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LOAD-TRANSFER CABLE EQUIPMENT

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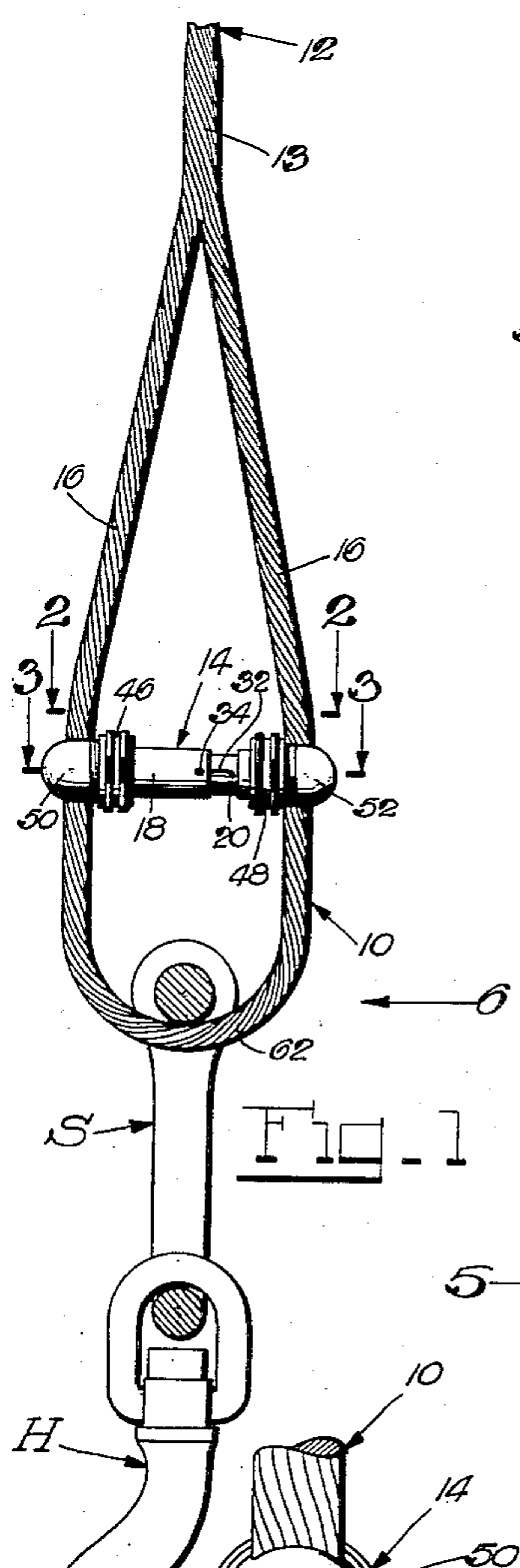

