

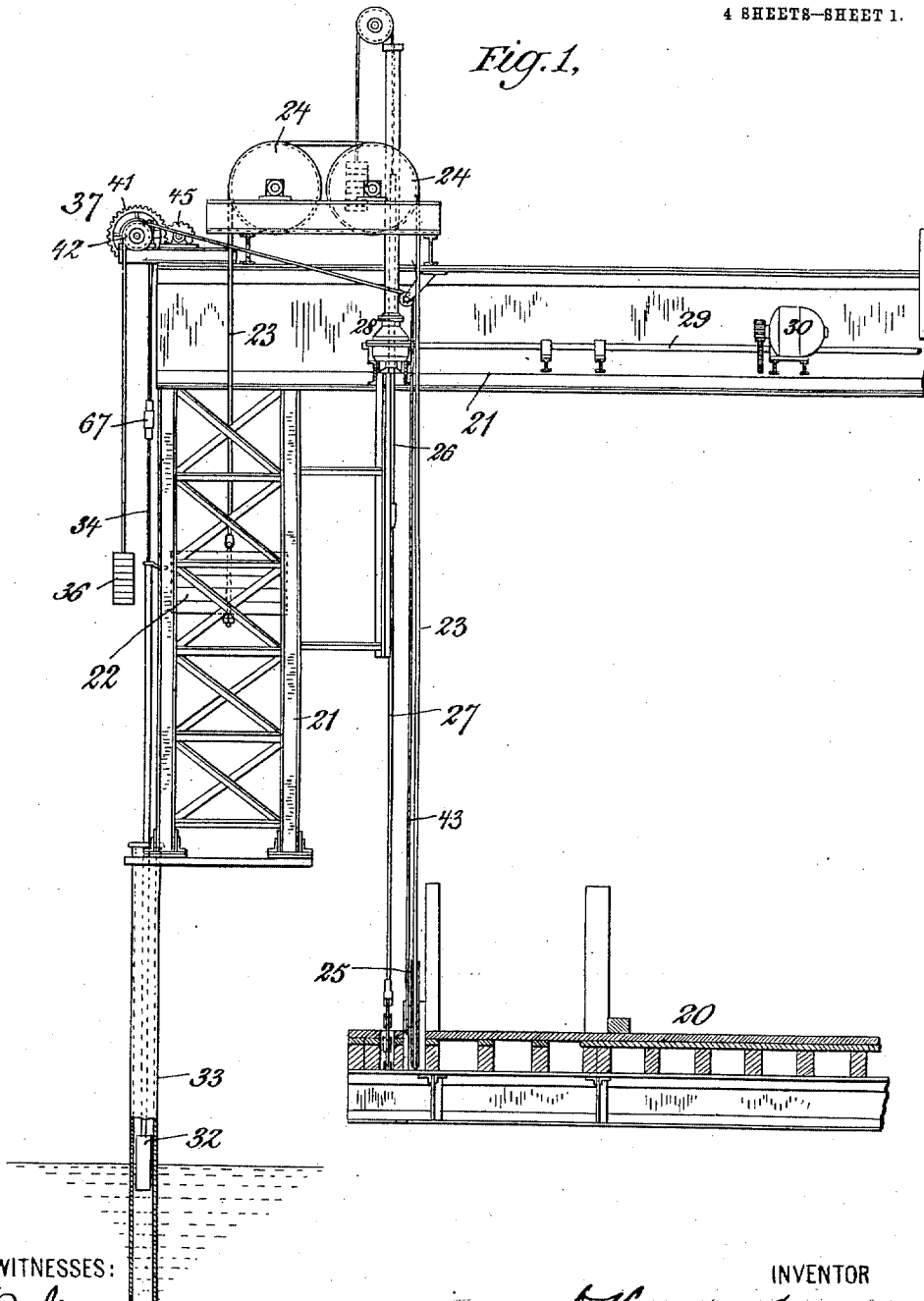
D. H. HAYWOOD.
 MEANS FOR OPERATING BRIDGES AND THE LIKE.
 APPLICATION FILED JULY 26, 1910.

980,522.

Patented Jan. 3, 1911.

4 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

F. B. Graves
Symant Andrews & Co.

INVENTOR

D. Howard Haywood
 BY
Chapman Haywood
 his ATTORNEYS

D. H. HAYWOOD.
MEANS FOR OPERATING BRIDGES AND THE LIKE.
APPLICATION FILED JULY 28, 1910.

980,522.

Patented Jan. 3, 1911.

