Feb. 18, 1947. G. H. ATWOOD ET AL 2,415,805

MARINE RAILWAY

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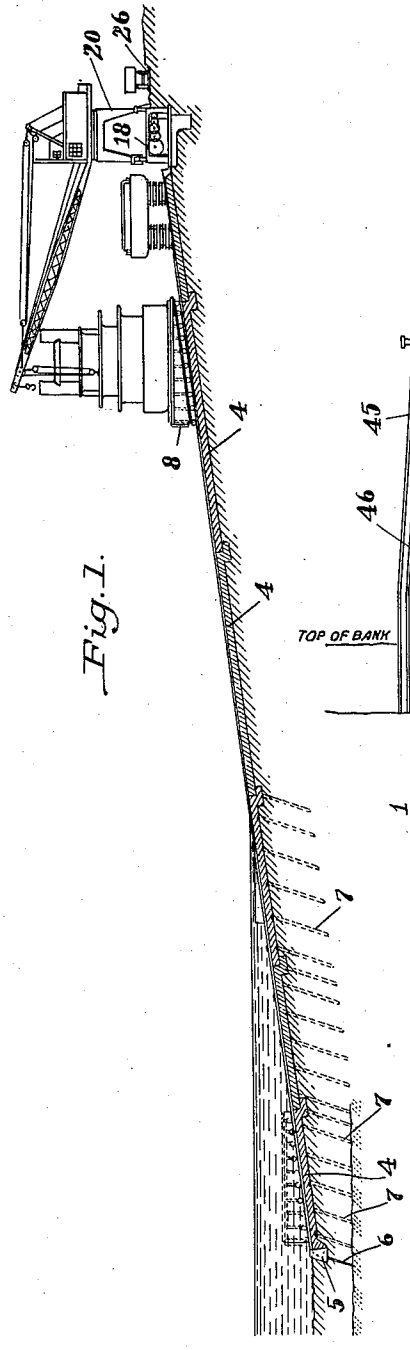


Fig. 1.

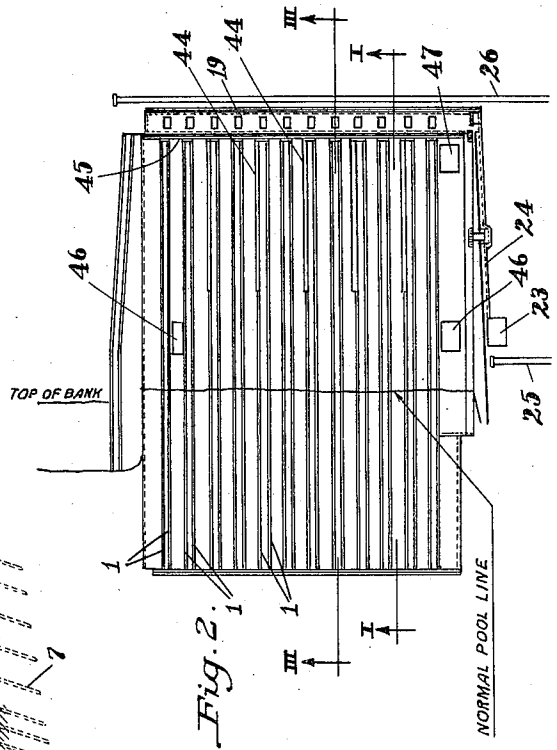


Fig. 2.

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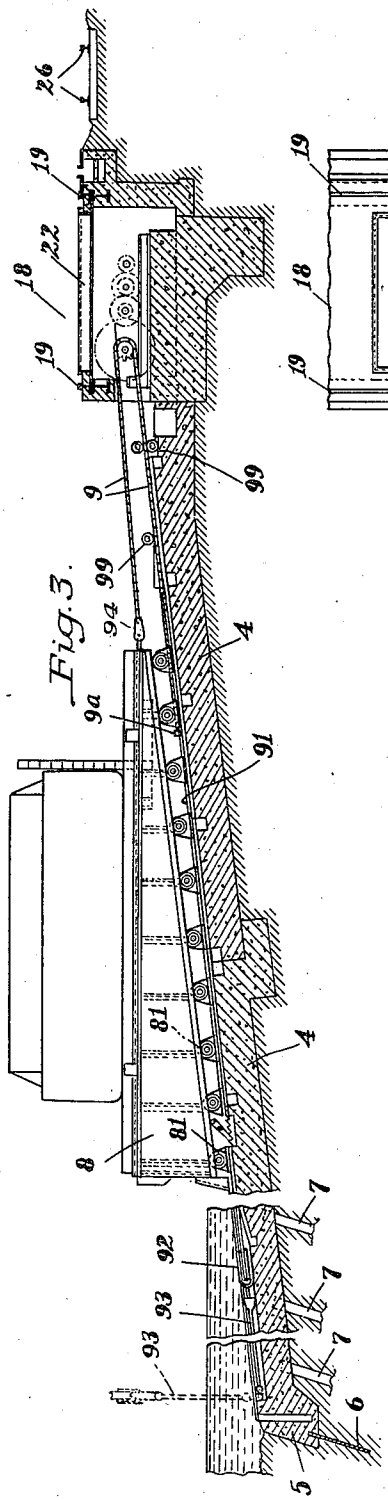