Fig. 1

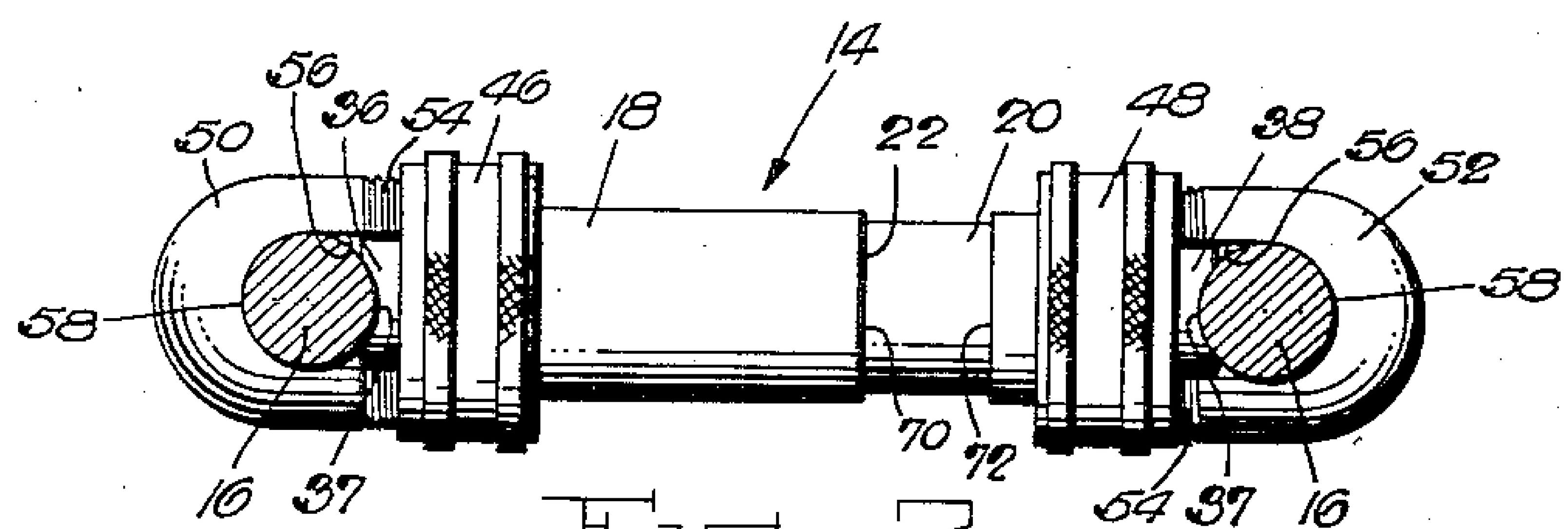

Fig. 2

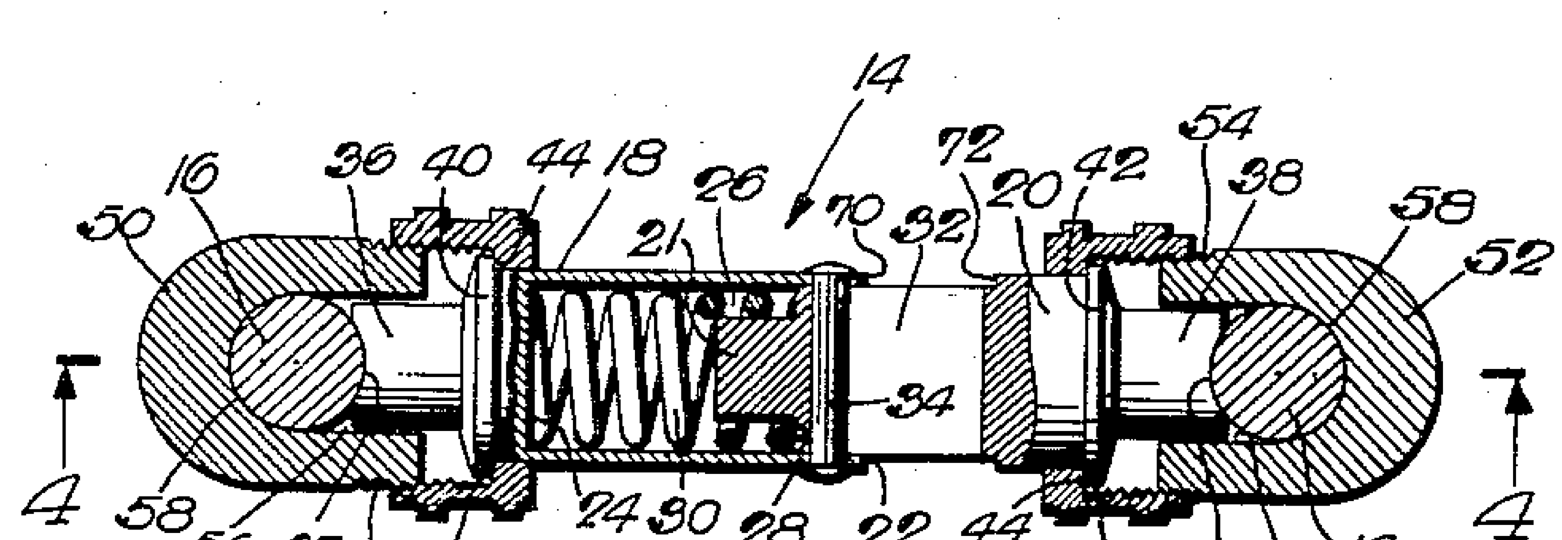

Fig. 3

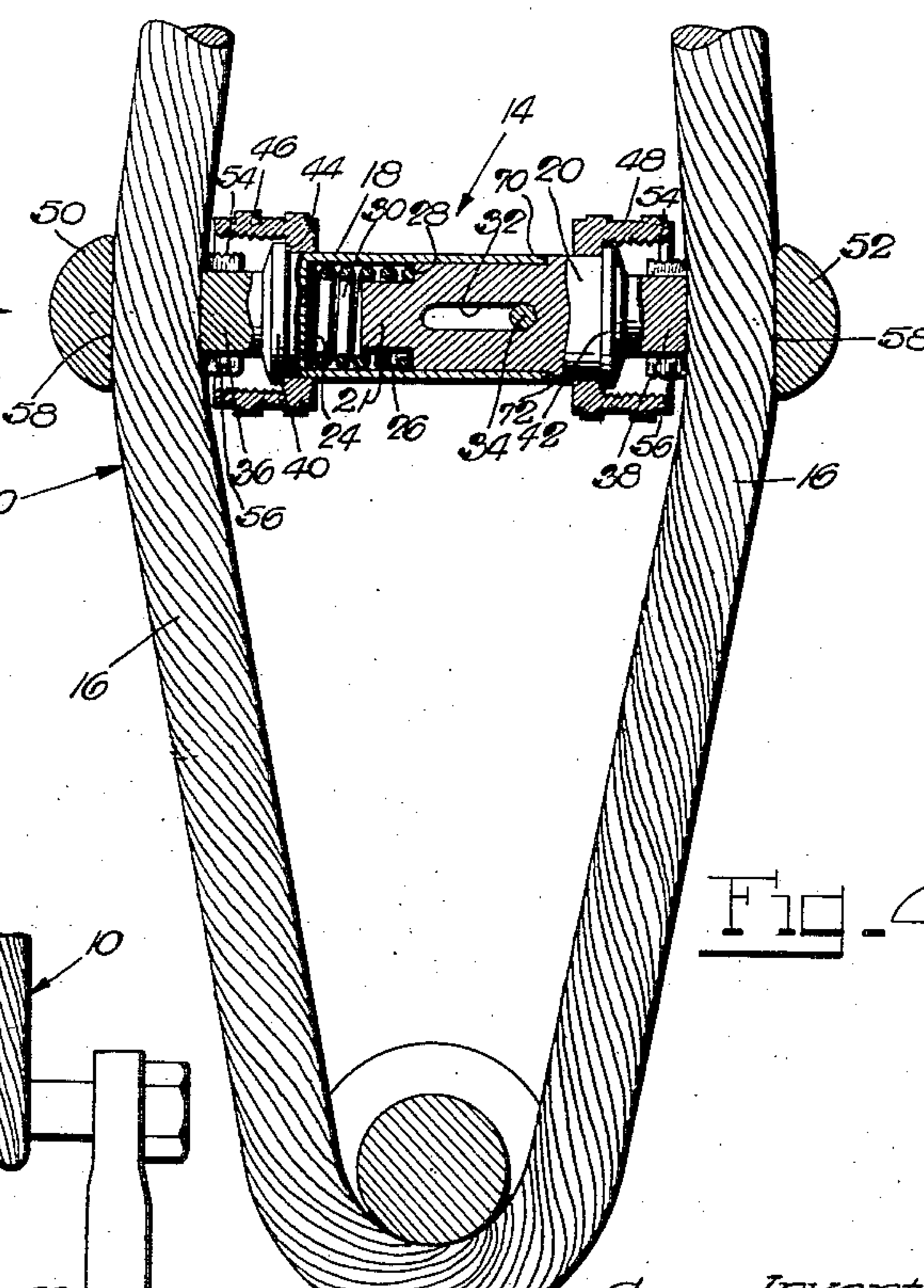

Fig. 4

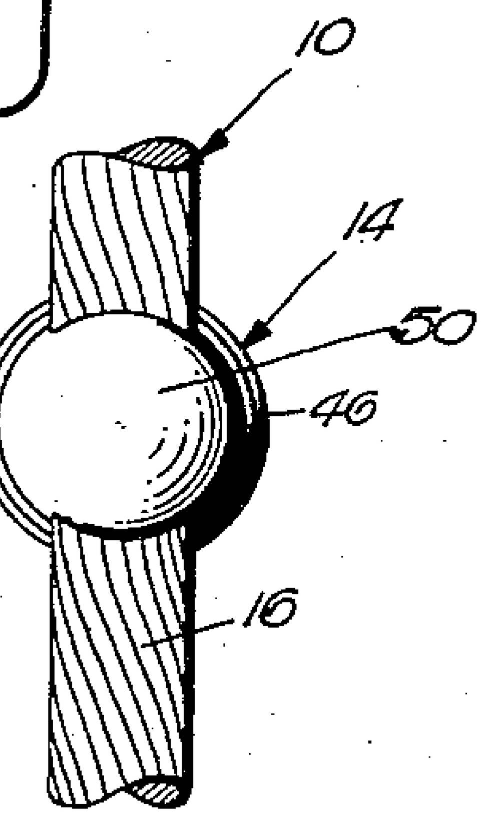

Fig. 5

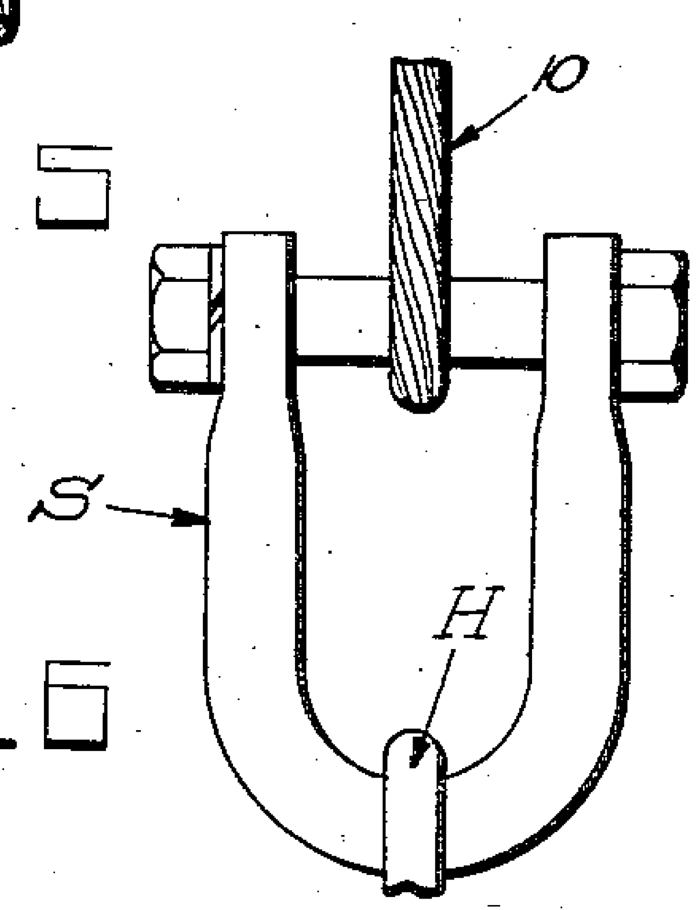

Fig. 6

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LOAD-TRANSFER CABLE EQUIPMENT

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15 Claims. (Cl. 294—74)

This invention relates to load-transfer cable equipment; and it relates more particularly to equipment of this kind characterized by the employment of a load loop or cargo loop that is non-collapsible by reason of its including bracing means, most desirably a spreader device which is itself also of novel type, acting to maintain said loop at all times open a minimum distance or width even under maximum load conditions. The invention is of especially great utility in connection with apparatus for the loading and unloading of ships and other cargo or freight carriers, for example.

In transferring heavy objects or loads of material from one location to another through a relatively short distance, as for example in transferring cargo from dock to ship or from ship to dock, it is common to make use of a crane or derrick of some description which, in whatever specific form it may take, includes hoisting tackle carried by a swingable arm or boom. Such tackle includes a stranded steel wire rope or cable reeved through a pulley block secured to the boom and having one end made fast to the winding drum or barrel of a power-operated winch, while the other end portion is formed to provide an eye or loop, which may be