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W. S. CLARKSON ET AL

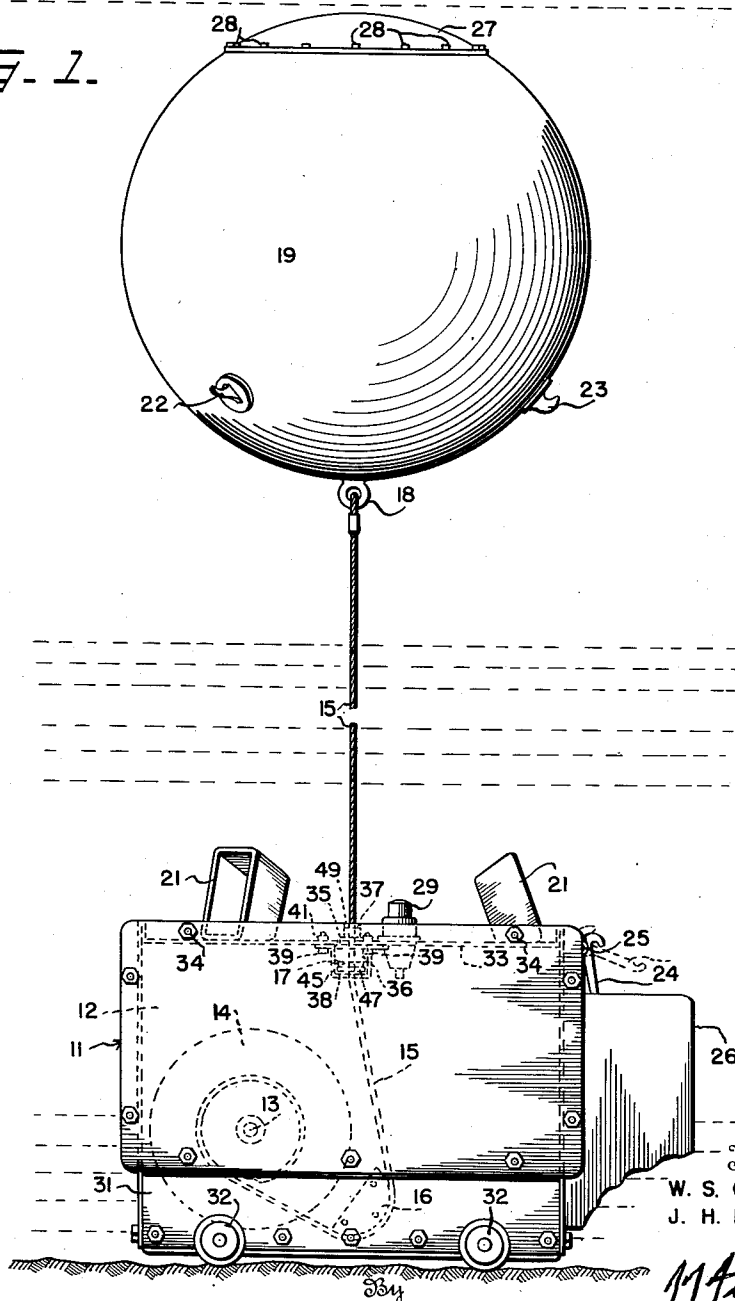
2,529,486

RESILIENT FAIR-LEAD

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2 Sheets-Sheet 1

FIG. 1.



