April 16, 1946. A. L. L. BAKER 2,398,351

MARINE STRUCTURE

Filed March 21, 1945 7 Sheets-Sheet 1

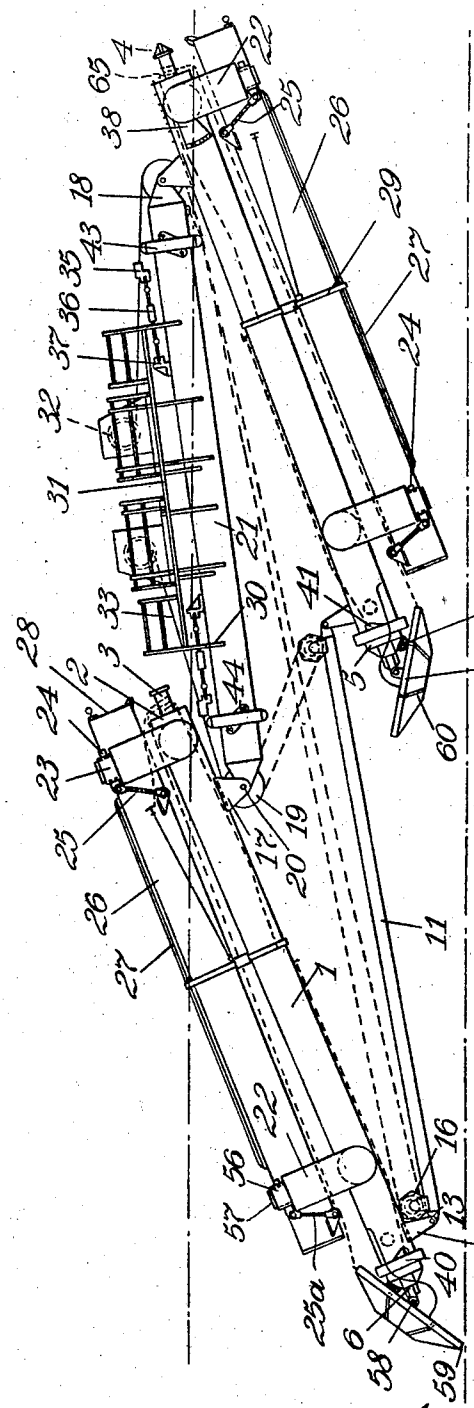


Fig. 1.

Inventor
A. L. L. Baker
By Glascock Downing & Seibold
Attys.

April 16, 1946. A. L. L. BAKER 2,398,351

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Filed March 21, 1945 7 Sheets-Sheet 2

