No. 696,097. Patented Mar. 25, 1902.

J. GRAHAM.

AUTOMATICALLY PROPELLED MULTIPLE HULL VESSEL.

(Application filed Jan. 28, 1901.)

(No Model.) 4 Sheets—Sheet 1.

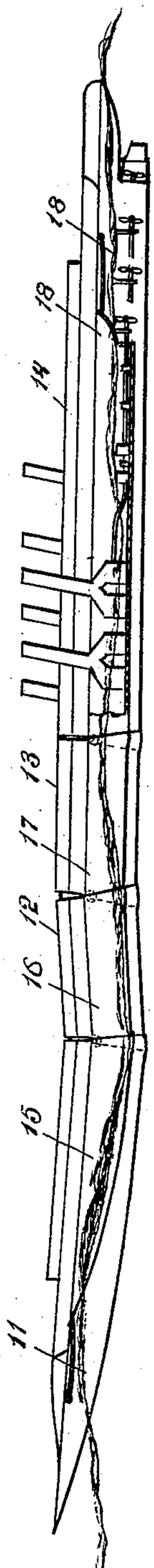

Fig. 1.

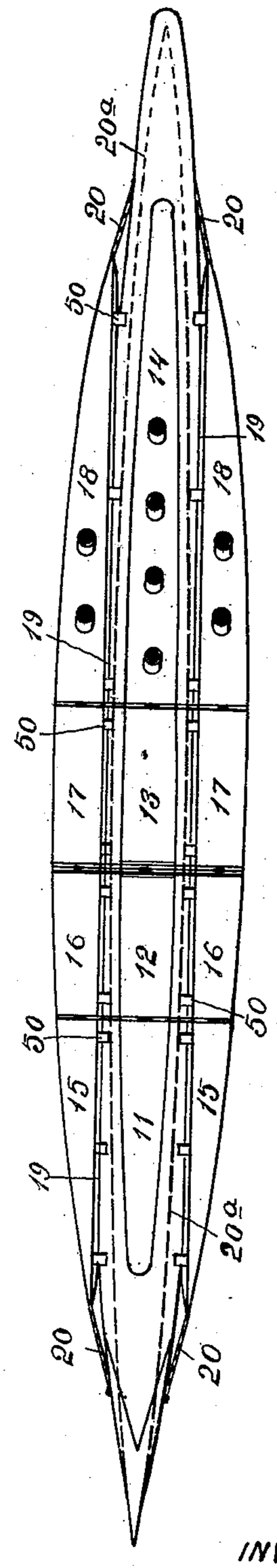

Fig. 2.

WITNESSES:

C. L. Delany

A. M. Quinn

INVENTOR:

James Graham,

BY A. J. Burke

ATTORNEY.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 696,097. Patented Mar. 25, 1902.

J. GRAHAM.

AUTOMATICALLY PROPELLED MULTIPLE HULL VESSEL.

(Application filed Jan. 28, 1901.)

(No Model.) 4 Sheets—Sheet 2.

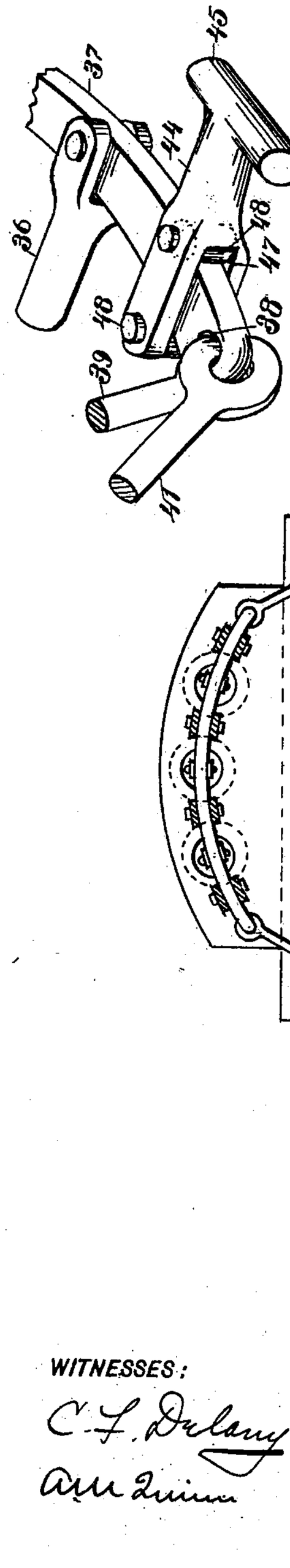

Fig. 4.

