March 29, 1949. J. S. CRANDALL 2,465,851

FLOATING DRY DOCK

Filed Sept. 30, 1944 3 Sheets-Sheet 1

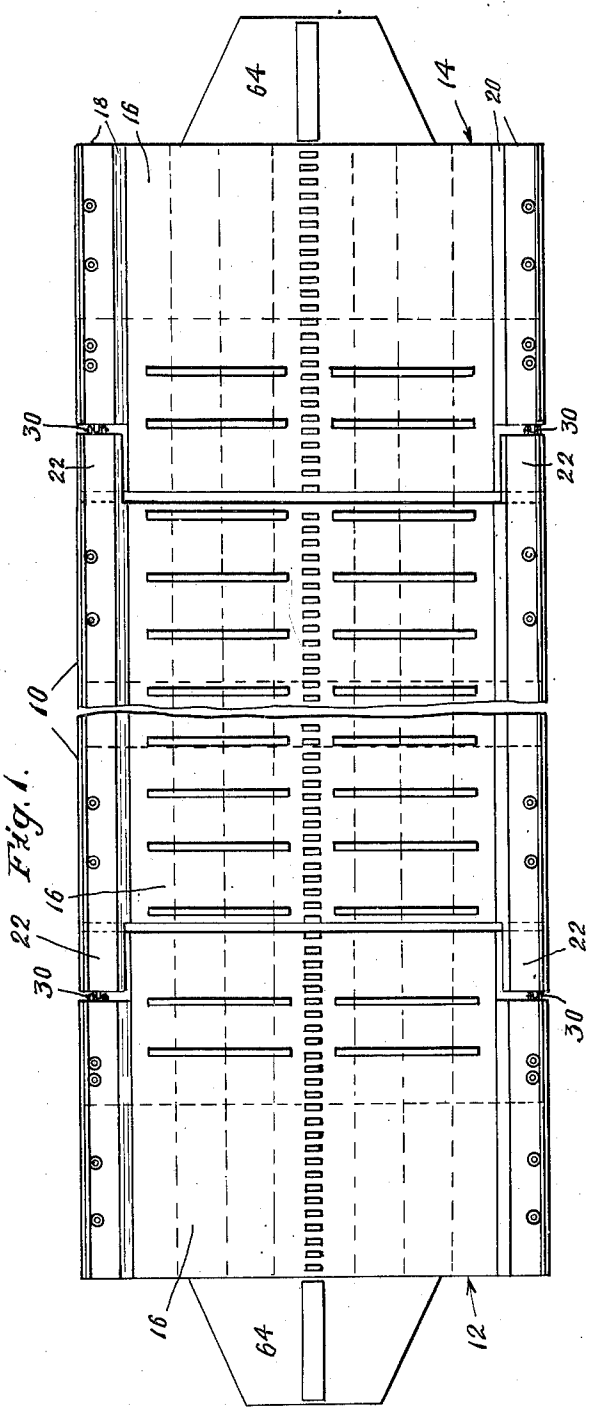


Fig. 1.

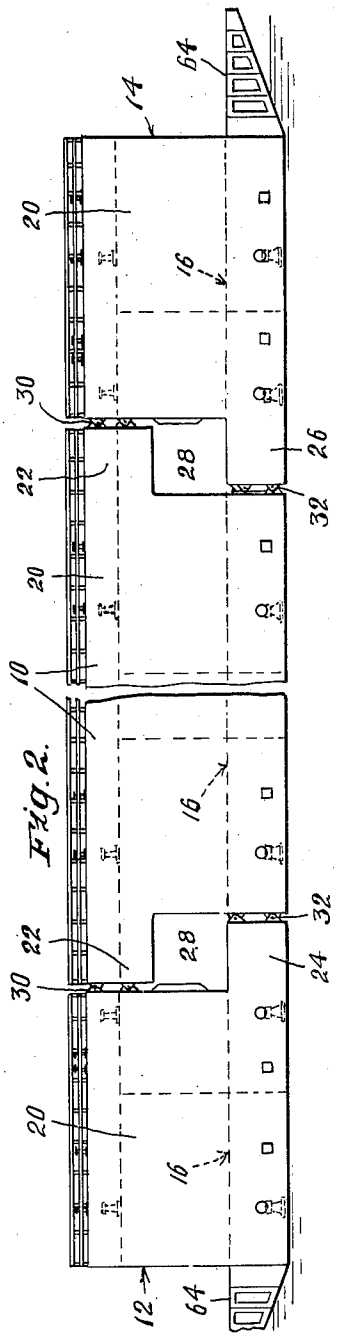


Fig. 2.