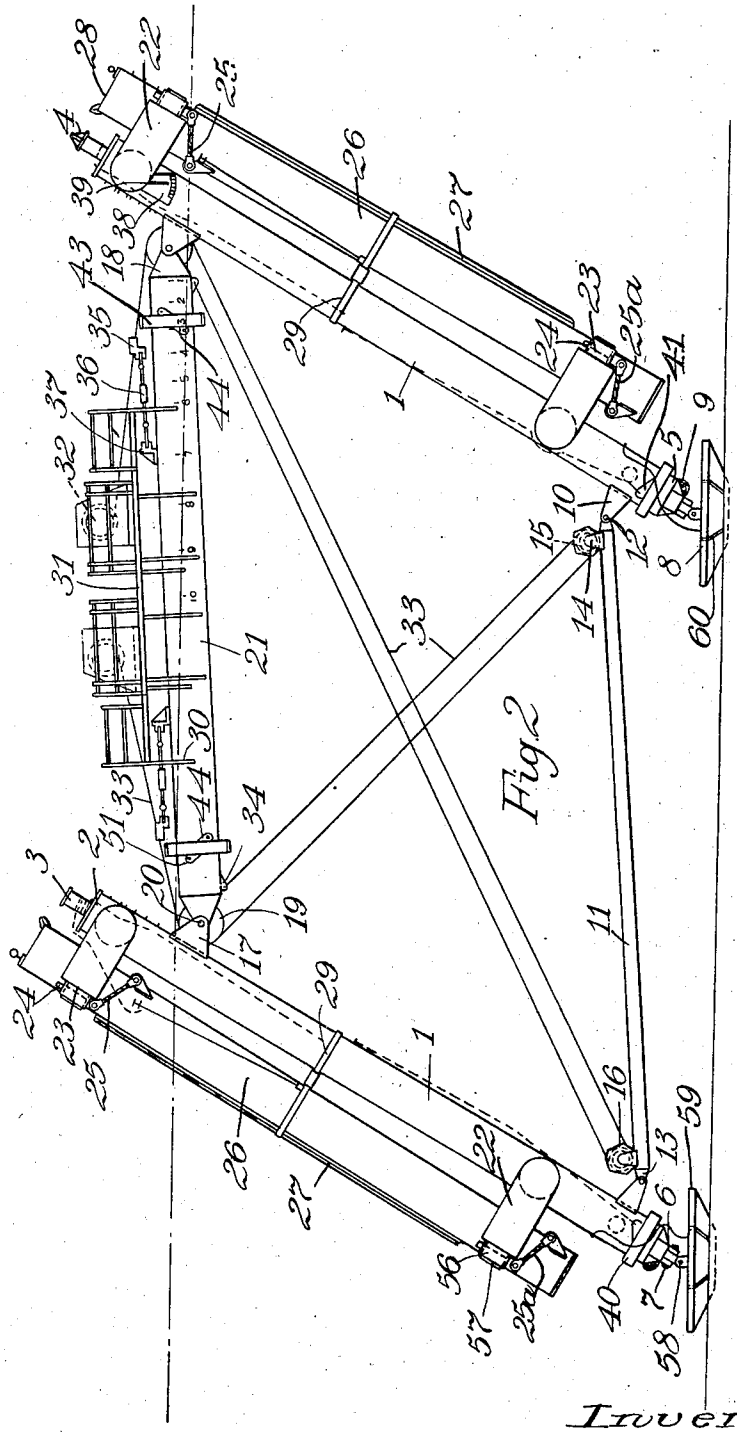


Fig 2

Inventor
A. L. L. Baker
By Glascock Downing Seibold Attys.

April 16, 1946. A. L. L. BAKER 2,398,351

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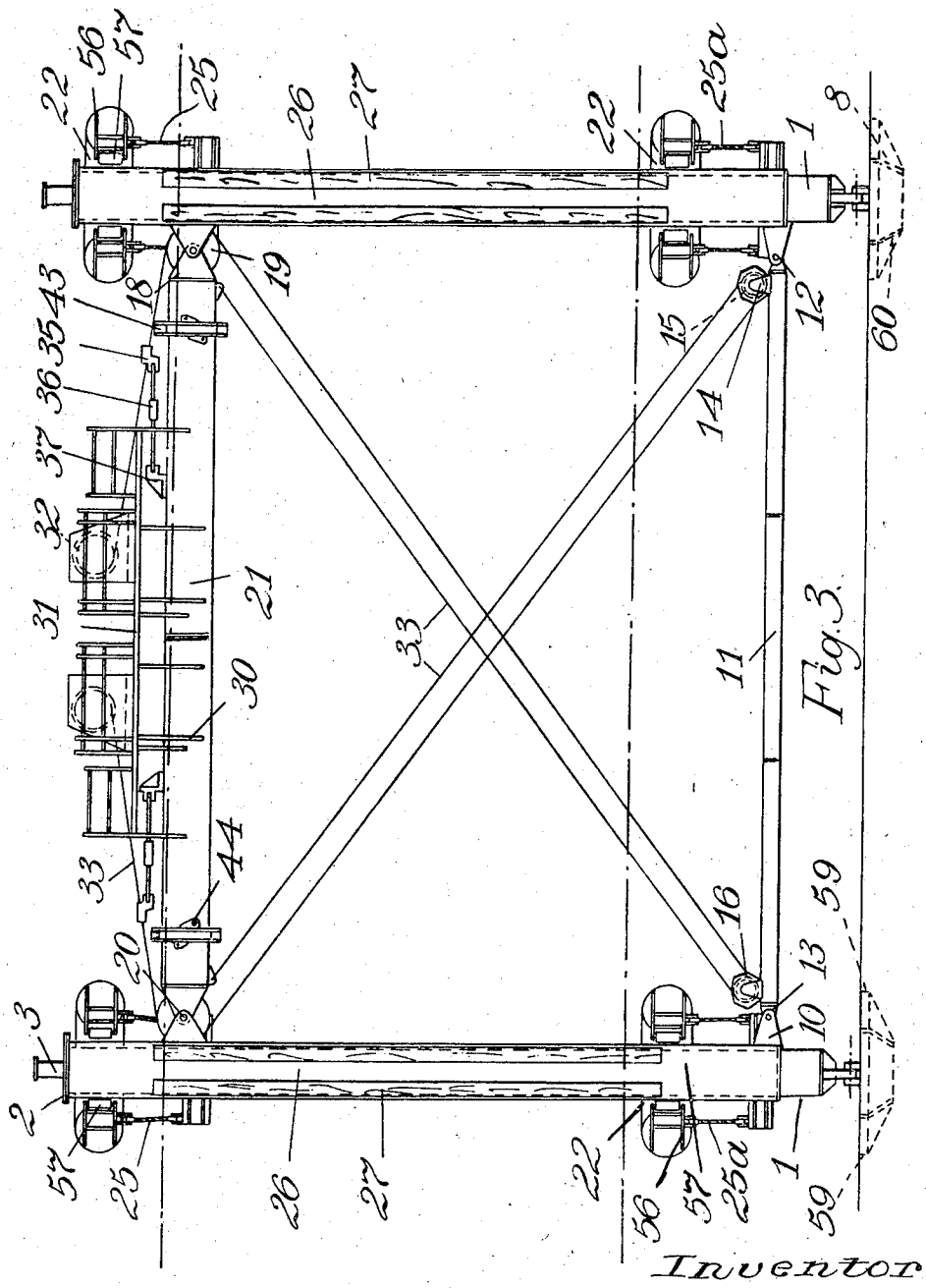


Fig. 3.