Fig. 3.

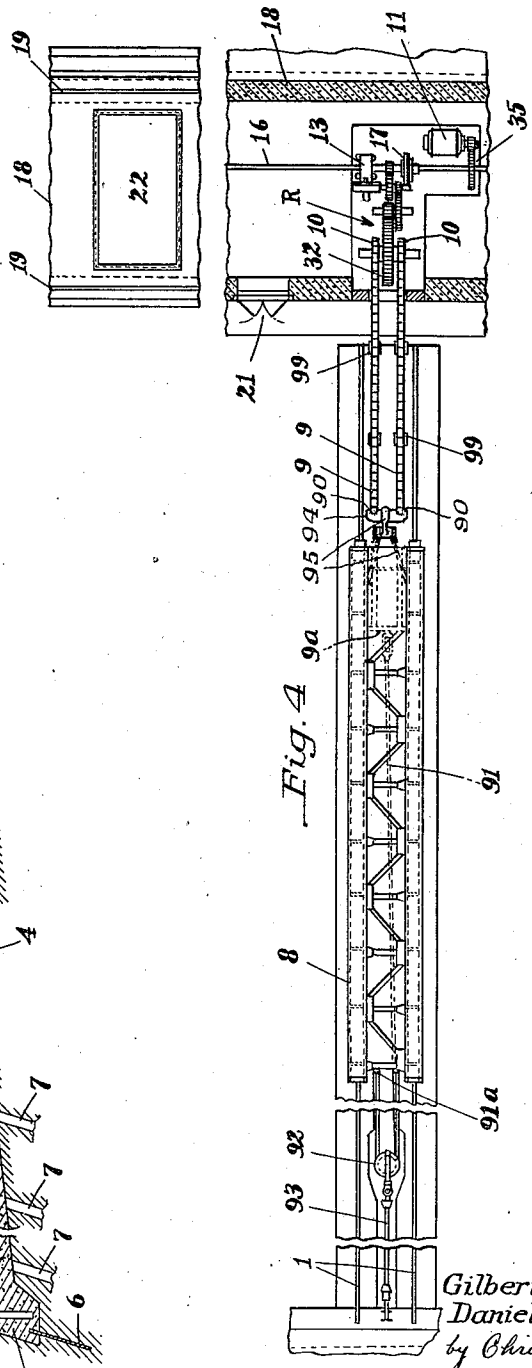


Fig. 4

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MARINE RAILWAY

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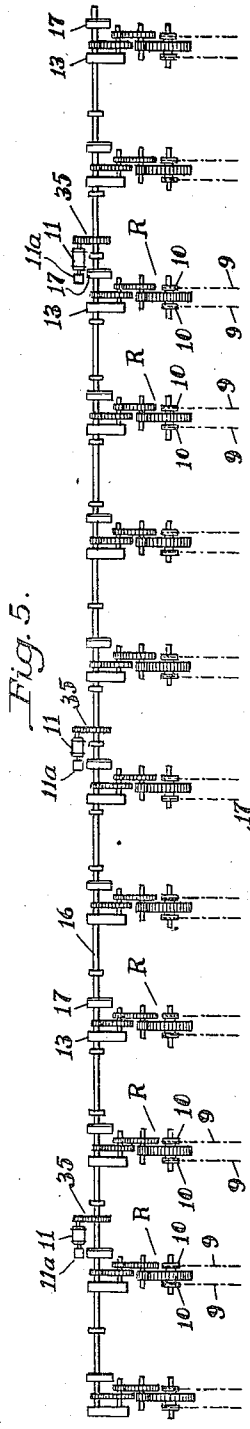


Fig. 5.

