J. A. L. WADDELL & J. L. HARRINGTON.

LIFT BRIDGE.

APPLICATION FILED AUG. 17, 1908.

952,486. **Patented Mar. 22, 1910.**

6 SHEETS—SHEET 1.

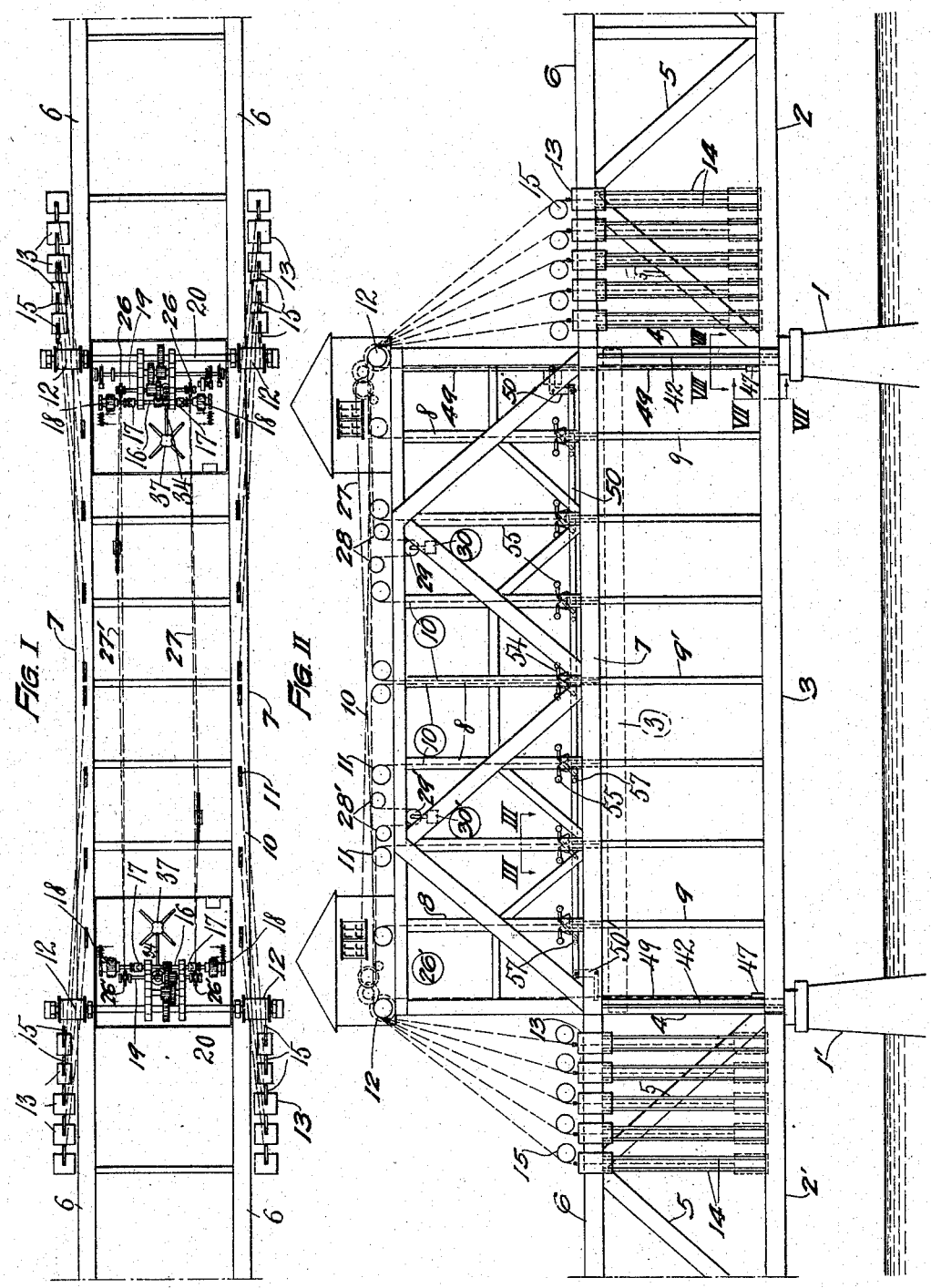


FIG. I

FIG. II

WITNESSES:

Harold C. Richards

Myrtle M. Jackson

INVENTORS.

J. A. L. Waddell.

John Lyle Harrington.

BY Arthur C. Brown

ATTORNEY.

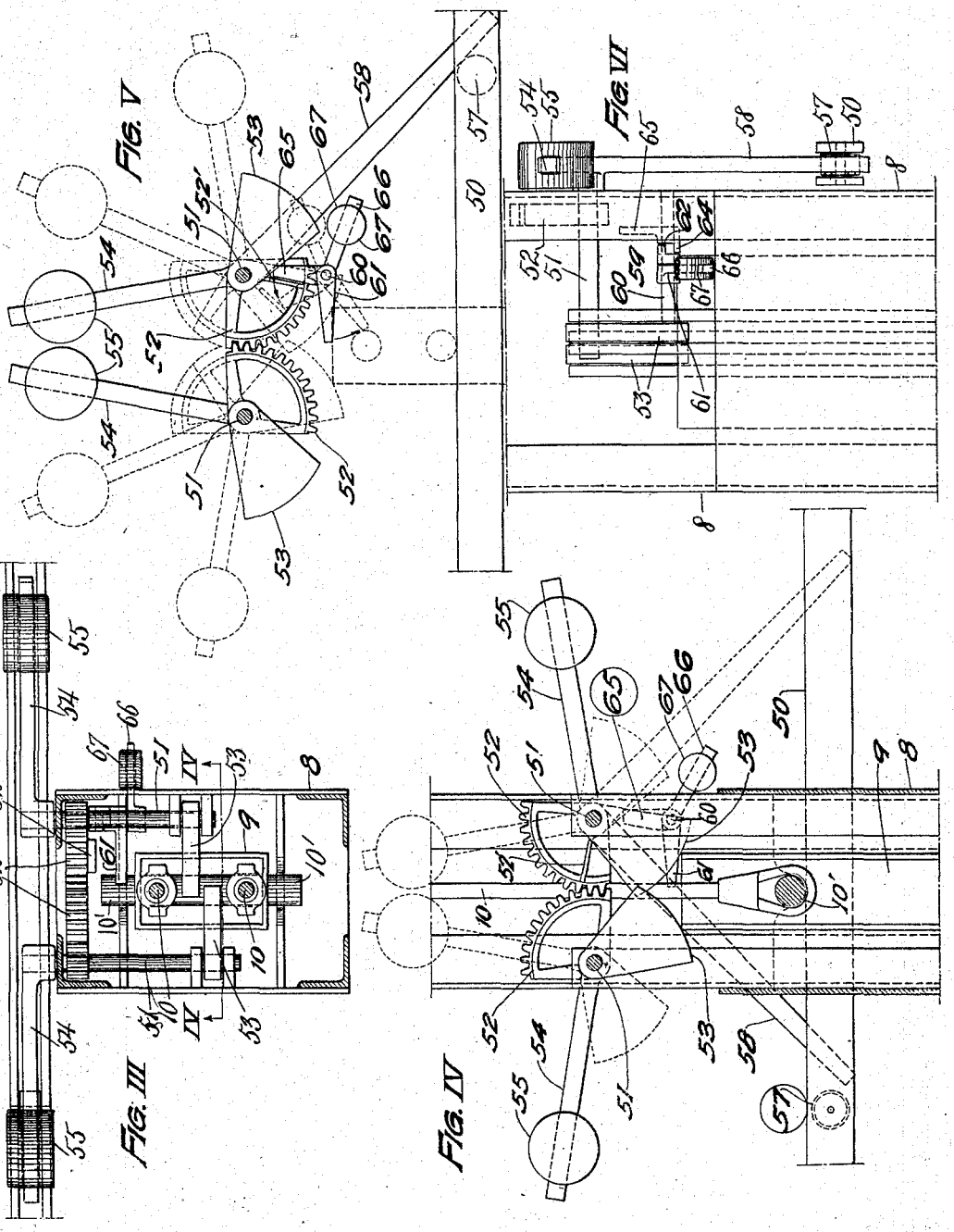
J. A. L. WADDELL & J. L. HARRINGTON.