INVENTOR
A. L. L. Baker
By Glascock Downing Seebold
Attys.

April 16, 1946. A. L. L. BAKER 2,398,351

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Filed March 21, 1945 7 Sheets-Sheet 4

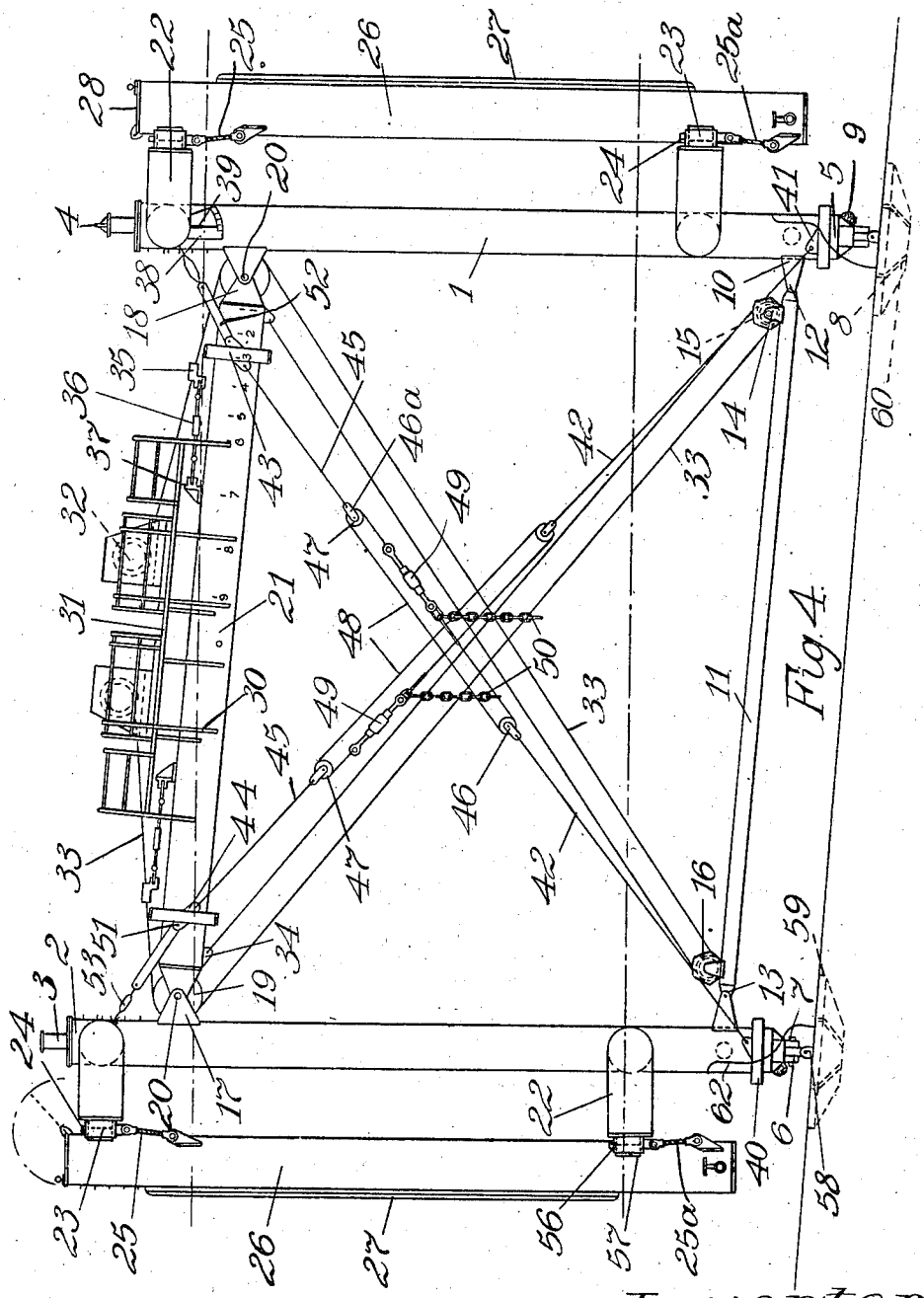


Fig. 4.

Inventor
A. L. L. Baker
By Glascock Downing & Seibold
Attys.