Fig. 3.

WITNESSES:

C. F. Delany

A. M. Quinn

INVENTOR

James Graham

BY A. J. Gerk

ATTORNEY

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 696,097. Patented Mar. 25, 1902.

J. GRAHAM.

AUTOMATICALLY PROPELLED MULTIPLE HULL VESSEL.

(Application filed Jan. 28, 1901.)

(No Model.) 4 Sheets—Sheet 3.

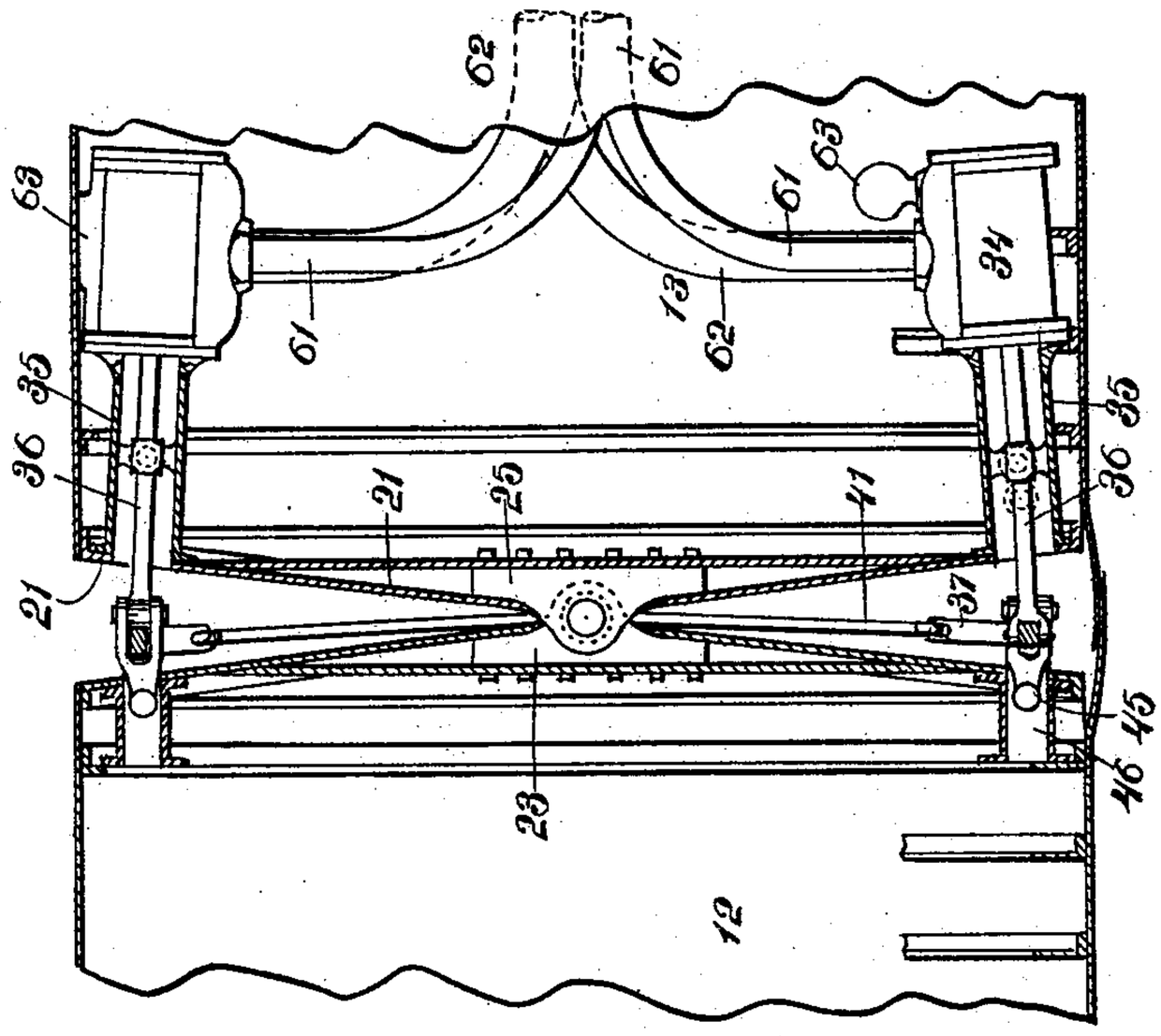

Fig. 4.