LIFT BRIDGE.

APPLICATION FILED AUG. 17, 1908.

952,486. Patented Mar. 22, 1910.

6 SHEETS—SHEET 2.



WITNESSES:

Harold E. Richards.

Myrtle M. Jackson

INVENTORS.

J. A. L. Waddell.

John Lyle Harrington.

BY

Arthur C. Brown

ATTORNEY.

J. A. L. WADDELL & J. L. HARRINGTON.

LIFT BRIDGE.

APPLICATION FILED AUG. 17, 1908.

952,486. Patented Mar. 22, 1910.

6 SHEETS—SHEET 3.

FIG. VIII

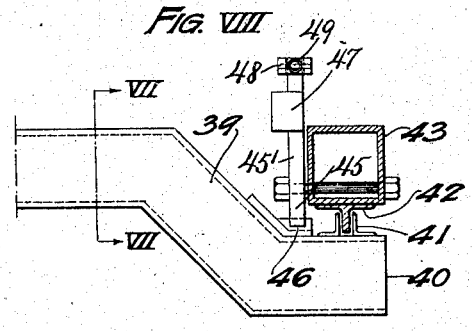


FIG. VII

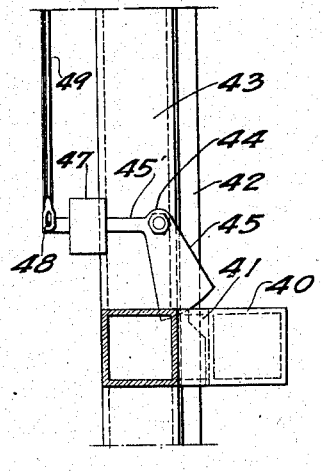
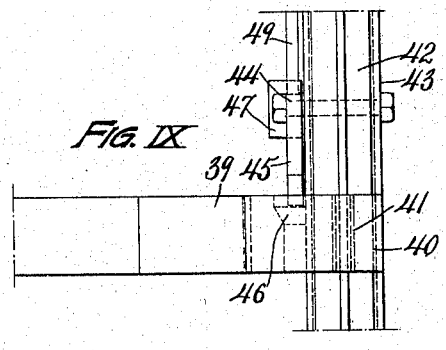


FIG. IX



WITNESSES:

Harold E. Richards.

Myrtle M. Jackson

INVENTORS.

J. A. L. Waddell.

John Lyle Harrington.

BY Arthur C. Brown

ATTORNEY.

J. A. L. WADDELL & J. L. HARRINGTON.

LIFT BRIDGE.

APPLICATION FILED AUG. 17, 1908.

952,486. Patented Mar. 22, 1910.