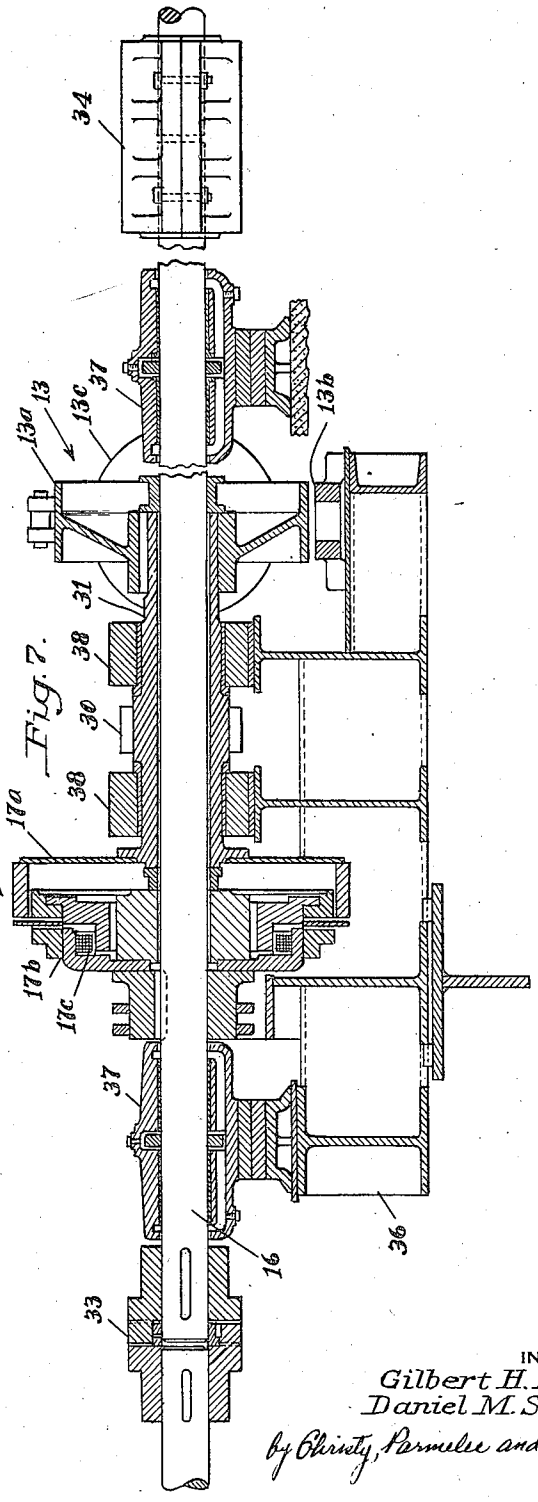


Fig. 7.