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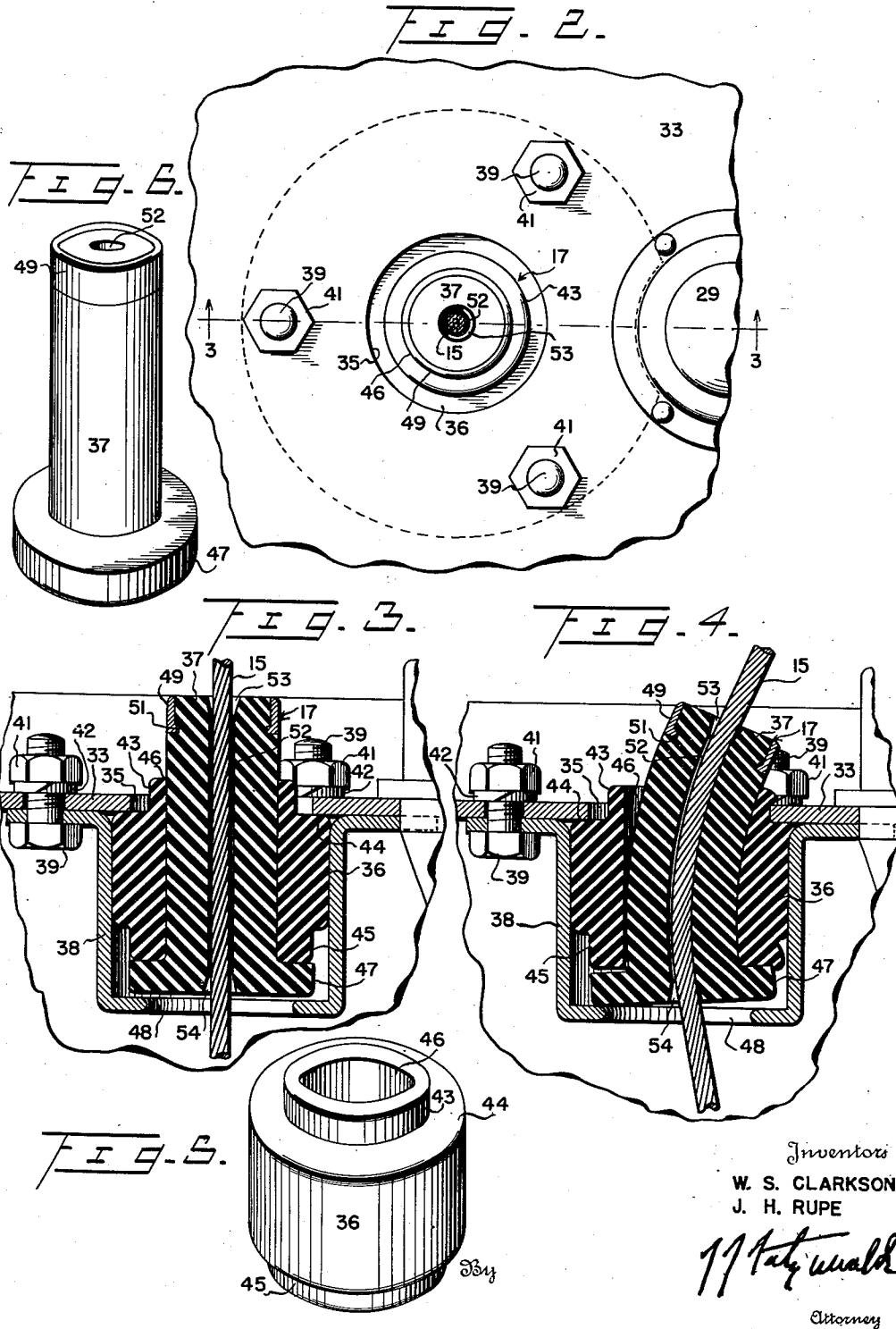
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UNITED STATES PATENT OFFICE

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RESILIENT FAIR-LEAD

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This invention relates to an improved fairlead for the anchor of a buoyant marine mine. More specifically, the invention relates to a fairlead of new and improved construction secured to the casing of a mine anchor adapted to pay out a length of cable therefrom through the fairlead until the mine has reached a predetermined depth of submersion within the water whereupon further paying out of the cable from the anchor is arrested.

In mine mooring devices heretofore devised in which a buoyant mine is releasably secured thereto before the mine is launched, it is the general practice to pay out the mooring cable through an annular shaped fairlead composed of metal or lignum vitae, as the case may be, secured to the casing of the mine anchor, the mooring cable being payed out from a drum arranged within the anchor casing. When the mine has risen to a predetermined depth of submersion within the water the drum is locked thereby preventing additional paying out of the cable from the mine anchor thereby mooring the mine at a predetermined depth of submersion within the body of water by the mooring cable and mine anchor. Considerable difficulty has been experienced heretofore with this type of mine as the result of wear of the fairlead caused by the movement of the mine within the water in response to tidal currents, storms and the like thereby causing the mooring cable to be flexed sharply against the fairlead, this flexure being accompanied by a rubbing motion between the cable and the fairlead sufficient to wear through the fairlead within a relatively short period of time, the rate of wear being, in some cases, accelerated by the presence of sand or other abrasive material introduced between the cable and the fairlead by movements of the water within which the mine is planted. When the mooring cable wears through the fairlead, it comes into contact with the casing of the mine anchor or the fairlead support and it has been found that the frictional movement of the mooring cable against the exposed metallic surface of the mine anchor or the support causes the cable to be worn rapidly and weakened sufficiently to sever the cable and release the mine from the anchor within a relatively short period of time.