4 SHEETS—SHEET 2.

Fig. 2,

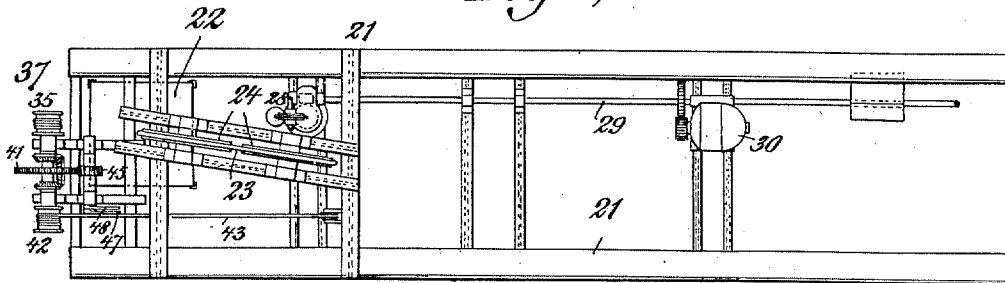


Fig. 3,

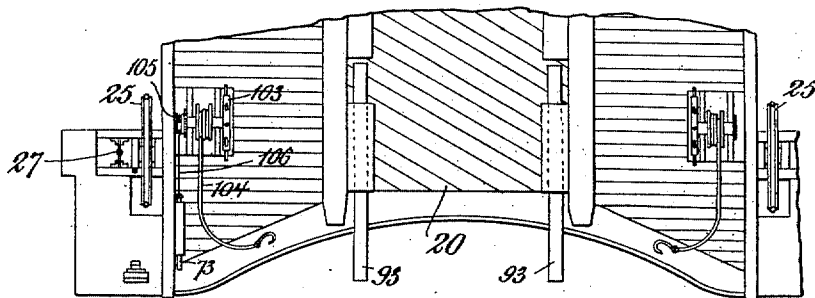


Fig. 9,

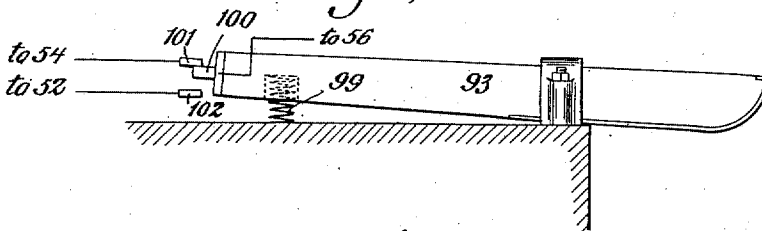
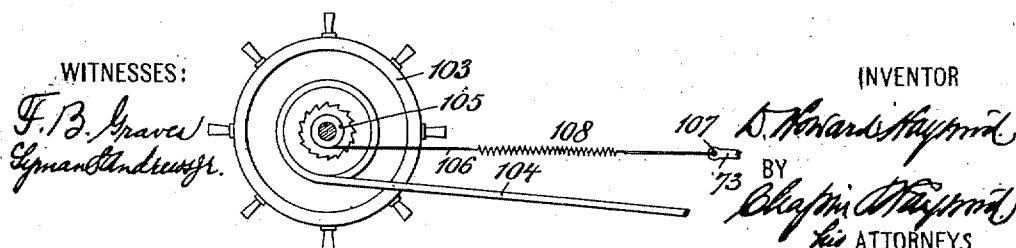


Fig. 10,



WITNESSES:

F. B. Spruce
Elyman C. Andrews Jr.

INVENTOR

D. H. Haywood
BY
Elyman C. Andrews Jr.
ATTORNEYS

D. H. HAYWOOD.
MEANS FOR OPERATING BRIDGES AND THE LIKE
APPLICATION FILED JULY 26, 1910.

980,522.

Patented Jan. 3, 1911.