6 SHEETS—SHEET 4.

FIG. X

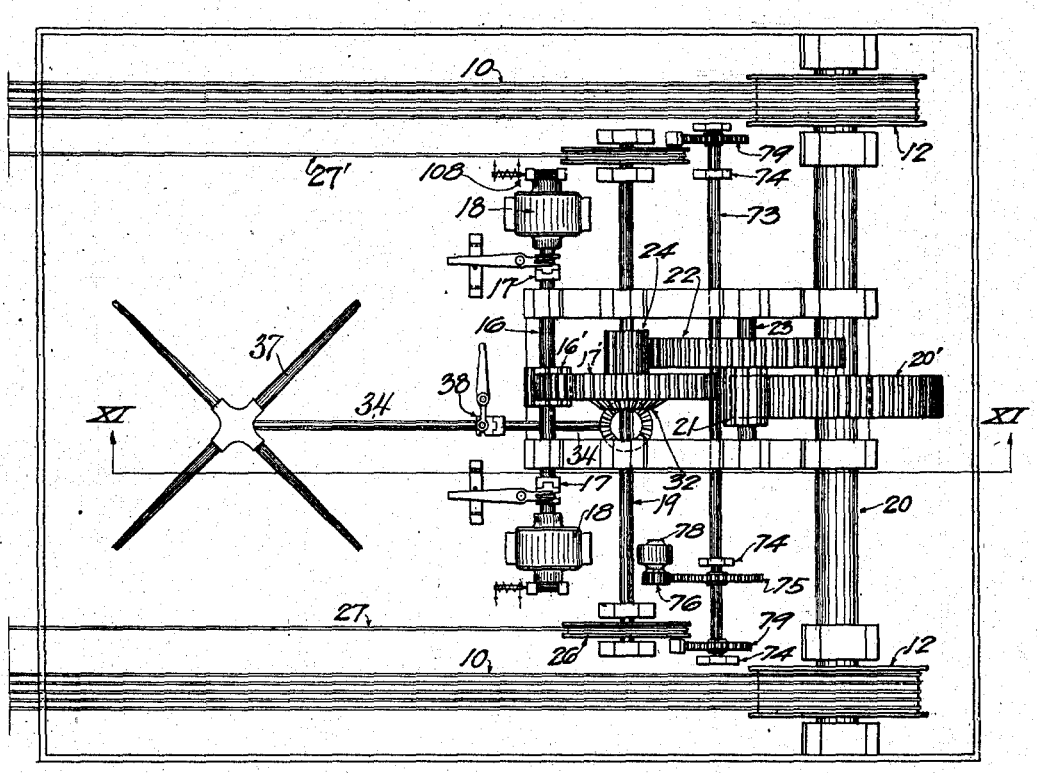


FIG. XI

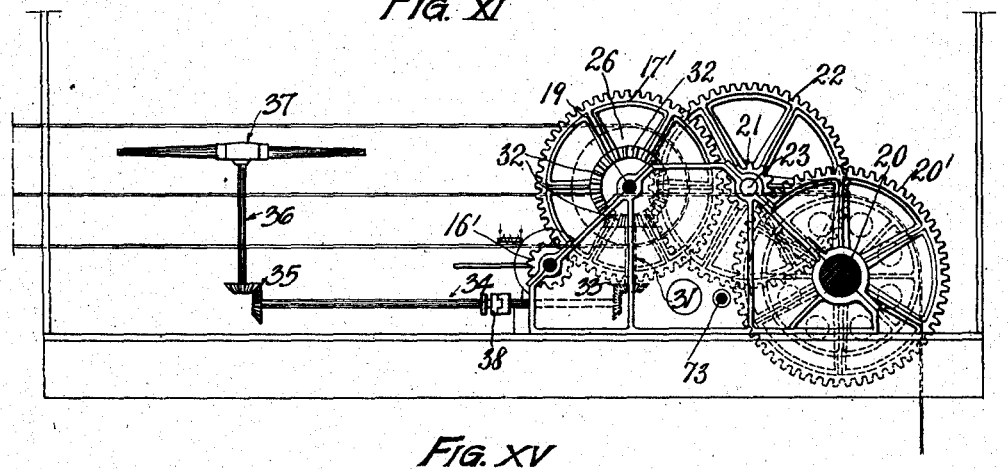
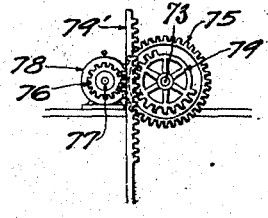


FIG. XV



WITNESSES:

Harold E. Richards

Myrtle M. Jackson

INVENTORS

J. A. L. Waddell,

John Lyle Harrington.

BY Arthur C. Brown

ATTORNEY.

J. A. L. WADDELL & J. L. HARRINGTON

LIFT BRIDGE.

APPLICATION FILED AUG. 17, 1908.

952,486. **Patented Mar. 22, 1910.**

6 SHEETS—SHEET 5.

FIG. XII

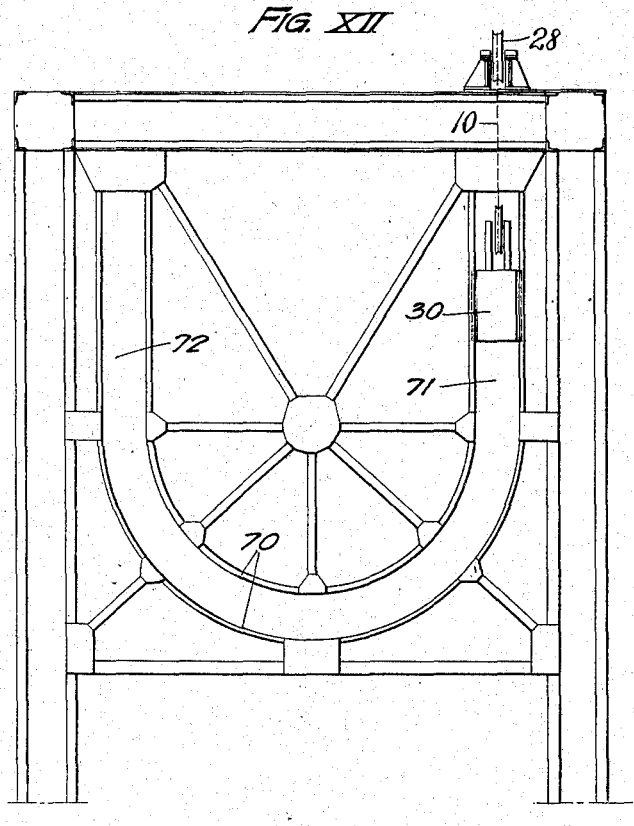
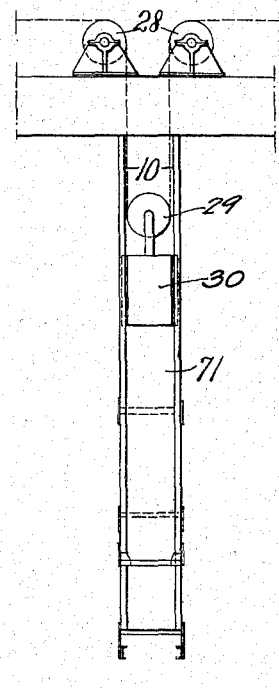


FIG XIII



WITNESSES:

Harold E. Richards.

Myrtle M. Jackson.

INVENTORS

J. A. L. Waddell.

John Lyle Harrington.

BY Arthur C. Brown.

ATTORNEY.

J. A. L. WADDELL & J. L. HARRINGTON.

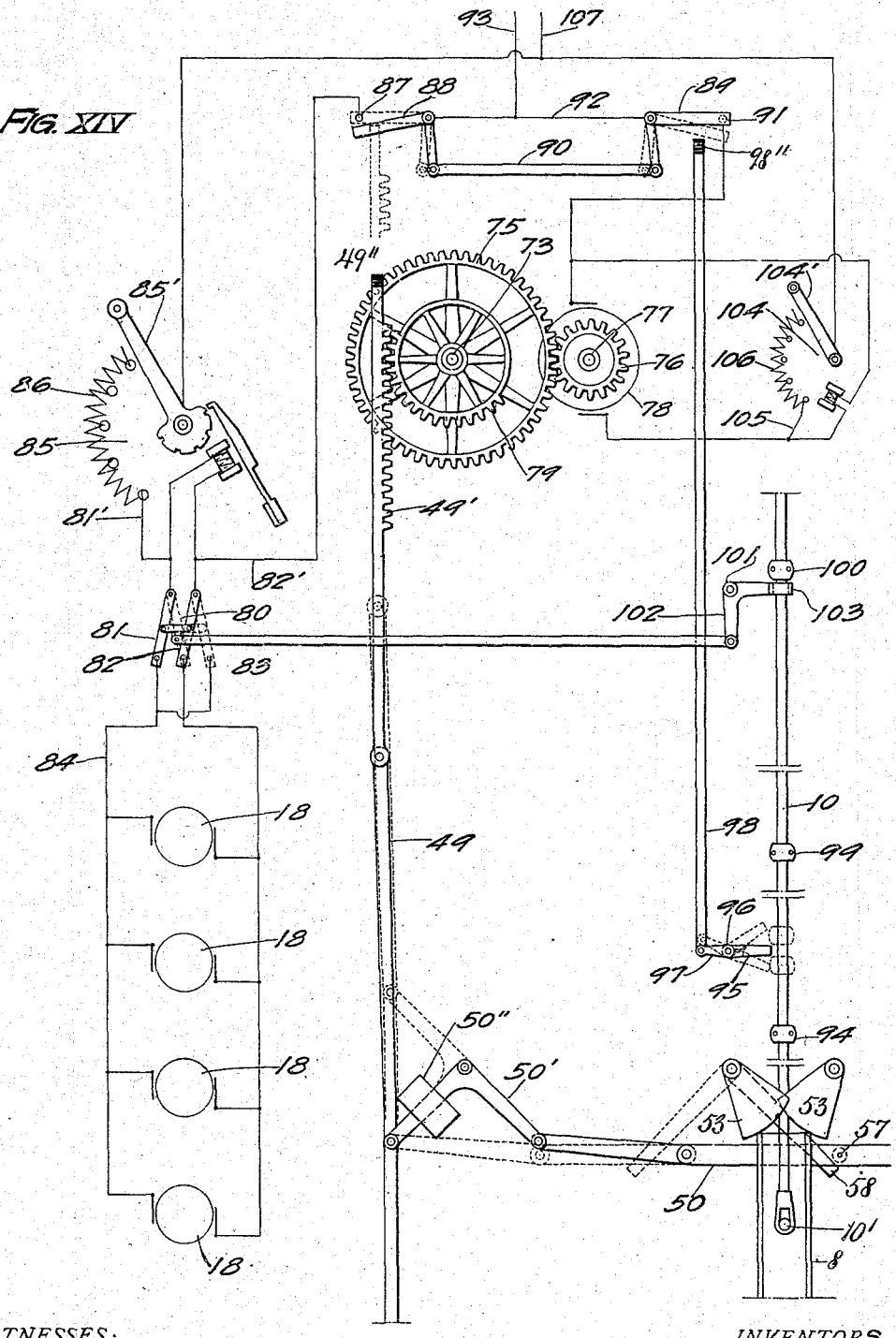
LIFT BRIDGE.