This difficulty is overcome by employing a fair-

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lead in accordance with the present invention in which the fairlead is composed of an inner sleeve portion or core through which the mooring cable is adapted to slide arranged within a resilient cylindrical bushing secured to the casing of the mine anchor by a cup shaped support within which the bushing is arranged. The core is composed of a flexible material such, for example, as rubber or any of the synthetic varieties thereof having sufficient hardness to impart a low degree of flexibility thereto slideably arranged within the aforesaid resilient bushing composed of rubber or any of the synthetic varieties thereof having a degree of hardness sufficient to impart a relatively greater flexibility thereto than the flexibility of the core.

An arrangement is thus provided in which the radius of curvature of the cable at the point of emergence thereof from the mine anchor is greatly increased by reason of the relatively high flexion resistance of a sleeve within which the cable is arranged and which extends along the cable for a distance sufficient to apply pressure thereto substantially uniformly whereby the bending force is distributed along that portion of the cable in contact with the core and the instant pressure applied to the cable at any one point along the radius of curvature is greatly reduced. By supporting the core within a resilient bushing of greater flexibility than the core, the bending moment applied to the core by the cable causes the core to assume a radius of curvature corresponding substantially to the radius of curvature of that portion of the mooring cable in contact with the fairlead by reason of the resilience of the bushing within which the core is supported in a manner such that the shock of impact of the cable against the fairlead as the result of movements of the mine within the water and/or vibrations of the mooring cable is reduced. The lower end of the core is provided with an enlarged end section or head formed integrally therewith adapted to permit a small endwise movement of the core by engagement with the lower end of the resilient bushing or the lower inner portion of the cup shaped support, as the case may be. The upper end of the core is reinforced in any suitable manner as by a ring or sleeve of suitable material such, for example, as metal arranged thereabout thereby to prevent damage to the upper end of

the sleeve in contact with the cable as the result of pressure applied thereto by the cable.

One of the objects of the present invention is to provide a new and improved fairlead for a mine for yieldably guiding and protecting the mooring cable thereof at or near the point of emergence of the cable from the anchor casing.

Another of the objects is to provide a new and improved fairlead having a relatively hard wear resisting surface in engagement with the mooring cable in which the bending characteristics of a relatively flexible fairlead are retained.

Another object is the provision of a new and improved fairlead for a marine mine in which the rate of wear of the fairlead and the mooring cable arranged therein is greatly reduced.

Another object is to provide a new and improved fairlead having means for reducing the shock of impact of the cable thereagainst.

Another object is to provide a new and improved fairlead having means for reducing the shock thereagainst caused by vibration of the cable of a moored mine.

Another object is to provide a new and improved fairlead for a marine mine in which the rate of fatigue of the mooring cable at the point of emergence from the mine anchor as the result of movements of the mine within the water is greatly reduced.

Another object is to provide a new and improved resilient fairlead having means for substantially increasing the radius of curvature of a predetermined length of the mooring cable in response to movement of the moored mine about a predetermined initial position.

Another object is the provision of a fairlead adapted to apply substantially uniform bending moment to a predetermined length of mooring cable of a marine mine as the mine moves about the anchor in response to movement of the surrounding water.

A further object is to provide a new and improved resilient fairlead for use with the types of mine anchors now in general use which is economical to manufacture, reliable in operation and which possesses all of the qualities of ruggedness and durability in service.

Still other objects, advantages and improvements will be apparent from the following description taken in connection with the accompanying drawings of which:

Fig. 1 is a view in elevation of a moored mine employing the fairlead of the present invention;

Fig. 2 is a greatly enlarged plan view partly broken away of the upper portion of the mine anchor casing showing the fairlead secured thereto;

Fig. 3 is a view partly broken away and partly in section taken along the line 3-3 of Fig. 2;

Fig. 4 is a view similar to Fig. 3 in which the mooring cable and fairlead are shown flexed as the result of movement of the mine from the position shown in Fig. 1;

Fig. 5 is a view in perspective showing a preferred form of a resilient supporting sleeve employed with the present invention; and,

Fig. 6 is a view in perspective of a preferred form of resilient core suitable for use with the sleeve of Fig. 5.