4 SHEETS—SHEET 3.

Fig. 5,

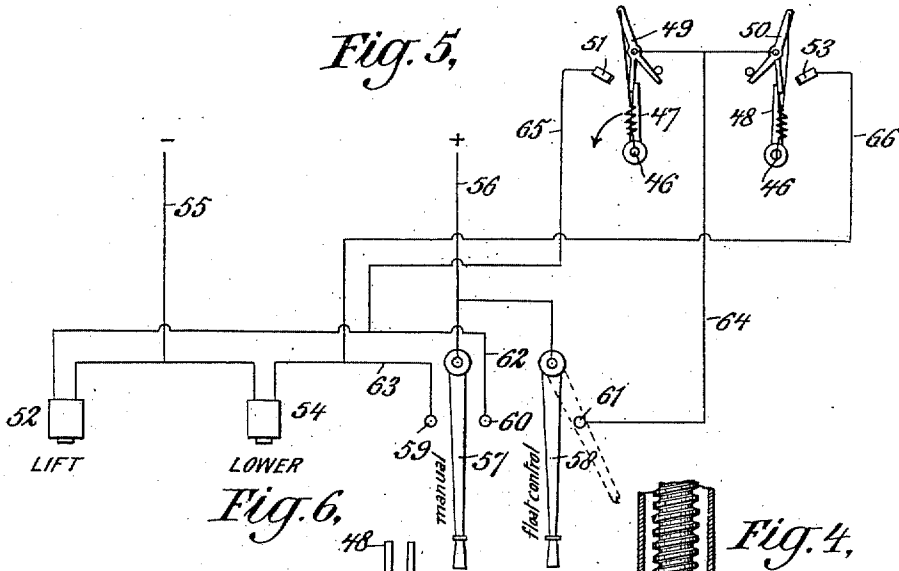


Fig. 6,

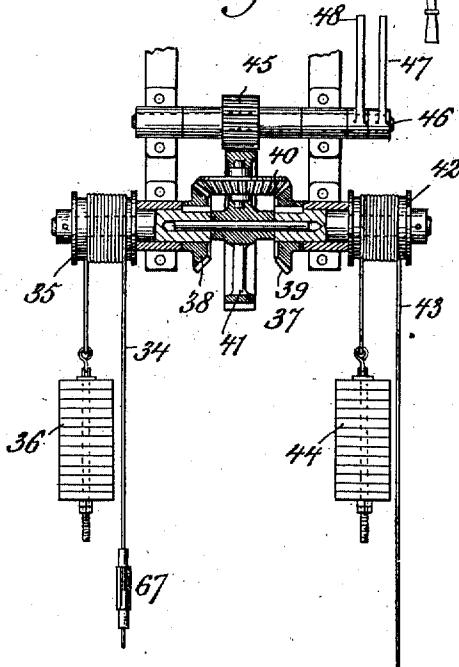
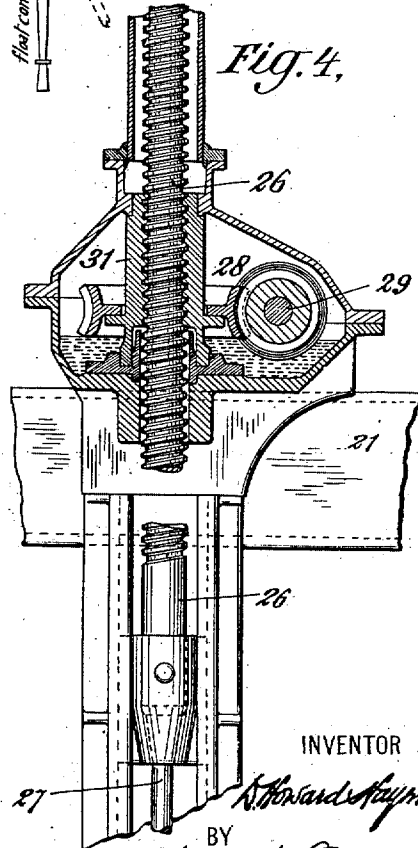


Fig. 4,



WITNESSES:

F. B. Grace
Lyman A. Andrews Jr.

INVENTOR

BY *D. H. Haywood*
Attorneys

D. H. HAYWOOD.
MEANS FOR OPERATING BRIDGES AND THE LIKE.
APPLICATION FILED JULY 26, 1910.

980,522.

Patented Jan. 3, 1911.

4 SHEETS—SHEET 4.

Fig. 7.

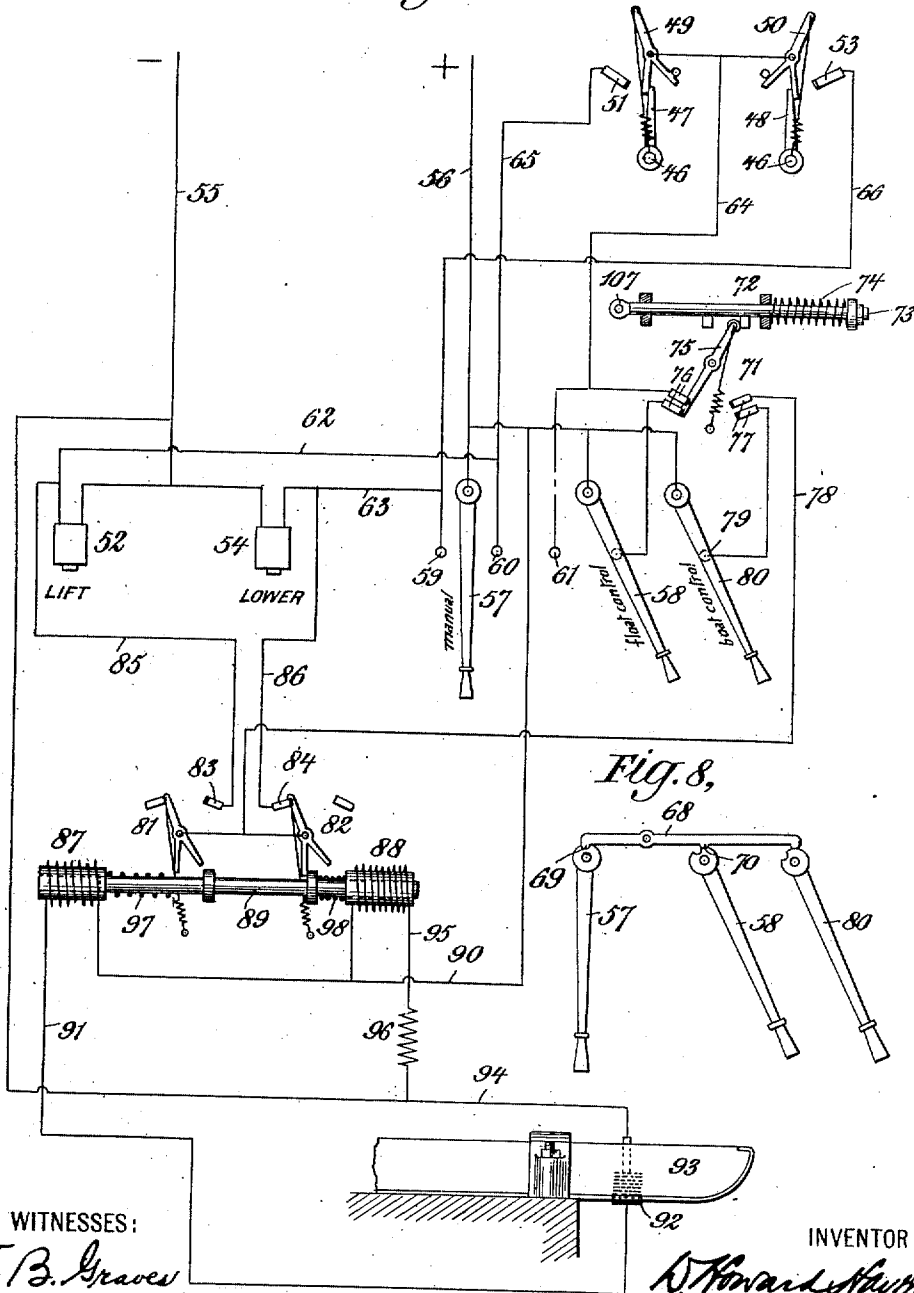
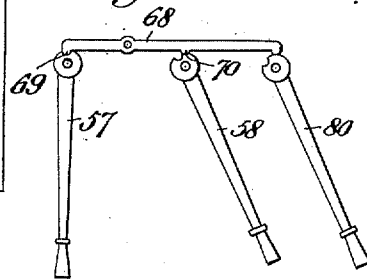