on the order of 2 or 3 feet in length under no-load conditions, by splicing or otherwise securing the cable end to the cable at a point thereon far enough back from said end to give a loop of the desired length. To the opposite or rounded free extremity of the loop thus formed is secured by appropriate fastening means of some kind, such as a shackle, a load or cargo hook which releasably engages, or from which is releasably suspended, the load to be hoisted and transferred.

Crane or derrick equipment of this general type is widely used in stevedoring operations, for example, where it is subjected to extremely rough usage. Although the load required to be handled at one time in such service does not ordinarily exceed about 5 tons dead weight, standard safety regulations require that the wire cable employed shall test at least 20 tons breaking strength. This is because, due to sudden starting or stopping of the winch, often through careless operation, or to any of various other causes, the strain which the cable is actually called upon frequently to withstand momentarily under such severe service conditions often greatly exceeds 5 tons. A ⅞-inch diameter hoisting cable of twisted steel wire strands is commonly employed in such equipment.

Despite the considerable stiffness and resiliency of such a cable, whereby it strongly resists being bent at a sharp angle, the cable is flexible enough to permit its being readily bent on a reasonably long-radius curve, as in forming the end of such above described terminal loop. Under heavy load, the cable loop naturally elongates and narrows more or less. Upon release of the load, the loop normally tends, because of the rather stiff resiliency of the cable, to spring back immediately, undamaged, into its original more rounded or widely open form and shorter length. However, if through careless operation of the power winch, for example, the cable is given a quick jerk in lifting or arresting descent of a heavy load engaged by the cargo hook, the resultant large force suddenly concentrated upon the cable, acting transversely thereof within the relatively small surface area thereof contacted by the shackle at the lower extremity of the loop, may cause the cable to be bent so sharply at this locality as to narrow or collapse the loop considerably or, in extreme but by no means uncommon cases, to close it virtually completely. Where such virtually complete closure or collapse occurs, the result is not uncommonly such acute-angle permanent deformation of the loop at its lower end as to require forcibly wedging apart the thus "frozen" loop sides or branches, in order to open the loop sufficiently to free the shackle. This is because, at the vertex of such angular deformation, the cable strands have been stressed by the sharpness of the bending or flexure beyond their elastic limit and have taken a permanent set. Wedging the loop sides apart and thereby partially reversing this acute bend in the cable necessarily results in serious strand weakening and more or less strand breakage at the bend, an effect externally evidenced by fraying of the cable surface at this locality. Considerations of safety require that the entire loop thereupon be cut off, and a new loop spliced in the cable as before described.