Referring now to the drawings for a better understanding of the invention on which like numerals of reference are employed to designate like parts throughout the several views and more particularly to Fig. 1 thereof, there is shown thereon a mine anchor indicated generally by the

numeral 11 having a recessed portion or chamber 12 therein within which is rotatably mounted as at 13 a drum or reel 14 having a mooring cable 15 secured thereto. The mooring cable is wrapped about the drum and passed over the cable guide 16 secured to the casing of the anchor in any suitable manner and having an arcuate surface thereon adapted to guide the cable as it leaves the drum, the cable thereafter passing through a fairlead indicated generally by the numeral 17. The other end of the cable is secured to the eye bolt 18 secured to the casing of the mine 19. The mine may be of any suitable type adapted to rise within the water by reason of a positive degree of buoyancy imparted thereto and thereby withdraw the cable 15 through the fairlead after the mine has been launched within the body of water and disengaged from the mine anchor.

The mine, it will be noted, is supported prior to the launching thereof by the supports 21 attached to the upper portion of the anchor casing and maintained securely thereagainst by reason of the provision of certain link members which engage the hooks 22 and 23 secured to the casing of the mine. The release arm 24 is pivotally secured to the mine casing at 25 and releasably maintained in the position shown in solid outline on Fig. 1 by reason of certain control mechanism arranged within the casing 26 adapted to unlock the arm 24 and release the mine from locked engagement with the anchor as the mine is launched, the arm 24 moving to the position shown in dashed outline as the mine is released, as is well known in the art to which the present invention pertains.

The mine is also provided with a cover or cap 27 secured thereto as by the bolts 28 whereby the mine is adapted to be hermetically sealed after an explosive charge and firing mechanism have been assembled therein. Preferably, though not necessarily, the casing of the mine anchor is provided with a valve comprising a spring actuated plunger 29 adapted to be released as the mine moves away from the casing thereby to admit water within the casing of the mine anchor and decrease the buoyancy thereof, as is well known in the art. The mine anchor is provided with a downwardly extending portion 31 to which is secured the wheels 32 whereby the launching of the mine is facilitated. The portion 31 of the mine anchor is also adapted to enclose and support a heavy weight or a plurality of weights whereby the mine anchor is maintained in fixed engagement with the bed of the body of water regardless of the action of tidal currents or other movements of the water tending to cause the mine anchor to be shifted from the initial planted position thereof.

The rotatable drum may be of any type suitable for the purpose such, for example, as the differential drum for mine anchors disclosed in the copending application of James B. Glennon, Serial No. 635,117, filed September 27, 1932, for Differential Drum for Mine Anchors, now Patent No. 2,435,580, dated February 10, 1948, in which the cable is paid out from a cable drum until the mine is moored at a predetermined depth within the water, and in which means are provided for locking the drum to the mine anchor when the predetermined depth of submersion of the mine within the water is reached. The casing of the mine anchor comprises a plate 33 secured thereto as by the bolts 34 having an aperture 35 therein adapted to receive the upper

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portion of the fairlead 17 comprising the resilient sleeve or bushing member 36 and flexible core 37.

The sleeve 36 is preferably annular in shape and composed of resilient material suitable for the purpose such, for example, as rubber or any of the synthetic varieties thereof, the outer surface of the sleeve being cylindrical and adapted to fit slidably within the cup shaped support 38 secured to the plate 33 as by the bolts 39, nuts 41 and washers 42. The external diameter of the upper portion of the sleeve 36 is reduced at 43 sufficiently to permit a lateral movement of the upper portion of the sleeve within the aperture 35 as the cable 15 is flexed. Substantial movement of the sleeve member 36 upwardly is prevented by engagement of the shoulder 44 formed thereon with the inner surface of the plate 33. The sleeve is also provided with a portion 45 of reduced external diameter adapted to permit a certain amount of lateral movement of the lower end of the core 37 as the cable 15 is flexed. The sleeve 36 is also provided with a cylindrical aperture 46 within which the core 37 is arranged, the end of the core having an outwardly projecting collar 47 formed preferably integrally therewith adapted to engage the lower portion of the sleeve member 36 and the bottom of the cup shaped support 38, the diameter of the shoulder 47 being somewhat less than the inner diameter of the cup shaped member and somewhat greater than the aperture 48 formed within the bottom of the cup shaped member.

The upper portion of the core 37 is provided with a sleeve or ring 49 preferably having an inwardly projecting portion 51 adapted to engage the core and maintain the ring securely fixed thereto at all times thereby reinforcing and supporting the upper end of the core sufficiently to prevent damage thereto as the mooring cable is flexed. The core is also provided with an aperture 52 arranged axially therein within which the cable 15 is adapted to slide, the sliding movement of the cable being facilitated by reason of the provision of chamfered or tapered portions 53 and 54 in abutting and aligned relation with respect to the apertured portion 52.

