E. L. BURWELL.

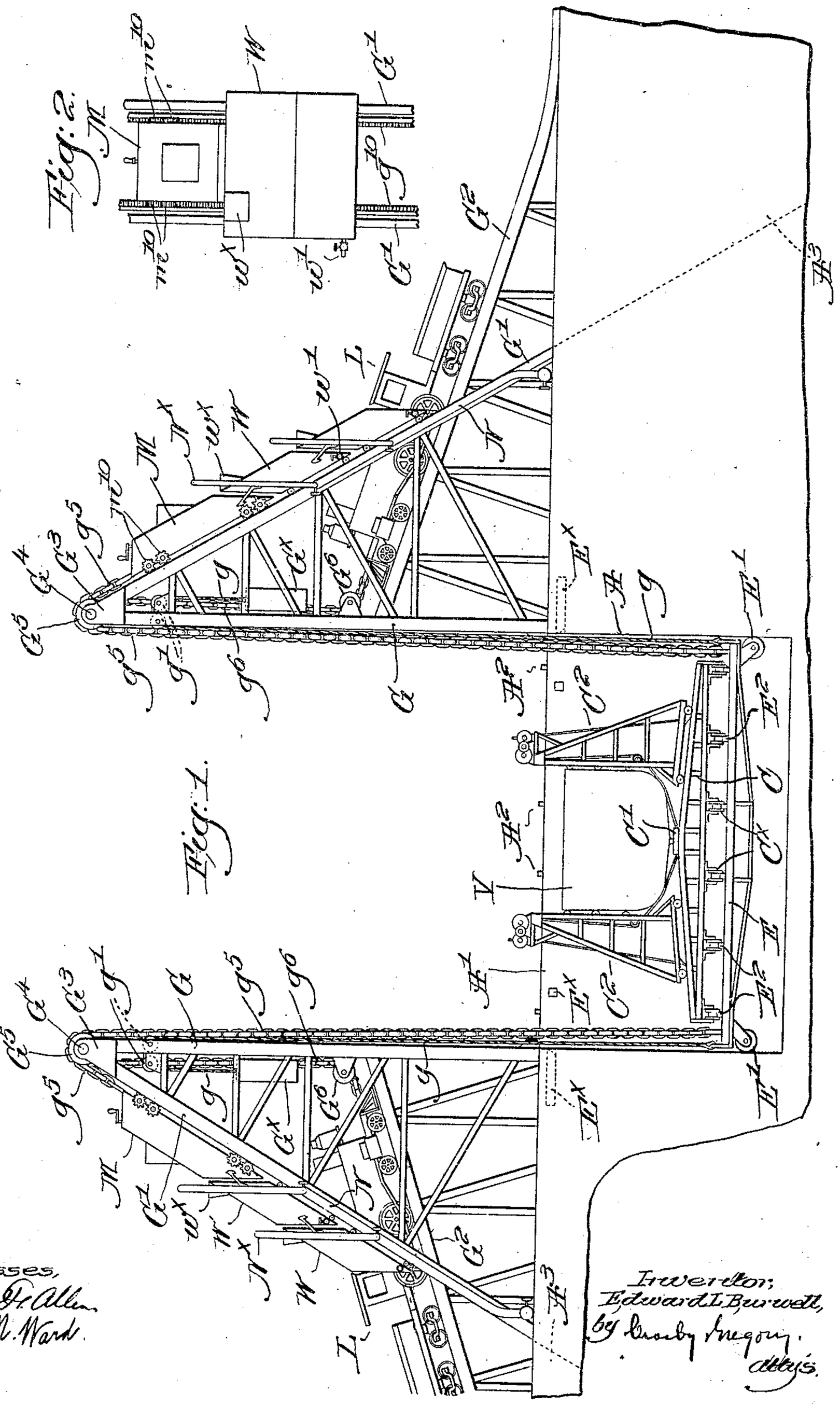
SHIP ELEVATOR APPARATUS.

APPLICATION FILED JAN. 10, 1910.

**955,131.**

Patented Apr. 19, 1910.

2 SHEETS—SHEET 1.




Witnesses,
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Joseph M. Ward.

