April 9, 1935. H. P. ELLIOTT 1,996,955

FLOATING WHARF

Filed Dec. 30, 1933 2 Sheets-Sheet 1

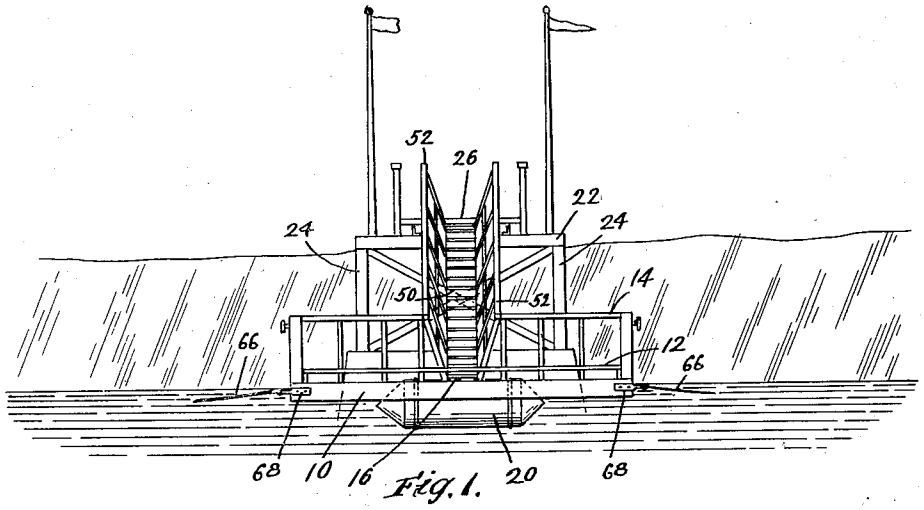


Fig. 1.

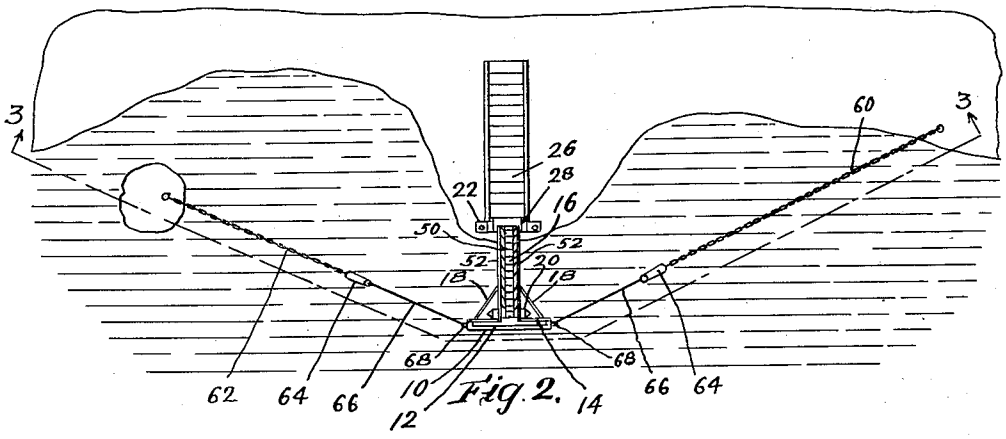


Fig. 2.

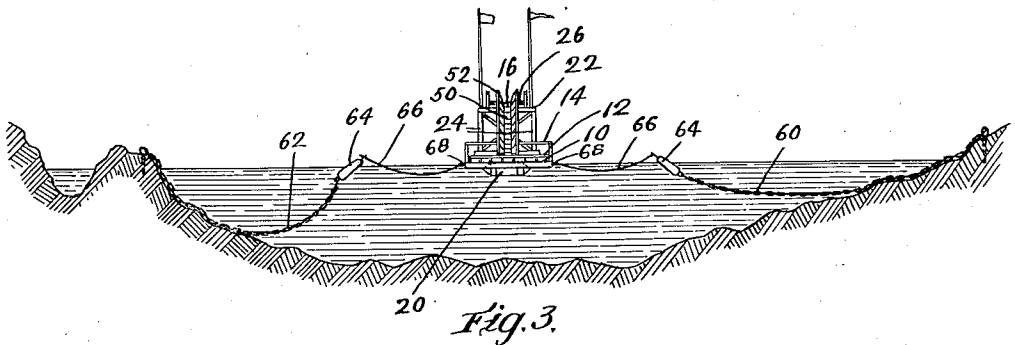


Fig. 3.