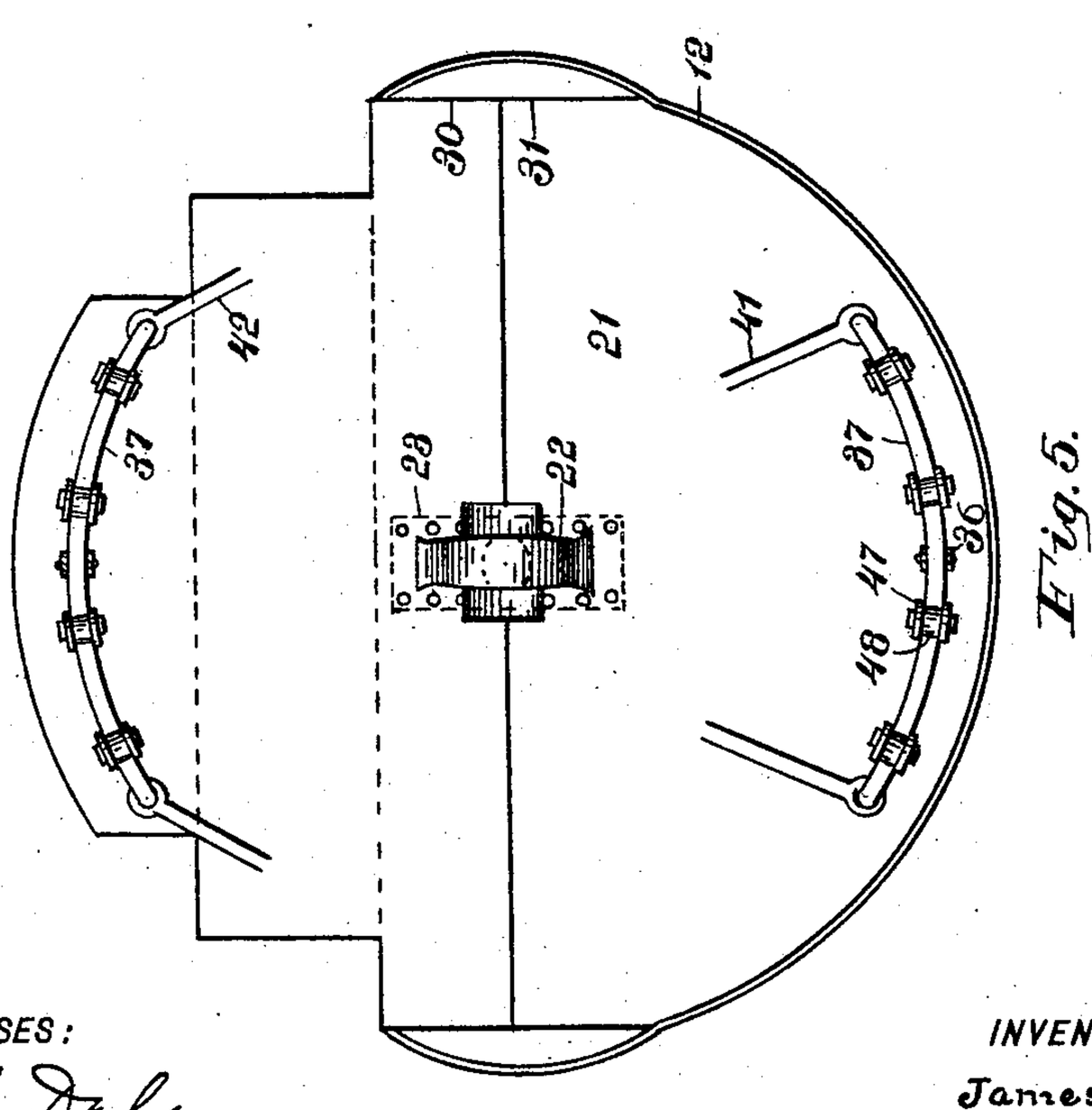

Fig. 5.

WITNESSES:

C. L. Delany

A. M. Quinn

INVENTOR

James Graham,

BY A. J. Burke

ATTORNEY

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 696,097. Patented Mar. 25, 1902.

