No. 700,280. Patented May 20, 1902.

C. H. WOODRUFF.

APPARATUS FOR UNLOADING VESSELS.

(Application filed Nov. 27, 1901.)

(No Model.) 2 Sheets—Sheet 1.

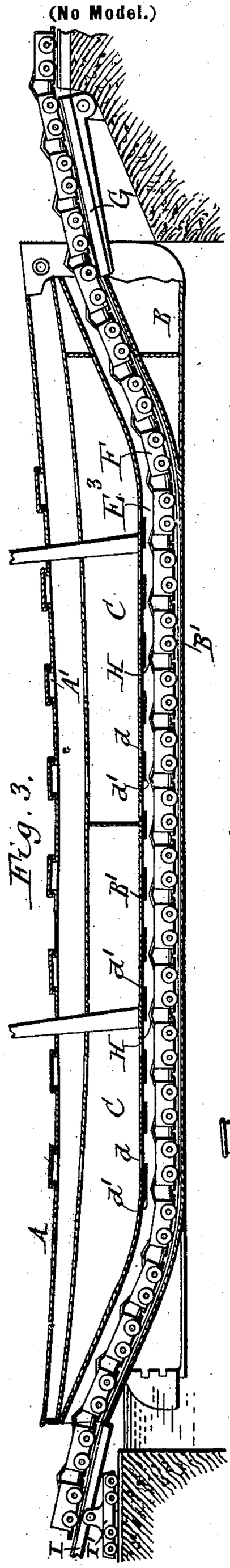


Fig. 3.

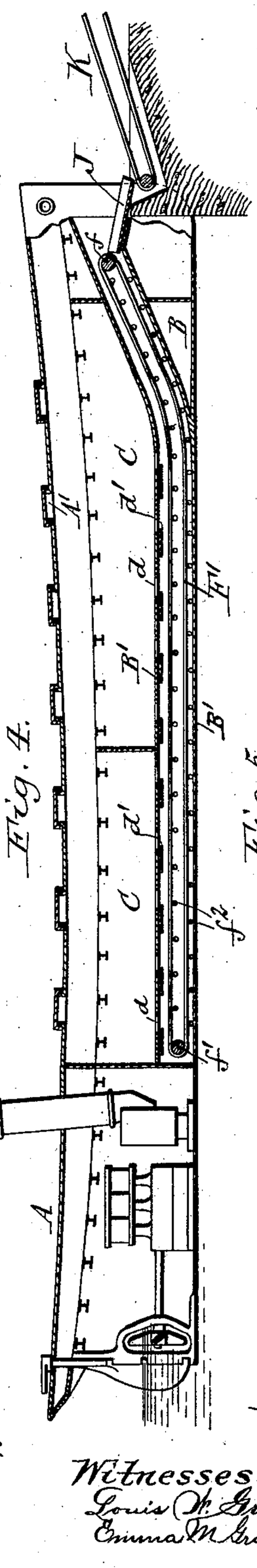


Fig. 4.

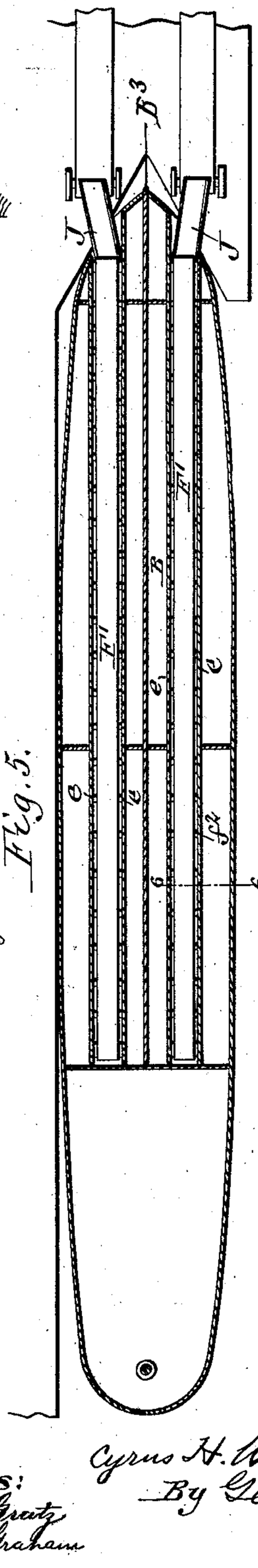


Fig. 5.