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FLOATING WHARF

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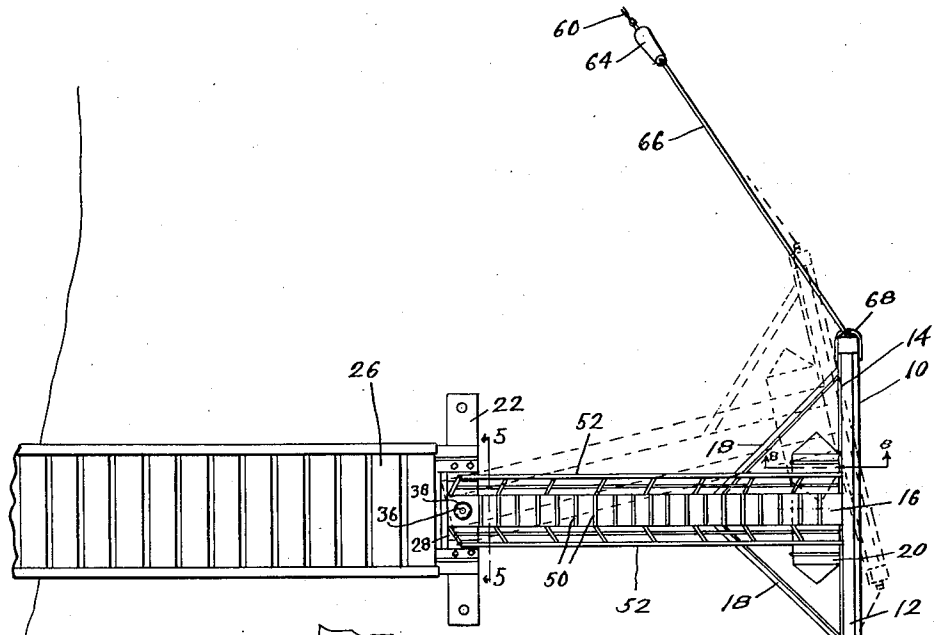


Fig. 4.

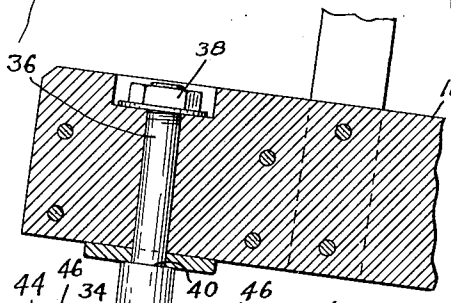


Fig. 6.

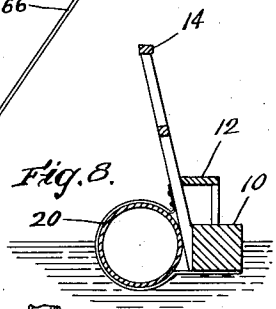
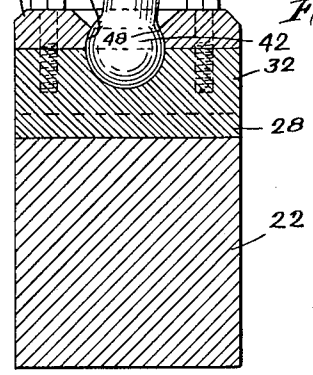


Fig. 8.



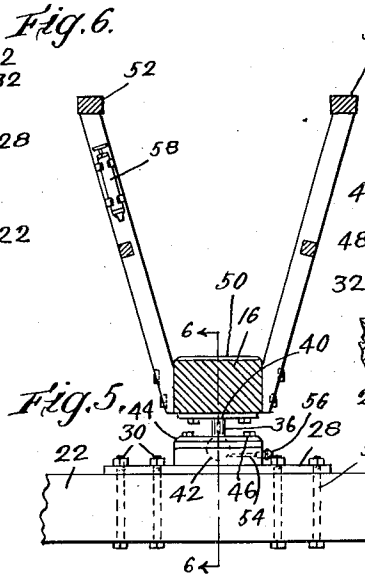


Fig. 5.

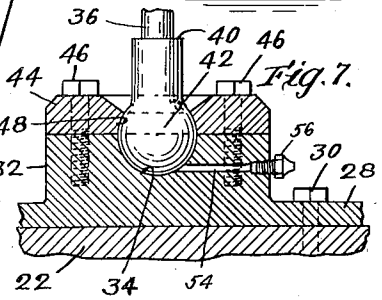


Fig. 7.

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UNITED STATES PATENT OFFICE

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FLOATING WHARF

Harmon P. Elliott, Watertown, Mass.

Application December 30, 1933, Serial No. 704,660

13 Claims. (Cl. 61—48)

This invention relates to floating wharves.