Inventor;
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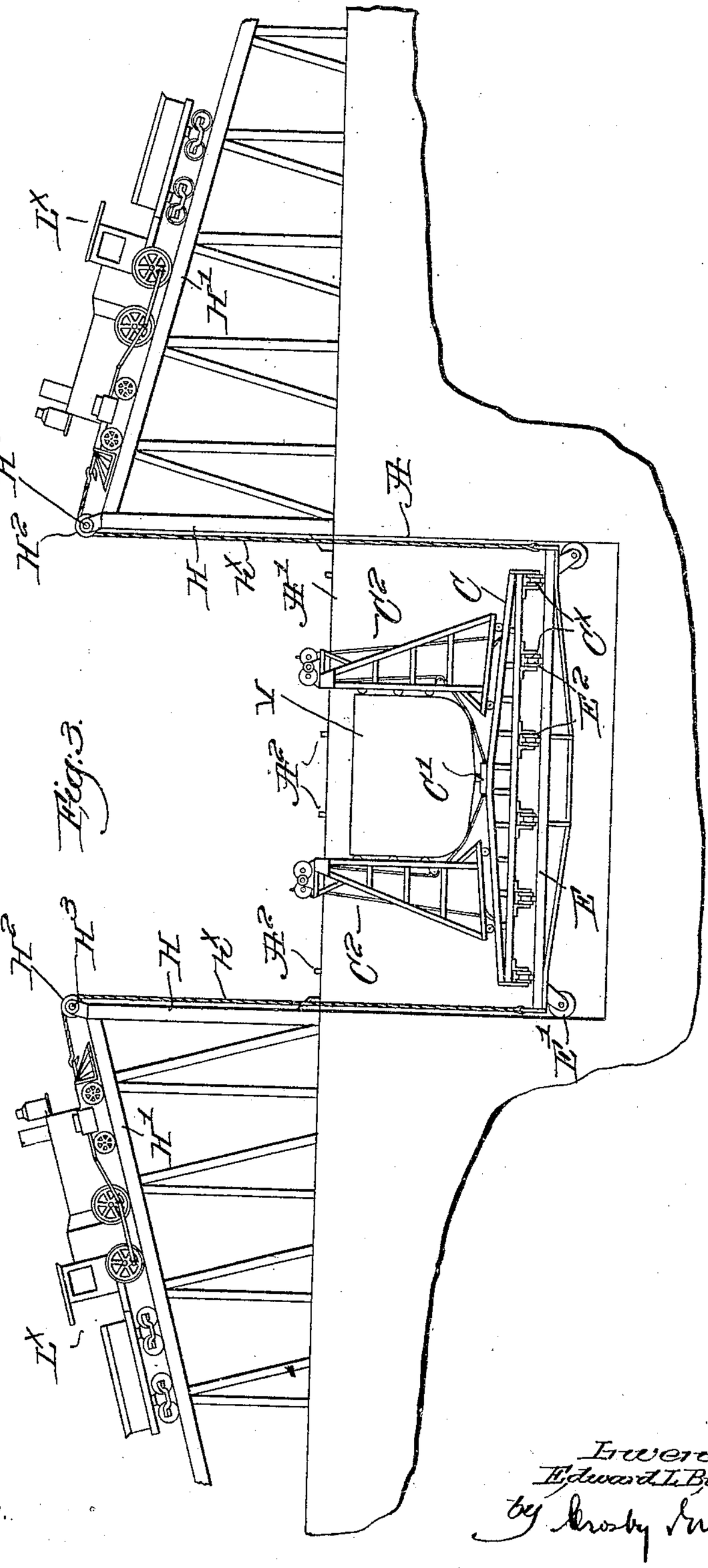

Fig. 3.

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# UNITED STATES PATENT OFFICE.

EDWARD L. BURWELL, OF WINCHESTER, MASSACHUSETTS.

## SHIP-ELEVATOR APPARATUS.

955,131. Specification of Letters Patent. **Patented Apr. 19, 1910.**

Application filed January 10, 1910. Serial No. 537,127.

*To all whom it may concern:*

Be it known that I, EDWARD L. BURWELL, a citizen of the United States, and resident of Winchester, county of Middlesex, State of Massachusetts, have invented an Improvement in Ship-Elevator Apparatus, of which the following description, in connection with the accompanying drawing, is a specification, like characters on the drawing representing like parts.

This invention relates to marine railways in general, and it has for its more particular object the production of novel means for elevating a ship or other vessel from the dock to the land, whereby the vessel may be moved bodily to another point for examination, repairs, etc.

