaging position by a compression spring **36.** In FIG. **4** the jaws are shown spread apart to slidably receive therebetween sling legs **18***a* and **18***b*, only one line **18** being shown for clarity, although it should be understood that both lines **18** and **20** intersect between jaws **30** and **32,** and, accordingly, depressions **35** are similarly arranged in corresponding crossing relation.

In the modification of FIG. **4,** lines **18** and **20** are fabricated with metal balls **38** much like conventional fishing line weights, which are swagged or otherwise securely fixed to the line in spaced relation. The operation of saddle **25** is apparent from the drawings. The length of the individual sling legs are adjusted in accordance with the lifting requirements, and their selected position locked within saddle **25** by releasing spring **36,** making sure that balls **38** are seated in their corresponding recess **35.** The mating of balls **38** and recesses **35** prevent any axial movement in the lines. Thereafter the lengths of the sling legs can be quickly adjusted by unlocking the saddle and repositioning the legs axially therein without the necessity of adding lengths of line, or disconnecting the lines from the load or the saddle hook.

Another type of saddle fixture **40** shown in FIG. **5** is adapted to adjustably receive a line having a series of spaced, chain-like locking elements formed along its length. In FIG. **5** the locking elements are illustrated as conventional metal chain links **42** which may be required for hoisting high-tonnage loads. For light loads, the links may be formed of two strands **43** and **44** of braided polypropylene line alternately threaded one through the other to form consecutive loops, as illustrated in FIG. **7.** Still another type of linked line is shown in FIG. **6,** wherein the loops are formed in two parallel metal wires **46** and **48** by means of metal sleeves **50** swagged or otherwise secured around both wires at spaced locations along selected lengths of the wires.

In FIG. **5,** saddle **40** also comprises an inverted U-shaped bolt **52** on which are freely threaded two spaced plates, upper plate **54** and lower plate **56** secured on the bolt by nuts **58.** An anchor bolt **60** is centrally mounted in one of the plates, i.e., the upper plate in the modification of FIG. **5.** A free end of bolt **60** is adapted to engage an opening **62** in the lower plate. Bolt **60** is designed to be passed through selected links of each chain leg for anchoring the legs at the desired length. Plate **54** is maintained in a fixed relation to plate **56,** with the threaded links anchored therebetween, by a pair of latches **64,** pivotally mounted to plate **54** and adapted to hook over the ends of plate **56.** Readjustment of the lengths of the sling legs is accomplished simply, by releasing latches **64,** lifting anchor bolt out of the lower plate and longitudinally moving the legs to their new position. As in the prior saddle modification, adjustment is accomplished without releasing the sling from the load or from the saddle, and without adding or removing additional components.

The invention sling offers numerous advantages over prior art devices in its simplicity in design and operation. The novel sling can be applied to a wide range of load capacities, enabling a choice of different sling leg material and configuration depending on the specific use. The four slings are fabricated of two identical lengths of line having spaced protuberances simplifying fabrication. Use of four legs in diagonal orientation provides adjustment in two directions to handle roll and pitch movements. The sling legs are detachably supported and restrained at their confluence by a single attachment in a positive manner preventing undue movement of the load or transit. The length of the sling legs can be easily changed by relatively inexperienced personnel without having excess line material to dispose or, or the adding of additional lengths of line by means of connectors, etc.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. An adjustable load-carrying sling apparatus comprising:

at least two pairs of flexible sling legs having means at their lower ends for attachment to a load;

each pair of sling legs being fabricated of a single length of continuous and uninterrupted flexible line material arranged in criss-cross relation at intermediate portions thereof;

each leg having a plurality of locking elements fixedly secured at spaced-apart positions along at least a selected portion of its length;

a lifting saddle member for supporting both lengths of flexible material at their intermediate criss-cross positions forming at least four sling legs;

a means for locking the saddle to any selected one of said elements on both of said sling legs where they criss-cross for varying the length of the respective legs;

whereby the individual lengths of the sling legs can be readily adjusted and positively locked in position to accommodate different orientations of the load along two transverse axes.

2. An adjustable load-carrying sling apparatus comprising:

at least two pairs of flexible sling legs having means at their lower ends for attachment to a load;

each pair of legs being fabricated of a single length of continuous and uninterrupted flexible line material;

said pairs of legs being arranged in criss-cross relation at intermediate portions;

each leg having a plurality of looped elements fixedly secured at spaced-apart positions along at least a selected portion of its length forming the flexible line;

a lifting saddle member for supporting said pairs of legs at their intermediate positions forming at least four sling legs;

said saddle having a single pin adjustably positioned through a selected looped element in each pair of legs at their criss-crossed portions;

whereby the individual lengths of the sling legs can be readily adjusted and positively locked in position to accommodate load lifting conditions.

3. The sling apparatus of claim **2** wherein each of said flexible lines are formed of at least two strands of braided material which are alternately threaded through each other to form the loops.

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