J. GRAHAM.

AUTOMATICALLY PROPELLED MULTIPLE HULL VESSEL.

(Application filed Jan. 28, 1901.)

(No Model.) 4 Sheets—Sheet 4.

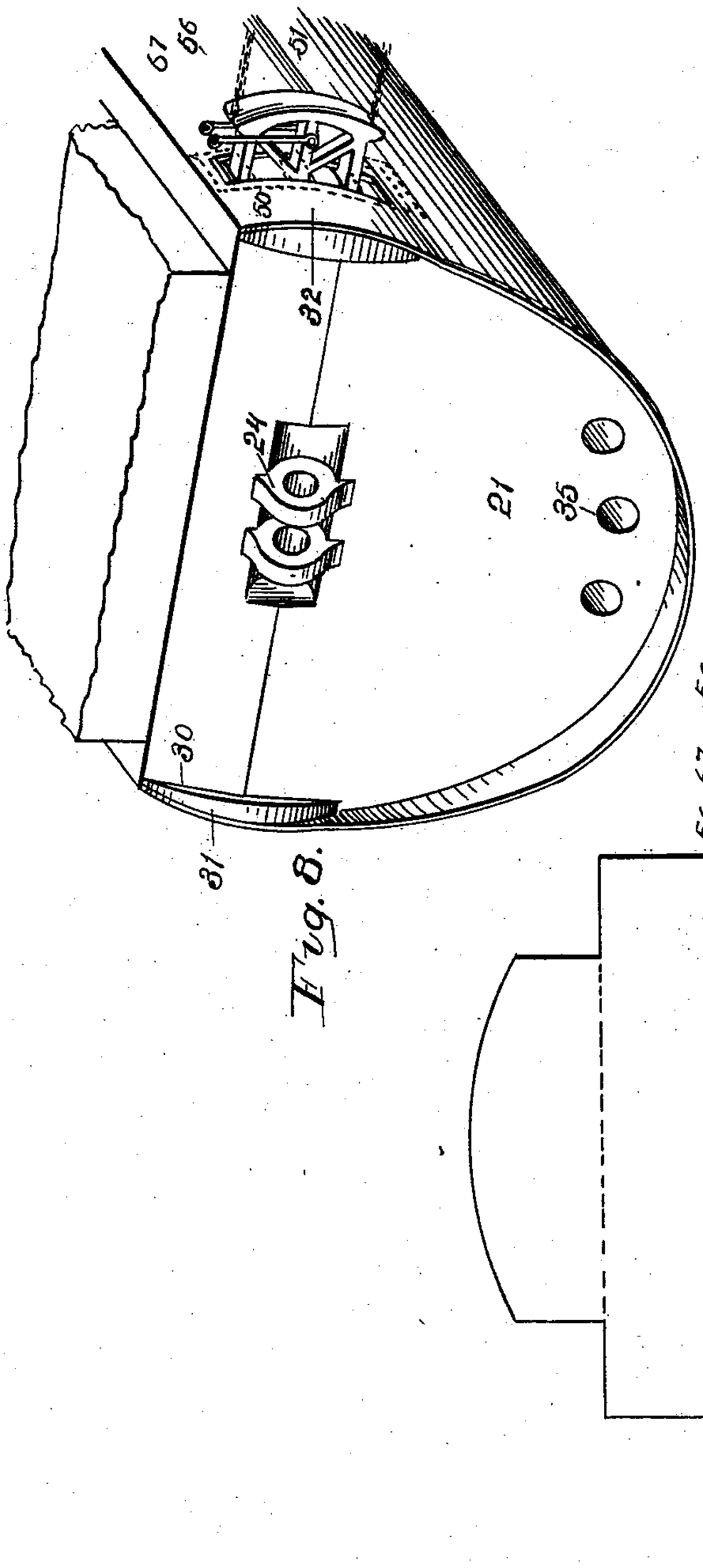

Fig. 8.