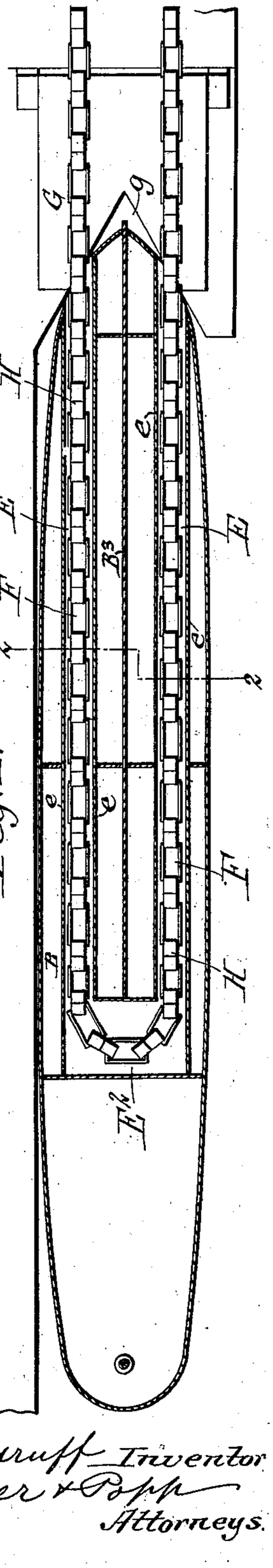


Fig. 1.

Witnesses:
Louis W. Gratz
Emma M. Graham

Cyrus H. Woodruff Inventor
By Geyer & Popp
Attorneys.

No. 700,280. Patented May 20, 1902.

C. H. WOODRUFF.

APPARATUS FOR UNLOADING VESSELS.

(Application filed Nov. 27, 1901.)

(No Model.) 2 Sheets—Sheet 2.

Fig. 2.