Fig. 8.



WITNESSES:

F. B. Graves
Lyman Andrews

INVENTOR

D. Howard Haywood
BY
Chapin Haywood
his ATTORNEYS

UNITED STATES PATENT OFFICE.

DANIEL HOWARD HAYWOOD, OF NEW YORK, N. Y.

MEANS FOR OPERATING BRIDGES AND THE LIKE.

980,522.

Specification of Letters Patent.

Patented Jan. 3, 1911.

Application filed July 26, 1910. Serial No. 573,974.

To all whom it may concern:

Be it known that I, DANIEL HOWARD HAYWOOD, a citizen of the United States of America, and a resident of New York, county and State of New York, have invented certain new and useful Improvements in Means for Operating Bridges and the Like, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

Ferry bridges at tide water are usually operated at the present day either by the water itself, the forward or free end thereof being supported upon a floating pontoon so that the bridge is lifted and lowered by the water as the tide ebbs and flows, or they are heavily counterbalanced and then raised or lowered by manually controlled or operated mechanism. The pontoon system of support is being largely discarded for the latter method of operation for several reasons, first, the pontoons often become damaged and are caused to leak, and this is especially true in winter time in such parts of the world wherein the water freezes and ice thus forms or collects in the ferry slips, the incoming boats ramming the ice cakes against the pontoons and thereby damaging them; second, such pontoons when operating properly are necessarily connected with the bridge at some distance inward from the end thereof and the lowering and raising of the extremity of the bridge, such being the part intended for proper registry with the incoming ferries, moves through a greater distance than does the pontoon and hence the registry is not maintained for different heights or levels of the bridge; third, the ferryboats themselves vary in deck line above the level of the water even when loaded to a predetermined extent, that is to say, one boat with the same load may have a higher deck line than another boat, but in addition to that the distance of the deck line from the surface of the water necessarily varies in accordance with the extent to which the boat is loaded and also with respect to the position of the load upon the boat. For this and other reasons the most approved practice at the present day is to employ a motor for lifting and lowering the ferry bridge, the said motor being manually controlled as by means of a switch or a set of switches, it being the duty of an attendant to maintain the bridge normally at a point higher than the deck of the highest unloaded ferryboat,

and then when the boat has entered the slip and engaged the bridge, to cause the motor to operate to lower the bridge until the toggles thereof rest upon the deck of the ferryboat. Then when the ferryboat is about to leave the dock it is his duty to raise the ferry bridge to the foregoing normal position so as to lift it free from the deck of the ferryboat, and as the tide rises and falls it is his duty to continually operate the motor from time to time so as to raise or lower the bridge to maintain the same at approximately its proper level. Difficulty has been found in the foregoing method of operation, however, in that it sometimes happens that the operator has failed to lift the bridge to the required height before the ferryboat comes in, in which case the ferryboat rams the ends of the toggles or other damage ensues. For the purpose of avoiding this difficulty and for simplifying the operation of ferry bridges and avoiding as much as possible dependence upon an operator, I provide a float controlled means in combination with the means for lifting and lowering the bridge whereby the bridge is automatically maintained normally at a predetermined level above the water, such level being preferably slightly above the deck level of the highest unloaded ferryboat, and I provide other means, either hand operated or automatic, for lowering the bridge to the proper level after the boat has engaged the bridge, the automatic method of control conveniently constituting the substitution of the vessel itself as the controlling float for the float normally employed, so that the level of the deck line is itself the determining feature for the level of the ferry bridge.