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MARINE RAILWAY

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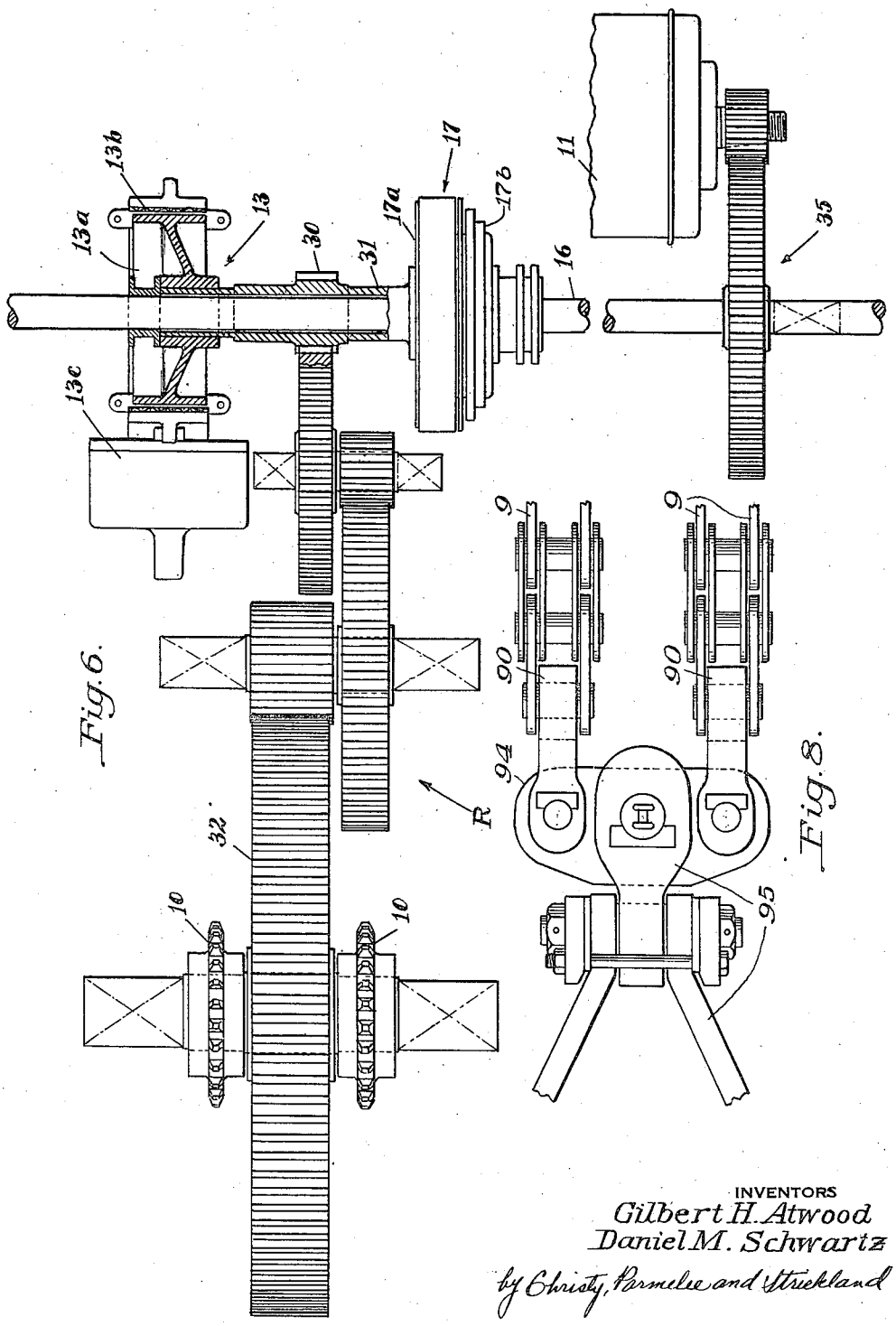


Fig. 6.

Fig. 8.

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2,415,805

MARINE RAILWAY

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Application December 19, 1944, Serial No. 568,875

12 Claims. (61—67)

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Our invention relates to marine railways for removing boats from the water, and positioning them ashore where they are accessible for repairs or other work. The invention consists in certain new and useful improvements in the boat-moving mechanism of such a railway.

In Letters Patent No. 1,860,177, granted to F. R. Dravo et al. on May 24, 1932, and owned in common with our present invention, a marine railway is illustrated and described, and in exemplary way we shall describe our present invention as it is organized in such railway.

The railway consists of an inclined bed extending from below the edge of a waterway upward upon the shore or bank, and on the bed tracks extend transversely of the water-line from a suitable distance beneath the water to a suitable distance inshore. Carriages are severally borne by and movable on the tracks. Means are provided for moving the carriages. In service the boat to be brought ashore is drifted on even keel into broadside position at the lower end of the railway, and is steadied by means of shore lines. The carriages are lowered until they abut upon the hull of the boat, and then the shore lines are slackened off and the carriages moved downward on the tracks, pushing the boat offshore until, in deeper water, they pass beneath the hull. As soon as the carriages clear the hull their descent is arrested, and the vessel is hauled shoreward, above the submerged carriages, until it rests against certain stops provided for the purpose on the carriages. Thereupon, the vessel is tied to the two end carriages, or to the hauling chains by which they are powerfully shifted on the rails, and then all of the carriages are moved in unison up the inclined railway, raising the vessel and carrying it upward to desired position on the shore where it is sustained for the work to be done. If the work is to be of long duration, the vessel may be blocked-up on the upper end of the railway, or it may be moved on transfer cars to repair or storage areas at the sides of the railway, and the carriages released for duty in moving other boats.

In the marine railway of the said Dravo Patent No. 1,860,177, each carriage is equipped with a hauling chain, and a hauling unit including a prime mover is provided for operating each hauling chain. The prime mover (an electric motor, ordinarily) of each hauling unit is positively geared to the chain-actuating mechanism of the unit, and each unit with its connected prime mover is adapted to be selectively clutched to a freely journaled line-shaft which is common to all of the units.

