This invention relates to fairleads for cables and ropes, more particularly for use in guiding ships' mooring ropes, and provides an improved and simplified fairlead which enables a cable or rope to lie outwards from the fairlead within a wide angular range horizontally, vertically and obliquely, and yet is of simple and robust construction and capable of withstanding severe conditions of use and climate, for example, as experienced on seagoing ships.

An object of the invention is to provide a fairlead, adapted to enable the deflections of mooring cables in use when a ship is being passed through deep locks, such as are now provided with lifts of 50 feet and higher, comprising a frame including horizontal top and bottom members and a pair of vertical side members, a pair of inboard horizontal rollers mounted one above the other between said side members and a pair of substantially vertical outward rollers mounted between said top and bottom members, said two pairs of rollers being wholly disposed between the inboard and outward limits of said frame.

Preferably, said frame presents a smooth uninterrupted outer face, of which all the margins are rounded, and said two pairs of rollers are wholly disposed on the inboard side of said face, i.e. that side of the frame which is directed towards a winch.

The horizontal rollers may be more closely spaced than the vertical rollers, so as to afford a wide rectangular opening for the passage of a mooring cable, and for an eye on the end of such a cable. Further, since a ship in a deep lock will usually ride less above than below the level of bollards to which the mooring cables are attached, so that such cables will not normally extend obliquely forward at a large downward angle, the pair of horizontal rollers may be disposed towards the lower ends of the pair of vertical rollers. The upper ends of the latter may extend above the upper horizontal roller so as to be capable of guiding a cable at a large upward angle obliquely forward or aft.

A further object of the invention is to provide a fairlead as aforesaid modified to serve for simultaneously guiding two independently movable cables or ropes, said fairlead comprising a frame including horizontal top and bottom members and a pair of vertical side members, a pair of inboard horizontal rollers, each comprising two independently rotatable, co-axial roller sections, mounted one above the other upon said side members, a pair of substantially vertical outward rollers mounted upon said top and bottom members, said two pairs of rollers being wholly disposed on the inboard side of said frame, and another substantially vertical roller extending between the levels of the bottom of the lower horizontal roller and the top of the upper horizontal roller mounted at the middle of the inboard side of said horizontal rollers.

Embodiments of fairleads according to the invention will be described by way of example with reference to the accompanying drawings, wherein:

FIG. 1 is a front or outward elevation of one embodiment, and

FIG. 2 is a rear or inboard perspective view thereof;

FIGS. 3 and 4 are similar views of another embodiment;

FIGS. 5 and 6 are similar views of another, modified embodiment, and

FIGS. 7 and 8 are similar views of an alternative modified embodiment.

In the embodiment shown in FIGS. 1 and 2, a frame 10 consists of a unitary metal casting comprising a top member 11, a bottom member 12, and lateral inboard section members 13, and lateral outward section members 14 with integrally projecting webs 14 having inboard flanges 22 the upper ends of which are curved to merge smoothly into the ends of the top member 11. The frame provides a vertical web 24 of said top member 11 and lateral outward flanges 23 of the side members 12 in a common plane, presenting a plane face web of which all the internal and external edges are rounded.

A pair of vertical rollers 16 are mounted in cylindrical lugs 15 at top and bottom, and a pair of horizontal rollers 18, 19 are mounted in enlargements 17 on the webs 14. The ends of the spindles 20 of the vertical rollers 16 are accessible at apertures in the upper surface of the horizontal web of the top member 11, while the ends of spindles 21 of the horizontal rollers are accessible at the outer sides of the webs 14. All four rollers are cylindrical and as shown have the same diameter. The horizontal rollers 18 and 19 are mounted with their axes in one substantially vertical plane so that their peripheries are spaced apart by about one half of a diameter. The vertical rollers 16 are mounted in a substantially parallel plane, and so that their peripheries are spaced apart by about 2 diameters, said peripheries being close to the peripheries of the horizontal rollers. The lower ends of the vertical rollers 16 are substantially level with the lower arc of the lower horizontal roller 18, and the upper ends of said vertical rollers extend by about 1½–2 diameters above the upper arc of the upper horizontal roller 19. The spindles 20, 21 respectively pass through said rollers and their respective mountings 15, 17 so that any one of the rollers is removable for replacement or repair by withdrawal of its spindle, the ends of which are freely accessible.
The frame 10 is made, to accommodate the larger rollers 16 spaced to afford an elongated rectangular opening 27, as a wide unitary casting, wherein the flanges 22, 23 of the members 12 diverge to a wide base as shown. Between the lower ends of said flanges 22 and 23 are provided horizontal flange members 26 so that the fairlead can stand firmly upon a ship's deck and support the strains imposed by a cable extending in either direction laterally. Further to comply with said regulations, the rounding 28 of the middle portion of the top member of the frame may have a relatively large radius (for example, a radius of at least 150-175 mm.).

