

March 17, 1953

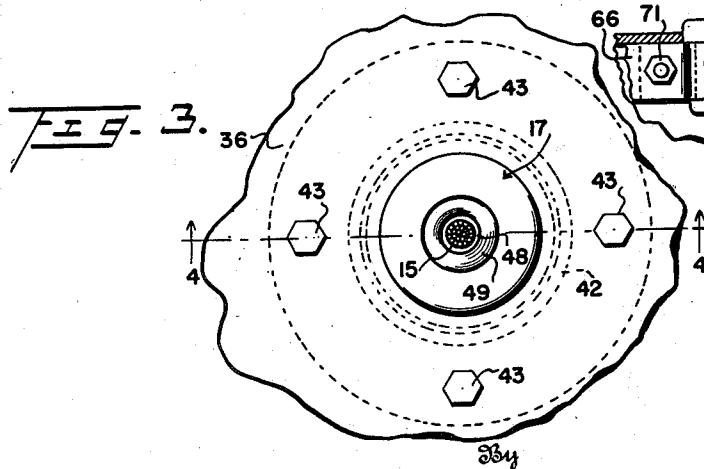
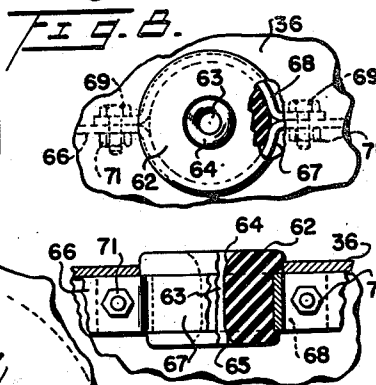
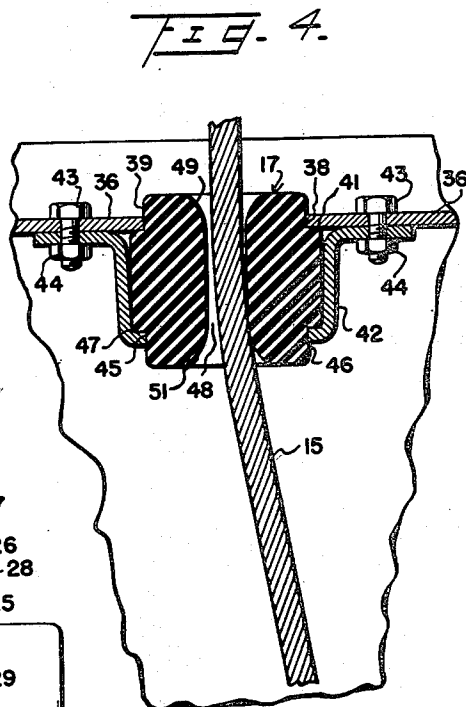
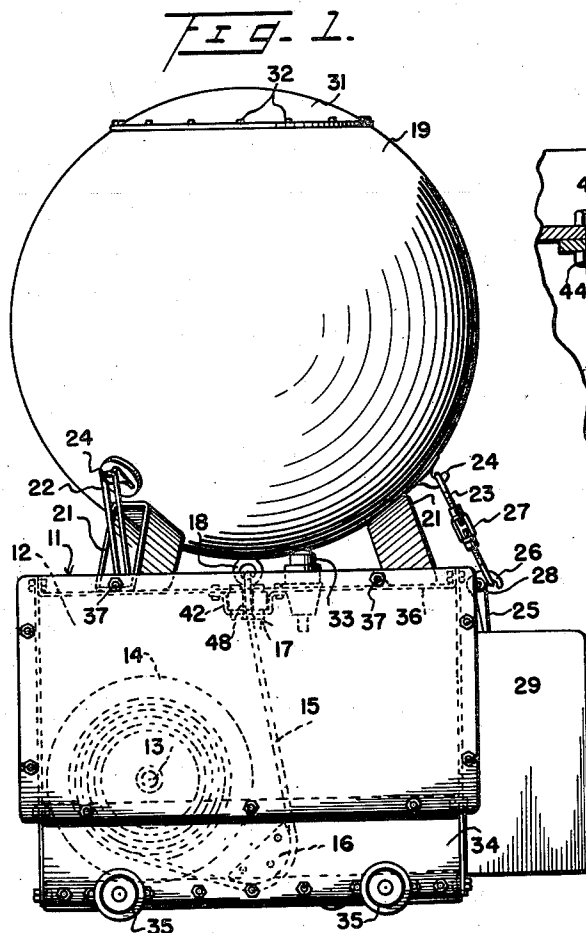
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2,631,819