As distinguished from such an organization, our invention comprises the provision of one or more prime movers for positively driving the line-shaft, together with means for selectively

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engaging the chain-operating mechanisms of the several hauling units to the driven shaft. The several prime movers are geared to the shaft at axially spaced-apart points, and a pair of hauling chains, instead of one, is provided for each carriage. By virtue of this organization the number of prime movers may be substantially less than the number of the hauling units, and the hauling units may, advantageously, be connected to and disconnected from the source of rotation at will. As in the case of the previously patented structure, each hauling unit is provided with a brake to impede or arrest operation of its chain-actuating mechanism as desired. Thus it is that the load-distribution among the several motors and the distribution of torsional stress along the shaft are more effectively maintained. All of the advantages of the prior structure are realized with greater economy and efficiency.

The invention will be understood upon reference to the accompanying drawings, in which:

Figure 1 is a view in vertical and longitudinal section, taken on the plane I—I of Figure 2, of a marine railway in which our invention is embodied;

Figure 2 is a view of the railway in plan and to smaller scale, the body of water, at whose margin the railway is installed, will herein be considered to be navigable river, on which river craft such as steamboats, tugs and barges travel;

Figure 3 is a fragmentary view in vertical and longitudinal section, taken on the plane III—III of Figure 2, to larger scale than Figure 1, and illustrating details of carriage structure and of the carriage hauling or moving means;

Figure 4 is a fragmentary view, showing in plan parts which are shown in side elevation in Figure 3;

Figure 5 is a diagrammatic view of the hauling units and prime movers of the railway;

Figure 6 is a view partly in paln and partly in horizontal section, showing to larger scale the line shaft and one of the prime movers fragmentarily, and illustrating in detail the hauling mechanism of one of the several units organized with the shaft;

Figure 7 is a fragmentary view to still larger scale, showing in vertical section on the axis of the line shaft the parts of the mechanism of one hauling unit that are in immediate association with the shaft; and

Figure 8 is a fragmentary view in plan of the means for securing the hauling chains to the carriages.

Referring to the drawings the tracks 1 of the railway are laid in pairs, as shown in Figure 2. As in the case of the structure of the Dravo patent above identified, the tracks of each pair may be spaced apart at a relatively narrow interval, say five feet, and the successive pairs of tracks are

spaced apart a relatively wide interval, say twenty-three feet, there being twelve pairs of tracks in this instance. The tracks are laid at a slope of 1:8; they may be about four hundred feet long and may extend one hundred and sixty feet beyond the water-line, to a depth of about twenty feet below the surface of the water. The rails rest on steel beams embedded in reinforced concrete pads 4, as shown in the Dravo patent. Across the lower end of the railway extends a concrete wall 5, upon which the pads 4 at their lower ends abut. The wall 5 in turn rests in part on a solid line of sheet-steel piling 6, driven in this case through the sedimentary river-bed to rock, to prevent undercutting by river current. Wooden piles 7, driven on a 1:4 batter, underlie so much of the track beams as extends below the water-line; these resist the tendency of the railway to creep down hill.

A separate carriage 8 travels upon each pair of tracks, and in this installation there are in all 12 carriages. In this case the carriage is of wedge shape and of double box girder construction; it is forty-eight feet long and at the river end stands ten feet high. It is provided with lines of double-flanged wheels 81 which engage the tracks 1.

The construction of the carriages and of the other elements not otherwise herein described in detail may be understood upon reference to the said Dravo patent. Each carriage is moved along its pair of tracks, by means of a hauling member, which consists in a pair of sprocket-chains 9, 9 anchored at one end 90 to the ends of an equalizer bar 94, which is pivotally secured at its center to a bridle 95 extending from the inshore end of the carriage, as shown in Figures 4 and 8. The bar 94 serves to equalize the pull in the two chains, correcting for variations in length due to differences in stretch, sag, etc. The equalizer bar is limited in its movement, as will be apparent in the showing of Figure 8, so that if one chain breaks in service the carriage is held by the remaining chain.

The chains are trained upon a pair of axially spaced sprocket wheels 10, 10 at the land end of the railway, and passing around the sprocket wheels the chains extend down the inclined railway, and ride rollers 99 between the rails. The matched pair of chains is of sufficient length to permit the carriage to be lowered to the water end of the railway, with some surplus. The otherwise free ends of the chains, the ends remote from the points of attachment to the carriage, are both secured to a cross-bar 9a which in turn is secured to a single back-haul line 91 of steel rope which extends around a sheave 92 at the water end of the railway, and at its other end is secured at 91a to the carriage. The sheave 92 is rotatably borne in an anchorage in the form of a bar 93, adjustable in its effective length. This bar is pivoted, and is of such length that by swinging it the upper end may be raised clear of the water for purposes of adjustment and for proper attention to the sheave 92. In Figure 3 the raised position of the bar 93 is shown in dotted lines. While a single wire rope 91 is shown attached by cross-bar 9a to the free ends of both chains 9, it will be understood that a wire rope and a sheave may be provided for each of the two chains of the carriage.