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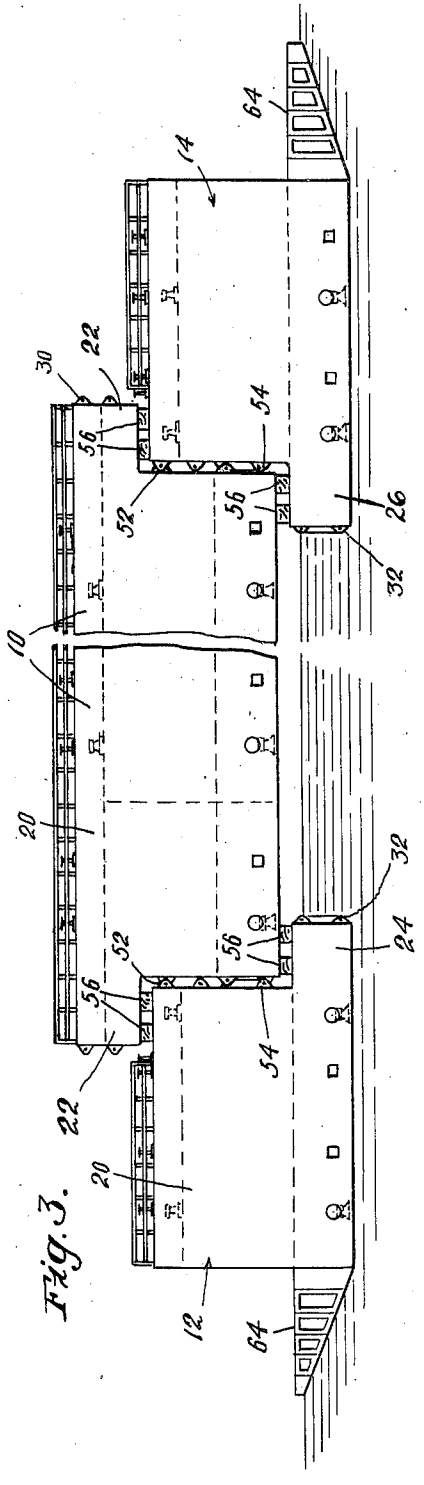


Fig. 3.