By means of the foregoing I dispense with the pontoon support for the bridge, while at the same time I provide an automatic means by which the level of the ferry bridge is determined with respect to the tide level, thereby reducing to a minimum the dependence upon an operator and obviating the dangers resulting from a wrong position of the bridge, such as that of the ferryboat ramming the ends of the toggles.

In order that my invention may be thoroughly understood, I will now proceed to describe an embodiment thereof, having reference to the accompanying drawings illustrating the same, and will then point out the novel features in claims.

In the drawings: Figure 1 is a view in

partial front elevation and partial transverse section of ferry bridge operating mechanism constructed in accordance with my invention. Fig. 2 is a view looking down upon the upper gallows frame thereof. Fig. 3 is a detail view looking down upon the end of the ferry bridge. Fig. 4 is a view in central vertical section through a portion of the elevating machinery. Fig. 5 is a diagrammatic view of electric circuits employed in the semi-automatic operation of the ferry bridge. Fig. 6 is a detail sectional view of differential switch operating means employed in connection with the electrical controlling mechanism. Fig. 7 is a diagrammatic view showing the system applied to the complete automatic control of a ferry bridge. Fig. 8 is a detail view of a mechanical interlock for certain of the switches employed. Fig. 9 is a detail view of a modified form of a portion of the controlling means shown in Fig. 7. Fig. 10 is a detail fragmentary view showing operating means for a selecting switch employed, under the control of the mooring means for the ferryboat.

Referring first of all to Figs. 1, 2, 3, and 4,—20 designates a ferry bridge to be operated and 21 a gallows frame for carrying the operating means therefor. In order to permit of the illustration of the structure upon a somewhat larger scale only a little more than one-half of the ferry bridge and gallows frame is shown in Fig. 1, but as the other half is, in most instances, a duplication of the half shown, this will be sufficient to illustrate my invention. The ferry bridge is counterbalanced by means of heavy counterbalancing weights 22, preferably one set upon each side thereof, though one set only is shown in the drawings; each set is connected thereto by means of a cable 23 which passes over guide pulleys 24—24 carried by the gallows frame and thence beneath a pulley 25 carried by the bridge, the end thereof being finally anchored to a portion stationary with the gallows frame. The bridge is arranged to be raised and lowered by means of an elevating screw 26 (for details of which see Fig. 4), the said elevating screw being connected by means of a suitable connection 27 with the ferry bridge and being operated by a worm and worm wheel connection 28, the worm shaft 29 of which is driven by an electric motor 30. The elevating screw 26 is conveniently counterbalanced by a weight and cable connection at its upper end for the purpose of saving wear and tear thereon and upon the driving nut 31 thereof. If the motor 30 be caused to run in one direction or the other the bridge will be raised or lowered through the operation of the elevating screw as will be well understood.

Conveniently located at some point where

it will not be affected by floating ice or other objects, and also preferably located at some point wherein the water will not be frozen up in cold weather, I provide a float 32. For purposes of protection I preferably locate this weight in a tube 33, the lower end of which is disposed at some distance below the level of the water at low tide, and to this float I connect a cable 34, the upper end of which passes several times around a drum 35 and terminates in a counterbalancing weight 36. The float 32 is designed to maintain a constant level with respect to the surface of the water in which it is immersed, thus rising and falling with the water as the tide ebbs and flows. The drum 35 constitutes a portion of a differential switch operating means 37 shown in detail in Fig. 6. This differential switch operating means may, of course, take many forms, but the form I have shown in Fig. 6 is one which is convenient for illustration and simple in its operation. It comprises two bevel gears 38 and 39 arranged facing each other and with their axes in the same line, the teeth of both of them being disposed in mesh with a complementary bevel gear 40, the axis of which is disposed at right angles to the axis of the said gears 38 and 39. This bevel gear 40 is mounted to rotate in a differentially operated wheel 41 mounted to rotate axially in line with the gears 38 and 39, but unconnected therewith except through the intermeshing of the gears. The bevel gear 38 is secured fast to the drum 35, while the bevel gear wheel 39 is secured fast to a similar drum 42. A cable 43, connected at its lower end with the ferry bridge, passes several times around the drum and terminates in a weight 44 as shown. The periphery of the differential wheel 41 is preferably provided with teeth so that the wheel 41 constitutes a spur gear and the teeth thereof are disposed in mesh with a pinion 45 secured fast upon a horizontal shaft 46 carrying switch operating elements 47—48. The operation of this differential switch operating means is as follows: As the tide rises and the float 32 is lifted, the drum 35 will be rotated in one direction. The effect of this will be to impart a planetary movement of rotation to the bevel gear 40 and hence a rotary movement to the differential spur gear 41 in the same direction as the drum 35. This will cause the rotation of the switch operating shaft 46 in the opposite direction, turning the switch operating arms 47 and 48 in, say, an anti-clockwise direction. The effect of this, as will be presently shown, will be to cause the motor 30 to lift the bridge and thereupon the connection through the cable 43 therefrom to the drum 42 will cause the drum 42 to be rotated in a reverse direction to that in