FAIR-LEAD FOR MINE ANCHORS

Filed June 19, 1942

3 Sheets-Sheet 1



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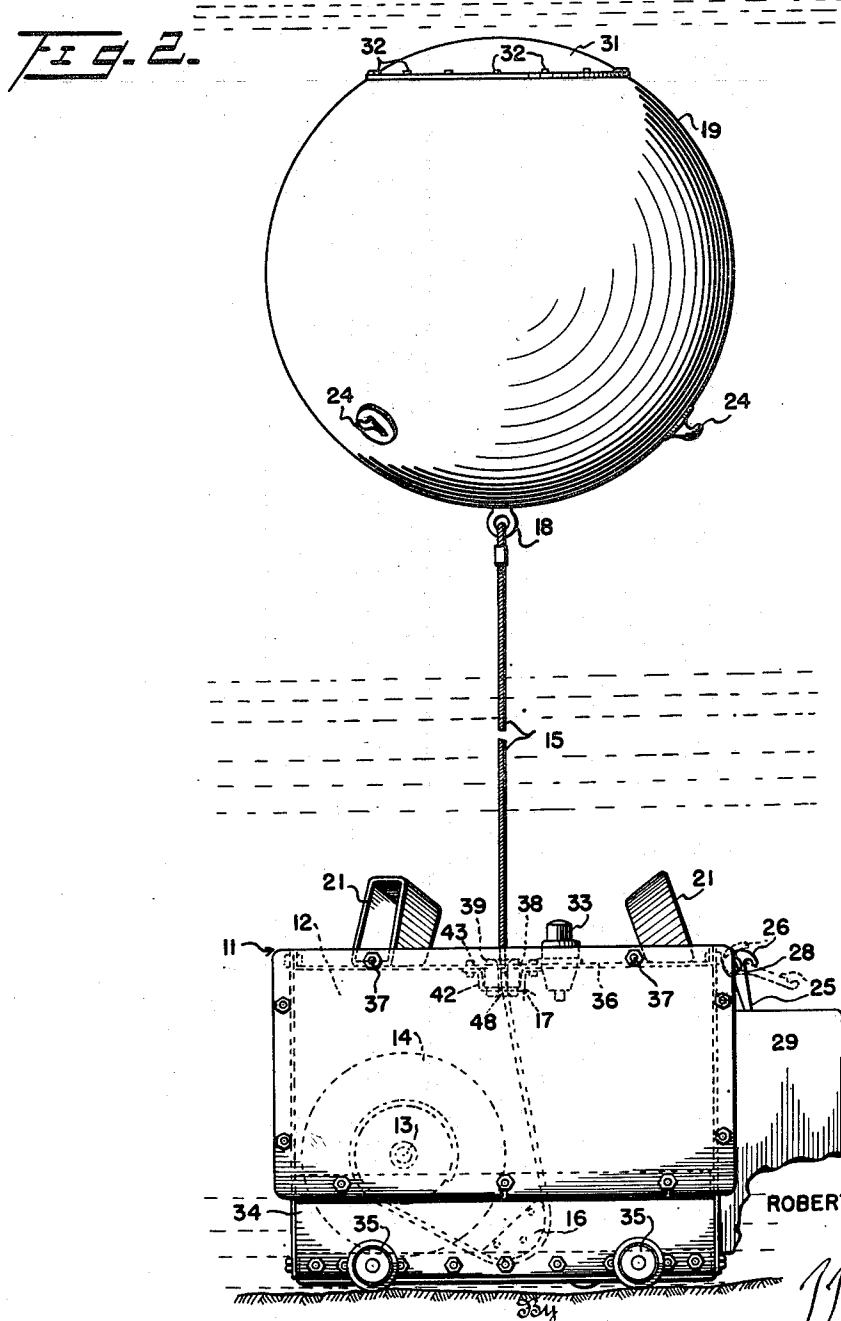
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3 Sheets-Sheet 2