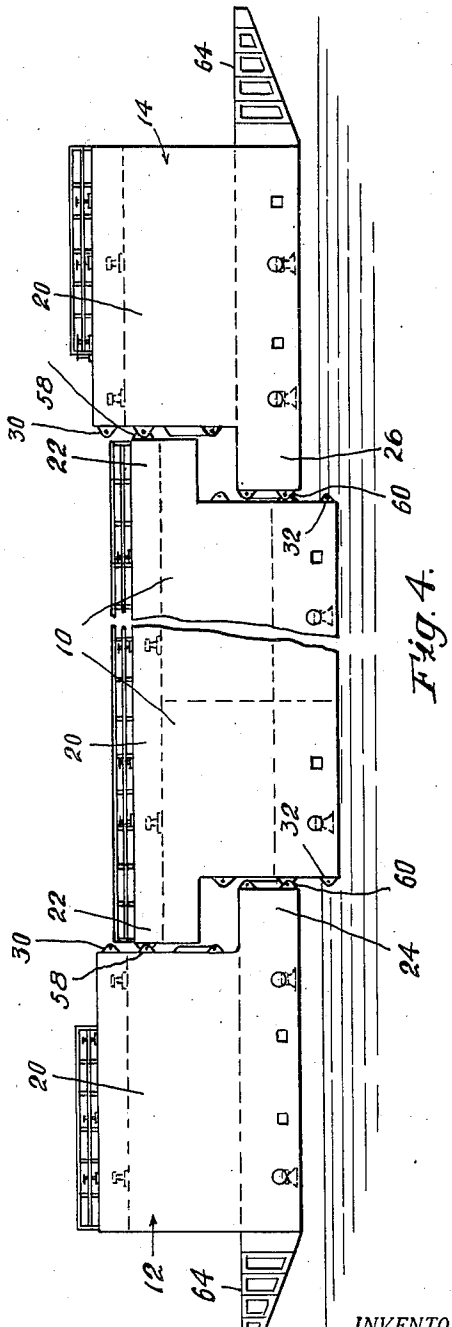


Fig. 4.

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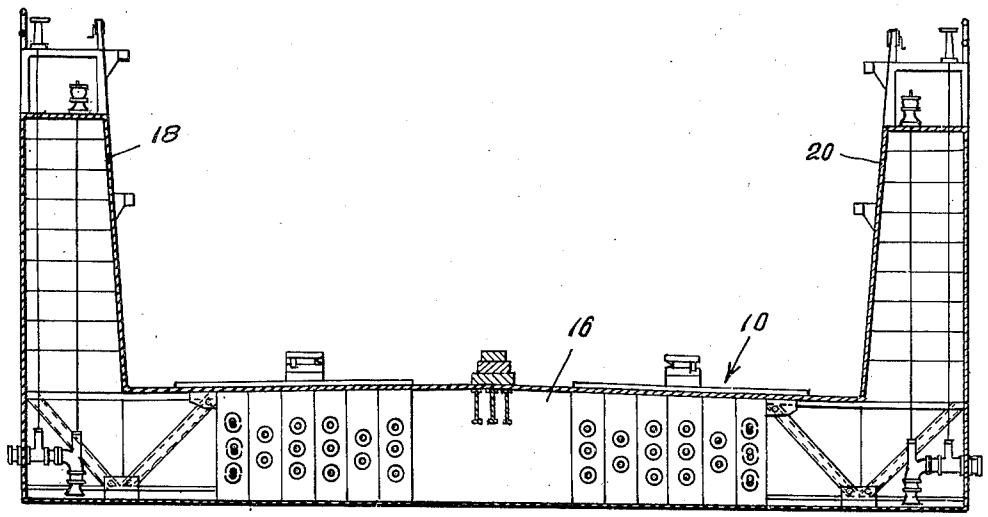


Fig. 5.

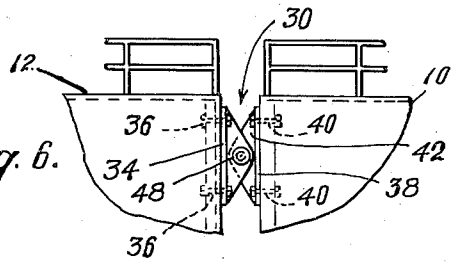


Fig. 6.

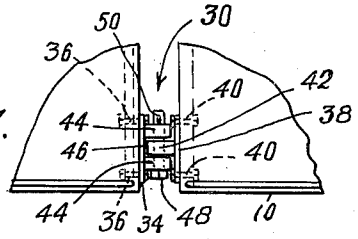


Fig. 7.

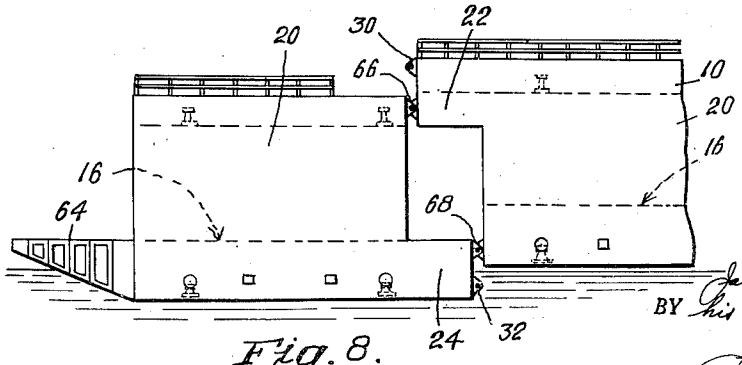


Fig. 8.