April 16, 1946. A. L. L. BAKER 2,398,351

MARINE STRUCTURE

Filed March 21, 1945 7 Sheets-Sheet 5

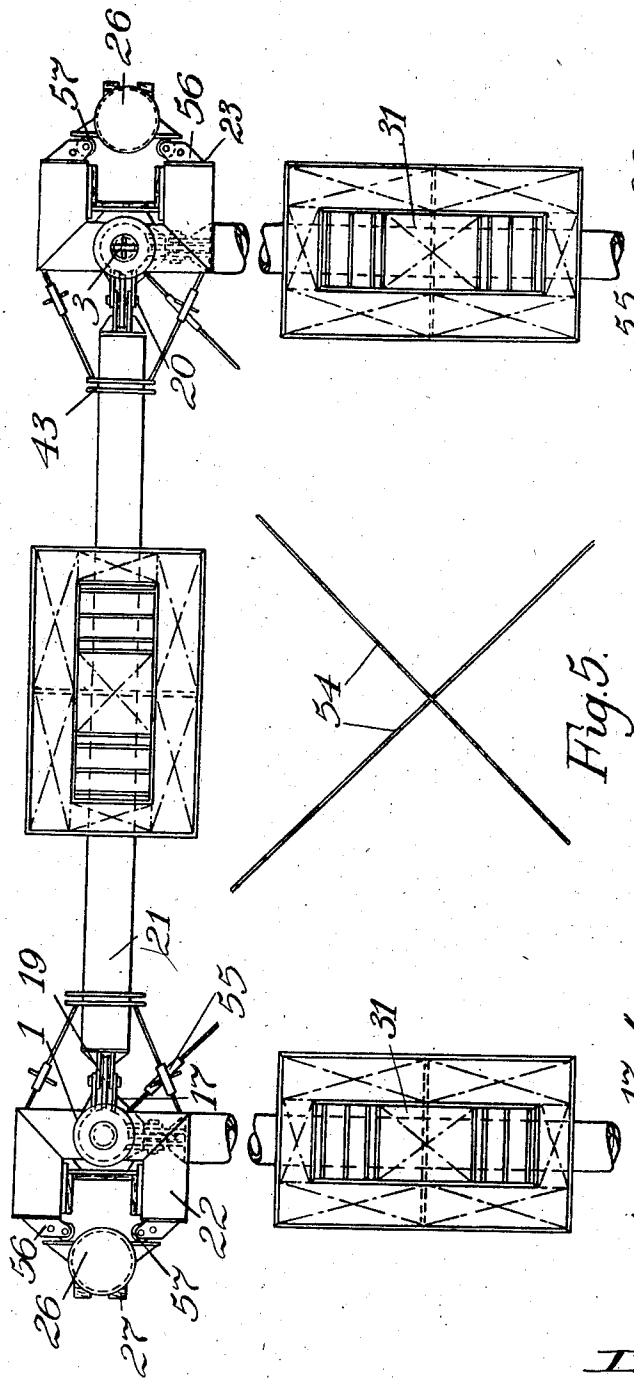


Fig. 5.

Inventor
A. L. L. Baker
By Glascock Downing & Seibold
Attys.

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MARINE STRUCTURE

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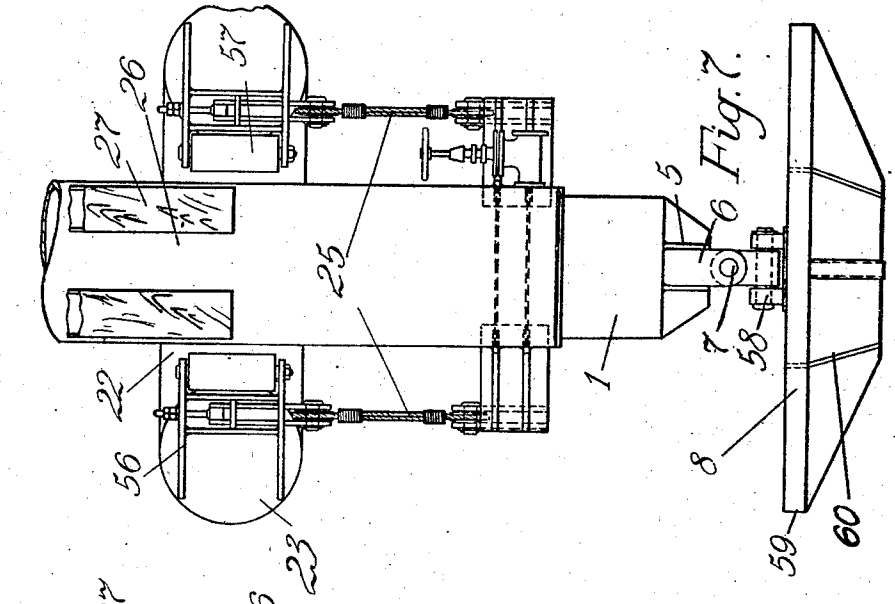


Fig. 7.