which the drum 35 was rotated by the rising float and in the rotation of the bevel gear 39 to rotate the bevel gear 40 in its reverse direction and so to restore the wheel 41 and the switch shaft 46 and switch arms operated thereby to their normal positions, it being readily understood that the motor will continue to operate until such normal position is restored. At this time suitable operation of switches will stop the motor and the parts will remain at rest until the tide again rises or falls or the motor is operated by some other means.

Fig. 5 shows diagrammatically the switches and circuits for controlling the motor, the operating arms 47 and 48 being shown as in a position to operate pilot switches 49—50. In this diagram the two arms 47 and 48 are shown as separated but this is for purposes of illustration only, their shafts being the common shaft 46 of Fig. 6. The switch 49 is arranged to close a contact point 51 in an electric circuit containing a motor controlling switch 52, while the switch 50 is arranged to close a contact point 53 in an electric circuit containing a motor controlling switch 54. The details of these switches 52 and 54 are not shown as being well known in the art, it being sufficient for the present specification to state that when the motor controlling switch 52 is operated the motor will operate to lift the bridge, while when the motor controlling switch 54 is operated the motor will operate to lower the bridge. When neither of these motor controlling switches 52—54 are operated the motor will be stationary and the bridge will be held against movement. These motor controlling switches derive their source of power from two line wires 55—56 leading from a suitable generator not shown, the latter line wire connecting with two hand switch levers 57—58 from whence the current may pass through contact points 59—60 or 61 in accordance with the position of the switch levers, the two said motor controlling switches being connected directly through wires 62—63 with the contact points 59—60 upon one side thereof and upon the other side connecting with the other said line wire 55. The contact point 61 is connected by means of a wire 64 with the levers of the switches 49—50 and the contact points 51 and 53 of the said switches connected through wires 65—66 with the wires 62 and 63 respectively, so that when the switch lever 58 is in engagement with the contact point 61 the switches 49 and 50 will be connected with the motor controlling switches 52—54 in parallel with the contact points 59—60. Assuming now that the lever 58 is in its dotted position, *i. e.*, closing the contact point 61,—if the tide rises and the differential switch operating means 37 is operated in the manner aforesaid, the

operating arms 47—48 will be moved in the direction of the arrow in Fig. 5. This will cause the operation of the switch 49, closing circuit at the point 51 through the motor controlling switch 52, which, for purposes of simplicity of description, we will hereafter term the "lifting switch", the motor controlling switch 54 being correspondingly termed the lowering switch. The circuit for the lifting switch may then be traced as follows: commencing at the positive line wire 56, thence through the switch handle 58 to the contact point 61, thence through the wire 64 to the pilot switch arm 49, thence to the contact point 51 through the wire 65 to the wire 62 thence to the lifting switch 52, and thence back through the negative line wire 55. For so long a time as the pilot switch 49 is operated the lifting switch will be operated and the motor will continue to lift the bridge, but it being remembered that as the bridge lifts, the differential operating mechanism 37 reverses so that the switch operating shaft 46 is brought back to its normal position, it will, in such movement, reverse the position of the switch 49, returning it to the normal position in which it is shown in Fig. 5, thereby breaking contact at the point 51 and breaking the circuit for the lifting switch 52. From the foregoing it will be readily understood that should the float 32 fall, due to the ebbing of the tide, the shaft 46 will be moved in a direction opposite to that of the arrow in Fig. 5 in which case the switch 50 will be operated, the contact point 53 being thereby closed, and a circuit established for the lowering switch 54 as follows: commencing from the positive lead wire 56 thence to the switch lever 58, thence through the contact point 61 and the wire 64 to the lever of the pilot switch 50, thence through the contact point 53 and the wire 66 to the wire 63, thence to the lowering switch 54 and thence back through the negative line wire 55. The lowering of the bridge will operate the differential operating mechanism 37 whereby to return the switch 50 to its normal position, in the same manner as described in the foregoing, directly the bridge has been lowered to an extent corresponding to the lowering of the water.