APPLICATION FILED AUG. 17, 1908.

952,486. Patented Mar. 22, 1910.

6 SHEETS—SHEET 6.

FIG. XIV



WITNESSES:

Harold E. Richards

Myrtle M. Jackson

INVENTORS.

J. A. L. Waddell.

John Lyle Harrington.

BY Arthur C. Brown

ATTORNEY.

UNITED STATES PATENT OFFICE.

JOHN A. L. WADDELL AND JOHN LYLE HARRINGTON, OF KANSAS CITY, MISSOURI.

LIFT-BRIDGE.

952,486. Specification of Letters Patent. Patented Mar. 22, 1910.

Application filed August 17, 1908. Serial No. 448,882.

To all whom it may concern:

Be it known that we, JOHN A. L. WADDELL and JOHN LYLE HARRINGTON, both citizens of the United States, residing at Kansas City, in the county of Jackson and State of Missouri, have invented certain new and useful Improvements in Lift-Bridges; and we do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

Our invention relates to lift bridges and more particularly to a bridge of that class adapted for spanning a ship canal or other channel through which vessels are accustomed to travel.

It is the object of our invention to provide a double deck bridge in which the upper deck is permanent and located at an elevation high enough to provide head-room for vessels passing therebeneath, and a lower deck having a movable span adapted to cooperate with adjacent fixed spans or to the shores to provide a traffic way, and for elevation beneath the fixed deck to open the channel for the passage of vessels.

It is also our object to provide suitable mechanism by which the movable deck may be suspended from the permanent structure so that the suspenders of the former may telescope into the corresponding members of the latter.

A further object is to provide an economical and effective counterbalancing mechanism by means of which the weight of the movable deck may be balanced and divided during its upward or downward travel.

A further object is to provide an effective means for locking the movable span in its traffic carrying position, and a mechanism for releasing such locking parts; also automatic means for locking each of the suspender members when the movable deck is at the lower limit of its travel, and for actuating such locks to free the deck for vertical motion.

A further object is to provide motor driven mechanism for overcoming the friction and inertia of the movable deck and its counterbalances, and to induce an upward or downward travel thereof when it is desired to open or close the channel.

A further object is to provide other improved details of structure which will presently be fully described, pointed out in the claims, and illustrated in the accompanying drawings, in which:—

Figure I is a top plan view of a bridge constructed according to our invention. Fig. II is a side elevation of same. Fig. III is a cross section on the line III—III, Fig. II, showing the telescoping portions of the permanent and movable deck, and a portion of the mechanism by which such parts are locked. Fig. IV is a section of one of the suspender locks, on the line IV—IV, Fig. III, showing the parts in locking position, in full lines. Fig. V is a similar view with the arrangement of the parts reversed, and more clearly illustrating the unlocking mechanism. Fig. VI is a side elevation of Fig. IV. Fig. VII is an enlarged vertical sectional view on the line VII—VII, Figs. II and VIII, showing the span lock. Fig. VIII is an enlarged cross sectional view on the line VIII—VIII, Fig. II, showing the span and lock and movable deck guide. Fig. IX is an enlarged detail view of a portion of one end of the movable deck, showing the guide parts. Fig. X is an enlarged plan view of the motor parts that actuate the movable deck and counterbalances. Fig. XI is a section of same on the line XI—XI, Fig. X. Fig. XII is an enlarged detail view of the chamber within which the weight on the cross transmission cable is located. Fig. XIII is a side view of same. Fig. XIV is a diagram of the electric control. Fig. XV is a detail view of a portion of the lock rack and gear.

Referring more in detail to the parts:— 1 and 1′ designate the piers upon which the inner ends of the permanent deck spans 2 and 2′, and the respective ends of the movable span 3 are adapted to rest. Supported on the uprights 4 and struts 5 of the lower permanent spans 2 and 2′ is a superimposed deck 6, which is permanently extended across the entire channel, and has a central span 7, from which the vertically movable span 3, of the lower deck, is suspended.

Forming part of the upper deck structure are the posts 8, which are arranged at

regular intervals throughout the length of the span 7, and are centrally channeled to receive the suspender posts 9 of the lower, vertically movable span 3, of the lower deck. Secured to each of posts 9 is a cable 10, which extends upwardly through a channeled post 8 to the top of the span 7, and extends laterally over a pulley 11 and drum 12, on the top of span 7, and has its outer end connected with a counterpoise weight 13 that is adapted for vertical travel in a guide frame 14 carried by the permanent spans 2 and 2′ of the lower deck. The posts 8 and 9 are arranged in pairs, one member of each pair being at opposite sides of the deck and the cables 10 being extended over the sheaves and drums 11—12 on opposite sides of the bridge and each connected with an independent counterbalance 13. Such counterbalances are of like weight in order to insure a like action on the opposite suspender posts 9 and lifting deck 3 during its upward or downward travel. Each of the suspender posts is provided with an individual cable and counterbalance, the cables running over individual sheaves 11 and extending toward the nearer span end, and over the sheaves 15 which are mounted on the floor of the upper deck in position to guide the various cables to a point above the path of the counterbalances with which they are connected. It will be noted that there is an uneven number of suspender posts and that each central post 9′ is provided with two cables 10 which extend to opposite ends of the permanent span 7 where they are provided with counterweights 13 one half as large as those previously described. The object of providing the center post with the plurality of cables and weights is to insure an equalization of counterbalance during the span travel.