But even where a sudden jerk or quick pick-up of the load is not heavy enough to close the loop but only to narrow (and elongate) it to a lesser degree not resulting in too sharply bending the cable at the curved lower extremity of the loop, the severe conditions under which the equipment is normally required to operate in actual service necessarily involves constant recurrence, over and over again of (1) narrowing or partial collapse of the loop under applied load, alternating with (2) rebound or spring-back of the loop into the more open or rounded form in which the inherent spring-like character of the steel cable tends, so long as the cable does not become permanently bent at the loop vertex by local over-stressing at this point, constantly to maintain the loop open. Consequently, when such a cargo loop is in use, there is always occurring at its shackle-engaged extremity a back-and-forth bending movement of the cable strands in greater or less degree, due to the alternating load pick-up and load release. This cycle of alternating transverse bending stresses occurs a very large number of times in one ordinary day's operation of such equipment. It is also accompanied, naturally, by considerable friction between the twisted wire strands. All this eventually results in metal fatigue, wear and more or less breakage, externally manifested by surface fraying at the affected locality. Under the severely rough service conditions encountered in stevedoring operations, this effect is often produced in a surprisingly short time. Here again, even though such complete loop collapse as to "freeze" the loop branches together may at no time have occurred, the appearance of "fraying" is the signal rendering it mandatory to cut off of the cargo loop and splice a new one.

While the strand-deteriorating effect produced at the lower end of the loop by the cyclical back-and-forth or in-and-out movement of the loop branches has been more particularly stressed hereinabove, it should be noted that this effect may be produced also at the upper or spliced end of the loop, although generally in much less noticeable degree.

Not only does the necessity for relatively frequent replacement of a damaged cargo loop entail loss of time and consequent expense by reason of the interruptions in equipment operation thereby necessitated, but an even more important consideration is that, for any given hoisting cable, the number of times it is possible to cut off a defective or unsafe loop and to re-loop a further portion of the cable by splicing as described, is small. After only a few such loop replacements, the cable, although it may still be perfectly sound, has become useless for further service in such equipment and must be discarded. This is because its length has reached the minimum at which it will function operatively in the particular equipment involved. Such cables, being fabricated of high grade steel wire, are costly. Their relatively short service life in such equipment gives rise, therefore, to a frequently recurring expense item of substantial magnitude.

The length limitation just referred to arises from the fact that the pressure exerted upon a layer of cable turns on the winding drum of the winch by succeeding layers wound thereon under heavy load tension is so great that it is not practical to have the cable sufficiently long at the start to provide more than a relatively very small "reserve" on the winding drum. If a greater reserve were provided, thus materially prolonging the time before progressive shortening of the cable by loop replacements would require paying out and re-winding the lowermost layer or layers of the reserve cable turns, these turns would have become so set or fixed in curvature by the aforesaid pressure of superimposed layers that serious kinking of the cable would result from any attempt to pay them out and re-wind them, as part of the necessary working length of the cable. For this reason, hoisting cables of the type here in question are supplied by the manufacturers in standard lengths varying, of course, with the particular equipment set-up in which they are designed to be used, the cable in any given instance being of a length not much exceeding the "working" length required for the particular set-up aforesaid. An over-all length on the order of 175 feet or thereabouts for a new cable as supplied by the manufacturer represents common practice in stevedoring work.

Another difficulty incidental to use of cargo loops heretofore available has been the severity and sharpness of the shocks to which the cable as a whole is subjected, and which are transmitted by the cable to the blocks on the derrick as well as to the power winch and other equipment parts, due to sudden pick-up of heavy loads and the resultant quick narrowing or collapsing (partial or complete) of the loop to its final load position. This is very hard on the equipment as a whole, necessitating frequent shutdown for repairs and causing rapid deterioration.

An important object of the present invention is, therefore, to prolong substantially the service life of a cable loop of the general type hereinabove referred to, particularly of cargo loops such as those widely used in stevedoring operations.

A further object of the invention is, by thus prolonging the service life of such a cable loop, to render replacement of the cable as a whole less frequently necessary.

Still another object of the invention is to enable lessening the intensity or sharpness of stress shocks imparted to the cable and the equipment with which it is associated by the sudden pick-up of heavy loads attached to the cable loop, thereby materially cutting down over-all wear and tear.

More specifically, it is an object of the invention to provide a novel type of cable loop construction whereby loop-narrowing movement of the branches or sides of the loop toward each other, caused by picking up a load, is so controlled that complete closing of the loop can not occur, and that said movement takes place less abruptly than with cable loop constructions heretofore known.

In accordance with the principles of the invention, the foregoing objects and attendant advantages, as well as others which will become apparent hereinafter, are attained by providing a cable loop of the character described with stiffening or bracing means, most desirably in the form of a compressible spreader device, extending transversely of the loop and engaging the cable at the opposite sides or branches of the loop; the arrangement being such that complete closure or collapse of the loop under load tension is positively prevented, while limited movement of the loop sides or branches toward each other, insufficient to cause excessive bending or flexure of the cable under load, is permitted.