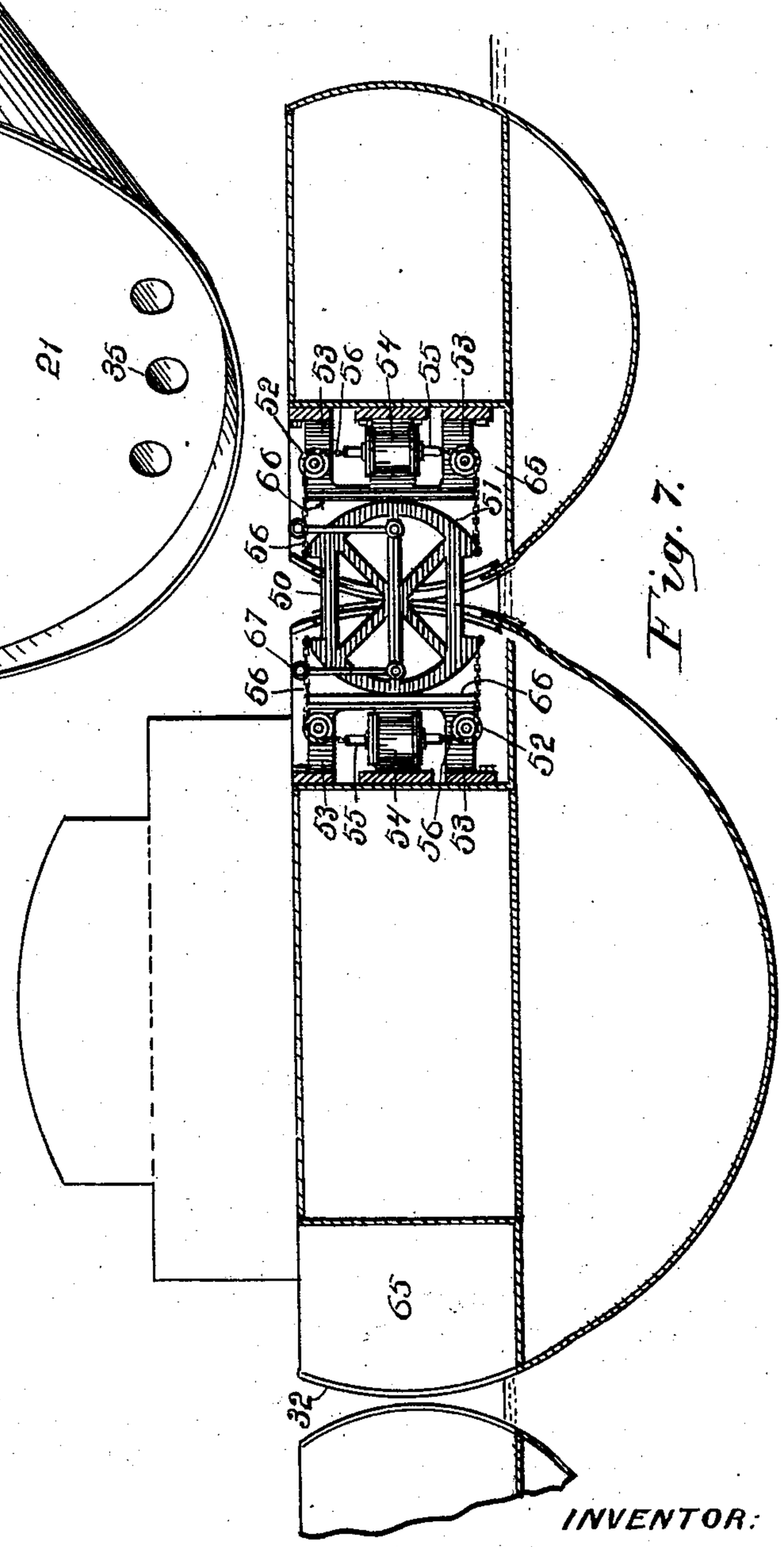

Fig. 7.

WITNESSES:

C. L. Delany

A. M. Quinn

INVENTOR:

James Graham.

BY A. J. Berk

ATTORNEY.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JAMES GRAHAM, OF NEW YORK, N. Y.

AUTOMATICALLY-PROPELLED MULTIPLE-HULL VESSEL.

SPECIFICATION forming part of Letters Patent No. 696,097, dated March 25, 1902.

Application filed January 28, 1901. Serial No. 45,180. (No model.)

To all whom it may concern:

Be it known that I, JAMES GRAHAM, a subject of the Queen of Great Britain, and a resident of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Automatically-Propelled Multiple-Hull Vessels, of which the following is a specification.

The object of this invention is to so construct a ship or other floating structure that the undulating motion of the water of flotation will generate a power which can be utilized to propel the same and also to reduce the motion of the ship in a seaway.