In referring to the power mechanism, which is in duplicate, one set of parts being arranged in a suitable motor-house at each end of the span 7 of the upper permanent deck, we will describe but one of such devices, with the understanding that such description relates equally to both.

16 designates a motor shaft which extends transversely on the upper span and is adapted for connection or disconnection, through the clutch mechanism 17, with either or both of the motors 18, one of which is located at each end of such motor shaft.

19 designates a counter-shaft mounted parallel to shaft 16, and operatively connected therewith through the gear wheels 16′—17′, the shaft 19 in each power set being connected with the shaft 19 on the opposite set through parts which will be hereafter described.

20 designates a driving shaft, revolubly mounted adjacent to and extending parallel to the shafts 16 and 19 and connected with the latter, preferably through the gear 20′ on shaft 20, the gear 21—22 on the idler shaft 23, and the pinion 24 on the counter shaft 19; the connection between the parts being preferably as described in order to provide a speed reduction between the motor and the shaft 20. As such parts are of ordinary construction and have the usual journaled bearings, well known in the art, they have not been specifically described, although illustrated in the drawings. On each end of shaft 20 is a drum 12, over which the cables 10 are adapted to travel. The weight of the suspended deck span and the counterbalances are carried by the drums 12 and sheaves 11 during the upward and downward travel of the span, and there is sufficient friction of the cables 10 against the drums 12 to induce movement of the cables when the drums are revolved. The weight of the span is equalized by the weight of the counterbalances so that the only work necessary for the drums to perform in actuating the parts is that of overcoming the friction of the cables on their revoluble bearings and the inertia of the span and counterbalances.

On the shaft 19, at one end of the span 7, is a sheave 26. Similarly mounted on the ends of the shaft 19 on the opposite tower are similar sheaves 26′. Extending over the sheaves 26—26′ are the cables 27—27′, both of which are crossed in their travel, so that the cable 27 will extend between the top of sheave 26 and bottom of sheave 26′, and the cable 27′ will extend between the bottom of the opposite sheave 26 and the top of the relative sheave 26′. On each side of the permanent span 7 is a pair of idler sheaves 28—28′ over which the respective cables 27—27′ are adapted to travel.

29—29′ designate sheaves that are suspended on the cables 27—27′ and carry weights 30—30′, for constantly tensioning the respective cables. With a mechanism of this kind arranged in the manner described, power from the shaft 19, on either side of the permanent span, may be transferred to the shaft 19 on the opposite set through the cables 27—27′, the weights 30—30′ producing sufficient tension of the cables on their respective sheaves to prevent slipping and the weights being so arranged that one of the cables extends directly between the sheaves on opposite ends of the span when the motors are driven in one direction, and the opposite cable extends directly between the other pair of sheaves when the motors are driven in the opposite direction. This arrangement is provided for the reason that, should the pull on both cables come on the portions which carry the weights 30—30′, there would be a tendency of the cables to

lift their weights before applying the energy to the opposite sheaves, while if the cables extend directly between the sheaves, energy is applied instantly from the sheave on one of shafts 19 to the sheave on the opposite shaft. By arranging the two cables with the weights 30—30′ opposed to each other, no matter in which direction the motors are operated, one of the cables will provide a direct transmission between the shafts 19, so that should the motors in one set become inoperative, the entire deck span may be lifted from the motors in the opposite set, and the transmission applied at the same instant to both ends of the span, thereby obviating unequal elevation of the span ends. With either motor in each set adapted for disconnection with the driving shaft, it can readily be seen that should one of the motors in either set become inoperative it may be cut out and the transmission parts actuated by a single motor.

From the foregoing it is evident that the parts may be operated by the full set of four motors, by any two of the motors, or by a single motor at either end of the span, it being preferred, when the motors are of an electrical type, to control them from a single head, so that they may act in unison, but as such controller may be of an ordinary and well known type, it is not shown in detail in the drawings.

In case all of the motors should become inoperative, we provide means for actuating the transmission parts by hand, such means comprising a vertical shaft 31, having a miter gear connection 32 with the shaft 19 and a similar miter gear connection 33, with a shaft 34 having in turn a miter gear connection 35 with a second vertical shaft 36 that is provided with a hand winch 37; the shaft 34 being provided with a clutch 38 by which the winch may normally be disconnected with the transmission parts, but by which it may be connected therewith when the motors become inoperative and it is desired to actuate the parts by the hand mechanism.

At each end of the movable span 3 are the arms 39 which project laterally beyond the longitudinal line of the stationary spans 2 and 2′ and have the longitudinal members 40. Secured to the inner sides of members 40 are the yoked brackets 41 that embrace guide flanges 42 on the sides of the stationary end posts 43 of the permanent span members, the yokes being adapted for free vertical travel over the flanges 42, but fitting thereover sufficiently close to prevent material longitudinal movement of the span. Pivoted on each post 43 is a bell crank lever 44, one end of which consists of a cam head 45 that projects downwardly and is adapted for engagement with a lip 46 on the laterally projecting member 39 and arm 40. The opposite arm 45′ of lever 44 is provided with a weight 47 that normally retains the cam head tensioned in the direction of the lip 46, and with a pin 48 with which the lever rod 49 is connected. Rod 49 is insulated at its upper end 49″ projects upwardly into the power-house, where it connects with a rack 49′, which is actuated by a mechanism which will presently be described, to rock the cam head 45 of lever 44 from the path of lip 46, and against the tension of the weight 47. The curvature of the cam head 45 is such that the head will bind against the span lip 46 when rocked by the tension of its weights, and the lever 44 is so mounted that an upward pressure of the span will tend to increase the binding action of the cam and increase the hold of the lever on the lip 46. With such a locking device the movable span 3 is held securely in its lower, traffic carrying position, so that the lower deck may be used safely as an ordinary bridge, but when it is desired to lift the span, the cam head lock may be rocked to free the span. While the rod 49 at each end of the movable span may extend to its respective power house, we prefer to extend the rod on but one end of the span and connect the rod at the opposite end therewith by the beam 50 that actuates the suspender locks and a bell crank 50′, so that both rods 49 may be actuated by a single actuating mechanism.

Pivotally mounted in opposite sides of each of the posts 8 of the upper permanent span is a shaft 51, upon which is rigidly mounted a toothed segment 52, the segments on opposite sides of each post being adapted to mesh with each other to produce united action of the separate spans. Rigidly mounted on each of shafts 51 is a locking cam 53, which is so arranged that when the toothed segments 52 are at the upper limit of their travel, the cams 53 will be projected inwardly into position for engagement with the upper end of the suspender posts 9 of the lower span, when the latter is at the downward limit of its travel. Also rigidly mounted on each of shafts 51 is an arm 54, having a weight 55 that is adapted to overbalance the segments 52 and cams 53, and normally retain the latter in their locking positions.