A fairlead constructed as either of the embodiments above described is adapted to be mounted on board ship so as to receive between the inboard pair of horizontal rollers 18, 19, a mooring cable extended from a winch and passed outboard between the pair of vertical rollers 16 to a bollard. As shown, the horizontal rollers are more closely spaced than the vertical rollers so as to afford said wide rectangular opening 27 for the passage of such a mooring cable, and for an eye on the end thereof.

When such a fairlead is substantially aligned between the winch and a bollard, a mooring or warping cable can extend from between the horizontal rollers to the bollard, horizontally or at an upward or downward inclination, without touching either of the vertical rollers.

Extensive rounding 28 of the top member and rounding 29 of the bottom member of the frame, between the ends of said vertical rollers 16, enables the cable when so disposed to extend at a large upward or downward angle without fouling the frame.

When taken to a bollard forward or aft of the line from the winch to the fairlead, the cable after passing through the aperture 27 is deflected partly round one or other of the vertical outboard rollers 16. The disposition of the latter rollers permits the cable in such a position to extend forward or aft obliquely at a downward angle of as much as 45° or an upward angle of as much as about 50°. This arrangement provides adequate guidance for a cable from a ship to a bollard in a deep lock, throughout the displacement of a ship from riding high above the wall of a filled lock to lying deep within the lock when the water level has been lowered.

Alternatively, in the use of a fairlead, a large cable, or a smaller cable when subjected to severe downward warping, can be passed through the fairlead over the top of the upper horizontal roller 19. Should the need arise, it is possible to pass more than one rope through the fairlead, for example, one through the aperture 27 between the horizontal rollers 18, 19, and one through the space between the upper roller 19 and the top member of the frame, provided that they diverge on the outboard side.

In a modified fairlead as shown in FIGS. 5 and 6, adapted to comply with other regulations concerning the simultaneous location of two ropes within the wide rectangular gap 27 afforded between the two pairs of rollers, each of the horizontal rollers may be divided at its middle, so as to comprise a pair of individually rotatable halves 38, 39. Extending between the inboard flanges 22 of the lateral channel members 12 of the frame 10 is a horizontal transverse web 30 comprising at its middle a mounting 31 for the upper end of another vertical roller 32, and the bottom member 15 has at its inboard side an extension 33 to provide a mounting for the lower end of said roller 32. Said web member 30 is mounted between the levels of the axis and the upper arc of the upper horizontal rollers 39. The relatively short vertical roller 32 thus divides the said wide gap 27 into two portions, each of which constitutes a channel for one of two ropes which may thereby be freely movable independently and if desired in opposite directions through the fairlead, primarily so that these ropes can diverge from the outboard face of the fairlead to separate bollards at a mutual angle that may be as large as 180°.

Since there is between the horizontal rollers 38, 39 and said inboard vertical roller 32 a dead space which can never in any circumstances be entered by a rope guided by any plurality of the assembly of five rollers as described, there is provided in this space, between the transverse web 30 and the base 13, a vertical bracing element 34 to support the middle of said web, and preventing outwardly upper and lower mountings 35, 36 for the middle of the spindles of the horizontal rollers. It is not necessary to make the horizontal roller sections 38, 39 or the fifth vertical roller 32 as large as the vertical rollers 16, since it is not normally possible for a rope passing from a winch through the fairlead to be bent tightly around the periphery of any one of the latter three rollers.