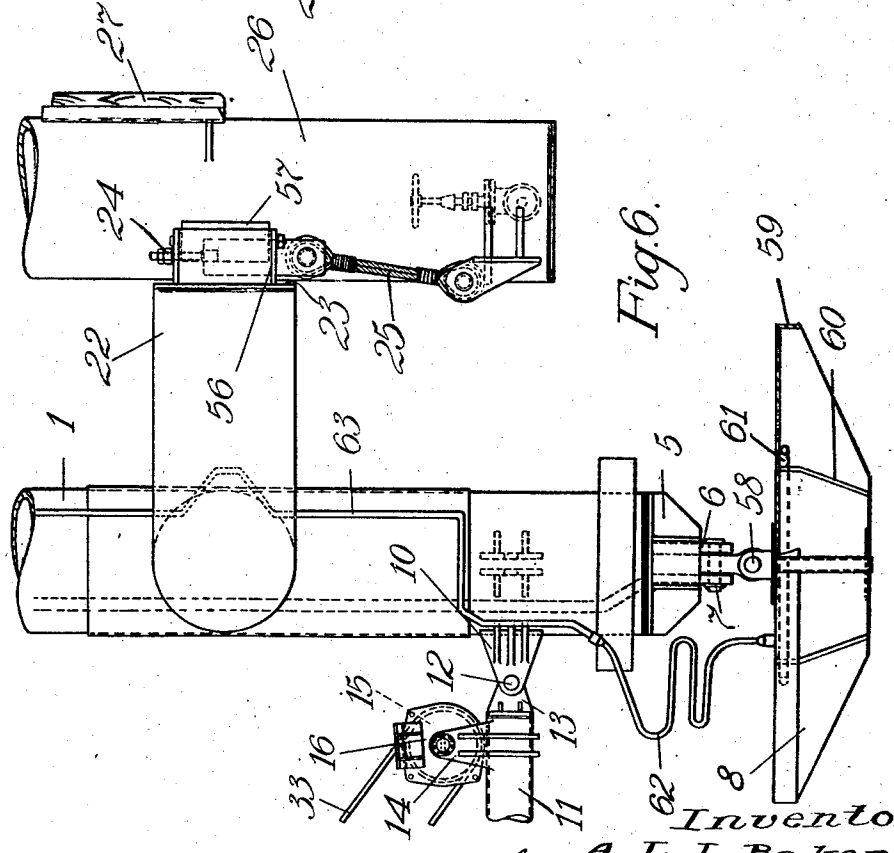


Fig. 6.

Inventor
A. L. L. Baker
By Clarence Downing Tibbetts
Attys

April 16, 1946. A. L. L. BAKER 2,398,351

MARINE STRUCTURE

Filed March 21, 1945 7 Sheets-Sheet 7

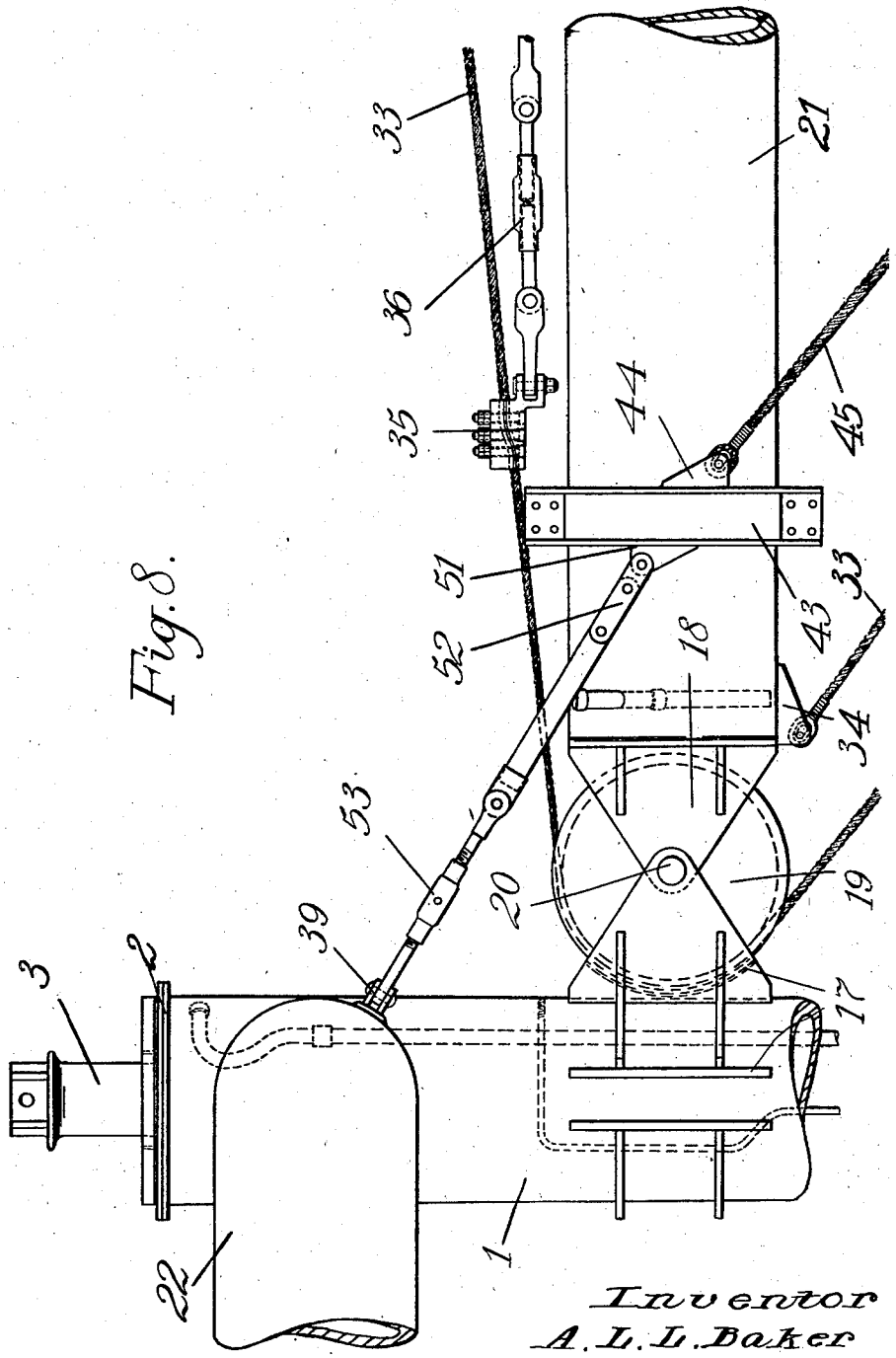


Fig. 8.