Associated with each carriage is a hauling unit, consisting of a train of reduction gearing R driven by a pinion 30 integral with a sleeve or quill 31 upon the line-shaft 16, Figures 6 and 7. The last gear 32 in the train of the hauling unit gears is secured between, and on the same shaft with, the sprocketwheels 10, 10, and this arrangement of the gear 32 between the sprocket-wheels centralizes the reaction of the tension on the two roller chains 9, 9 upon the gear. The line-shaft is formed of a series of lengths of shafting coupled end to end as shown at 33 and 34 in Figure 7, and to all intents and purposes the line-shaft is as a single shaft extending in continuity across the upper end of the railway. While in some cases the line-shaft may be positively driven by means of a single prime mover, it is advantageously driven by a plurality of prime movers which in this instance comprise three electric motors 11 geared at appropriately spaced points 35 to the shaft to insure substantially uniform distribution of driving torque to the shaft. See Figure 5. Each motor is provided with an electrically controlled brake. The motor brakes are indicated at 11a in Figure 5 of the drawings, brake-equipped motors being common pieces of equipment now available on the open market. The quill 31 of each hauling unit is freely rotatable on the line-shaft, but at one end is organized with a magnetic clutch 17, whereby the hauling units may be selectively engaged to and disengaged from the powerfully rotated line-shaft, and at opposite end the quill is provided with a magnetic brake 13.

The magnetic clutches and brakes may be of conventional construction. Each clutch 17 includes a disk portion 17a (Figures 6 and 7) united to the quill 31, a portion 17b united to the rotating line-shaft 16, and a magnetic coil 17c adapted upon being energized to unite the two clutch portions and thereby unite the gear-driving quill 31 with driving shaft 16. The magnetic brake consists of a brake drum 13a secured to the quill, a brake-band 13b embracing the drum, and a device 13c which includes an electro-magnet and a spring (not shown, but of usual construction). Normally, with the electro-magnet de-energized, the spring holds the band tight upon the drum, and so secures it and the quill and gearing against rotation. Alternately, when the electro-magnet is energized, it overpowers the spring and releases tension upon the band so that the rotary parts are freed for rotation.

The hauling units, line-shaft and driving motors are contained in a machinery house 18 which extends across the upper or land end of the railway, and, of course, a suitable foundation 36 for the mechanism and suitable bearings 37 for the line-shaft and bearings 38 for the quills 31 are provided, as indicated in Figure 7. The walls of the machinery house 18 may serve as a support for the rails 19 of a service track, upon which a gantry whirler-crane 20 travels, to handle material for the repair work or new work which may be conducted on the marine railway. A service railway 26 extends along the land side of the machinery house.

Entrance doors 21 to the machinery house are provided between the succeeding pairs of tracks 1, and through the roof hatchways with removable covers 22 are formed. These hatchways are arranged, one immediately above each hauling unit, and they are sufficient in size to permit the removal of the hauling unit complete, when required.

The motors, the magnetic clutches, and the magnetic brakes may be made subject to control from a single properly situated station 23, Figure 2, and by a single operator having clear view

of the whole railway. The hauling units with their quill shafts, the motor-driven line-shaft and the magnetic clutches constitute an assembly in which any one hauling unit may be operated alone, or any combination of the whole twelve units may be united to the driven line-shaft. A system of signal lights may be arranged, as described in the Dravo patent noted, to indicate to the operator which particular units are connected to the line-shaft for service. Watt meters may be provided in manifest manner, to indicate the load on each of the several motors 11, although it is to be noted that contrary to the marine railway of said Dravo patent, all of the motors for driving the hauling units are positively geared to the line-shaft, whereby serious overloading of one motor or another is prevented.

It will be obvious to the electrical engineer, particularly in the light of the disclosure of the Dravo patent, that a system of push-buttons may be provided in the control station, and, in response to the selective pressing of these buttons, the hauling units of the individual carriages may be clutched to the line-shaft 16 and moved and then released, so that any carriage may be inched into proper position relatively to another carriage or other association of carriages. Such inching of an individual carriage will ordinarily be done above the water line and before lowering a set of carriages to receive their load. After a floating vessel has been brought to position over a previously lowered set of carriages, further inching may, if necessary, be performed. Inching may also be done in case a particular carriage becomes overloaded in course of hauling. It will further be perceived that, when a boat is to be raised whose hull is not flat bottomed, cradles may be provided to engage the hull and to be engaged immediately by the carriages, and when such cradles are employed, there will be greater likelihood of necessity for inching the carriages after submergence. The controls for the motors, clutches and the brakes are provided with the necessary interlocks and with overload and safety features.