In the practical application of my present invention a dock or basin is used in connection therewith, such dock or basin having a sufficient depth of water at all stages of the tide to float a vessel of the largest size for which the apparatus as a whole is constructed, and an adequate elevator is installed in the dock. Such elevator will in practice be provided with a longitudinally movable cradle so constructed and arranged as to properly sustain the vessel in upright position on suitable supports, so that when the elevator is lifted to the shore level the cradle and vessel can be removed from the elevator on suitable tracks laid on shore. In another application, Serial No. 489,930, filed by me April 14, 1909, I have shown and described a form of cradle particularly adapted for such use, and herein no claim is made to such cradle, nor do I herein claim broadly the counter-balancing of the elevator and cradle by suitable weights, as the same is made the subject-matter of claims in my application referred to.

In the application referred to the load, that is, the weight of the vessel and contents, is taken care of by a system of lifting or weight units, which latter are arranged to travel on inclined guideways and by suitable means the weight units are connected with the elevator in such manner that their weight will be sufficient to lift the elevator and its load to the level of the shore tracks. The said weight units are therein shown as drawn up the guideways by suitable draft mechanism and coupled together in sufficient number, but they are in a sense dead weights, possessing in themselves no motive or propelling power which can be utilized to convey them to the point of action on the guideways.

Inasmuch as motors of some kind, preferably steam or electric, will be necessary for moving the cradle and the vessel thereon upon the shore tracks I have in my present invention made provision for utilizing such motors as weight units for lifting the elevator and its load to the level of the shore tracks. Thus the weight units herein may be termed motor weight units, meaning by such term units of weight that are self-propelling, as opposed to dead-weight units which must be propelled into operative position by extraneous power. By utilizing such motor weight units I not only facilitate the positioning of the same for operative use in lifting the elevator, but I also use the dead weight of such units, through the action of gravity, for elevator lifting purposes, and I can also utilize in addition the tractive power of such units, as will appear hereinafter. The weight units herein are heavy electric or steam motors, either or both, and to increase the lifting action such motor weights may have coupled to them one or more gravity weight units, which in themselves possess no motive power capable of moving them from place to place. By such arrangement the scope of the plant is made very elastic, as more or less power can be readily brought into action according to circumstances. After the cradled vessel has been raised by the elevator to the shore level the elevator is locked in position and such portion of the motor weight units as may be required can then be utilized to draw the cradle and vessel upon the shore tracks to any desired point.

The various novel features of my invention will be fully described in the subjoined specification and particularly pointed out in the following claims.

Figure 1 is a view in elevation of an apparatus embodying my present invention, viewed from the inlet or entrance of the dock or basin, the elevator, cradle and vessel therein being shown in readiness to be raised, and I have shown both electric and steam motors utilized as lifting units; Fig. 2 is a right hand side elevation of a portion of one of the inclined tracks or guideways, with a motor lifting unit and connected gravity units thereon; Fig. 3 is a view simi-

lar to Fig. 1, but showing the apparatus arranged with guideways particularly adapted for use with steam motors, such as heavy locomotives, as the lifting units.

Referring to Figs. 1 and 3, A is the dock or basin, of suitable construction, open at its outer end and closed at its inner end A′, the floor of the dock being at such a level that a vessel may be floated thereinto at low tide. The elevator E, of any suitable construction and properly braced and stiffened, has guide-rolls E′ which travel along the vertical side walls of the dock as the elevator rises and falls, and longitudinal rails $E^2$ are fixed on the elevator floor. Said rails are adapted to register with corresponding rails $A^2$ leading from the inner end of the dock when the elevator is raised to the shore level. Locking means to retain the elevator and its load elevated in discharging position is shown in Fig. 1, and may for convenience be heavy slide-bars $E^\times$ horizontally movable in the side and end walls of the dock, such locking bars being moved into position beneath the elevator when the latter is at shore level. Any other suitable locking means can be used, however, provided the requisite strength for sustaining the load is maintained. Upon the tracks $E^2$ on the elevator is mounted the cradle, comprising a truss portion C provided with truck wheels $C^\times$ to travel on the tracks $E^2$, $A^2$; a line of keel-blocks C′, and side supports $C^2$, but the particular structure of the cradle forms no part of my present invention. The vessel V, when floated into the dock, is positioned on the cradle and supported thereon in such manner that vessel and cradle can be transported from one point to another as a unit. At each side of the dock I provide a super-structure of suitable character, and referring to Fig. 1, it comprises essentially vertical members G and outwardly and downwardly inclined the members $G^2$ are also arranged in pairs, ened, said members G′ being arranged in pairs, Fig. 2, and at a relatively steep inclination, their lower ends extending into chambers $A^3$, see dotted lines, Fig. 1, below the top of the dock structure. In practice the members $G^2$ are also arranged in pairs, but they lead from the shore level of the dock to the uprights G at a much smaller angle than the members G′.