Inventor
A. L. L. Baker
By Glascock Downing Seibold
Attys.

Patented Apr. 16, 1946 2,398,351

UNITED STATES PATENT OFFICE

2,398,351

MARINE STRUCTURE

Arthur Lempriere Lancey Baker, Sevenoaks, England

Application March 21, 1945, Serial No. 583,989
In Great Britain July 22, 1943

10 Claims. (Cl. 61—46)

This invention relates to structures and particularly marine structures, adapted to function as piers or supports for bridges, viaducts, or as dolphins, jetties, wharves or the like berthing places for vessels and has for its object to provide structures adapted more particularly for transport by water to the place for their erection.

The invention consists, broadly, in a structure comprising at least two strut elements pivotally connected one with the other at each of their two opposite sides and at points spaced apart in their length by at least two distance pieces or links forming with the strut elements in effect sides of parallelograms and furnished with steel wire ropes or equivalent flexible members anchored adjacent to one end of a distance piece and taken over a pulley or runner adjacent to the opposite end of an adjacent distance piece and thence to a winch or equivalent means whereby the effective length of the flexible member between its anchorage and the winch may be shortened to cause the strut elements to move away from one another while remaining in parallel relationship so that the lower ends of the two strut elements may seat at different levels on the surface on which the structure is erected with the strut elements substantially vertical and parallel.

A structure so formed, it will be appreciated, may be collapsed, that is to say, the two strut elements may be brought together for facilitating storage and transport to the place at which the structure is to be erected, when by tensioning or shortening the effective length of the flexible members associated with them, the strut elements may be moved apart in the operation of erection.

Each of the strut elements will normally constitute a frame and in most cases the two strut elements will be connected one with the other on each side by more than two distance pieces.

In such case the steel wire ropes or equivalent flexible members will be anchored adjacent to one end of a distance piece or link and taken over a pulley or roller adjacent to the opposite end of the next adjacent distance piece or link, along the link and generally parallel therewith over a further pulley or roller and from this point over a pulley or roller located adjacent to the opposite end of the next succeeding distance piece or link and then to a winch associated with it.

As will be appreciated, the structure may comprise any desired number of distance pieces or links greater than two arranged on each of its sides and with the uppermost links or distance pieces there may be associated a platform for use by the operators of the winches.

Generally, at least two flexible members arranged in the manner above mentioned, will be associated with the links or distance pieces on each side of the structure, one such flexible member being anchored adjacent to one end of one link or distance piece and the other adjacent to the opposite end of the same link or distance piece, so that when erected the flexible members will extend diagonally in two senses across the parallelogram formed by the links or distance pieces and the partions of the struts with which they are associated.

Cross bracing or ties may be provided which will extend in plan generally diagonally between the strut elements.

In other words the cross braces or ties will extend from the left-hand side of one such strut element to the right-hand side of the other strut element, and between the right-hand side of the first-mentioned strut element and the left-hand side of the second-mentioned element.

These ties may be rods hinged at one of their ends to a strut element, the opposite ends extending through a ring and being associated with nuts or the like whereby a desired degree of tension may be secured.

The pivotal connection between the links or distance pieces and the strut elements may be secured by providing on the latter brackets or lugs for pivots connecting the distance pieces or links individually to the strut elements.

Normally, in accordance with the invention, the lower ends of the strut elements are furnished with spuds, footings or the like adapted to provide a suitable grip or area of support against the bottom, on which the structure is erected, and these spuds or the like will in general be hingedly connected with the strut elements.

Preferably, the strut elements are provided with means whereby their lengths may be adjusted to bring their upper extremities, when the structure is erected, to a common level.

Thus, the upper ends of the strut elements may be provided with members telescopically engaging them to enable a horizontal platform or the like to be secured to the structure.

Further, the upper ends of the strut elements may be formed as bollards.

The strut elements, distance pieces and fenders, if provided, may be formed of any appropriate material, for instance, timber, structural steel, or reinforced concrete and where necessary or desirable they may be provided with auxiliary floats for floating them into position and ballast for stabilizing them or facilitating their erection.

Conveniently, the strut elements and optionally also the distance pieces or links, and the fenders, if provided, are formed of tubing and are arranged to be filled or partially filled with air so that the structure may be floated into position, after which the air may be released from the tube, water being admitted, to destroy the buoyancy of the structure so that the ends of the struts, in the case of a marine structure, will sink to and rest upon the bottom, in the erection of the structure.