A floating wharf is frequently placed in localities where it is subjected to violent buffeting by waves coming upon it from different directions and by swells and cross currents of the water as well as to the periodic rise and fall of tide water. The waves and the water currents, especially those set up by winter storms tend to pitch, twist and turn the wharf in many directions. It is advisable to moor the wharf in such manner that it can yield or move at least to a certain extent in response to the forces acting upon it so as not to impose undue strains on the structure of the wharf. Heretofore, however, any usual mooring means has been inadequate because the momentum of the wharf, suddenly applied to a part of the mooring structure when at the end of the range of permitted movement, has ruptured the structure. In at least one locality, up to the present invention, no floating wharf construction has been devised that would successfully resist the effects of winter storms.

It is an object of the present invention to provide a floating wharf construction and mooring means therefore so arranged that the wharf is permitted full freedom for vertical movement and for endwise pitching or rolling and yet is restrained against displacement in a given direction, preferably along the line of attack of the prevailing storm waves and currents, so that no momentum can be acquired in such direction, and progressively increased resistance is opposed to the movement of the wharf in a right-angled direction so that the momentum of the wharf is gradually absorbed and the movement of the wharf arrested without undue strains on the mooring structure. Thus the wharf is restrained from acquiring momentum in the direction of application of the greatest displacing forces thereon and sidewise movement is checked gradually so that all parts of the mooring structure are free from heavy strain.

The floating wharf of the present invention comprises a floating structure rigidly connected to the outer end of a strut beam, which beam projects laterally from the floating structure and is anchored to suitable rigid or non-yielding anchorage structure located preferably on land. The strut beam thus maintains the floating structure a definite distance off shore. The strut beam also supports or constitutes the gangplank by which access from land to the floating wharf is provided. The land end of the strut beam has a universal or ball and socket swivel connection with its anchorage so that not only can the floating structure and the strut beam rise and fall in response to variations of tide level but also so that the floating structure and the strut beam are free to rotate on an axis lengthwise of the beam as is occasioned when one end of the floating structure is elevated by the crest of a wave and the other end of the structure is in the trough of a wave. While the swivel connection is necessarily free enough to permit free movement of the wharf it is essential that there should be no loose play in the connection so that the wharf can not gain movement by reason of the loose connection to develop sufficient momentum to wreck or rapidly wear the connection. The floating structure also is anchored at its ends by heavy cables or chains extended along lines generally at right angles to the strut beam and which for the most part normally lie upon the bottom and are connected through floating members or spars and lighter cables or hawsers to the ends of the floating structure. Said cables are so arranged that movement of the structure away from one of them submerges the buoy and progressively raises successive lengths of the heavy chain from the bottom and straightens the cable. This action imposes a progressively increasing resistance to movement of the wharf so that the movement is absorbed without shock and undue strain to the cables or to the structure. A floating wharf so constructed constitutes a further object of the present invention.

A further object is generally to improve the construction of floating wharves.

Fig. 1 is a front elevation of a floating wharf embodying the present invention.

Fig. 2 is a plan view of the wharf.

Fig. 3 is a section taken along line 3—3 of Fig. 2.

Fig. 4 is an enlarged plan view of the wharf.

Fig. 5 is a section taken along line 5—5 of Fig. 4.

Fig. 6 is an enlarged section taken along line 6—6 of Fig. 5.

Fig. 7 is an enlarged detail of the ball and socket joint of Fig. 5.

Fig. 8 is a sectional detail taken along line 8—8 of Fig. 4.

The floating wharf embodying the present invention comprises a floating structure consisting principally of a long beam 10 alongside of which the boat is adapted to come to transfer passengers. The beam 10 is provided with an elevated walk 12 extended longitudinally thereof and the front edge of which is set back from the front edge of the beam. The beam is also pro-

vided with a guide rail 14 thereof extended lengthwise and on the land side thereof. Said beam 10 in the middle is rigidly connected with a strut beam 16 which extends at right angles therefrom toward the shore and has braces 18 that connect intermediate parts of the strut beam with the ends of the floating beam. A hollow cylindrical float member 20 is located under the strut beam immediately at the rear of the floating beam 10 and is suitably rigidly attached to both to provide the major part of the buoyancy of the structure. The land end of the strut beam is connected to an elevated anchorage structure here shown as a cross beam 22 supported upon the tops of upright posts 24 and serving as the outer terminus of a permanent walk or platform 26 extending to the shore.