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Patented Mar. 29, 1949

2,465,851

UNITED STATES PATENT OFFICE

2,465,851

FLOATING DRY DOCK

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Application September 30, 1944, Serial No. 556,565

5 Claims. (Cl. 114—46)

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This invention relates to improvements in floating dry docks.

More particularly it provides improvements in self-docking floating dry docks which customarily are made in sections and which are designed so that some one or more sections thereof may be conditioned and utilized for elevating and supporting one or more other sections thereof sufficiently above the water surface so that work may be done on normally submerged regions of the elevated sections.

It has been proposed heretofore to provide a main central section of dry dock and separable end sections, each constituting in itself a complete dry docking unit with means for submerging it or for rendering it buoyant at will. But, in order to dock a vessel of any sizeable proportions, the sections are connected together so that all of the sections act as a unitary floating dry dock.

Also it has been proposed heretofore to design the dry dock sections so that the end sections can be utilized to elevate and buoy up the central section thereby to get its under surface suitably spaced above the water level to permit inspection thereof and work to be done thereon when necessary. But these prior proposals have involved a submergence and positioning of the end sections sufficiently under the central section so that the center of buoyancy of the end sections coincides with the center of application of the lifting force. The end sections too, according to prior disclosures, may be floated between the side wings of the central section while the latter is suitably submerged, after which the central section can be rendered buoyant to lift the end sections thereon above the water level.

It is among the objects of my present invention to provide a self-docking floating dry dock having one or more central or intermediate sections, and two end sections, each section constituting in itself a complete buoyant unit having provision for endwise connection to an adjacent section in a manner which provides a substantial transverse passageway between the sections, extending from side to side thereof.

I provide an upper horizontally projecting portion at an end of one section and a lower horizontally projecting portion at an end of another section which is to be connected to the first mentioned section. These projecting portions are disposed in vertically relatively widely spaced relation, and suitable mechanical connections secure them in the said spaced relation as well as securing the sections endwise together.

Another object of the invention is to provide a

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construction of dock sections whereby sections thereof may be associated endwise together in a manner which provides a couple tending to rotate one of the sections, and means connecting the sections together and balancing the moment of the said couple.

The mentioned vertically spaced projecting end portions on connected dock sections constitute means, spaced from the centers of buoyancy of the respective sections, for inter-engagement of the ends of adjacent sections, and the mechanical connections securing the sections together resist and balance the resulting couple.

A further object is to provide a sectional self-docking floating dry dock any section of which may be dry docked on one or more other sections thereof by a mere vertical relative shifting of the endwise relationships of adjacent sections, so that the sections may be detachably rigidly connected together with either one of two adjacent sections substantially elevated relative to the other section.

I provide the ends of adjacent sections with a structure which permits their relative vertical shifting, and provide mechanical means whereby the sections may be secured together in any of a plurality of endwise relationships.

A feature is that when adjacent sections are shifted vertically but not longitudinally relative to each other from their normal vessel-docking relationship, the previously mentioned transverse passageway, from side to side between the sections, and having substantial dimensions, may be preserved during operations of dry docking any one or more of the dock sections.

Still another object is to provide a sectional self-docking floating dry dock whose central or intermediate section has a horizontal end projection relatively high up on the section for engaging over the top end region of an end section of the dock, and whose said end section has a horizontal projection relatively low down on the section for engaging under the bottom end region of the adjacent central or intermediate section, both of said regions of engagement of projections being substantially spaced from the center of buoyancy of said end section in direction toward the said central or intermediate section, whereby the central or intermediate section may be dry docked on two similar end sections.