It consists, essentially, of a train of water-floats or hulls connected together in tandem, so that the sinuous wave motion in line with the axis of the hulls will cause the several sections to oscillate, and a line of secondary or auxiliary floats or hulls is also joined to each side of the main hulls, so that the three trains of floats are adapted to rock each on its own axial line when encountering transverse waves. The different hulls thus connected together are so connected up with hydraulic operating machinery that the enormous power developed by the oscillatory and rocking motions may be utilized to propel the ship.

It is not designed herein to specifically point out the minute structural details in the formation of the hulls or of the attaching mechanism which would be required, but to merely specify such typical forms of construction as will enable me to illustrate the principle involved, as other and subsequent applications will be necessary to set forth such specific construction as may be essential to the same.

In the drawings, Figure 1 is a side elevation of a ship constructed in accordance with my improvement, the aft section of which shows an inboard profile of the auxiliary hull. Fig. 2 is a top or plan view of a ship, showing a train of main hulls with an auxiliary line of hulls on each side. Fig. 3 is an end view of the three series of hulls, taken from the point of connection looking aft. Fig. 4 is a detail view in perspective of portions of the transverse connecting-bar for the cylinder connections. Fig. 5 is an end view of one of the main hulls looking forward. Fig. 6 is a central vertical longitudinal section of the connected ends of two of the main hulls. Fig. 7 is a cross-section of the three lines of hulls, showing manner of hinging same together; and Fig. 8 is a perspective view of end of one of the main hulls, showing the relative location of one of the wells and the mechanism therein.

In constructing my invention I prefer to form a central or main train of hulls, as 11 12 13 14, the forward hull 11 having substantially the same bow structure and the aft hull 14 the same stern formation as an ordinary ship, with the exception that it is substantially circular in cross-section. On each side of this main train of hulls is a line of hulls similar in cross-section. On each side of this main train of hulls is a line of hulls similar in cross-section and outer water-line, the inner stream-line, however, being parallel with the keel of the center hull, but smaller in cross-section, the fore and aft sections 15 18 being shorter than the corresponding sections 11 14 in the main line; but the intermediate sections 16 17 are necessarily of equal length with the corresponding sections 12 13, above referred to. As these three longitudinal trains of hulls are hinged together at intervals it becomes necessary to make the abutting edges of the main and auxiliary hulls so that the connecting mechanism can be readily applied, so that it will be noted by reference to Fig. 3 that the outer lines of the main hulls and the contact-lines of the auxiliary hulls, as indicated by 19, coincide with each other and the prow and stern of the fore and aft sections prevent abrupt outward curves only a short distance from the respective ends. These ends are connected with the main hulls by means of the cables 20, so as to keep the auxiliary trains in position against any longitudinal strain. The dotted lines 20^a represent the water-line of the main hulls.

The three aft hulls contain the propelling-machinery of the vessel, as shown. Each section or hull has its contact end provided with a transverse bulkhead 21, the upper and the lower ends of which recede from each other, as shown by the double inclined ends, so that centrally in the hull and transversely across the same the bulkheads are close together, while at the upper and lower ends the bulk-

heads are separated, as shown in Fig. 6. The rear end of each bulkhead has a centrally-projecting ear 22, which is secured to a suitable base 23, this base being bolted or otherwise secured to the frames and stanchions in the hull structure and attached to the longitudinal beams or such other special structural forms as may be necessary to reinforce the same. The forward end of each hull, which is designed to be hinged to the end just described, has a pair of projecting ears 24, secured to the bases 25, secured in like manner to the ship. These ears rest alongside the single ear 22 and are secured together in position by means of a cross-pin 26, (shown in position in Fig. 3,) and this pin has within its bearing in the ear 22 a circular enlargement 27, so that it will provide for a slight torsional movement between the adjacent hulls, and the contact-surfaces of the ears 22 24 are also slightly curved, so as to provide for this motion. The outer edges of each hull on a horizontal line from this hinged point has a buffer-head 30, which projects out a suitable distance beyond the end of the bulkhead, the contact ends 31 being slightly curved, as shown in Fig. 8, to correspond with the swing of the hulls on the pivot-pin 26. The hulls along the lines of these buffer-heads are slightly bulging, as shown at 32, to provide for the rocking motion between the main and auxiliary hulls, as will be more fully shown hereinafter. It should be observed that each bulkhead has therein two openings, (shown at 21^a, Fig. 3,) through which the pipes are placed which convey the pressure fluid from one hull to the other. Said pipes when they pass from one section to the next are provided with flexible connections (not shown herein) to provide for the motion between the sections. The drawings herein show only the main hull thus hinged; but in practice the auxiliary hulls will be similarly hinged together, although not so illustrated.