While the invention may be embodied in various specific forms, one especially desirable practical embodiment thereof is shown, by way of illustrative example, in the accompanying drawings, wherein

Fig. 1 shows the novel cable loop construction in side elevation, with attached cargo or load hook, the parts being in no-load position;

Figs. 2 and 3 are enlarged sections on the lines **2—2** and **3—3**, respectively, of Fig. 1;

Fig. 4 is a section, partly in elevation, on the line **4—4** of Fig. 3, but with the parts in the position assumed under load sufficiently great to narrow the cable loop to the minimum width permitted by the stiffening or bracing means;

Fig. 5 is a fragmentary view in side elevation, looking in the direction of arrow **5** in Fig. 4; and

Fig. 6 is another fragmentary view in side elevation, looking in the direction of arrow **6** in Fig. 1.

Referring to the drawings, and more particularly to Fig. 1 thereof, **10** designates generally a loop on a flexible hoisting cable **12**, which in this instance is formed of twisted steel wire strands. The loop **10** is usually formed of a length of the flexible cable itself bent into loop form and having its end suitably secured to the cable, in this instance by splicing as indicated at **13**. A load or cargo hook H of conventional type is flexibly secured in the usual manner to the lower extremity of the cable loop for free swinging movement with respect thereto by suitable fastening means such as a shackle of well-known type indicated generally at S (Figs. 1 and 6). The cable loop is rendered non-collapsible under load tension by bracing or stiffening means, indicated generally at **14**, extending within the loop crosswise thereof and terminally secured to the cable at opposite sides of said loop at an intermediate location in its length. Said bracing or stiffening means functions to maintain the loop arms or branches positively spaced or spread apart at least a predetermined minimum distance at the location where it is placed in the loop, regardless of the load tension to which the loop and the cable as a whole may be subjected.

As hereinabove indicated, the bracing means or spreader device **14** is most desirably compressible to a limited extent between the loop arms or sides by the inwardly directed thrust they exert upon it when the loop is subjected to heavy load tension, thereby tending to narrow or even collapse the loop. As here shown, therefore, and referring more particularly to Figs. 2 and 3, said means **14** comprises two telescoping members **18** and **20**, member **18** having a tubular portion open at one end **22**, while the cooperating member **20** has a portion formed as a plunger fitting and axially slidable within the tubular portion of member **18**. Within the tubular portion of member **18**, a compression-type coiled spring **30** of suitably heavy gauge steel wire is confined between the bottom **24** of said tubular portion and the annular shoulder **28** on plunger **20**, whose forwardly projecting reduced portion **21** serves, in conjunction with the adjacent wall of member **18**, to provide an annular recess **26**. In order to limit positively the extent to which the spreader device is compressible by inward pressure or thrust of the cable loop sides against its ends, as well as to prevent separation of the telescoping members **18** and **20** by the action of the spring upon cessation of such thrust, the plunger **20** is in this instance provided with a longitudinally extending diametral slot **32**, through which and also through aligned apertures in member **18** adjacent the open end **22** thereof extends a cross-pin **34**, whose ends are peened or headed over, as shown in Fig. 3, to prevent its being accidentally dislodged. In the fully expanded condition in which members **18** and **20** are shown in Figs. 1–3, the spring **30** is already somewhat compressed. In this condition, engagement of cross-pin **34** with member **20** at the left-hand end of slot **32** positively prevents further expansion of spreader **14** and hence, also, any further widening of the cable loop. On the other hand, in the fully compressed condition shown in Fig. 4, further contraction or shortening of the spreader, with further narrowing of the cable loop is positively prevented primarily by abutment of the annular end **70** of member **18** with the annular shoulder **72** provided on member **20**, also by reason of the fact that cross-pin **34** is now at or near the opposite end of slot **32**. Shoulder **72** and a cross-pin **34** in slot **32**, therefore, comprise stop means for positively preventing compression of the spreader device beyond a predetermined limit.

Referring now to further desirable structural features of spreader device **14**, the telescoping members **18** and **20** are provided at their outer ends with outwardly projecting shanks **36** and **38**, respectively, which are adapted to bear against the opposite sides **16** of the cable loop **10**. In order to afford maximum seating area for the loop sides **16**, the ends of the shanks **36** and **38** may be concavely rounded or grooved as indicated at **37** (Figs. 2 and 3). The members **18** and **20** are further provided with shoulders **40** and **42**, respectively, against which bear the internal shoulders **44** of knurled coupling nuts or sleeves **46** and **48**, respectively. There are further provided two identical clamping plugs or yoke-pieces **50** and **52**, each of which is externally threaded at **54** for releasable connection with the adjacent nuts **46** and **48**. Each of the plugs **50** and **52** is provided in one end thereof with round-bottomed open recess or groove **56** of a width sufficient to accommodate the cable and of a depth considerably greater than the cable diameter. The rounding of the bottom of the groove **56**, as at **58**, is in order to afford maximum seating area for the cable forming the loop.