The pairs of members G′ form guideways, and other guideways are formed by the pairs of members $G^2$, there being as many guideways for each super-structure as may be necessary or convenient. Cables $g$ attached at their lower ends to the sides of the elevator lead up to and over guide sheaves $g'$ on the super-structure, and have attached counter-balancing weights $G^\times$, the aggregate weight of the counter-balancing members $G^\times$ being sufficient to practically counter-balance the dead weight of the elevator and cradle, as in my application before referred to. Suitable bearings $G^3$ at the top of each super-structure support a heavy rotatable and horizontal shaft $G^4$, and as shown in Fig. 1 the two shafts are in parallelism above and near the plane of each side wall of the dock. Heavy drums or sheaves $G^5$ are secured to the shafts, a sheave being located between each pair of inclined members G′, and other sheaves of the series are located above sheaves $G^6$ lower down on the vertical members G, the sheaves $G^6$ being located midway between each pair of inclined members $G^2$. Strong lifting chains or cables $g^5$, $g^6$ are attached to the elevator at the sides thereof and are carried up around the sheaves $G^5$, said cables $g^6$ leading downward to and around the sheaves $G^6$, with their free ends outward, while the cables $g^5$ have their free ends led out and downward from the sheaves $G^5$ direct. In practice there might be an alternating arrangement of the guideways G′, $G^2$, at each side of the dock, as many as necessary, depending upon the capacity of the dock, each of the guideways being arranged to sustain suitable lifting units.

Herein I have shown upon the guideways $G^2$ motor lifting or weight units L, such as steam locomotives, which are attached to the free ends of the lifting cables $g^6$, the inclination of the guideways $G^2$ being such that they can be traversed by such locomotives. Such motor units L will in practice travel up the guideways under their own power and couple onto the lifting cables $g^6$, and if desired a plurality of such motor units can be coupled together for cumulative action as lifting devices, their weight being utilized for the purpose. In addition to the gravity action such motor units can add to the lifting effect by their tractive force if desired, so that not only can they be moved conveniently into and out of lifting position but the power exerted by them for lifting purposes can be materially increased by bringing into play the tractive effort thereof. When not required for lifting purposes these motor units can be employed in transferring the cradle and its vessel from the elevator to points on shore, and vice versa, as in practice the lower ends of the guideways $G^2$ will connect with the system of shore tracks $A^2$.

The guideways G′ are too steep for steam motors, and upon them I use electric motors M, which may conveniently be of the third rail or storage-battery type, to combine with power a very considerable dead-weight, and in order to facilitate their travel on the guideways G′ the latter are preferably provided with rack-rails $g^{10}$, Fig. 2, to be engaged by suitable driving cogs $m^{10}$ on the motor lifting or weight units M. The

latter I have shown as arranged to couple directly onto the free ends of the lifting cables $g^5$, Fig. 1, and I have also shown such motor units M as coupled to gravity-actuated units W, which latter may be wheeled trucks of suitable character adapted to travel on the guideways G′. Herein the gravity-actuated units are box-like structures of iron or steel, closed at the top and having hopper-like inlets $w^\times$ for the introduction of water or other heavy medium, and if these tank-cars are to be filled with water I provide suitable filling nozzles $N^\times$ connected with stand-pipes N carried at the side of the guideways G′, the nozzles overhanging the latter and being properly spaced to discharge into the hopper-like inlets $w^\times$, substantially as in my pending application. Outlets $w'$ are provided for emptying the units W, so that they may be hauled up, empty, into position and then they are filled to bring them up to the desired weight. Any suitable number of the gravity-actuated units W can be hauled up by each motor unit M, and when they are filled not only will the action of gravity upon the dead weight of the train be utilized for turning the shaft $G^4$ and lifting the elevator, but the tractive power of the motor unit M can be added thereto, with great effect, owing to the rack-rail and cog construction referred to.

The dead weight of a vessel and its cargo can be estimated with sufficient accuracy to make it manifest about what power will be required to effect the raising of the loaded elevator, and the lifting units are applied in such number and with such arrangement as will most easily and conveniently effect the desired operation. With small vessels, full or empty, it may be necessary to use only the motor units L, while with others the motor units L and M will be required. Again, in the case of very heavy loads it may be necessary to utilize not only all of the motor and gravity-actuated units possible, but also to bring into action the tractive power of the motor units. Thus the apparatus is capable of a very wide range in its effective operation without necessitating an undue expansion of the plant as a whole.