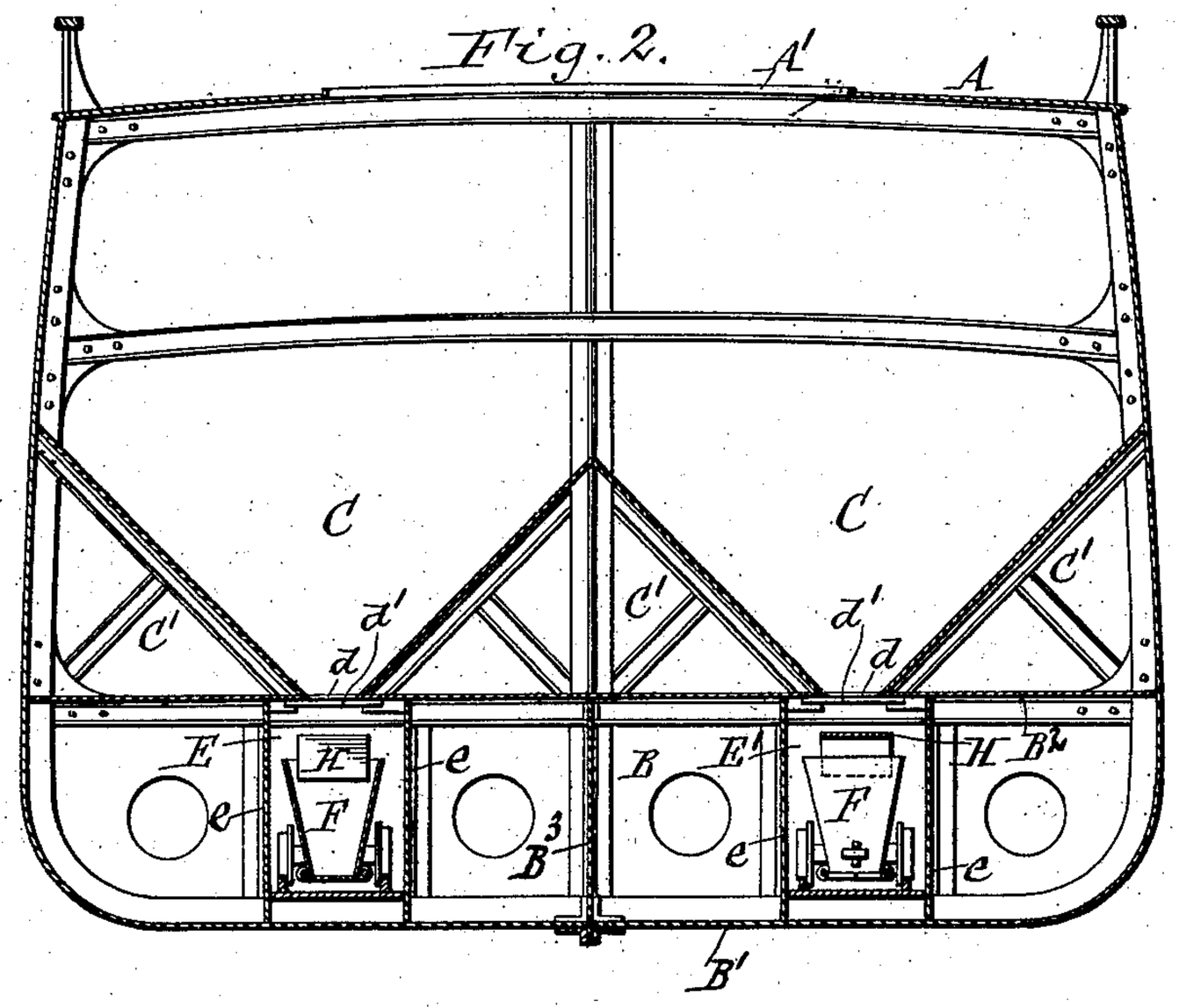


Fig. 6.

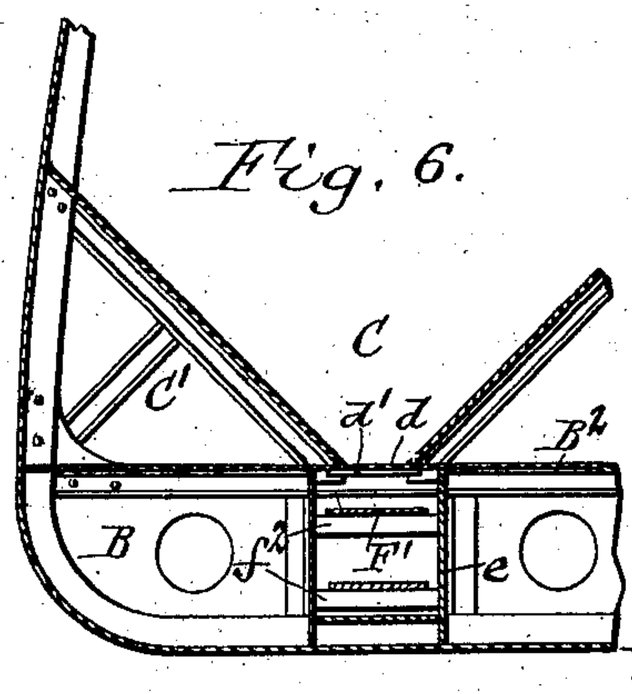


Fig. 7.

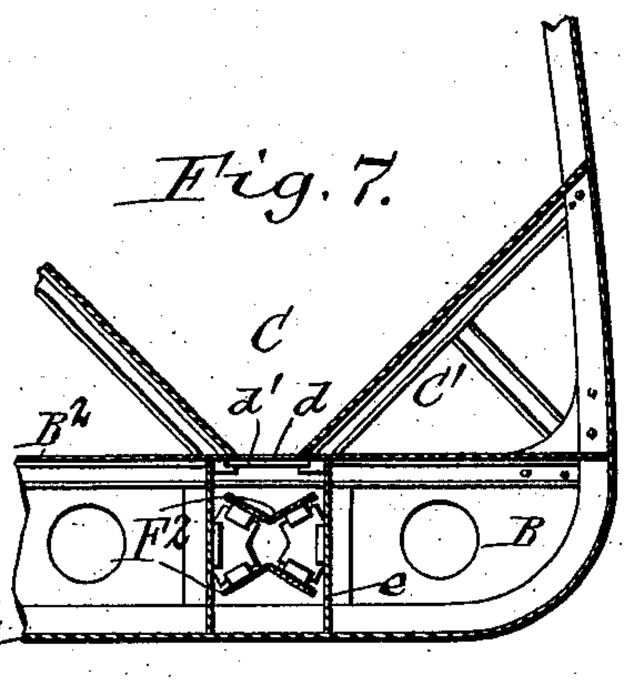
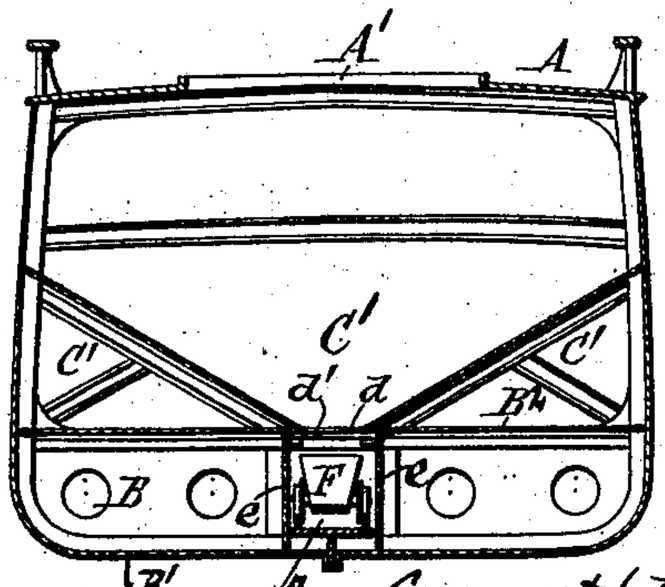