50 designates the beam that is mounted on and extends longitudinally with the floor of the permanent span member 7 and is provided, adjacent to each of the post locking sets, with a roller 57. Rigidly secured to one of the shafts 51 in each locking set is an arm 58 that is inclined downwardly in the direction of the roller 57 on beam 50, when the locking parts are in their set position. Beam 50 is connected by the bell crank 50′ with the rod 49, by which the lower span locking parts are actuated, so that upon the actuation of rod 49, the span

locking lever 44 and beam 50 will be actuated simultaneously to free the span arms and suspender posts from their locking parts.

60 designates a shaft that is revolubly mounted in each of posts 8, beneath one of the segments 52.

61 designates an arm that is revolubly mounted on shaft 60 and is adapted to project into the path of the hanger pin 10 of the vertically movable suspender post 9. Rigidly mounted on shaft 60 is an arm 65, having a jaw 62 within which a jaw 64 on arm 61 is adapted for limited travel. Arm 65 is adapted for engagement with the under, inclined edge 52′ of the toothed segment 52.

66 designates an arm that is rigidly mounted on the shaft 60 in each post locking set, and carries a weight 67 that is adapted to normally tension the arms 61 and 65 in the direction of the arrow, Fig. V. When the movable span is in its lowered position, the post locking parts are in the position indicated by full lines Fig. IV, the cam plates 53 being in engagement with the end of the posts 9, so that an upward movement of the suspender posts would be resisted by the shafts 51, through the cam plates. When it is desired to elevate the span, the rod 49 is elevated to rock the bell crank 44 on the end posts of the permanent spans to free the ends of span 3 from cams 45. Simultaneously with the rocking of lever 44 the beam 50 is moved longitudinally, so that the rollers 57 will engage the rocking levers 58, and revolve shafts 51 to move the gear segments 52 downwardly, and the cam segment 53 outwardly from their engagement with the suspender posts, so that such posts may be free to rise in the chambers in the upper permanent span posts 8, the weight arms 54 being elevated upon the revolution of the segment and cam shafts until they pass their upper center and reach the position indicated in dotted lines Fig. IV, when the tension of the weights will hold the parts in such unlocked position during the upward and downward travel of the suspender posts. As the posts 9 move upwardly, their hanger pins engage the arms 61 and rock same upwardly, the arms revolving on the shafts 60, and the jaws 62 traveling in the jaw 64 so that the shafts 60 are not revolved upon the upward movement of the arms. When the hanger pins have moved above their contact with the arms 61, the arms drop back to their original position, so that when the posts move downwardly the arms 61 will engage the under side of the pins 10′ in order that they may be rocked downwardly and the shafts 60 revolved in the direction indicated by the arrow, Fig. V, through the engagement of the jaws 62 with the jaws 64 on the arm 65. When shaft 60 is revolved, it moves the arm 65 against the edge of the gear segment 52, and causes shaft 51 to revolve until the weight arms 54 have been rocked outwardly past their vertical center, to enable the weights 55 to descend by gravity and move the shafts 51 around until the gear segments 52 and roller arms 58 have assumed their initial position. When the suspender post 9 has reached its lowered position the arm 61 is freed therefrom, and the shaft 60 is free to revolve, the weight arm 66 on shaft 60 revolving said shaft to return the shaft and the parts carried thereon, to position for a successive engagement and actuation similar to that just described.

In the drawings, the weights 30 which tension the cross transmission cables, are shown to be suspended over the roadway of the upper bridge parts. To obviate injury to passengers on the bridge, as well as to the bridge structure, should either of the cables break and allow the weights to fall, we have provided a chamber into which the weights may descend and be supported, without coming in contact with the bridge structure; such chamber comprising a U shaped frame 70 within one leg 71 of which the weight 30 is suspended. The chamber in frame 70 is of sufficient dimensions to permit free travel of the weight therein, so that should the cable break, the weight will descend through the leg within which it is normally suspended, and, being guided by the curved side and bottom of the frame, move upwardly in the opposite leg 72 a distance proportionate to the momentum generated during its descent in the first leg. After the force has been expended, in the leg 72, the weight moves backwardly and forwardly in the frame until it comes to rest at the bottom of the frame, from which position it may be easily recovered and replaced without damage to the bridge or danger to passengers.

While rod 49 may be actuated by any suitable mechanism we prefer to provide the following parts for this purpose. 73 designates a shaft that extends transversely on the upper span 7 and is revoluble in the bearings 74. Rigidly mounted on shaft 73 is a gear wheel 75 which meshes with a pinion 76 on a motor shaft 77 that is actuated by an electrical motor 78. Also rigid on shaft 73 is a gear segment 79 which meshes with the rack 49′ on the upper end of the lever rod 49, the parts being so arranged and connected that when the motor 78 is operated the rod 49 will be raised, through the mechanism described, to unlock the span and suspender parts, and will automatically return to original position.

80 designates a pole changer comprising the positive and negative switch arms 81—82 and the contact parts 83 which latter

are connected with the motors 18 through the wires 84, as shown. The positive switch wire 81′ of the pole changer leads to the contact member 86 of the controller 85, and the negative wire 82′ leads to a post 87.

88—89 designate bell crank levers that are connected by an arm 90 and are adapted for respective movement over the contact 87 and a similar contact 91, the levers 88 and 89 being connected by the wire 92 that is connected with the negative lead 93, such levers acting as switches for a purpose presently set forth.

On one of the cables 10 is a button 94 which is adapted for primary engagement with the under side of the hinged arm 95 of a lever 96, the arm 97 of which is connected with a pitman 98, which is insulated at its upper end 98″ and extends upwardly within a short distance of the switch lever 89, the parts being so arranged and constructed that the arm 95 of lever 96 will yield to permit the button 94 to pass on its upward travel, but will hold when engaged by the button on its downward travel. Also rigidly secured to cable 10 are the buttons 99—100.

101 designates a bell crank lever, the arm 102 of which is connected with the pole changer arms 81 and 82, while the opposite arm has a collar 103 that surrounds the cable 10 intermediate buttons 99—100, so that when the cable 10 moves upwardly the button 99 will rock the lever 101 in one direction and when it descends the button 100 will rock same in the opposite direction, thereby regulating the direction of travel of the motors.

104 designates the controller for the motor 78, and 105 the negative circuit wire which is connected with contact member 106 and with the switch arm 89.

85′ and 104′ respectively designate switch arms forming part of the controllers 85 and 104, both of which are connected with the positive lead wire 107. With a contact of this character it is impossible to close a circuit through the driving motors until the locking parts have been rocked to free the ends of the movable span and the suspender posts, the action of the parts being presently more fully described.

We prefer to provide the motors with solenoid brakes for preventing damaging impact of the span with the deck or piers, but as these parts are well known in the art, they have not been specifically described although indicated in the drawings (reference numeral 108). When the span is in its closed position, the levers 88 and 89 will be in the position indicated in full lines, Fig. XIV, the lever 88 being out of contact with the post 87, and the lever 89 in contact with the post 91. With the parts in this condition the circuit through the driving motors is broken at the post 87 so that an operation of the motors 18 is prevented until a contact is made between such post and lever.