As the elevator and cradle are practically counter-balanced the principal function of the lifting means is to compensate for the weight of and lift the vessel and contents, and this can if desired be effected without utilizing the tractive effort of the motor units. It will be desirable in many cases, however, to practically counter-balance the weight of the vessel and contents by the weight of the lifting units, as a whole, and then to overcome inertia and slightly overbalance the weight by making use of the tractive power of the motor lifting units. Manifestly this arrangement provides for very exact control, and without the expenditure of a great amount of power.

I have not shown any gravity-actuated lifting or weight units connected with the locomotives L but it will be apparent that ordinary hopper cars loaded with stone, sand, or other heavy medium can be coupled onto the motor units L if desired, to act in connection therewith precisely as the weight units W and the motor units M act. The structure shown in Fig. 3 can be used in cases where the vessels to be elevated are relatively small, or for large vessels when the employment of a number of locomotives in the vicinity provides a sufficient supply of such motor units for elevating purposes when required. The superstructure at each side of the dock comprises essentially the vertical members H, and inclined members H′ at such grade or inclination that the motor units $L^\times$, such as locomotives, can readily traverse the same, the members H′ constituting guideways for the lifting units, and at their lower ends connecting with the shore tracks or rails. Each superstructure will include as many of the guideways as may be necessary, according to the capacity of the elevator, the latter having attached lifting cables $h^\times$ which lead up to and around the sheaves $H^2$ on horizontal shafts $H^3$, one of such shafts being rotatably mounted in suitable bearings at the top of each superstructure. The free ends of the lifting cables are coupled onto the motor units $L^\times$ as previously described with relation to the apparatus shown in Fig. 1.

I have not shown counterweights in Fig. 3, nor locking means, but in practice the apparatus would preferably be provided with such devices as previously described.

The description of the apparatus has been described in detail hereinbefore, so far as relates to elevating a vessel preparatory to its removal from the dock. When a vessel is to be returned thereto and floated the cradle supporting the vessel will be run onto the lifted elevator and the latter will then be lowered. Such lowering follows the connection of a proper number of lifting units with the lifting cables, in order to balance the elevator and its load when free to descend, and the descent can be effected by various ways. That is, some of the gravity-actuated units can be disconnected in sufficient number so that the weight of the vessel and contents will cause the elevator to descend, or the motor units may be caused to move, by their tractive power, up the inclined guideways, as the elevator descends, the effect of such tractive effort reducing the effective power of the lifting elements. This tractive power of the motor units is thus a reserve or auxiliary means for controlling not only the ascent but also the descent of the elevator and its load, as will be manifest,

while such power is at all times available for moving the lifting units into or out of operative position.

Having fully described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. In apparatus of the class described, a dock or basin into which a vessel can be floated, an elevator vertically movable in such dock, a cradle longitudinally movable on the elevator and adapted to sustain a vessel in upright position, an over-head shaft above and at each side of the dock, provided with a series of sheaves, an inclined track or guideway leading downward and corresponding with the position of the sheaves, lifting cables connected with the elevator and carried up over the sheaves, and lifting units adapted to travel on each track and to be connected in varying number with the upper end of each cable, some of said lifting units being self-propelled, to thereby position themselves on the tracks or guideways.

2. In apparatus of the class described, a dock or basin into which a vessel can be floated, an elevator vertically movable in such dock, a cradle longitudinally movable on the elevator and adapted to sustain a vessel in upright position, an over-head shaft above and at each side of the dock, provided with a series of sheaves, an inclined track or guideway leading downward and corresponding with the position of the sheaves, lifting cables connected with the elevator and carried up over the sheaves, means to counterbalance the dead weight of the elevator and cradle, and a plurality of motor lifting units adapted to propel themselves upon the tracks into position to be connected with the free ends of the lifting cables, to effect the lifting of the elevator and its load by the cumulative action of their weights, the tractive power of said motor units being also available to increase the lifting effect thereof.

3. In apparatus of the class described, a dock or basin into which a vessel can be floated, an elevator vertically movable in such dock, a cradle longitudinally movable on the elevator and adapted to sustain a vessel in upright position, a series of sheaves rotatably supported above the dock at each side thereof, lifting cables attached to the elevator and carried up over said sheaves, inclined guideways adjacent at their upper ends to the free ends of said cables, a plurality of separate lifting units adapted to be connected in series and attached to the free ends of the cables, each series of units including a self-propelling or motor unit, the lifting units acting cumulatively upon and effecting vertical movement of the elevator and its load, and locking means to maintain the elevator in raised position.