The core 37 is composed preferably of rubber or any of the synthetic varieties thereof of sufficient hardness to present a tough wear resisting surface to the cable 15 at the apertured portion 52 thereof and possessing sufficient flexibility to enable the core to be flexed arcuately in response to movements of the mine within the water. The sleeve member 36 is also composed of flexible resilient material such, for example, as rubber or any of the synthetic varieties thereof having a greater degree of flexibility and compressibility than the core 37 whereby the sleeve is adapted to be deformed by compression of a portion thereof as the cable 15 is flexed from the initial vertical position thereof within the water.

This will best be understood by reference to Fig. 4 on which is shown the core 37 flexed to the right by the mooring cable 15, the axis of the core substantially coinciding with the axis of the cable throughout that portion of the cable included within the core. The core 37 and cable are thus flexed along the arc of a circle of relatively large radius by reason of the pressure applied to the core by the resilient sleeve member 36 which, as will be noted, is forced into engagement with the apertured portion 35 of the plate 33 and the inner cylindrical portion of the cup shaped support 38 respectively. The lower

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portion 45 of the sleeve member 36 is also compressed outwardly and upwardly by the lower portion of the core 37 comprising the collar 47 formed thereon.

The lower end of the core 37 including the collar 47 is thus tilted at an angle such that the collar 47 on the opposite side thereof is forced against the bottom of the cup shaped support 38. From the foregoing it will be apparent that there is provided a tough wear resisting core having a low degree of flexibility in contact with the mooring cable throughout a considerable length of cable in which the core is yieldably supported by a resilient sleeve having a higher degree of flexibility and compressibility than the core disposed within a rigid cup shaped member. The core is thus adapted to flex uniformly along the arc of a circle of relatively large diameter as the cable is flexed by reason of the uniform distribution of pressure applied to the core by the resilient sleeve as the sleeve is compressed by the horizontal component of the force applied to the cable 15 by the mine as the mine is moved laterally from an initial rest position directly above the fairlead.

By providing a core in which the outwardly extending portion thereof is enclosed within and reinforced by an annular protecting member adapted to follow the movements of the core as the cable is flexed, the upper end of the core in contact with the cable is given additional support by the aforesaid annular member sufficient to prevent the core from becoming damaged or torn by the pressure of the cable against the upper portion thereof. Furthermore, by providing a fairlead comprising a core composed of wear resisting material combined with a low degree of flexibility arranged within a cylindrical support having a higher degree of flexibility and compressibility than the core, the wear resulting from the flexion and tension of the mooring cable as the mine moves within the water about the mine anchor is distributed between the mooring cable and the surface of the core in contact therewith, the outer surface of the core and the inner surface of the resilient sleeve with which the core is in contact, and the outer surface of the resilient sleeve and the cup shaped member and apertured portion of the plate 33 within which the sleeve is arranged. The wear on the fairlead and cable in contact therewith is additionally reduced by reason of the engagement of the collar 47 with the lower portion of the resilient sleeve 36 and the cup shaped support 38 respectively.

Under certain conditions of service it has been found that a moored mine may perform a rotary movement or path of travel through the water in response to a flow of water past the mine such, for example, as may be caused by tidal currents and apply a sudden tug or jerk of increased tension to the mooring cable concurrently with each such rotary movement or path of travel of the mine and, furthermore, the relative movement of the cable with respect to the water may cause a vibrating condition to be set up in that portion of the mooring cable intermediate the mine and the anchor. By employing a resilient fairlead in accordance with the present invention, the fairlead responds yieldably to each such vibration or tug of the cable and thus the degree of vibratory or oscillatory movement of the cable and the frequency and rhythm of movement thereof is substantially reduced with a corre-

sponding reduction in the wear of the fairlead and the rate of fatigue of the mooring cable.

While the invention has been described with particularity as to one preferred embodiment and a combination of mechanisms and of each of the various elements of the combination, it is to be understood that this has been done for purposes of disclosure and that various changes and substitutions may be readily apparent to those skilled in the art, after understanding the invention herein disclosed, and that the terms employed in the claims are, therefore, to be considered as words of description rather than of limitation.

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

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. In a fairlead for mounting on a plate having an aperture therein, a central core having a bore therethrough, a sleeve having a central bore therethrough within which the core is tightly fitted, said sleeve having a reduced upper section fitting loosely in the aperture in the plate and an enlarged central section, a cup having a central aperture and adapted to tightly grip said enlarged central section of the sleeve, and means for attaching the cup to the plate with said central aperture thereof in alinement with said core.