When it is desired to open the channel for the passage of a vessel, the switch 104 is moved into contact with the member 106 to close a circuit through the motor 78, and the latter operated to revolve the gear wheel 75. Upon the revolution of wheel 75, the gear segment 79 is revolved, the segment teeth meshing with the teeth of the rack 49′ and raising the rod 49. When the rod 49 is elevated, the bell crank levers 44 are rocked to free the members locking the ends of the movable span, and, being connected with the beam 50, rocks such beam to move the suspender post locking parts out of their set position. After the actuation of the locking parts, as described, a further upward movement of the rod moves the upper end of the rack 49′ into engagement with the under side of lever 88, causing the lever 88 to move into engagement with the post 87, and the lever 89 to leave its contact with the post 91. When the lever 89 leaves its contact with the post 91, the circuit through motor 78 is broken between the motor and the negative lead 93, allowing the switch 104′ to return automatically to initial position, and leaving the rack 49′ in engagement with the band portion of the rack segment. With the parts in the position noted, the switch 85′ is moved into contact with the member 86 to energize the motors 18 and the span 3 lifted by the cables 10 and posts 9—9′. As the span moves upwardly the button 94 on one of the cables 10 passes the hinged lever arm 95, the arm yielding under the engagement of the button because of its hinged construction. As the span reaches the upward limit of its travel, the button 99 on the cable 10 engages the collar of the bell crank 101 and rocks the arm 102 to reverse the contacts of the pole changer 80. While the pole changer switch arms are moved between the contacts 83 the circuit through the motors 18 is broken and the controller arm 85′ is automatically returned to initial position so that the motors remain inoperative until such arm is again moved into the active position.

We have previously stated that we prefer to equip the structure with solenoid brakes, for stopping the span at both the upper and lower limit of its travel, but that we claim no invention in such mechanism. To explain the application of the brake, however, we will state that the brake is preferably in the main motor circuit, so that when the current is off of the motors 18 the motor shafts are locked, but upon the energization of such motors the brake arms are rocked to release such shafts. As the brake structure and the controllers 85 and 104 are of an ordinary type, well known in the art, we have not de-

scribed same in detail and have merely indicated them in the drawings.

When it is desired to lower the span, the switch arm 85′ is again moved into contact with the member 86, energizing the motors 18 and causing same to operate in a direction opposite to their first operation, so that the cables 10 and posts 9 travel downwardly. As the span approaches the lower limit of its travel, the button 94 engages the upper side of the arm 95, which holds against downward pressure, causing the lever to rock on its pivot and move the pitman 98 upwardly into engagement with the lever arm 89, and rock same into contact with the post 91, to close a part of its lock circuit, at the same time rocking the arm 88 out of contact with the post 87. When the arm 88 leaves its contact with the post 87 the circuit through the motors 18 is broken, the rheostat arm 85′ automatically is returned to initial position, and the solenoid brakes are applied. Coincident with the engagement of the button 94 with lever 96, the button 100 engages the collar on lever 101 and rocks same to return the pole changer switches to their original position, to effect an elevation of the movable span when the main motors are again energized. Before the span has reached its closed position, the cable pins 10′ have engaged the arms 61 on the shafts 60 and rocked same downwardly, to cause the arms 65 to move the rack segments 52, such segments being carried around by the arm engagement until the weights 55 have passed their vertical centers, when they descend of their own weight and carry the cam segments 53 into their locking position over the upper ends of the posts 9. Upon the return of the post locking parts to their original position, the weight 50″ on the bell crank 50′, moves the rod 49 downwardly to rock the cams 45 into locking position over the span plates 46, the rack portions 49′ of such rod moving over the smooth rim of the gear wheel 79 while the parts are assuming such position

With a locking device of the character described, the movable span is doubly insured against accidental displacement, and such span firmly locked at each of its corners, and at various points throughout its length.

By providing the power mechanism described, the driving shafts 20 may be actuated by the full set of four motors or by any combination thereof, as any individual motor may be cut out through the clutches 17. Should both motors in one of the power houses become inoperative, the shaft 20 in that house may be operated by the motors on the opposite tower through the cross cables 27 or 27′, an instantaneous transmission of power being secured between the towers irrespective of the direction of travel of the motors, because of the opposed arrangement of the cross cables 27—27′. The cross cables are arranged in the manner specified for the reason that, should the weights 30 be suspended from relative portions of both cables, a direct transmission would be secured when the motors are traveling in one direction, but, when the motors are reversed, the pull would first tend to lift the weights 30 before the power could reach the opposite transmission shaft and cause one end of the span to lift before the other.

It is apparent that should all of the motors become inoperative, they may be cut out and the entire mechanism operated by means of the hand winch on either tower.

Having thus described our invention, what we claim as new therein and desire to secure by Letters Patent is:—

1. In a lift bridge, a traffic deck including a vertically movable span, a stationary span extended over said movable span, suspender posts located at each side of said movable span and at intervals throughout its length, counterpoise weights arranged at the span ends, and ropes connecting said weights with said suspender posts, one of the suspender posts at each side of the span being at its longitudinal center and having separate ropes leading to opposite ends of said span, substantially as set forth.

2. In a lift bridge, a traffic deck including a vertically movable span provided with suspender posts, a stationary deck located over said span and provided with rope bearings, ropes carried by said bearings and connected with said posts, counterpoise weights carried by said ropes, and locking members carried by said stationary deck and adapted for engagement with the upper ends of said posts when said span is in its traffic carrying position.

3. In a lift bridge, a traffic deck including a vertically movable span provided with suspender posts, a stationary deck extending over said span, counterpoise weights, ropes carried by said stationary deck and supporting said span and weights, locking members revolubly mounted on said stationary deck and adapted for engagement with said posts, and means for yieldingly tensioning said locking members toward their locking position.

4. In a lift bridge, a traffic deck including a vertically movable span, suspender posts on said span, a stationary deck extending over said span, counterpoise weights connected with said suspender posts, and cam members carried by said stationary deck and adapted for automatic movement into locking engagement with the tops of said posts as said span reaches the lower limit of its travel.

5. In a lift bridge, a traffic deck including a vertically movable span, suspender posts on said span, a stationary deck extending over

said span, counterpoise weights connected with said posts, cam members revolubly mounted on said stationary deck and adapted for engagement with said posts, and weights connected with and adapted for yieldingly tensioning said cam members substantially as set forth.

6. In a lift bridge, a traffic deck including a vertically movable span, suspender posts on said span, a stationary deck extending over said span, counterpoise weights, ropes carried by said stationary deck and supporting said weights and span, and locking units mounted on said stationary deck, each of said units comprising a pair of cams, revolubly mounted and adapted for movement over said posts when the span is in its traffic carrying position, means for rocking one of the cams in each locking unit, and means connecting the cams in each pair substantially as and for the purpose set forth.