In applying the brace, strut or spreader device **14** to the cable loop, the plugs **50** and **52** are removed from the nuts **46** and **48** and the device is placed between the loop with the ends of the outwardly projecting shanks **36** and **38** of the members **18** and **20** bearing against the respectively adjacent inner faces of the arms **16** of the cable loop. The plugs **50** and **52** are thereupon positioned with their grooves **56** over the loop arms and then connected with the adjacent nuts **46** and **48** by turning the latter. By tightening the nuts **46** and **48**, the rounded groove bottoms **58** in the plugs **50** and **52** and the complementarily grooved ends **37** of the shanks **36** and **38** of the members **18** and **20** are drawn into firm clamping engagement with the cable at opposite locations on the loop arms, as shown. The spreader **14** is now firmly anchored to the loop **10** at a location intermediate its upper and lower extremities. Because the danger of too sharp bending of the cable is greatest at the lower extremity where the loop is engaged by the shackle, spreader **14** should ordinarily be located, as shown in Fig. 1, somewhat closer to the lower extremity **62** of the loop than to the upper.

The yielding contractibility of the spreader device **14** is an important factor in prolonging the useful life of the cable loop. By reason of this characteristic, the device acts as a very efficient shock absorber which functions to especial advantage when a load is picked up suddenly. Thus, a considerable part of the initial shock of a sudden load pick-up is taken up and absorbed by the spreader device instead of being almost instantly transmitted with full intensity to the cable loop, the cable as a whole, and the associated operating equipment. In this connection, the limit imposed upon the yielding contractibility of the device **14** is of further advantage, in that the latter will under no circumstances permit flexure at the curved extremity **62** of the cable loop much beyond that indicated in Fig. 4, even if a heavy load on a sudden or jerky pick-up should quickly contract the spreader to its minimum length.

By appropriately varying the design of the spreader device in respect to type and characteristics of its shock-cushioning member (specifically spring **30**) employed and/or other constructional details, in a manner obvious in view of the present disclosure, the degree of resistance offered by said device to inward thrust of the loop arms, as well as the range within which variations in loop width are positively confined, can be predetermined as may be necessary to meet the requirements of any particular situation involving equipment of the general character here in question. For the usual run of stevedoring work, it is good practice to so construct said spreader device that an inward or horizontal thrust against its ends amounting to at least about 500 pounds must be exerted by the loop sides or branches in order to compress or contract the loop to minimum predetermined length as illustrated in Fig. 4.

The ease with which, through provision of the releasable cable clamps, the position of the spreader or bracing means on the loop may be quickly shifted so as to afford maximum protection against dangerously sharp flexure of the cable in a given equipment set-up or under given operating conditions, is a valuable feature of the novel load or cargo loop construction.

The invention may be carried out in specific ways other than those herein set forth without departing from the spirit and essential characteristics of the invention. The present embodiments are, therefore, to be considered as being only illustrative and not restrictive, it being intended that all changes coming within the meaning and equivalency range of the appended claims shall be embraced therein.

What is claimed is:

1. Load-transfer cable equipment, comprising, in combination, a flexible and resilient stranded wire cable having an end portion formed into a load loop which has a curved extremity that is adapted for attachment of a load thereto, together with loop-bracing means extending across said loop intermediate its extremities and terminally secured to its opposite sides; said bracing means having shock-absorbing means compressible under inward thrust of the cable at the loop sides to yieldingly resist narrowing of the loop under load tension, said bracing means being provided with stop means for positively arresting such narrowing of the loop beyond a predetermined limit to prevent unduly sharp bending of the cable at said curved extremity.

2. Load-transfer cable equipment comprising, in combination, a flexible and resilient stranded wire cable having an end portion formed into a load loop which has a curved extremity that is adapted for attachment of a load thereto, together with loop-bracing means extending across said loop intermediate its extremities and terminally secured to its opposite sides; said bracing means having shock-absorbing means compressible under inward thrust of the cable at the loop sides to yieldingly resist narrowing of the loop under load tension and stop means for positively arresting such narrowing of the loop beyond a predetermined limit to prevent unduly sharp bending of the cable at said curved extremity; said bracing means being further provided at each end with a clamp comprising parts separable to engage the cable between them, and means for connecting said parts and causing them to grip such cable firmly.

3. Load-transfer cable equipment as set forth in claim 2, wherein such shock-absorbing means comprises members telescoped one within the other, a compression spring interposed between them to yieldingly oppose relative movement thereof to contract or shorten the brace, said stop means limiting such contracting movement, and stop means limiting relative movement of said members to lengthen or expand the brace.

4. Load-transfer cable equipment comprising the com-

bination, with a resilient steel cable having a terminal portion self-spliced to form a cargo loop having a normally rounded lower extremity, together with means for attaching a load to said lower extremity, said means including a member having a portion of small surface area in engagement with said lower extremity of the loop such that sudden pick-up of a heavy load tends to collapse the loop and thereby to bend its said extremity out of the latter's normally rounded form and into relatively angular form, of strut or brace means extending transversely across said loop and secured to said cable at the opposite sides or branches of said loop to prevent narrowing of the loop beyond a predetermined limit, said brace means comprising telescopically cooperating members relatively movable with respect to each other transversely of said loop without affecting the securement of the brace means to said cable, whereby to permit variation in effective length of said brace means and hence of the loop width under varying load conditions, said brace means further including stop means limiting such relative movement of said members.