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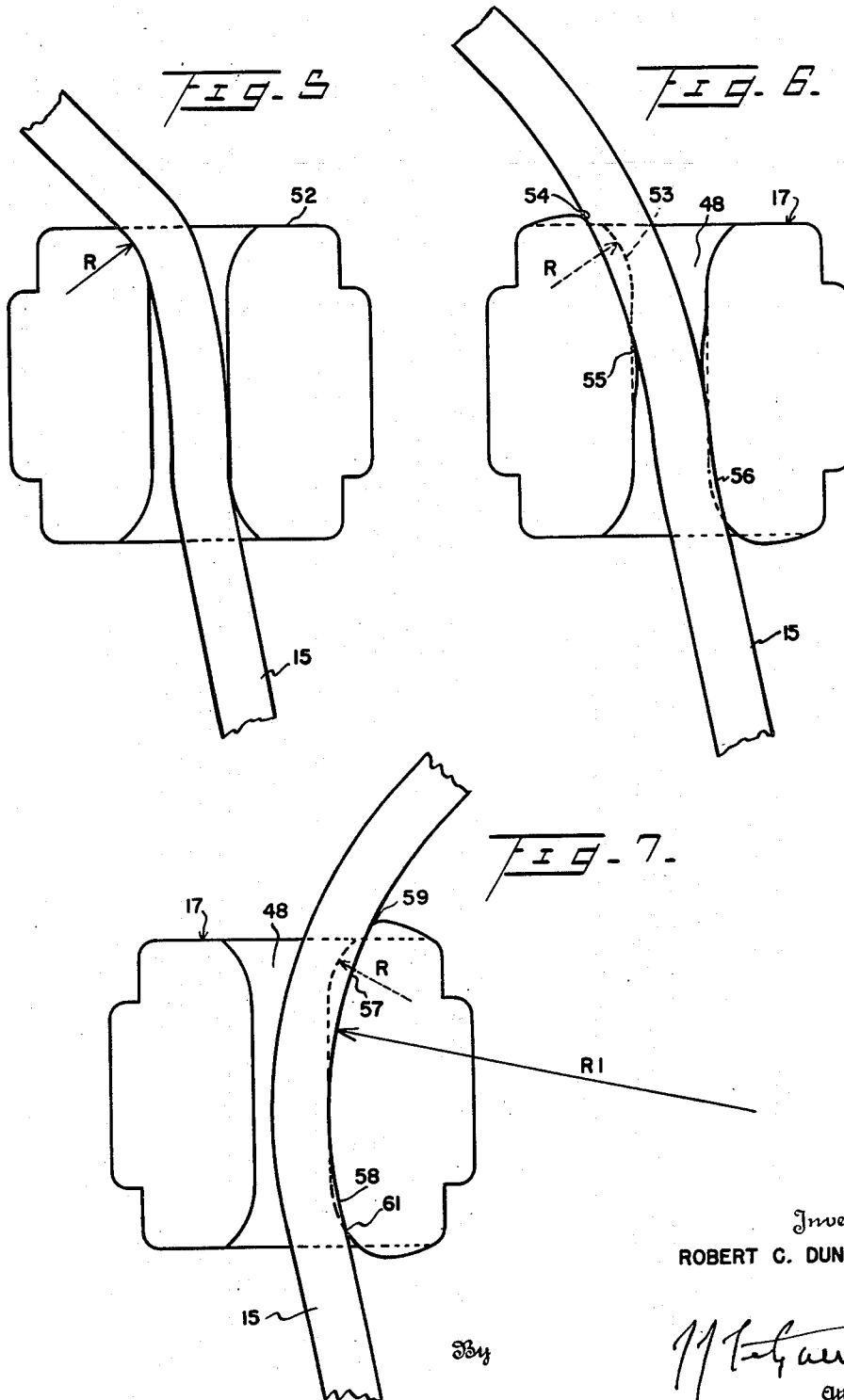
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UNITED STATES PATENT OFFICE

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FAIR-LEAD FOR MINE ANCHORS

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Application June 19, 1942, Serial No. 447,673

3 Claims. (Cl. 254—190)

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sec. 266)

1

This invention relates to an improved fairlead for the anchor of a buoyant marine mine. More specifically, the invention relates to a fairlead secured to the casing of a mine anchor in which a buoyant mine is adapted to be released from locking engagement therewith when the mine is launched and the mooring cable is payed out through the fairlead from a drum within the mine anchor until the mine has reached a predetermined depth of submersion within the water, the drum being thereafter locked to the mine anchor.