An additional object is to provide floating dry dock sections having provision for endwise connection of the end sections to a central or intermediate section or sections for dry docking of the end sections on the central or intermediate section or sections. It is a feature of my previously

mentioned construction, in which each end section has a lower horizontally projecting portion and the adjacent end of a central or intermediate section has an upper horizontally projecting portion, that the said central or intermediate section needs to be lowered or submerged relative to the adjacent end section a vertical distance sufficient to partially close the transverse passage normally provided between the upper and lower projecting portions of the sections, and the sections may be secured in their new relation by suitable mechanical connections capable of successfully resisting the weight of an end section when the central or intermediate section is elevated to lift the end section a suitable distance clear of the water.

A still further object is to provide a self-docking sectional floating dry dock whose end sections practically and conveniently may be longer than has been feasible with prior constructions.

It is, moreover, my purpose and object generally to improve the construction of self-docking sectional floating dry docks.

In the accompanying drawings:

Figure 1 is a top plan view of a floating dry dock embodying features of my present invention, a central part thereof being broken away;

Figure 2 is a side elevation of the floating dry dock of Figure 1, with the dock sections connected in their normal relationships for use of the dock for dry docking a vessel;

Figure 3 is a side elevation showing the preferred relationships of the dock sections when connected for dry docking of the central section on the two end sections;

Figure 4 is a side elevation showing the relationships of the dock sections when connected for dry docking of the two end sections on the central section;

Figure 5 is a typical cross-sectional view through any one of the dry dock sections;

Figure 6 is a fragmentary view showing, in elevation and on a larger scale, one of the mechanical connections between sections;

Figure 7 is a top plan of Figure 6; and

Figure 8 is a fragmentary side elevation showing a modified arrangement and relationship of sections for dry docking the central section on the end sections.

Referring to the drawings, the dry dock therein represented comprises a central section 10 and two end sections 12 and 14, although it will be obvious that two or more central or intermediate sections suitably connected together may be utilized in place of the single central section 10 illustrated in the drawings. Also it should be understood that the dock sections 10, 12 and 14 may be of either wood or metal construction or may be a combination of wood and metal, or of other suitable materials, without departing from the spirit and scope of my present invention.

Each of the dock sections 10, 12 and 14 preferably has a cross-sectional construction generally as represented in Fig. 5 of the drawings, comprising a hollow bottom or platform indicated generally at 16 and two upstanding hollow wings 18 and 20 extending along opposite sides of the platform, between which side wings and over the platform a vessel may be floated while the dock is submerged, to be thereafter lifted clear of the water by rendering the dock sections sufficiently buoyant to lift the vessel above the surface of the water.

Each dock section constitutes in itself a complete buoyant dry docking unit with the customary mechanism and connections for pumping water into and out of the interior buoyancy compartments.

My present invention has to do primarily with the structure at the end regions of the respective dock sections, the connections by which adjacent sections are connected together, and the relationships of connected sections for different dry docking operations.

Referring more particularly to Figs. 1 and 2 of the drawings, wherein the sections are connected for use of the dry dock in docking a vessel, each end of the central section 10 has an upper horizontally projecting part 22, and the adjacent end of each end section 12 and 14 has a lower horizontally projecting part 24 and 26 respectively. Each of the projecting parts 22, 24 and 26 preferably has depth from its top to its bottom a substantial amount less than one-half the total depth of its section, so that when the sections are aligned with their bottom surfaces in a common plane, as in Fig. 2, a substantial transverse space 28 is provided between the projecting parts 22 of central section 10 and the projecting parts 24 and 26 of the end sections 12 and 14. Also the ends of the main bodies of the adjacent sections are spaced apart a distance approximating the distance of horizontal projection of the parts 22, 24 and 26, so that the transverse space 28 constitutes a transverse passageway of generally rectangular shape extending from side to side of the dry dock and which can have dimensions permitting passage of workmen through the passageway whose floor is the top surface of a projecting part 24 or 26 of an end section.