A trench 24 is provided for carrying electrical connections from station 23 to the machinery house, and a feed-line from a suitable source of electric power to the station as indicated at 25. Covered service trenches, whose position is indicated at 44, Figure 2, are formed in the pavement between the pairs of rails 1, 1, and extend from the upper end of the railway downward. They are arranged at convenient intervals, and in this instance they are shown to be arranged on the upstream side of alternate pairs of tracks. At their upper ends they connect with a cross-trench, indicated at 45. These trenches 44 are provided, as will be understood, with convenient outlets, and they are serviceable to contain electric conduits and various pipe lines for air, water, steam, etc.

Rudder pits, sunk beneath the general level of the pavement, are provided in suitable locations. In this installation rudder pits 46 are provided at both the down-stream and the up-stream sides of the railway, and conveniently at a distance about 35 feet to the land side of the water-line; and an additional rudder pit 47 is provided at the extreme upper end of and on the down-stream side of the railway. These pits afford access, for the ready removal of and installation of rudders of vessels sustained on the railway.

From the foregoing description, it will be seen that the provision of a line-shaft having a motor drive, with each motor having its individual brake and each individual hauling unit having a magnetic clutch for connecting and disconnecting the hauling unit through the line-shaft to the prime movers or motors 11, affords many advantages.

A typical sequence of operation may be mentioned: With the motor brakes set, the hauling unit clutches 17 are closed and the hauling unit brakes 13 are simultaneously released. The motor brakes secure the line-shaft against rotation, and the quills 31 of the hauling units, being clutched to the line-shaft, prevent the gears R of the hauling unit rotating, thereby holding the carriages stationary. When the carriages are to be moved, the motors are started and the motor brakes simultaneously released, to be engaged again only when the motors stop. In such way one or any desired number of carriages may be clutched to the line-shaft and moved. The clutches 17 and brakes 13 of the hauling units are operated only when the line-shaft is at rest, this practice saving wear on the clutch and brake linings. Additionally, the electrical control includes switches whereby any individual motor brake may be released, and one motor only used to drive the line-shaft for a particular group or combination of carriages. Furthermore, if one or more of the motors should fail and be removed the remaining motor or motors may drive the railway at reduced capacity. If the motor brakes, motor gears 35, or line-shaft at any point should fail, with the effect that the motor brakes cannot hold the carriages, the main power supply may be shut off, which causes all of the hauling unit brakes 13 to set.

When the carriages are to be drawn either individually or in a group upward on the railway, the motors 11 are rotated in the appropriate direction of rotation. When the carriages are to be lowered on the railway the motors are reversed. And so the operation of the apparatus will be understood by those skilled in the art, and the substantial advantages of our improvements in the drive for the carriages of a marine railway will be realized.

Within the terms of the appended claims, many modifications and variations may be made without departure from the spirit of the invention.

We claim as our invention:

1. In a hoist mechanism having a plurality of hauling units for moving a plurality of ship-supporting carriages upon the tracks of a marine railway, said hoist mechanism having a drive that comprises a plurality of prime movers united for joint operation, the number of said prime movers united in said drive being less than the number of said carriages, and means for selectively connecting the hauling units to said united prime movers of said drive to effect the operation of either a selected carriage or a selected group of carriages.

2. In a hoist mechanism having a plurality of hauling units for moving a plurality of ship-supporting carriages upon the tracks of a marine railway, said hoist mechanism having a drive that comprises a plurality of prime movers united for joint operation, the number of said prime movers united in said drive being less than the number of said carriages, and means for selectively connecting the hauling units to said united prime movers of said drive to effect the operation of either a selected carriage or a selected group of carriages, together with brakes

severally organized with said hauling units for locking each carriage against movement when its hauling unit is disconnected from said united prime movers.

3. In a hoist mechanism having a plurality of hauling units for moving a plurality of ship-supporting carriages upon the tracks of a marine railway, said hoist mechanism having a drive that comprises a line-shaft and a plurality of prime movers geared at spaced-apart points thereto, said hauling units severally comprising quills mounted on said line-shaft, carriage-moving mechanism arranged between each quill and an associate carriage, and means for selectively connecting the quills to said line-shaft, whereby the several prime movers geared to said line-shaft may be connected as a unit to drive either a selected carriage or a selected group of carriages.