In mine mooring devices heretofore devised in which a buoyant mine is releasably secured thereto at the time of launching, it is the general practice to pay out the mooring cable through an annular shaped fairlead composed of suitable metal or lignum vitae secured to the casing of the mine anchor from a drum arranged within the anchor casing until the mine has assumed a predetermined depth of submersion. When this occurs the drum is locked thereby preventing additional paying out of the cable from the mine anchor and the buoyant mine is therefore moored at the predetermined depth of submersion within a body of water by the mooring cable and the 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 anchor is planted. When the mooring cable wears through the fairlead and comes into contact with the casing of the mine anchor or the fairlead support, as the case may be, 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 fairlead in accordance with the present invention in which the fairlead is composed of suitable

2

resilient or yieldable material such, for example, as a composition of rubber or any of the synthetic varieties thereof secured to the anchor casing and having an aperture therein of sufficient size to allow the cable to pass therethrough freely as the mine rises within the water away from the mine anchor and thereafter to support the mooring cable yieldably at the point of emergence from the anchor casing whereby the mooring cable is cushioned by the fairlead at all times and the life and effectiveness of the mooring cable is increased.

One of the objects of the present invention is the provision of a new and improved fairlead for yieldably guiding the cable of a moored mine at or near the point of emergence of the cable from the anchor casing.

Another of the objects is to provide new and improved means for increasing the life and effectiveness of the mooring cable of a buoyant mine.

Another object is the provision of a fairlead of improved construction in which the degree of flexure of the fairlead at the point of emergence from the mine anchor is reduced.

Another of the objects is the provision of a new and improved fairlead for a marine mine in which the rate of wear of the fairlead is reduced.

Another object is to provide a new and improved fairlead adapted 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 complete mine assembly employing the fairlead of the present invention;

Fig. 2 is a view in elevation of the mine assembly of Fig. 1 showing the mine moored within a body of water;

Fig. 3 is a greatly enlarged detailed plan view of the fairlead and a portion of the anchor casing;

Fig. 4 is an elevational view taken substantially along the line 4—4 of Fig. 3;

Fig. 5 shows in diagrammatic form a portion of the mooring cable arranged within a fairlead of the type now in general use;

Fig. 6 shows in diagrammatic form a portion of a cable arranged within the fairlead of the present invention and flexed to the left;

3

Fig. 7 is a view similar to Fig. 6 showing the mooring cable flexed to the right;

Fig. 8 is a view partially in section and partially broken away of an alternative form of fairlead in accordance with the present invention and the supporting means therefor; and,

Fig. 9 is a view in elevation and partially in section of the device of Fig. 8.

Referring now to the drawings for a better understanding of the invention 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 passes over a 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 attached to the eye bolt 18 secured to the casing of the mine 19. The mine may be of any suitable type preferably spherical in shape 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 the link members 22 and 23 secured to the anchor casing which engage the hooks 24 secured to the casing of the mine. The link 23 also engages a release arm 25 at the curved end 26 thereof and includes a turn buckle 27 by means of which the mine is locked against the mine anchor prior to the launching of the mine within the water. The release arm 25 is pivotally secured to the mine casing as at 28 and releasably maintained in the position shown on Fig. 1 by reason of certain control mechanism arranged within the casing 29 adapted to unlock the arm 25 and release the mine from locked engagement with the anchor as the mine is launched, as is well known in the art to which the present invention pertains. The mine is also provided with a cover or cap 31 secured thereto as by the bolts 32 whereby the mine is adapted to be hermetically sealed after an explosive charge and firing mechanism have been assembled therein.

The casing of the mine anchor may advantageously be provided with a valve comprising a spring actuated plunger 33 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 also provided with a downwardly extending portion 34 to which is secured the wheels 35 whereby the launching of the mine is facilitated. The portion 34 of the mine anchor is adapted to enclose and support a heavy weight or 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.