Preferably all of the horizontally projecting parts 22, 24 and 26 are of the same or approximately the same length so that, when the sections are aligned as in Fig. 2, the upper projecting parts 22 of central section 10 extend approximately to the adjacent end of the main body of end sections 12 and 14, and the lower projecting parts 24 and 26 of end sections 12 and 14 extend approximately to the adjacent ends of the main body of central section 10. According to my invention an upper mechanical connection 30 is provided at each side of the dock detachably securing each end section to the central section, and a similar lower mechanical connection 32 is provided at each side of the dock detachably securing each end section to the central section.

The mechanical connections at 30 and 32 necessarily must be capable of successfully resisting shearing and other stresses which may be imposed upon them in normal uses of the dock for dry docking a vessel, including a condition where the major part of a vessel's weight may be applied to the central section 10. In Figs. 6 and 7 of the drawings, each connection 30 and 32 is shown as comprising a rugged and strong relatively short channel member 34 secured as by bolts 36 to one section, and a similarly rugged and strong coacting member 38 secured as by bolts 40 to the other section and having a projecting ear 42 for engaging within the channel of member 34. Holes 44 in the side walls of the channel member 34 and a hole 46 in ear 42 of member 38 are adapted to be brought into register for reception of a removable locking bolt 48 which may be retained by a cotter pin 50 or by any other suitable means which permits ready disconnection of the sections. The members 34 and 38 and the locking bolt 48 at each connection can be made of sufficient sizes and strengths so that the four connections at each juncture of

dock sections can effectively maintain the needed substantially rigid inter-connection of sections under all conditions of use.

It is an important feature of my invention and disclosed construction that the central section 10 conveniently and effectively may be itself dry docked on the end sections 12 and 14, and that the end sections 12 and 14 may be conveniently and effectively dry docked on the central section 10.

Fig. 3 illustrates the preferred manner of dry docking the central section on the end sections, and Fig. 4 shows how the two end sections can be dry docked on the central section.

In Fig. 3, the end sections 12 and 14 have been submerged sufficiently relative to the central section 10 so that the lower projecting parts 24 and 26 can be moved under the ends of the main body of central section 10. Simultaneously the adjacent end of the main body of each end section moves under the upper projecting parts 22 of the central section. Mechanical connections 52 and 54, similar to the connections 30 and 32, detachably secure the sections together as a substantially rigid unit.

In the arrangement of Fig. 3, it is important that the lower projections 24 and 26, in effect, shall engage the overlying portion of the section 10, and that the end regions of the end sections which underly the upper projections 22 shall, in effect, be in engagement. Hence, the filler blocks 56 are provided so that lifting forces are applied directly to the central section through the blocks 56.

It will be obvious that the end sections 12, 14 need to be submerged relative to the central section only a relatively small amount, and need to be displaced longitudinally from their normal relations to the central section only a relatively small amount, when being moved to their positions of Fig. 3. The regular pumping equipment and connections for all sections are readily accessible for use in this operation of dry docking the central section.

In Fig. 3, it will be obvious that the center of buoyancy of each end section 12, 14 is a substantial distance outward from the center of application of load thereto, so that a couple exists which tends to rotate each end section. The mechanical connections 52, 54 at opposite ends of the dry dock resist and balance the moments of the couples while the main lifting forces are transmitted through the blocks 56.

A dry docking of the end sections on the central section, as in Fig. 4, is even more simple than the previously described dry docking of the central section. In Fig. 4, no relative longitudinal movement of sections is required, but only a submerging of the central section relative to the end sections until the mechanical connections at 58, 60, similar to the connections 30, 32, and 52, 54, can be effected. In this case, the end sections are lifted bodily by the central section with the full weight of an end section carried at the connections 58, 60 at each end. Inasmuch as an end section is considerably smaller and much lighter than the central section, the mechanical connections at 58, 60 can be made capable of sustaining the total weight of an end section.

Because the length of each end section 12, 14 is substantially less than the space between the side wings 18, 20 of the central section, the end sections may, if desired, be dry docked on the central section by turning them through ninety degrees from their normal positions and then floating them between the wings of the central section while the latter section is suitably submerged, after which the central section can be rendered buoyant to lift the end sections thereon clear of the water. In such a case, the fantail platform 64 at each end of the dry dock first will be moved onto the end section with which it serves, between the side wings thereof. The said platforms may be removable or hinged for this purpose.