4. In a hoist mechanism having a plurality of hauling units for moving a plurality of ship-supporting carriages upon the tracks of a marine railway, said hoist mechanism having a drive that comprises a line-shaft and a plurality of prime movers geared at spaced-apart points thereto, said hauling units severally comprising quills mounted on said line-shaft, carriage moving mechanism arranged between each quill and an associate carriage, and means for selectively connecting the quills to said line-shaft, whereby the several prime movers geared to said line-shaft may be connected as a unit to drive either a selected carriage or a selected group of carriages, together with means organized with each hauling unit for automatically securing the associate carriage against movement when the hauling unit is disconnected from said prime movers.

5. In a hoist mechanism having a plurality of hauling units for moving a plurality of ship-supporting carriages upon the tracks of a marine railway, said hoist mechanism having a drive that comprises a plurality of lengths of shafting united end to end to provide a line-shaft, a plurality of prime movers connected to different lengths of said shafting in the line-shaft to drive the line-shaft as a single shaft member, said hauling units severally comprising quills mounted on said line-shaft, carriage-moving mechanism arranged between each quill and an associate carriage, and means for selectively connecting the quills to said line-shaft, whereby the several prime movers geared to said line-shaft may be connected as a unit to drive either a selected carriage or a selected group of carriages.

6. In a hoist mechanism having a hauling unit for moving a ship-supporting carriage, a pair of chains secured to said carriage and connected to said hauling unit for moving the carriage, and means for equalizing the pull as between the chains of the pair and for retaining connection to the carriage in the event that either chain breaks.

7. In a hoist mechanism having a plurality of hauling units for moving a plurality of ship-supporting carriages upon the tracks of a marine railway, said hoist mechanism having a drive that comprises a line-shaft, means for positively rotating said line-shaft, a hauling unit connected to each carriage, and means for selectively connecting said hauling units through said line-shaft to said shaft-rotating means to effect the operation of either a selected carriage or a selected group of carriages.

8. In a hoist mechanism having a plurality of hauling units for moving a plurality of ship-supporting carriages upon the tracks of a marine railway, said hoist mechanism having a drive that comprises a line-shaft, a motor for positively driving said line-shaft, a brake for each hauling unit for securing the unit against carriage-shifting movement, a clutch for each hauling unit for engaging the unit to said line-shaft, and a brake associated with each motor for locking the line-shaft against rotation while the clutches and brakes of the hauling units are being operated.

9. In a hoist mechanism having a plurality of hauling units for moving a plurality of ship-supporting carriages upon the tracks of a marine railway, said hoist mechanism having a drive that comprises a line-shaft, a motor geared to drive said line-shaft, each hauling unit including a quill mounted of said line-shaft, brakes for severally securing said quills against rotation, clutches for severally engaging said quills to said line-shaft, and a brake associated with said motor for locking the line-shaft against rotation while the clutches and brakes associated with said quills are being operated.

10. In a hoist mechanism having a plurality of hauling units for moving a plurality of ship-supporting carriages upon the tracks of a marine railway, said hoist mechanism having a drive that comprises a line-shaft, a plurality of motors geared at spaced intervals to said shaft to drive the same, each hauling unit including a quill mounted on said line-shaft, brakes severally for securing said quills against rotation, clutches for severally engaging said quills to said line-shaft, and a brake associated with each of said motors for locking the line-shaft against rotation while the clutches and brakes associated with said quills are being operated.

11. In a hoist mechanism having a plurality of hauling units for moving a plurality of ship-supporting carriages upon the tracks of a marine railway, said hoist mechanism having a drive that comprises a line-shaft, a motor connected to drive said line-shaft, a brake to lock said line-shaft against rotation when said motor is at rest, and a plurality of clutches operable to engage said units selectively to said line-shaft while said brake locks the shaft against rotation.

12. In a hoist mechanism having a plurality of hauling units for moving a plurality of ship-supporting carriages upon the tracks of a marine railway, said hoist mechanism having a drive that comprises a line-shaft, a motor connected to drive said line-shaft, a brake to lock said line-shaft against rotation when said motor is at rest, and a plurality of clutches operable to engage said units selectively to said line-shaft while said brake locks the shaft against rotation, and a brake organized with each hauling unit to lock the unit against operation when the clutch of the unit is positioned to disengage the unit from the line-shaft.

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The following references are of record in the file of this patent:

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