4

The rotatable drum 14 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. Glen-non, issued February 10, 1948, Patent No. 2,435,580 for Differential Drum for Mine Anchors in which the cable is payed 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 36 secured thereto as by the bolts 37 having an aperture 38 therein adapted to receive the fairlead 17 at the reduced portion 39 thereof. The fairlead is also provided with a shoulder 41 adapted to engage the lower surface of the plate 36 as the fairlead is clamped thereagainst by the annular support 42 and bolts 43 having nuts 44 threaded thereon. The support 42 is provided with a centrally arranged aperture 45 within which is fitted the fairlead 17 at the reduced portion thereof, a shoulder 47 being provided on the fairlead to engage the support 42 in the manner illustrated. The fairlead 17 is preferably circular in shape and provided with a centrally arranged aperture 48 having vortically flared ends 49 and 51 whereby the cable 15 arranged therein is adapted to be flexed along the flared portion in a manner which will be more clearly apparent as the description proceeds.

The fairlead is composed of resilient wear resisting material adapted to be compressed yieldably by the mooring cable as the mine moves or weaves within the water as the result of tidal currents whereby the contour of the aperture within which the fairlead is disposed is deformed by the pressure of the mooring cable against the fairlead such that the aperture is brought substantially into agreement with the contour of the cable and the area of contact between the fairlead and the cable is increased proportionally to the pressure of the cable against the fairlead.

This condition will best be understood by consideration of Figs. 5, 6 and 7 of the drawings of which Fig. 5 shows diagrammatically the mooring cable 15 arranged within a fairlead 52 composed of material now in general use such, for example, as metal or lignum vitae. For the purpose of description the fairlead 52 is illustrated with an aperture therein having flared ends of the same general proportions as the fairlead 17 when the fairlead 17 is not deformed by the mooring cable.

The lower end of the mooring cable 15, it will be understood, is continued past the cable guide 16, Fig. 2, and thence to the locked drum 14 to which the cable is secured. The upper end of the cable is attached to the moored mine and the mine is assumed to be urged as by a tidal current sufficiently to cause the mooring cable to assume an angle of forty-five degrees with respect to that portion of the cable extending between the fairlead and the mine when the mine is in the position shown on Fig. 2 of the drawings. The cable issuing from the mine anchor is caused to be flexed into engagement with the outer flanged portion of the fairlead 52 and bent arcuately by the pull of the mine against the mine anchor into conformity with the profile of the upper flared portion of the aperture within the fairlead, the degree of bending being illustrated by the relatively short radius R, Fig. 5, correspond-

5

ing to the radius of the upper flared portion of the fairlead.

On Fig. 6 is shown the mooring cable 15 passing through the fairlead 17 of the present invention and extending toward the left to the moored mine 19 which, as in the case illustrated by Fig. 5, is urged by a tidal current to a position such that that portion of the cable extending between the mine and the fairlead makes an angle of forty-five degrees with the vertical position of the cable shown on Fig. 2. The fairlead 17, it will be noted, is deformed by the pressure of the cable 15 at the upper portion of the aperture 43 therein such that the area of contact between the fairlead and the cable is considerably increased and a portion of the fairlead is forced away from the initial position indicated by the dashed outline 53 of radius R, the cable being in contact with that portion of the fairlead extending between the points 54 and 55 thereof. The deformed portion of the fairlead intermediate the points 54 and 55 may be regarded as an arc of a circle of greatly increased radius with respect to the radius R, and the radius of curvature, therefore, of the cable 15 at the upper portion of the fairlead is greatly increased whereby the degree of flexure of the fairlead is correspondingly reduced.

An arrangement is thus provided in which the resilience of the fairlead is employed to increase the contact area between the cable and the fairlead proportionally to the pull of the mine anchor and the rate of wear of the fairlead in response to movements of the mine within the water is greatly decreased by reason of the resilient nature of the fairlead and the material of which it is composed. Furthermore, the pressure of the mooring cable against the fairlead causes the fairlead to be additionally deformed as at 56 whereby the wear between the fairlead and the cable at the lower portion of the fairlead is also reduced.

On Fig. 7 the cable 15 is shown bent to the right at an angle of forty-five degrees by the pull of the tide against the mine, the upper portion of the fairlead 17 being deformed as at 57 and the lower portion as at 58 whereby the cable is forced into contact with the fairlead throughout a distance included between the points 59 and 61 thereof such that the mooring cable is bent arcuately about a relatively large radius of curvature R1.