The forward end of each hull has at the base and similarly at the top and equidistant from the pivot-pin a series of horizontally-disposed cylinders 34, secured in any suitable manner to the ship, and these cylinders have, preferably, tubular guideways 35, which terminate with open ends in the bulkhead 21. The connecting-rods 36 are bifurcated at their outer ends and are adapted to embrace a transverse connecting-bar 37, to which they are hinged by pins, said bar being curved to conform to the arc of the hull, as shown in Figs. 3 and 5. This bar extends past the connecting-rods of all the cylinders, of which I show in this instance three, said bar terminating at each end in an eye 38, Fig. 4, to which is attached in case of the lower bar two links—one link 39 extending upward and being secured to an eye 40 in the bulkhead alongside of the ears 25, while the other link 41 extending upward and being hinged to the link 42, which joins with the end of the upper curved transverse connecting-bar. This system of links thus serve to keep the bars 37 in position, so that the connecting-rods 36 will always be substantially in alinement with the tubular guideways 35.

The rear bulkhead of each hull has intermediate each connecting-rod and at a point equidistant outside of each outer connecting-rod an arm 44, provided with a cross-head 45, which is mounted in a suitable casting 46, secured to the hull. The outer end of this arm is bifurcated, as shown at 47, the bifurcated ends resting on opposite sides of the cross connecting-bar 37 and extending beyond the bar and having a roller 48 between the two bifurcated ends on each side of the bar 37, so that they bear against the opposite edges of the bar. It will thus be seen that the outer end of the arm 44 has a limited vertical motion, while at the same time the bar 37 can move through the bifurcated end between the rollers, and thus provide for both motions, while at the same time this arm or the series of arms on this cross connecting-bar perform the function of moving the piston-rod of the cylinders as the hulls oscillate to and fro. It is obvious that the auxiliary hulls may have similarly-arranged cylinders—as shown, for instance, at the lines 49. Each cylinder 34 has a suitable valve-chest and supply and exhaust pipe 61 62 and also one or more air-chambers 63, placed at any suitable point.

In order to secure the main and auxiliary hulls together, the hulls along the bulging sides are provided near the abutting ends of the sections with wells 65 of sufficient size and depth to receive therein one end of a peculiarly-formed double-ended sheave 50, the other end of the sheave being in the wall of the adjacent hull. These sheaves are shown in the plan view, Fig. 2, as represented by side view in Fig. 7 where two of the hulls are thus connected together, and also in Fig. 8. The body of the sheave rests within the wells 65, with the curved ends 51 bearing against vertical guide-plates 66, which are cast integral with the frame 53, that is connected with and supported by the transverse beams of each hull. On a horizontal line fore and aft of the apex formed by each of the curved ends is a roller 52, which is also secured to the frame 53, and between each upper and lower roller is a vertical cylinder 54, having a double-ended piston-rod 55. A chain 56 connects the end of each projecting rod, passes upward vertically over its corresponding roller, and thence horizontally to the apex of the sheave 50. The sheaves are suspended at each end by rods 67, as shown. It is obvious that as the hulls rock the sheave causes the piston to reciprocate to and fro, and thus produce the pumping motion required. It will also be seen that this connection permits the adjacent hulls to move vertically a limited distance independently of each other.

In the illustrations I do not show any particular manner of connecting up the cylin-

ders, as this invention has no reference to that feature. It is obvious that I may employ water in the cylinder or other suitable fluid whereby the energy generated by the oscillatory motion of the several hulls may be utilized as an auxiliary propelling power.

Attention is called to the fact that it is contemplated in the equipment of the vessel herein described to use steam or other power for propelling purposes in the usual manner, and the auxiliary propelling power herein set forth is utilized whenever the conditions of the water of flotation is such as to enable me to generate power.

What I claim as new is—

1. A series of floats or hulls hinged together transversely and longitudinally and having power-generating mechanism connected therewith for propelling said floating structure.