From the foregoing it will be seen that the bridge may be maintained at a predetermined level with respect to the level of the water entirely automatically, the differential mechanism connected to the float and to the bridge determining the height of the latter in accordance with the former, with accuracy and precision. I preferably provide that the level at which the bridge shall be maintained is that slightly in excess of the deck of the highest ferryboat when the same is unloaded. This relative height may be varied by a permanent adjustment at will,

and as a convenient means for adjusting the same I have provided a turn buckle 67 in the cable 34. This turn buckle may, if preferred, be located in the cable 43, or a turn buckle may be provided in both of them, and of course other means may be provided for this purpose, if preferred.

After the boat has entered the slip and engaged the bridge it will, of course, be necessary to lower the bridge to a point of registry therewith. This may be done automatically in a manner to be presently explained, but in Fig. 6 I have shown in the switch 57, a convenient manual controlling means for effecting this result. A manipulation of the switch lever 57 so that it engages the contact points 59 will complete a circuit for the lowering switch 54, which may be readily traced in Fig. 5 as follows: commencing from the positive line wire 56, to the lever 57, thence to the contact point 59, through the wire 63, to the lowering switch 54, and thence back to the negative line wire 55. By this means the operator may cause the bridge to be lowered down to the level of the deck of the ferryboat after the ferryboat is in position, the lever 57 being then returned to its normal position. I conveniently provide either electrical or mechanical interlocking means between the levers 57—58 so that only one of them can be operated at a time. A conventional form of mechanical interlock is shown in Fig. 8 in which a locking lever 68 is provided with projections 69—70 for engaging with recesses in the hubs of the switch levers 57—58, the lever being so disposed with respect to the notches that either switch lever can be moved only when the other lever is in a central position and that when one of the levers is so moved the other lever will be locked against movement. Having in mind such interlocking it will be seen that it will be necessary for the operator to throw the switch lever 58 to its inoperative position before he can throw the switch lever 57 to a position to lower the bridge to the level of the ferryboat deck as aforesaid. Thereafter the switch lever 57 will be thrown to its inoperative position, and then when the ferryboat is ready to leave the dock it will only be necessary to throw the automatic switch lever 58 over to engage the point 61 for the automatic control to operate to lift the bridge to the required extent, for when the bridge was lowered by the manipulation of the hand lever the differential mechanism was operated by the movement of the bridge in such a direction as to throw the switch 49, thus closing the contact point 51 and holding the circuit in readiness to be completed by the movement of the automatic controlling switch lever 58. Thus when the boat is ready to leave, the automatic control may be again resumed, the same first acting to

lift the bridge to its normal height above the ferryboat deck, and thereafter acting to maintain it at the required level.

The foregoing is a simple and for some purposes perhaps the best means for operating the ferry bridge, the height thereof being normally controlled by the float mechanism, and only arranged to be manually controlled at specified times such as when a boat is in the dock. Even when a boat is in the dock and is so tied up for any length of time, as when being laid up at night or otherwise not being employed for transferring passengers, freight, or the like, the aforesaid automatic float controlled means may be employed if desired, as will be readily understood. I have, however, devised an automatic means for controlling the level of the ferry bridge in accordance with the level of the deck of the ferryboat in engagement with the bridge at the time, which may be either automatically or manually substituted for the float controlled means, and I will now describe this means having particular reference to Fig. 7. In this figure I have shown a selecting switch 71 and an operating means 72 therefor which may be operated by engagement with a portion of the ferryboat itself, or it may be operated by hand, or it may be operated by the mooring means by which the ferryboat is secured to the bridge. In the form shown it comprises a plunger rod 73 spring pressed by means of a spring 74 to the normal position in which it is shown, the said plunger rod having abutments for engagement with the switch lever 75 of the selecting switch 71. This switch lever is arranged to connect a pair of contact points 76 when in one position and another pair of contact points 77 when in another position. The contact points 76 are arranged in a break in the wire 64, a wire leading therefrom to the switch lever 58 and thence to the line wire 56,—while the points 77 are arranged in a break in a wire 78 which leads from a contact point 79 controlled by a hand switch lever 80 which is in turn connected with the line wire 56, the said wire 78 leading to two switches 81—82. These switches are arranged to engage contact points 83—84 respectively, the said contact points being connected, the former through a wire 85 with the lifting switch 52, and the latter through a wire 86 with the lowering switch 54. The switches 81—82 are conveniently controlled electrically by the ferryboat itself and in Fig. 7 I have shown one means to accomplish this result as follows: Two oppositely arranged solenoid magnets 87—88 act upon cores connected with a common plunger rod 89; this plunger rod is provided with collars which engage the levers of the switches 81—82 in such a way that if the energization of the two solenoids be balanced the

plunger will assume a central position and both of the switches will be thrown to inoperative positions, while if one or other of the solenoids be energized to a sufficient extent in excess of the other, the corresponding switch 81 or 82 will be operated. In Fig. 7 the solenoid magnet 88 is shown as being energized sufficiently in excess of the solenoid 87 to have attracted the plunger rod over to the right, thereby having caused the operation of the switch 82, the lever thereof being thus in electrical engagement with the contact point 84. The solenoids are shown as connected upon one side through a common wire 90 with the line wire 56, while upon the other side the solenoid 87 is connected through a wire 91 with a carbon pressure device 92 carried by a toggle means 93 connected to the ferry bridge and with which the deck of the ferryboat is arranged for engagement, a return wire 94 from the said carbon device 92 returning to the negative line wire 55. The solenoid 88 is also connected to the negative line wire by means of a wire 95 which leads therefrom through a rheostat 96 to the said wire 94.