The resilient fairlead may be composed of material suitable for the purpose such, for example, as rubber or any of the synthetic varieties thereof or a material of the following composition:

Parts by weight

Rubber	100
Zinc oxide	5
Carbon black	45
Stearic acid	4
Sulphur	3
Phenyl-beta-naphthyl-amine	2
Mercaptobenzothiazole	1
Tetramethyl thiuram disulphide	.05

Of the foregoing materials, the last two named are materials sold under the trade names of "Captax" and "Tuads" respectively.

The foregoing materials may be placed within a mold and heated for twenty minutes at twenty pounds of steam and thereafter for twenty-five minutes at thirty pounds of steam and given a final heat treatment for ten minutes at twenty pounds of steam. In preparing a mass for vul-

6

canization the stock may be rolled in a spiral or preferably cut out of circular disks whereby the disks may be stacked upon one another prior to vulcanization thereof.

On Figs. 8 and 9 are shown in plan and elevation respectively a fairlead and support therefor according to an alternative form of the invention, the structure including, among other elements, a resilient fairlead 62 composed, for example, of the foregoing material having an aperture 63 therein with vortically flared ends 64 and 65 adapted to be inserted within the plate 36, a suitable aperture being provided within the plate for this purpose. The fairlead is maintained in the assembled position with respect to the plate by reason of a support 66 secured to the plate 36 in any suitable manner as by welding or bolting the parts together and having an arcuate portion 67 adapted to engage a complementary recessed portion within the fairlead. The fairlead is maintained in the assembled position by reason of the provision of the arcuate clamping member 68, bolts 69 and nuts 71.

While the invention has been described in detail with respect to two specific examples thereof which give satisfactory results, it will be understood by those skilled in the art, after understanding the invention, that various changes and modifications may be made without departing from the spirit and the scope of the invention, and it is intended, therefore, in the appended claims to cover all such changes and modifications.

The invention herein described and claimed may be manufactured and used by and 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. A fairlead for mounting on a submarine mine anchor having a top plate with an aperture therethrough comprising an elongated resilient cylindrical body having an axial bore extending therethrough, a cylindrical cup-shaped member secured to said top plate and tightly fitted about said body throughout the length thereof, an inverted flange formed on said cup-shaped member and forming an opening in axial alignment with said plate aperture, a nipple formed on one end portion of said body in engagement with said flange and extending through said opening, a second nipple formed on the other end portion of said body in engagement with said plate and extending through said aperture, and a pair of shoulders formed on said body at the junction of said end portions and nipples, said shoulders being in engagement with said plate and flange respectively for preventing axial movement of said fairlead.

2. A fairlead for a mine anchor adapted to moor a buoyant submarine mine and having a top plate with an aperture therein through which the mooring cable extends, comprising an elongated resilient body having a bore therein through which the cable is payed out, said bore terminating in rounded surfaces, said resilient body having a pair of oppositely disposed end portions of reduced diameter providing a pair of shoulders at the junction of said body and end portions, one of said shoulders being in abutting engagement with said top plate, a member secured to said plate for supporting said fairlead within said mine anchor, a cylindrical portion formed on said member in abutting engagement with said resilient body and disposed between said shoulders thereby to com-

7

press said resilient body radially throughout the length thereof and produce a large radius of curvature to the cable in contact with said body as the cable is bent laterally when the mine oscillates with respect to the fairlead in response to cross currents, and flange means on said cylindrical portion in abutting engagement with the other of said shoulders for preventing axial movement of said fairlead.

3. A fairlead for a mine anchor adapted to moor a buoyant submarine mine and having a top plate with an aperture therein through which the mooring cable extends, comprising an elongated resilient body having a bore therein through which the cable is payed out, said bore terminating in rounded surfaces, said resilient body terminating in a pair of oppositely disposed end portions of reduced diameter providing a pair of shoulders at the junction of said body and end portions, one of said shoulders being in abutting engagement with said top plate, a support secured to said plate for supporting said fairlead, a cylindrical portion formed on said support in engagement with said resilient body and disposed between said shoulders thereby to compress said

8

resilient body radially throughout the length thereof and produce a large radius of curvature to the cable in contact with said body as the cable is bent laterally when the mine oscillates with respect to the fairlead in response to cross currents, flange means on said cylindrical portion in abutting engagement with the other of said shoulders for preventing axial movement of said fairlead, and means including an annular member formed on said cylindrical portion for securing said support to said plate.

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