5. Load-transfer cable equipment comprising the combination, with a resilient steel cable having a terminal portion formed into a cargo loop and means for attaching a load to said loop, of strut or brace means extending transversely across said loop and secured to said cable at the opposite sides or branches of said loop to prevent narrowing of the loop beyond a predetermined limit, said brace means comprising cooperating members relatively movable with respect to each other transversely of said loop without affecting the securement of the brace means to said cable, whereby to permit variation in effective length of said brace means and hence of the loop width under varying load conditions, said brace means further including stop means limiting such relative movement of said members; said equipment being further characterized by the fact that the brace means is secured to the cable at each side of the loop by clamping means comprising a threaded yoke-piece which engages the cable externally of the loop in alinement with the adjacent brace member, and a coupling nut rotatable upon such brace member, retained thereon by suitable abutment means, engaging the threaded portion of said yoke-piece and operable in cooperation therewith to clamp the cable between said yoke-piece and said brace member.

6. Load-transfer cable equipment as set forth in claim 4, wherein the load-attaching means includes a shackle member engaging the lower extremity of said loop, and wherein compressible means is interposed between the relatively movable members of said brace means and is arranged yieldingly to resist shortening of the effective length of said brace means before said stop means for limiting such relative movement of said members comes into action.

7. A spreader device for bracing and stabilizing a load or cargo loop of a load-transfer cable, which comprises a longitudinally compressible brace adapted to extend across the load or cargo loop of a load-transfer cable between the sides thereof, with its ends concavely rounded for terminal engagement with the cable internally of the loop, a pair of members each recessed to fit over the cable externally of the loop in alinement with said brace, and coupling means operable to so connect each recessed member with the adjacent brace end that the cable is securely clamped between them.

8. A spreader device for bracing and stabilizing a load or cargo loop of a load-transfer cable, which comprises a longitudinally compressible brace adapted to extend across the load or cargo loop of a load-transfer cable between the sides thereof, with its ends concavely rounded for terminal engagement with the cable internally of the loop, a pair of members each recessed to fit over the cable externally of the loop in alinement with said brace, and coupling means operable to so connect each recessed member with the adjacent brace end that the cable is securely clamped between them; said brace comprising members telescoped one within the other, a compression spring interposed between them to yieldingly oppose relative movement thereof to contract or shorten the brace, stop means limiting such contracting movement, and stop means limiting relative movement of said members to lengthen or expand the brace.

9. A spreader device as set forth in claim 8, wherein the telescoped members are pin-and-slot connected.

10. A spreader device as set forth in claim 9, which further includes shoulder means provided on one of said telescoped members for engagement with the other of said members and in order to stop brace-shortening relative movement of said members.

11. A spreader device for bracing and stabilizing a load- or cargo-loop of a load-transfer cable, which comprises a longitudinally compressible brace adapted to extend across the load- or cargo-loop of a load-transfer cable between the sides thereof, and a releasable cable-clamp at each end of said brace operative to grip the cable at the opposite sides of said loop irrespective of the extent to which said brace may be compressed, and wherein said brace has a laterally projecting shoulder adjacent each end thereof, while each cable-clamp comprises an externally threaded plug provided with a transverse recess wide enough to receive the cable and deeper than the cable diameter, together with a coupling sleeve which is rotatable on said brace, which is provided internally with a shoulder adapted, upon outward movement of the sleeve along said brace, to engage the adjacent brace shoulder for arrest of such movement, and which is internally threaded for connecting engagement with the threaded portion of said plug; whereby upon the threaded sleeve being so engaged with the threaded plug after the cable is received in said transverse recess and upon said sleeve being turned to tighten the coupling connection thus made, the cable is firmly clamped between said plug and the end of the brace.

12. A spreader device as set forth in claim 11, wherein said brace comprises a member having a tubular portion closed at one end only, a plunger member longitudinally slidable in such tubular portion and extending outwardly beyond the open end thereof, and a compression spring in said tubular portion interposed between the closed end thereof and said plunger member.

13. A spreader device as set forth in claim 12, wherein the end faces of said brace and the bottom of the transverse recess of each said plug are concavely curved for effective clamping engagement of the cable between them.

14. A spreader device as set forth in claim 13, wherein said plunger member has an external shoulder adapted and arranged to abut the open end of said tubular portion of the other member after the brace has been compressed to a predetermined extent, whereby to prevent further shortening thereof.

15. A spreader device as set forth in claim 14, wherein said spring is pre-compressed in the predetermined full length condition of said brace, said brace members being pin-and-slot connected to prevent the pre-compressed spring from expanding the brace beyond said predetermined full length, while permitting compression of the brace from its full length to predetermined minimum length.

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