2. A series of floats or hulls hinged together fore and aft and adapted to oscillate as they move through the water of flotation and having power-generating mechanism attached to the connecting hulls above and below the hinged points.

3. A series of floats or hulls hinged together side by side and adapted to rock in the water of flotation, said hinged hulls having mechanism connected therewith for generating power.

4. A main train of floats or hulls secured together by transversely-swinging motion and twin auxiliary floats, also transversely hinged together, said main and auxiliary hulls being hinged together longitudinally.

5. A main line of floats or hulls secured together fore and aft by transversely-swinging hinges, and twin auxiliary floats; similarly hinged together, said main and auxiliary floats being hinged together longitudinally, and having mechanism connected therewith for generating power.

6. A floating structure comprising separate hulls hinged together transversely and longitudinally and adapted to oscillate and rock in the water of flotation.

7. A floating structure comprising a plurality of hulls, hinged together transversely and longitudinally and adapted to oscillate and rock in the water of flotation and said structure having therein mechanism operated by said oscillatory and rocking motion whereby power may be generated.

8. A floating structure comprising a main series of hulls, secured together by transversely-swinging hinges, a series of auxiliary hulls on each side, similarly hinged to each other, and also longitudinally hinged to said main series, the midship hulls being shorter than the fore and aft sections, as set forth.

9. A floating structure comprising a series of hulls fore and aft, the abutting hulls having bulkheads with the horizontal mid-sections approaching each other and hinged together to provide an oscillatory and a torsional movement, as set forth.

10. A floating structure comprising a main series of hulls fore and aft, and an auxiliary series of hulls on each side, the abutting ends of said main and auxiliary hulls having bulkheads with their horizontal mid-sections approaching each other and hinged together to provide for oscillatory and torsional movements, and the auxiliary hulls secured longitudinally to the main hulls to provide a rocking motion, as set forth.

11. A floating structure comprising a main series of hulls fore and aft, and an auxiliary series of hulls on each side, the abutting ends of said main and auxiliary hulls having bulkheads with their horizontal mid-sections approaching each other and hinged together to provide an oscillatory and torsional movement, and the auxiliary hulls secured longitudinally to the main hulls, to provide a rocking motion, said rocking points having mechanism attached thereto for generating power, as set forth.

12. A floating structure comprising a plurality of hulls, hinged together fore and aft to provide an oscillatory movement, the bulkhead of one abutting hull having therein a series of cylinders, above and below said hinged connection between the bulkheads, the connecting-rods of said cylinders hinged to a transverse connecting-bar between the bulkheads, and the head of the other abutting hull having swinging arms on opposite sides of each connecting-rod, provided with bifurcated ends and antifriction-rollers engaging with said transverse connecting-bar, said bar being held in alinement by links secured to one of the bulkheads, as set forth.

13. A floating structure comprising a plurality of hulls, the abutting ends of said hulls having the horizontal mid-section approaching each other and the upper and lower ends of said hull receding from each other, to provide an oscillatory movement between said hulls, each side of the abutting bulkheads having, on a horizontal line, a buffer-head, and the submerged portion of said hulls having shields which project beyond the abutting ends of the hulls and overlap each other, as set forth.

14. A floating structure comprising a plurality of main hulls hinged together fore and aft by transverse hinges, a plurality of auxiliary hulls on each side longitudinally secured thereto by sheaves, to provide a rocking or rolling motion, the opposite ends of which sheaves rest in recesses in the adjoining hulls, said sheaves being connected at each end with cylinders whereby the rocking motion of said hulls will operate the piston of said cylinders, as set forth.

15. A floating structure comprising a plurality of main hulls, hinged together fore and aft to provide an oscillatory movement between said hulls, a plurality of auxiliary hulls secured together to provide a rocking motion, each hull having near its abutting end a buffer which projects past the end of said hull,

and has a curved longitudinal contact-line between the main and auxiliary hulls, said hulls being longitudinally hinged together at said bulging surfaces, as set forth.

16. A floating structure comprising a main train of hulls hinged together in tandem, in combination with an auxiliary train of hulls secured thereto to provide a rolling motion, said auxiliary line having fore and aft hulls shorter than the corresponding fore and aft sections of the main hull.

Signed at New York, in the county of New York and State of New York, this 10th day of January, A. D. 1901.

JAMES GRAHAM.

Witnesses:
A. J. ZERBE,
ROLLAND THOMPSON.