2. In a fairlead for mounting on a plate having an aperture therein, a central core having a bore therethrough and a collar on the bottom portion thereof, a sleeve having a central bore therethrough within which the core is tightly fitted, said sleeve having a reduced upper section fitting loosely in the aperture in the plate, an enlarged central section, and a reduced lower section engaging said collar, a cup having a central aperture and adapted to tightly grip said enlarged central section of the sleeve, and means for attaching the cup to the plate with said central aperture thereof in alinement with said core.

3. In a fairlead for mounting on a plate having an aperture therein, a central core having a bore therethrough, a sleeve having a central bore therethrough in which the core is tightly fitted, said sleeve having a reduced upper section fitting loosely in the aperture in the plate, an enlarged central section, and a reduced lower section, a cup having a central aperture in the bottom thereof and tightly gripping the enlarged central section of the sleeve, means for attaching the cup to the plate with the central aperture thereof in alinement with said core, and a collar on the bottom of the central core and engaging the lower reduced section of the sleeve, said collar being of greater diameter than the central aperture in the cup and spaced a predetermined distance from the bottom of the cup.

4. In a fairlead for a mine anchor adapted to pay out a length of mooring cable therethrough as the mine is planted, a central core having a bore therein through which the cable is payed out, said core being composed of resilient material of sufficient stiffness to provide a large radius of curvature of the portion of the cable in contact therewith as the mine weaves within the water, and a bushing disposed about said core and constructed and arranged to support the core and apply a lateral force thereto as the cable is bent by the pull of the mine thereon, said bushing being composed of material of greater resilience than the core whereby no appreciable

wear of the core is effected as the cable is bent by the pull of the mine.

5. In a fairlead for a mine anchor adapted to pay out a length of mooring cable therethrough as the mine is planted, a cylindrical flexible core having a bore therein through which the cable is payed out, said core being composed of wear resisting material of sufficient stiffness to provide a large radius of curvature of the mooring cable disposed therein as the mine is pulled laterally by a moving current within the water, a cylindrical bushing arranged about the core and composed of material having greater resiliency and compressibility than the core for yieldably supporting the core and preventing wear at the outer surface thereof whereby the cross section and stiffness of the core is not reduced as the result of the movements of the mine within the water, and means including an annular support arranged about said bushing for securing the bushing to the anchor, said last named means having an aperture therein of greater size than the diameter of the cable within which the cable is arranged.

6. In a fairlead for a mine anchor adapted to pay out a length of mooring cable therethrough as the mine is planted, a flexible core having a bore through which the cable is payed out, said core being composed of resilient wear resisting material of sufficient stiffness to provide a large radius of curvature of the cable therein as a lateral force is applied thereto by the mine in response to a moving current within the water, an annular resilient bushing having an axial length less than said core and composed of material of greater compressibility and less wear resistance than the core within which the core is arranged, and means including a cylindrical support for securing said bushing to the mine anchor.

7. In a fairlead for a mine anchor adapted to pay out a length of mooring cable therethrough as the mine is planted, a flexible core having a bore therein through which the cable is payed out, said core being composed of resilient wear resisting material of sufficient stiffness to provide a large radius of curvature of the cable therein as a lateral force is applied thereto by the mine in response to a moving current within the water, an annular resilient bushing having an axial length less than said core and composed of material of greater compressibility and less wear resistance than the core within which the core is arranged, means including a cylindrical support for securing said bushing to the mine anchor, and means on said annular bushing for preventing endwise movement of the core with respect to the anchor.

8. In a fairlead for a mine anchor having a length of mooring cable slideably arranged therein, said fairlead comprising a pliable core of wear resisting material and having a bore therein extending along a considerable length of the cable and of sufficient size to permit axial movement of the cable with respect thereto, and means including a resilient support composed of material of greater resiliency and flexibility than the core arranged intermediate the core and anchor for reducing the force of impact of the cable against the core as the mine moves suddenly within the water.

9. In a fairlead for a mine anchor having a mooring cable therein, a pliable core composed of tough wear and bend resisting material, said core extending along the cable for a length sufficient to provide a large radius of curvature there-

of as the mine is moved laterally within the water in response to a moving current and having a bore within which the cable is payed out as the mine is planted, and means including a resilient annular member arranged about said core and composed of material having a resilience greater than the core and of less length than the core whereby pressure is applied to the core by the member exteriorly and variably in accordance with the tension and flexion of the cable there-against.

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