Fig. 8.



Witnesses:
Louis H. Gratz
Emma M. Graham

Cyrus H. Woodruff Inventor
By Geyer & Popp
Attorneys.

UNITED STATES PATENT OFFICE.

CYRUS H. WOODRUFF, OF BUFFALO, NEW YORK.

APPARATUS FOR UNLOADING VESSELS.

SPECIFICATION forming part of Letters Patent No. 700,280, dated May 20, 1902.

Application filed November 27, 1901. Serial No. 83,859. (No model.)

To all whom it may concern:

Be it known that I, CYRUS H. WOODRUFF, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented new and useful Improvements in Apparatus for Unloading Vessels, of which the following is a specification.

This invention relates to the construction of vessels and the devices employed for unloading cargoes which are shipped in bulk, such as iron ore, coal, &c.

In the ordinary methods of discharging vessel-cargoes manual labor is employed to a large extent, and the unloading of large freight-carriers, such as have come into use in recent years, especially on the Great Lakes, is therefore a comparatively slow and expensive operation.

The object of my invention is to provide such vessels with improved unloading devices which dispense largely with manual labor and greatly expedite the discharge of the cargo and which at the same time avoid interference with or encroachment upon the cargo-space of the vessel.

In the accompanying drawings, consisting of two sheets, Figure 1 is a horizontal section of a propeller containing my invention. Fig. 2 is a cross-section, on an enlarged scale, in line 2 2, Fig. 1. Fig. 3 is a longitudinal section of a barge equipped with the improvement, the plane of the section being on one side of the keel. Fig. 4 is a longitudinal section of a propeller containing a modified construction of the discharge conveyer or carrier. Fig. 5 is a horizontal section of the construction shown in Fig. 4. Fig. 6 is a fragmentary transverse section, on an enlarged scale, in line 6 6, Fig. 5. Fig. 7 is a similar section showing a modified form of the discharge-carrier illustrated in Fig. 6. Fig. 8 is a transverse section showing another arrangement of the carrier.

Like letters of reference refer to like parts in the several figures.

The hull of the vessel is of modern approved construction—that is to say, provided with what is known in the art as a "water-bottom"—but is preferably made of structural steel. It has the usual spar-deck A, with hatchways A′ and the water bottom or chamber B, the bottom of which is formed by the main bottom B′ of the vessel and the top by the auxiliary or secondary bottom B^2.

B^3 indicates the main keel, arranged centrally in the water-bottom and extending from the main bottom to the secondary bottom. This water-bottom is customarily filled with water ballast when the vessel runs without cargo or with a light load and can be emptied when the vessel carries a cargo of ore or the like. It accordingly forms no part of the cargo-carrying capacity of the vessel, and the arrangement of the unloading devices therein, as hereinafter set forth, does not encroach on said carrying capacity.

In the portion of the hold directly above the top B′ of the water-bottom are arranged a number of longitudinal hoppers C or receptacles with hopper-bottoms, which form the bottom of the hold and which may extend throughout the available stowage-space of the hold, if desired. In a propeller they may extend from the bow back to the engine and boiler room, as shown in Fig. 4, while in a barge or similar sailing vessel they may extend practically from bow to stern. The hold preferably has two of such hopper-bottoms, one on each side of the keel, as shown in Fig. 2. The inclined bottoms of these hoppers are stiffened by braces C′. The hold and its hoppers are designed to contain the iron ore or other material in bulk, and the hopper-bottoms are provided in their lowest portions throughout their length with delivery-apertures *d*, closed by suitable gates or slides *d*′, which are preferably accessible from the water-bottom and provided with handles or other suitable contrivances for operating them.