4. In apparatus of the class described, a dock or basin into which a vessel can be floated, an elevator vertically movable in such dock, a cradle longitudinally movable on the elevator and adapted to sustain a vessel in upright position, an over-head shaft above and at each side of the dock, provided with a series of sheaves, an inclined track or guideway leading downward and corresponding with the position of the sheaves, lifting cables connected with the elevator and carried up over the sheaves, and lifting units adapted to travel on each track and to be connected in varying number with the upper end of each cable, some of said lifting units being self-propelled, to thereby position themselves on the tracks or guideways, and locking means to maintain the elevator in raised position.

5. In apparatus of the class described, a dock or basin into which a vessel can be floated, an elevator vertically movable in such dock, a cradle longitudinally movable on the elevator and adapted to sustain a vessel in upright position, a series of sheaves rotatably supported above the dock at each side thereof, lifting cables attached to the elevator and carried up over said sheaves, inclined guideways adjacent at their upper ends to the free ends of said cables, a plurality of separate lifting units adapted to be connected with the free ends of the cables, to act cumulatively upon and govern the ascent or descent of the elevator and its load, and means to cause the lifting units to exert tractive effort in addition to the lifting action due to the weight thereof.

6. In apparatus of the class described, a dock or basin into which a vessel can be floated, an elevator vertically movable in such dock, a cradle longitudinally movable on the elevator and adapted to sustain a vessel in upright position, a series of sheaves rotatably supported above the dock at each side thereof, lifting cables attached to the elevator and carried up over said sheaves, inclined guideways adjacent at their upper ends to the free ends of said cables, separate gravity acting lifting units adapted to travel on the guideways and to be connected in varying number with the upper end of a lifting cable, and self-propelling lifting units to move themselves and the gravity acting units into coöperation with the lifting cables, whereby the cumulative action of all of the units will operate through said cables to lift the elevator and its load.

7. In apparatus of the class described, a dock or basin into which a vessel can be floated, an elevator vertically movable in such dock, a cradle longitudinally movable on the elevator and adapted to sustain a vessel in upright position, parallel over-head

shafts supported above the dock at each side thereof, sheaves fast on each shaft, lifting cables attached to the sides of the elevator and carried up over the sheaves, and self-propelling means to apply to the upper free end of each cable a variable lifting weight, to effect vertical movement of the elevator and its load.

8. In apparatus of the class described, a dock or basin into which a vessel can be floated, an elevator vertically movable in such dock, means on the elevator to support and maintain upright a vessel thereon, and means to raise the elevator and its load to a predetermined height, said means comprising a plurality of heavy, self-propelling lifting units adapted to be operatively connected in varying number with the elevator to act by their weight cumulatively upon said elevator and raise the same.

9. In apparatus of the class described, a dock or basin into which a vessel can be floated, an elevator vertically movable in such dock, a cradle on the elevator to support and maintain upright a vessel thereon, counterbalancing means for the elevator and cradle, and means to raise the elevator and its load to a predetermined height, said means comprising gravity-actuated lifting units and motor lifting weights adapted to coöperate in varying number with the elevator to act cumulatively upon and lift the elevator and its load, the motor units positioning themselves and the gravity-actuated units for operation and being capable of increasing, by tractive effort, the lifting effect of the units.

10. In apparatus of the class described, an elevator, a cradle longitudinally movable thereon and adapted to engage and support a vessel in upright position, and means to move vertically the elevator and its load, comprising a plurality of motor lifting units adapted to propel themselves into position for coöperation with the elevator to act cumulatively thereupon.

11. In apparatus of the class described, an elevator, a cradle longitudinally movable thereon and adapted to engage and support a vessel in upright position, overhead sheaves, lifting cables connected with the elevator and leading upward therefrom to and around said sheaves, and means, including a plurality of self-propelling and heavy weight units adapted to be connected with the free upper ends of said lifting cables, to act cumulatively therethrough upon the elevator and effect ascent or descent thereof.

12. In apparatus of the class described, an elevator, means carried thereby to support a vessel in upright position, means to raise the elevator and its load, including a plurality of separate and heavy motor units adapted to be brought into coöperation with and to act cumulatively upon the elevator, to raise the same by the weight of said units, and devices to utilize the tractive power of such units in addition to the weight thereof, for raising the elevator.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

EDWARD L. BURWELL.

Witnesses:
JOHN C. EDWARDS,
THOMAS J. DRUMMOND.