In this case suitable gates or ports and connections will be provided in the tubes to permit or allow water or air or ballast to be ejected or introduced into them.

Accessory floats may be detachably associated with the structure for floating it into position and portions of the strut elements and the spuds, if provided, may be filled with sand, water or other ballast, to render them less buoyant than those portions of the structure which will be directed upward when it is erected.

Where a structure is designed to be employed as a dolphin, jetty or wharf, preferably in accordance with the invention, to the strut elements there are secured rigid fender elements suspended by means permitting them to be displaced in an inward direction by the pressure exerted against them of a vessel in berthing and to oppose a progressively increasing resistance to such displacement.

In other words, the fender elements, generally in respect to their structure and their suspension, may be as described in British specification No. 563,946.

Where fender elements are provided, the strut elements are furnished with brackets at appropriate points for the suspension of the fenders which themselves may be tubes adapted, when the structure is in position, to be filled with water, concrete, sand or the like.

These brackets may be bifurcated elements formed, for instance, of tubing and will be provided with links by which suspension of the fender elements may be effected by the aid of chains or the like, so that in their displacement they will operate to oppose an increasing degree of resistance to displacement in the berthing of a vessel.

In the storage and transport, detachable straps may be provided for securing the fender elements immovably in position against the strut elements with which they are associated. When the struts supporting the fenders are brought to a vertical position by operating winches supported on the upper links or distance pieces, the fenders also automatically assume a vertical position although the footings of the supporting struts are at different levels. Also if through settlement or scouring action after erection the footings of the supporting struts take up different levels, the fenders can at any time be restored to a vertical position.

When erected, a platform or staging may be secured in position on the upper end of the structure and such a staging may be arranged to extend between two or more adjacent structures of this character to provide a bridge, or between one of such structures and abutments positioned at each side of the space to be bridged in which case preferably there would be employed strut elements provided with members telescopically engaging them to enable the height of the supports for the platform to be adjusted as desired.

A plurality of structures of the kind in question may be erected adjacent to one another, or the struts may each be arranged to provide a number of points of support greater than two on the surface on which the structures are erected.

The invention will be described further in detail and by way of example with reference to the accompanying drawings, in which:

Figure 1 illustrates in side elevation a structure in accordance with the invention in the form of a dolphin alongside which vessels may be berthed, the structure being shown in the collapsed position for towing.

Figure 2 illustrates in side elevation the structure in process of erection.

Figure 3 illustrates in front elevation the structure fully erected on an uneven base.

Figure 4 is a side elevation thereof, and

Figure 5 is a plan view.

Figures 6 and 7 are views showing certain details on a larger scale, and

Figure 8 is a view of a further view also on a larger scale showing certain further details.

The structure illustrated comprises four strut elements each consisting of a length of tubing 1 provided at one end with a closure 2 on which is mounted bollards 3, two of the bollards being provided with eyes 4 for use in towing the structure into position when collapsed.

Its opposite end is closed with a plug 5 provided with a bifurcated extension 6 to which is pivotally connected by a pin 7 a foot 8 which in the position for towing is drawn or lashed into contact with a timber pad 9.

On each of the strut elements there is provided a bifurcated bracket 10 to which is connected a transverse member 11 in the form of a tube by means of a pin 12 passing through a perforated lug 13 which closes the end of the tube.

On this member there are provided brackets 14 carrying pulleys 15 located between guard elements 16.

On the strut elements there are provided also bifurcated brackets 17 formed in the construction illustrated by sections of plate welded to the member and between birfurcations of this bracket there is engaged a bifurcated lug 18 and a pulley 19 by means of a pin 20.

The bifurcated lug 18 is also formed of sections of metal plate welded to a plate closing the end of the tubular member 21 which forms an upper transverse element of the structure.

Further, to the tubular portions of the strut elements there are secured bifurcated brackets 22 also formed of tube and provided with closures 23 which form supports for eyebolts 24 to which are connected slings 25, 25a, suspending fender elements 26 formed of tube and furnished with timber rubbing pieces 27.

At one end these fender elements are closed and at the other end they are provided with lids 28 which when raised will permit sand or other loading material to be introduced into them.

When in position for towing, these fender elements are tied to the strut elements by straps 29 which are removed when the structure is erected.

On each of the transverse elements 21 which form links or distance pieces between the strut elements, there are secured by sections of plate 30 forming brackets, a platform 31 on which are mounted winches 32.

About the drums of these winches there are engaged cables 33 each of which passes over a pulley 19 and a pulley 15, the end being anchored at 34 to the transverse member.

These winches are operated in erecting and

collapsing the structure and when the structure is erected the cables are each engaged by a clamp 35 with which is associated a turnbuckle 36, one end of which is anchored to a bracket 37 on the upper transverse member, the purpose of the clamp and turnbuckle being to secure the final adjustment and securing of the cable. The construction of this clamp and turnbuckle will be described in greater detail below.

On two of the strut elements there are provided indicator quadrants 38 with which co-operate index pointers 39 by which in the erection of the structure the inclination of the strut elements may be determined.