Referring to the form of the invention shown in Figs. 1 and 2, E E′ indicate discharge tunnels or passages arranged lengthwise in the water-bottom directly under the delivery-apertures of the hopper-bottoms C, respectively, and extending throughout the length of the same. Each of these tunnels is formed by a pair of parallel walls *e*, which are suitably secured to the main and secondary bottoms B′ B^2. These tunnels extend through the bow of the vessel, at opposite sides thereof and above the water-line, as shown in Figs. 1, 3, and 4, and for this purpose the portions of the tunnels in the bow are inclined, so as to

rise to the proper height, as shown. As seen in Fig. 1, the tunnels are connected at their rear ends by a transverse passage E^2, which forms, with the longitudinal tunnels E E′, a continuous tunnel, comprising an entrance branch and a return or exit branch. The tunnel is provided in its bottom with longitudinal tracks, upon which run conveyer-cars or carriers F, which are adapted to receive the ore or other cargo from the hoppers of the hold and convey the same to a dock or other desired place of deposit. The empty conveyer-cars enter one branch of the tunnel and after being loaded return through its other branch, the cars entering and leaving the vessel at the bow when the tunnel has a return branch, as shown in Fig. 1.

To meet the varying conditions of the water-level, the dock at which the vessel is unloaded is provided with a vertically-adjustable extension G, which may be raised and lowered by any suitable apparatus. This extension has a V-shaped recess *g* for receiving the bow of the vessel in order to bring the same closely to the dock. The dock extension is also provided with tracks, which form continuations of those in the tunnel of the vessel when the dock extension is adjusted to the proper level, and the stationary part of the dock has similar tracks, which extend to the place of deposit.

The conveyer-cars may be drawn through the tunnel by a locomotive or other suitable means, and any appropriate or available motive power—as steam, compressed air, or electricity—may be employed for this purpose. The conveyer-cars are preferably run in trains, as shown in the drawings, and in this case the spaces between the cars are covered by roof-like shields H, which direct the descending material into the cars and prevent it from falling between the same.

The port-holes in the bow, which form the entrance and the exit of the tunnel, are ordinarily closed by suitable doors.

In unloading a vessel constructed according to my invention after properly mooring the vessel and adjusting the movable dock G the inlet and exit doors of the tunnel are opened, and a train of conveyer-cars is run from the dock into the tunnel. The cars are loaded by opening the delivery-slides *d′* of the hopper-bottoms C and after receiving their load are returned to the dock through the exit of the tunnel. If desired, the material may be allowed to flow continuously from the discharge-hoppers into the cars and the latter loaded without stopping them, the train of cars, with the shields H, forming practically a continuous receptacle.

By this improved system the vessel is expeditiously unloaded without manual handling of the cargo and with the employment of only such manual labor as is required to operate the cars and the delivery-slides of the discharge-hoppers. The expense of unloading the cargo is thus materially lessened, permitting the carrying rates to be reduced in a corresponding measure, while the detention period of the vessel in port is diminished accordingly, thus enabling the boat to make a greater number of trips in a season.

By the use of the hopper-bottom C the material in loading the vessel is evenly distributed on opposite sides of the same and at the same time leveled, thus doing away with the necessity of trimming.

The cars may be of the dumping type and constructed to dump their load either at the bottom or the side, and after leaving the tunnel they may be run up an inclined trestle and their load dumped into railway-cars or other transfer-carriers.

The tunnel is comparatively narrow, and as it is located almost wholly in the water-bottom it does not reduce the stowage capacity of the boat. Its walls extend throughout the height of the water-bottom and form struts which stiffen the keelson and adjacent frame members, this feature being especially desirable in flat-bottom boats, such as are used on the Great Lakes.