FIGS. 7 and 8 illustrate a similarly modified, smaller fairlead of the kind above described with reference to FIGS. 1 and 2. In this modification, where the horizontal web of the bottom member 13 does not extend inwardly as far as the inboard flanges 22 of the side members, there is provided, substantially at the level of the lower arc of the roller sections 38, a second transverse web 37 having at its middle a mounting 40 for the lower end of the spindle 41 of said roller 32. Since the spindles 21 of the horizontal rollers 38, 39 are in this embodiment relatively short, it is not necessary to provide a vertical brace 34 with mountings 35, 36 as shown in FIGS. 5 and 6.

It will be observed that in a fairlead according to any of the embodiments described, all the rollers are wholly disposed at the inboard side of the face outwardly presented by the frame. This outer face as seen in any of FIGS. 1, 3, 5 or 7 is smooth and uninterrupted and all edges and corners are rounded off. The rollers are adjusted at the positions 28 and 29 of the top and bottom members between the upper and lower ends respectively of the vertical rollers are rounded to a relatively large radius. Also the inboard lateral flanges 22 of the channel side members merge throughout their upper and upper curved parts with a substantial rounding into the webs 14 of said side members, so that a rope taken from a bit, situated on the ship's deck either forward or aft of the fairlead, to a towing vehicle or "mule" has not to be bent around a sharp angle or radius of the frame. Further, when such rope extends upwards or downwards at an angle from the outboard side of said fairlead to said towing vehicle, it will be only around part of one of the horizontal rollers, and the elliptical oblique section thereof affords a guiding curve less acute than that of the circular transverse section.

The invention provides an improved and simplified construction of fairlead capable of easy and economical manufacture, while being robust and providing an unobstructed outlet for a cable or rope within a wide conical ambit from the wide aperture 27 defined by the two pairs of rollers. Further, the rollers are so mounted, all on the inboard side of the frame, as to be easily removable for replacement or repair, when worn or damaged.

What I claim and desire to secure by Letters Patent is:

1. A fairlead for cables and ropes, comprising a rectangular frame including horizontal top and bottom members and a pair of vertical side members, a pair of inboard horizontal rollers, each comprising two independently rotatable, co-axial roller sections, mounted one above the other upon said side members, a pair of vertical outboard rollers mounted upon said top and bottom members, said two pairs of rollers being wholly on the inboard side of said frame, said horizontal rollers being more closely spaced than said vertical rollers to afford a wide rectangular opening defined by said pairs of rollers, said top and bottom members between the upper and lower mountings of said vertical rollers being narrowly and smoothly recessed, and another vertical roller mounted at the middle of the inboard side of said horizontal rollers and traversing said rectangular opening.
2. A fairlead for cables and ropes according to claim 1 wherein the defined rectangular opening is wider than the diameter of the rollers and wherein said other vertical roller extends from the level of the bottom of the lower horizontal roller at least to the level of the axis of the upper horizontal roller.

3. A fairlead for cables and ropes according to claim 1 wherein said pair of vertical side members presents a smooth, uninterrupted outer face whereof all margins are rounded, and wherein the defined rectangular opening is wider than the diameter of the rollers.

4. A fairlead for cables and ropes according to claim 1 wherein said horizontal and vertical side members are L-sectioned and jointly present a plane rectangular face web, wherein said horizontal rollers are mounted one above the other in inwardly projecting webs of said side members, wherein said vertical rollers are mounted in inwardly projecting webs of said top and bottom members, said two pairs of rollers being wholly on the inboard side of said face web, said horizontal rollers being disposed toward the lower ends of said pair of vertical rollers and extending transversely between the inboard margins of said side members, the upper ends of said vertical rollers extending above the upper horizontal roller a distance not less than 1½ times the diameter of one of said horizontal rollers, the defined rectangular opening being wider than the diameter of the rollers.

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