On the strut elements adjacent to their lower end there are provided collars 40 to which are connected lugs 41 to which one end of a tie 42 may be connected.

Each of the upper transverse elements is provided with a collar 43 to which is secured a lug 44 with which a tie 45 is also connected.

These ties are secured respectively to shackles 46, 46a, provided on members to which are pivotally connected pulleys 47 and about these pulleys there is passed a cable 48, one end of which is permanently connected to a turnbuckle 49 while the other end of the turnbuckle is provided with means by which one or other of the links of the chain 50 may be engaged so that the element as a whole will constitute a stay.

On each of the collars 43 there is provided a further lug 51 with which is connected one end of a link 52 the opposite end of which is connected with one end of a turnbuckle 53 the opposite end of which is connected, as shown in Figure 8, to the bifurcated bracket 39, a similar arrangement being provided on the opposite side of the upper transverse element to function as torsion resisting elements for the bracket.

When the structure is erected there may be arranged to connect the strut elements diagonal ties 54 adjacent the ends of which may be provided with turnbuckles 55.

Each arm of the bifurcated brackets 22 is provided at its end with an element 56 carrying a roller 57 adapted to guide the fender element in its displacement into the opening between the arms.

The joint between each of the feet and its associated strut element is arranged as a universal joint as may be seen more clearly from Figures 6 and 7, the universal joint being secured by the pin 7 above referred to and a further pin 58.

With the feet, each of which is provided with a peripheral flange 59 and diagonal webs 60, there is associated a perforated tube 61 connected by a flexible pipe 62 with a rigid pipe 63 secured to the strut.

This pipe is continued to a convenient position adjacent the platform and is designed to permit compressed air to be expelled through the perforations to facilitate the seating of the foot on, for instance, a sandy bottom.

In towing, the whole of the tubular elements will be maintained full or partly full of air and to this end with the several tubular elements there are provided connections by which air may be introduced into them and cocks or valves whereby water may be permitted to enter and displace the air in the operation of erection.

To facilitate the release of air and expulsion of water, the several tubular connections may be taken to a convenient position adjacent to the platforms and connected to a common header furnished with valves whereby air may be permitted to enter or escape from the tubes, and further there may be associated valves such as is shown in Figure 3 applied to a fender element for the admission and expulsion of water.

To secure the various elements in position for towing, there are provided lashing elements 65 which may be secured about the bollards or otherwise in such manner that they may be conveniently released when necessary.

I claim:

1. Structures and particularly marine structures, adapted to function as piers or supports for bridges, viaducts, or as dolphins, jetties, wharves or the like berthing places for vessels comprising distance pieces, at least two strut elements pivotally connected one with the other at each of their two opposite sides and at points spaced apart in their length by at least two of said distance pieces and forming therewith the sides of parallelograms, pulleys on the ends of certain of said distance pieces, flexible members each anchored adjacent to one end of other of said distance pieces and taken over the pulley on the opposite end of the adjacent distance piece, and adjusting means connected with each flexible member whereby the effective length of the flexible member between its anchorage and the adjusting means may be shortened to cause the strut elements to move away from one another while remaining in parallel relationship so that the lower ends of the two strut elements may seat at different levels on the surface on which the structure is erected with the strut elements substantially vertical and parallel.

2. A structure as claimed in claim 1 in which each of the strut elements constitutes a frame and in which each of two such strut elements are connected one with the other on each side by more than two distance pieces.

3. A structure as claimed in claim 1 in which the pivotal connection between the distance pieces and the strut elements is formed by brackets and pivots connecting the distance pieces individually to the strut elements.

4. A structure as claimed in claim 1 in which the lower ends of the strut elements are furnished with footings adapted to provide a suitable grip against the bottom on which the structure is erected.

5. A structure as claimed in claim 1 in which the lower ends of the strut elements are furnished with hinged footings adapted to provide a suitable grip against the bottom on which the structure is erected.

6. A structure as claimed in claim 1 in which the upper ends of the strut elements are provided with bollards.

7. A structure as claimed in claim 1 in which the strut elements are formed of tubing and are arranged to be filled with air so that the structure may be floated into position, after which the air may be released from the tube, water being admitted, to destroy the buoyancy of the structure so that the ends of the struts, in the case of a marine structure, will sink to and rest upon the bottom, in the erection of the structure.

8. A structure as claimed in claim 1 designed to be employed as a dolphin, jetty or wharf provided with rigid fender elements suspended from the strut elements and displaceable in an inward direction by the pressure exerted against them of a vessel in berthing and operable to oppose a progressively increasing resistance to such displacement.

9. A structure as claimed in claim 1 provided with brackets on the strut elements, suspension means carried by said brackets, and rigid fender elements carried by said suspension means as displaceable inwardly by pressure and operable to exert a progressively increasing resistance to inward displacement.

10. A structure as claimed in claim 1 provided with brackets on the strut elements, suspension means carried by said brackets, and rigid fender elements carried by said suspension means as displaceable inwardly by pressure and operable to exert a progressively increasing resistance to inward displacement, said brackets being formed of tubing.

ARTHUR LEMPRIERE LANCEY BAKER.