In accordance with the present invention the strut beam 16 is connected to the anchorage beam 22 by a universal connection that is free from any harmful slackness but permits the free swinging and rocking of the beam. To this end the strut beam is connected to the anchorage by a ball and socket joint. Said joint comprises a plate 28 rigidly secured by bolts 30 to the upper face of the cross beam 22 and having in the middle thereof an upstanding boss 32 provided with a semi-circular recess or socket 34 in the middle of its upper face. The beam 16 is provided with a spindle 36 which extends generally vertical through the beam and is provided with a nut 38 at its upper end by which the beam is clamped between the nut and an enlarged shoulder 40 of the spindle under the beam. The spindle at its lower end is terminated in a ball 42 which is seated in the spherical recess 34 of the boss 32. A cover plate 44 is secured by bolts 46 to the top face of the boss and has a spheroidal seat 48 therein which also engages the ball 42 and thereby retains the ball in the socket while permitting it sufficient angular movement in all directions. The beam 16 forms a gangplank between the platform 26 and the floating beam 10 and for this purpose is provided with cleats 50 and guard rails 52. The ball and socket joint is arranged to be lubricated at suitable times by an oil lubricant passage 54 located in the boss 32 and terminated in a coupling 56 through which grease or other lubricant can be injected into the ball and socket joint by a grease gun 58 conveniently retained removably in clips secured to a guard rail. With this arrangement the floating structure is free to rise and fall with the tides and is free to twist or rotate about an axis generally parallel to the beam 16 as occurs when one end of the beam 10 is riding on the crest of a wave and the other end of the beam is in the trough of the wave, without imposing any unusual strains on the floating structure and also without imposing any unusual strains in the ball and socket connection between the wharf and the anchorage. The strut member also retains the floating structure spaced from the shore, the strut member being, in general, extended in the direction from which the greatest forces strike the wharf. The ball and socket joint is free from any harmful slackness so that there can be no movement of translation between the ball 42 and its socket and hence the wharf can not pound or hammer upon its anchorage and thus the construction is such that little effort is required to maintain the wharf in position regardless of the pitching or tilting of the wharf when subjected to heavy or choppy waves and cross currents. The wharf is anchored against undue sidewise swinging movement about its pivot by cables or chains 60 and 62. These chains extend laterally in opposite directions away from the ends of the beam 10 and inwardly toward the shore line. The shore end of each chain is suitably anchored rigidly to the shore. The free end is anchored to one end of a floating member or spar 64. The other ends of the spars are connected by cables or hawsers 66 to attaching members 68 fixed to the opposite ends of the beam 10. The hawsers 66 preferably are adapted to float in the water or at least to have but little sinking effect. The chains 60, 62, spar 64, and hawsers 66 constitute mooring means for the wharf. The chains 60 and 62 are strong and heavy and under normal conditions the major portions of the chains are adapted to rest upon the bottom as is illustrated in Fig. 3. When the wind, waves or water currents act upon the wharf in a direction to swing it sidewise about its ball and socket joint a pull is exerted upon one of the cables. The hawser 66 becomes taut and then submerges the spar 64. The submerging of the spar exerts some checking effect upon the movement of the wharf. Upon further movement of the wharf, however, the links of the chain are elevated from the bottom in progressive order so that their weights are successively imposed upon the wharf and act to check and retard its movement gradually. As the movement of the wharf increases so that the slack of the cable is taken up, the weight of the suspended portion of the cable becomes more and more effective in checking the movement of the wharf. It is found that with this arrangement the movement of the wharf is arrested gradually without severe strains on the cables sufficient to rupture them. This manner of anchoring the wharf permits the free pitching and canting of the wharf in response to waves and water currents acting thereon without imposing any undue strains upon the structure and the sidewise swinging movement of the wharf is restricted within relatively small movements and is arrested without shock or undue strain to the parts.

A wharf having this construction has been the only one of many wharves installed in the same locality and subjected to the same conditions that has successfully withstood the effects of winter storms without breaking away from its anchorage and without damage to itself or to its mooring means.

I claim:

1. A floating wharf comprising a floating structure, a fixed anchorage, a rigid strut member extended between and connected with said anchorage and floating structure and maintaining said floating structure spaced from said anchorage, and means providing a universal connection between said strut member and said anchorage that permits said floating structure and strut member to pivot in all directions upon said anchorage.

2. A floating wharf comprising a floating structure, a fixed anchorage, a rigid strut member extended between and connected with said anchorage and floating structure and maintaining said floating structure spaced from said anchorage, means providing a universal connection between said strut member and said anchorage that permits said floating structure and strut member to pivot in all directions upon said anchorage, and anchored mooring means for said floating structure connected with said structure permitting a restricted freedom of movement

thereof and having parts operable gradually to check the movement thereof.