My improvement is applicable to barges and other sailing craft as well as propellers, and when applied to such vessels one or more discharge-tunnels E^3 may extend in a straight line from bow to stern, as shown in Fig. 3. In this construction the ends of the tunnels are inclined, so as to rise to a suitable height above the water-line both at the bow and the stern of the boat, and the conveyer-cars enter the tunnels at the bow and leave the same at the stern, or vice versa. In this case the dock may be built with a pocket or recess for receiving the vessel, so that the empty cars may be run from one wing of the dock into the tunnels and after being loaded be delivered upon the other wing, or a pontoon may be placed at one end of the boat, if desired. When a dock with such a pocket is employed, the same may be provided with a movable platform I, mounted on a carriage I′, which runs upon tracks on the dock. This permits the platform to be adjusted to suit vessels of different lengths.

The tunnel-walls *e*, like the main keel B^3, form part of the rigid and permanent bottom structure of the vessel and strengthen the same to such an extent as to permit the vessel to be safely built of greater beam and larger capacity.

If desired, any other suitable carrying or conveying devices may be employed in place of the cars F. For instance, an endless horizontal conveyer-belt F′ may be used, as seen in Figs. 4, 5, and 6, which show such belts in two independent discharge-tunnels of a propeller. These belts run around main guide-rollers *f f′* at their receiving and discharge ends and over intermediate supporting-rollers f^2. In this modification of the improvement the conveyer-belts extend from the rear ends of the tunnels to the bow of the vessel, and at the latter point the material is dis-

charged upon a chute J, which in turn delivers the material upon an endless delivery-belt K, arranged upon the dock, as shown in Figs. 4 and 5. The conveyer-belts in the tunnels of the vessel may be either flat, as shown in the last-mentioned figures, or trough-shaped, as shown at F^2 in Fig. 7.

In some cases it may be desirable to arrange a single discharge-tunnel in the water-bottom along the center of the vessel, as shown at E^4 in Fig. 8, in which case the tunnel is extended from a point near the stern to the bow, the tunnel being forked at the bow to form two branches, one for the entrance and the other for the exit of the conveyer-cars or other carriers. When such a single central tunnel is employed, the hold is built with a single hopper-bottom C', which discharges into the tunnel.

While the hoppers C are not indispensable, I prefer to use them; but it may be desirable in some cases to leave the bottom of the hold level instead of making it hopper-shaped and to provide the same with valved discharge-apertures directly over the tunnel, but in that case it is necessary to provide mechanical or other means for delivering the bulk of the material to said discharge-apertures. If desired, the plates forming the inclined hopper-bottoms may be removably supported on their braces, so that they can be removed and the cargo allowed to rest directly upon the top of the water-bottom. This construction permits the vessel to carry grain and similar light material, as well as heavy cargoes.

The tunnels may be filled with water for water ballast, if necessary.

It will be observed that in all the embodiments of the invention herein described one or more discharge-tunnels are arranged in the water-bottom underneath the hold for the passage of conveyer-cars or other carriers into which the superposed material in the hold is dumped through valved openings in its bottom.

I claim as my invention—

1. A vessel having its hold provided in its bottom with discharge-openings, gates applied to said openings, a permanent secondary bottom arranged between the bottom of the hold and the main bottom of the hull and forming with the latter bottom an intervening water-chamber, a tunnel or tunnels arranged in said water-chamber underneath said discharge-openings, and a discharge conveyer or conveyers arranged to pass through said tunnel or tunnels, substantially as set forth.

2. A vessel having its hold provided with a hopper-bottom containing discharge-openings, gates applied to said openings, a permanent secondary bottom arranged between said hopper-bottom and the main bottom of the hull and forming with the latter an intervening water-chamber, walls or partitions extending lengthwise through said water-chamber on opposite sides of said discharge-openings, and forming a discharge tunnel or tunnels, said tunnel or tunnels having an inclined end portion which rises above the water-line and opens through the end of the vessel, and a conveyer or conveyers arranged in said tunnels, substantially as set forth.

3. A vessel having its hold provided with a hopper-bottom containing discharge-openings which are located on opposite sides of the keel, gates applied to said openings, a permanent secondary bottom arranged between said hopper-bottom and the main bottom of the hull and forming with the latter a water-chamber, a main central keel extending throughout the height of said water-chamber, one or more pairs of walls arranged on opposite sides of said keel and extending from the main to the secondary hull-bottom and forming discharge-tunnels, said tunnels being located underneath the discharge-openings of the hopper-bottom, and conveyers arranged in said tunnels, substantially as set forth.

Witness my hand this 23d day of November, 1901.

CYRUS H. WOODRUFF.

Witnesses:
THEO. L. POPP,
CARL F. GEYER.