In Fig. 8, I show how the central section may be dry docked on the end sections without any longitudinal relative shifting of the sections. The end sections 12, 14 are merely lowered vertically relative to the central section 10, and connections 66, 68 secure the sections together. In this case, however, the advantage of the couples of the Fig. 3 arrangement is absent and the mechanical connections at 66, 68 must be capable of sustaining the entire weight of the central section.

I claim as my invention:

1. A floating dry dock comprising a plurality of buoyant sections detachably secured together in end to end relation, one of said sections having an upper horizontally projecting part at one end, and another adjacent section having a lower horizontally projecting part at its end which is toward the first mentioned section, said lower projecting part extending throughout the width of its section, and each said projecting part having depth substantially less than one-half the depth of its section, said lower projecting part of one section being disposed below said upper projecting part of the other section, and the end of each said projecting part of a section being detachably secured to an adjacent wall of another section in a relation providing a substantial space between said projecting parts, said space extending from side to side of the dry dock and constituting a passageway of which the said lower projecting part of one section constitutes the floor.

2. A floating dry dock comprising a plurality of buoyant sections in end to end relation, one section having a horizontally projecting part at one end in the plane of the bottom of the section and extending throughout the width of its section, and the adjacent section having upstanding side wings and each said wing having a horizontally projecting part approximately in the plane of the top of a wing, means for detachably securing the sections together with said wing projecting parts of one section disposed above the full width projecting part of the other section in one predetermined spaced relation providing a transverse passageway between the sections, and other means for detachably securing the sections together with said projecting parts disposed one above the other in a different predetermined spaced relation providing a smaller but substantial transverse passageway between the section.

3. In a self-docking floating dry dock, a relatively long central buoyant section and two shorter end sections, one at each end of the central section, and means at the adjacent ends of the sections for dry docking support of the central section on the two end sections, said means comprising a projection relatively high up on each end of the central section and a projection relatively low down on the adjacent end of each end section each said low down projection constituting an extension of the main buoyancy part of an end section and extending throughout the width of its section, the top end portion of each

end section being engaged under a said high up projection of the central section, and the said low down projection on each end section being engaged under a bottom end portion of the central section whereby the central section rests at each end on a buoyant part of each end section, the center of buoyancy of each end section being spaced a substantial distance outward from the said engagements at each end, whereby a couple is provided at each end tending to rotate the end sections, and means connecting the sections together and balancing the moments of said couples.

4. A floating dry dock comprising two buoyant end sections and at least one buoyant intermediate section, all in end to end relation, there being an upper horizontally projecting part on a said intermediate section adjacent to one end section and a similar upper horizontally projecting part on a said intermediate section adjacent to the other end section, and a lower horizontally projecting part on each end section extending throughout the width of the end section, and means detachably connecting each end section to an intermediate section with a said lower projecting part of an end section under and spaced a substantial vertical distance below a said upper projecting part of an intermediate section, thereby to provide a passage between them transversely of the dry dock, said upper and lower horizontally projecting parts spacing the main bodies of adjacent sections longitudinally apart, with the center of buoyancy of each end section spaced a substantial distance outward from said upper projecting part of the adjacent intermediate section.

5. A floating dry dock comprising a plurality of buoyant sections in end to end relation, one of said sections having an upper horizontally projecting part and the adjacent section having a lower horizontally projecting part extending throughout the width of the section, means for releasably connecting said adjacent sections together with said lower projecting part of one section under and spaced a substantial vertical distance below said upper projecting part of the adjacent section and with the bottoms of the sections approximately in a common plane, thereby to provide a substantial transverse passageway between said projecting parts when the sections are connected for dry docking a hull, said connecting means including a plurality of vertically spaced connecting elements on each of the connected sections whereby adjacent sections may be connected with their bottom surfaces in any of a plurality of different relative positions by selection of predetermined ones of said connecting elements for effecting the connection.

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