3. A floating wharf comprising a floating structure, a fixed anchorage, a rigid strut member extended between and connected with said anchorage and floating structure and maintaining said floating structure spaced from said anchorage, means providing a universal connection between said strut member and said anchorage that permits said floating structure and strut member to pivot in all directions upon said anchorage, and mooring chains connected to opposite ends of said floating structure and extended in opposite directions therefrom and having fixed anchorages for their remote ends, said chains resting for a substantial part of their lengths upon the bottom and one or the other of which is adapted to be raised off the bottom in a progressive manner upon continued movement of said floating member in the same direction whereby to impose progressively increased weight of chain to resist and thereby check the movement of said floating structure gradually.

4. A floating wharf comprising a floating structure, a fixed anchorage, a rigid strut member extended between and connected with said anchorage and floating structure and maintaining said floating structure spaced from said anchorage, means providing a universal connection between said strut member and said anchorage that permits said floating structure and strut member to pivot in all directions upon said anchorage, and mooring means for said floating structure comprising hawsers connected to opposite ends of said floating structure and extended in opposite directions therefrom, floating members secured to the remote ends of said hawsers, chains connected to said floating members and resting normally upon the bottom for a substantial part of their lengths and having fixed anchorages for their free ends.

5. A floating wharf comprising a floating structure, a strut rigid with said structure and extended therefrom, an anchorage, and a ball and socket connection between said anchorage and the free end of said strut which permits said floating structure and strut free pivotal movement in all directions.

6. A floating wharf comprising a floating structure, a strut rigid with said structure and extended therefrom, an anchorage, a ball and socket connection between said anchorage and the free end of said strut which permits said floating structure and strut free pivotal movement in all directions, and anchored mooring means connected with said floating structure which restricts its swinging movement sidewise of said beam.

7. A floating wharf comprising a floating structure, a strut rigid with said structure and extended therefrom, an anchorage, a ball and socket connection between said anchorage and the free end of said strut which permits said floating structure and strut free pivotal movement in all directions, anchored mooring means connected with said floating structure which restricts its swinging movement sidewise of said beam, said mooring means having a part that imposes progressively increased opposition to continued sidewise movement in the same direction.

8. A floating wharf including a floating beam, a strut beam rigid with said floating beam and extended at right angles thereto from the middle thereof, a fixed shore anchorage, and a ball and socket connection between said anchorage and the free end of said strut beam which opposes movement endwise of said strut beam but which permits said floating beam and strut free pivotal movement in all directions.

9. A floating wharf including a floating structure, a strut beam rigid with said floating structure and extended at right angles thereto from the middle thereof, a fixed shore anchorage, and a ball and socket connection between said anchorage and the free end of said strut beam which opposes movement endwise of said strut beam but which permits said floating structure and strut free pivotal movement in all directions, and means carried by said strut beam constituting a gangplank providing passage from shore to said floating structure.

10. A floating wharf including a floating beam, a strut beam rigid with said floating beam and extended at right angles thereto from the middle thereof, a hollow buoyant member for the wharf fixed under said strut beam behind said floating beam, a fixed shore anchorage, and a ball and socket connection between said anchorage and the free end of said strut beam which permits said floating beam and buoyant member free pivotal movement in all directions.

11. A floating wharf including a floating beam, a strut beam rigid with said floating beam and extended at right angles thereto from the middle thereof, a fixed anchorage located under the free end of said strut beam, a ball socket carried by said anchorage, and a vertical spindle fixed to said strut beam and having a ball end beneath said strut beam which is swivelled in said socket.

12. A floating wharf including a floating beam, a strut beam rigid with said floating beam and extended at right angles thereto from the middle thereof, a fixed anchorage located under the free end of said strut beam, a ball socket carried by said anchorage, a vertical spindle fixed to said strut beam and having a ball end beneath said strut beam which is swivelled in said socket, and mooring cables fixed to opposite ends of said floating beam and extended generally endwise therefrom and having fixed anchorages for their remote ends which limit swinging movement of said beams in the general plane thereof.

13. A floating wharf including a floating beam, strut beam rigid with said floating beam and extended at right angles thereto from the middle thereof, an elevated shore anchorage, a ball and socket connection between said anchorage and the free end of said beam which resists endwise movement of said strut beam but permits free pivotal movement thereof in all directions, said strut beam constituting a gangplank providing passage between shore and said floating beam, and mooring means for the ends of said floating beam comprising hawsers fixed to the ends of said floating beam and extended endwise thereof, spars secured at one end to the free ends of said hawsers, chains secured to the other ends of said spars and normally resting for a substantial part of their length upon the bottom and having their remote ends fixedly anchored.

HARMON P. ELLIOTT.