7. In a lift bridge, a traffic deck including a vertically movable span having suspender posts, a stationary deck extending over said span, counterpoise weights, ropes carried by said stationary deck and supporting said weights and span, and a locking unit mounted on said stationary deck adjacent to each of said suspender posts, each of said units comprising a pair of revoluble cams adapted for locking engagement with the upper end of the adjacent suspender post, means for yieldingly tensioning said cams toward their locking position, a beam adapted for longitudinal movement on said stationary deck, rollers on said beam, an arm connected with one of the cams in each locking unit and adapted for engagement with the roller on said beam, means operatively connecting the individual cams in each locking unit, and means for actuating said beam for the purpose set forth.

8. In a lift bridge, a traffic deck including a counterbalanced, vertically movable span and means for actuating same, a stationary deck extending over said span, posts carried by said span and a locking unit carried by said stationary deck adjacent to each of said posts, said locking unit comprising a pair of revoluble shafts, each provided with a cam segment, a rack segment, and a weight arm, an actuating arm rigidly connected with one of said shafts, an auxiliary shaft revolubly mounted adjacent to one of the rack segments, a segment engaging arm, and a weighted arm rigidly mounted on said shaft, and a pawl arm carried by said shaft and extending into the path of said vertically movable post, said pawl arm being adapted for revolution on its shaft when engaged by said post during the upward travel of said movable span and for holding engagement therewith during the downward travel of said span, and means for actuating said beam, substantially as set forth.

9. In a lift bridge, a stationary span having chambered posts, a traffic carrying deck located beneath said stationary deck and comprising a vertically movable span having suspender posts adapted to telescope into the posts on said stationary deck, counterpoise weights, ropes carried by said stationary deck and connecting said weights and suspender posts, and locking members adapted for engagement with said suspender posts.

10. In a lift bridge, a traffic carrying deck including a vertically movable span having vertical suspender posts, a stationary traffic carrying deck extending over said span and having posts adapted to receive said suspender posts upon the upward travel of said span, means for raising and lowering said span and locking members adapted for engagement with said suspender posts.

11. In a lift bridge, a traffic carrying deck including a vertically movable span having vertical suspender posts arranged at intervals throughout its length and at each side thereof, a stationary carrying deck extending over said span, counterpoise weights arranged at each end of said span, revoluble bearings on said stationary deck, a rope connecting each of said suspender posts with a counterpoise weight, means for actuating said revoluble bearings, and means for locking said suspender posts against upward movement when said span is in its traffic carrying position.

12. In a lift bridge, a traffic carrying deck including a vertically movable span having perpendicular suspender posts, a plurality of counterpoise weights arranged at each end of said span, a rope connecting each of said posts with a counterpoise weight, a stationary deck extending over said movable span, means on said stationary deck for supporting said ropes, separate means for locking each of said suspender posts when said span is in its traffic carrying position, and means for simultaneously actuating said locking devices to lock said span against upward movement when in its traffic carrying position.

13. In a lift bridge, a traffic deck including a vertically movable span, a stationary deck extending over said span, counterpoise weights, ropes carried by said stationary span and connecting said weights and said span, locking levers revolubly mounted adjacent to the span ends, lips on said span ends adapted for engagement with said levers, and means for simultaneously actuating said rocking levers, substantially as set forth.

14. In a lift bridge, a pair of traffic carrying decks, one superimposed on the other, a vertically movable span forming part of the lower deck of said bridge and having guide members extending therefrom and adapted

for engagement with stationary portions of said lower deck, lips projecting from said guide members, locking members having lip engaging portions yieldingly tensioned toward their locking position, and means for simultaneously actuating said locking members to free said span.

15. A lift bridge comprising a plurality of traffic carrying decks, one superimposed on the other, a vertically movable span forming part of the lower deck, revoluble bearings mounted on said upper deck, a motor driven shaft at each end of said upper deck and provided with end drums, counterpoise weights arranged at each end of said movable span, ropes connecting said span and counterpoise weights and supporting same on said bearings and said drums, motors connected with said shafts and adapted for actuating same, and means for automatically stopping said motors as said span approaches the upper or lower limit of its travel.

16. A lift bridge comprising a plurality of traffic carrying decks, one superimposed on another, a vertically movable span forming part of the lower deck of said bridge, chambered posts forming part of the upper deck, suspender posts forming part of said movable span and adapted to telescope into said chambered posts, a sheave revolubly mounted above each of said chambered posts, drums revolubly mounted at each end of said stationary span, weight frames arranged at each end of said movable span, weights located in said frames, a sheave revolubly mounted above each weight frame, ropes connecting said suspender posts and said weights and adapted for travel over said sheaves and said drums, and means for actuating said drums for the purpose set forth.

17. A lift bridge comprising a plurality of traffic carrying decks, one superimposed on another, a vertically movable span forming part of the lower deck and provided with perpendicular suspender posts, chambered posts forming part of an upper stationary span and adapted to receive said suspender posts, counterpoise weights arranged at each end of said span, ropes connecting said weights and said suspender posts, means for automatically locking said posts as said movable span assumes its traffic carrying position, means for actuating said ropes to raise or lower said span, and means for simultaneously actuating said locking device to release the suspender posts for the purpose set forth.

18. In a lift bridge, a plurality of traffic carrying decks, one superimposed on another, a vertically movable span forming part of the lower deck of said bridge, a power mechanism arranged on said stationary deck over each end of said movable span, rope drums included in each of the separate power mechanisms, counterpoise weights arranged at each end of said movable span, ropes connecting said weights and said span and adapted for engagement with said drums, sheaves included in each of said power mechanisms, ropes connecting relative sheaves on opposite power mechanisms, and a weight carried by each of said sheave ropes for the purpose set forth.

19. In a lift bridge, a plurality of traffic carrying decks, one superimposed on another, a plurality of power mechanisms arranged on an upper stationary deck, a motor driven shaft included in each power mechanism, drums rigidly mounted on said shafts, counterpoise weights, ropes connecting said counterpoise weights and said span and adapted for travel over said drums, a transmission shaft included in each power mechanism, sheaves mounted on said transmission shafts, ropes connecting relative sheaves on opposite transmission shafts, a weight frame carried by said stationary deck and comprising curved body members, and a weight suspended from each of said sheave ropes and adapted for travel in one of said weight frames for the purpose set forth.

20. The combination of a plurality of decks, one superimposed on another, a vertically movable span forming part of the lower deck, a locking mechanism comprising locking parts, and a racked lifting rod, a wheel having gear teeth extending partially around its periphery and adapted for meshing with the racked lifting rod, means for revolving said wheel, and a weight connected with said lifting rod, for the purpose set forth.

In testimony whereof we affix our signatures in presence of two witnesses.

JOHN A. L. WADDELL.
JOHN LYLE HARRINGTON.

Witnesses:
HAROLD E. RICHARDS,
MYRTLE M. JACKSON.