The operation of this system is as follows: The normal condition of the various instruments and devices is that shown in Fig. 7, the manual switch lever 57 is in its central neutral position, while the automatic switch levers 58 and 80,—the former governing the float controlling means and the latter the boat controlling means,—are in their operative positions, closing their respective contact points. The differentially operated pilot switches 49—50 are in their neutral or central position, the controlling means 72 for the selecting switch 71 is in its outward position wherein the selecting switch closes the contact point 76, while the boat operated switches 81 and 82 are, the former in an inoperative position and the latter in its operated position wherein the contact point 84 is closed. The operated position of the switch 82 is for the following reason: The carbon pressure device 92 interposes a high resistance in the portion of the wire 94 in which it is contained, being very much higher than the resistance offered by the rheostat 96, and as it is of course true that the amount of current which passes through the solenoids 87 and 88 respectively will be in inverse proportion to the resistance offered by the resistances 92 and 96, an excess of current such as will operate the solenoid 88 will pass therethrough moving the plunger 89 to the position shown and thus operating the switch 82. With the parts in the position shown the position of the float 32 will entirely control the position of the bridge. In the normal position of the parts as illustrated there will be no movement of the bridge because the differentially operated switches 49 and 50 are in a neutral posi-

tion, but should the float raise or lower the bridge will be raised or lowered correspondingly thereto by reason of the operation of the switches 49 or 50 in the manner aforesaid, and by the circuit which is thereby established through either the raising or lowering switches 52 or 54 exactly in the manner described in the foregoing. The position of the switches 81 and 82 will, in this case, be entirely immaterial because the circuit therefor will be broken at the contact point 77. When the boat enters the dock and engages the ferry bridge the operating mechanism 72 will be operated and the position of the switch lever 75 of the selecting switch 71 will be reversed, thereby breaking circuit through the contact point 76 and establishing a new circuit through the contact point 77. The breaking of the circuit at the contact point 76 will cut out the float control completely as it breaks circuit to the pilot switches 49—50, while the closing of the contact points 77 will establish a circuit to the switches 81—82. It being remembered that the normal position of the bridge before the boat came in is somewhat higher than that of the level of the ferryboat deck, the closing of the contact point 77 will establish a circuit to lower the ferry bridge which may be traced as follows: Commencing from the positive line wire 56 the circuit may be traced to the switch lever 80, thence to the contact point 79 closed thereby, and thence to the contact points 77 closed by the selecting switch lever 75, thence through the wire 78 to the lever of the boat controlled switch 82, thence to the contact point 84 and the wire 86 to the wire 63 and thence through a portion of the wire 63 to the lowering switch 54, and thence back through the negative line wire 55. The bridge will now be lowered until the toggles 93 rest upon the deck of the ferryboat. A slight lowering movement of the bridge after this will cause considerable pressure to be applied to the carbon pressure means 92, the effect of which will be to reduce the electrical resistance there-through until the resistance offered thereby substantially balances the resistance offered by the rheostat 96. This will equalize the energization of the solenoids 87—88 causing the plunger 89 to assume a central intermediate position, and thereby reversing the position of the switch 82 and opening circuit at the contact point 84. Circuit will thus be broken for the lowering switch 54 and the bridge will remain at rest. If, by reason of unloading the ferryboat or by a rise of the tide, the pressure upon the carbon pressure means 92 be increased to such an extent that it will offer a very considerably less resistance than will the rheostat 96, then the solenoid 87 will be operated, the switch 81 caused to close the contact point 83, and

the lifting switch 52 thereby operated. The bridge will then be lifted until the pressure upon the carbon pressure device is relieved to an extent wherein a substantial balance is again established between the solenoids and the plunger 89 is again caused to assume a central position. I have shown these solenoids as provided with springs 97—98 such as tend to cause the plunger to normally assume a central position wherein both of the switches 81 and 82 are in an inoperative position, so that the balance must be considerably disturbed in order that the one or the other of the solenoids be operated, and by this means too great a sensitiveness of the device is avoided. When the ferryboat leaves the dock the operating means for the selecting switch 72 will operate to reverse the position of the switch 71 thereby breaking circuit at the contact point 77 so as to cut out the boat controlling means and reestablishing the circuit at the contact point 76 to reestablish the float controlling means.

When the bridge was lowered to engage the deck of the ferry boat, the differentially operated means for the pilot switches 49 and 50 operated so as to close circuit at the contact point 51 in the circuit in which the lifting switch 52 is contained. This circuit was, at that time, however, broken through the contact point 76, hence there was no operation effected thereby, but when the circuit was reestablished at the contact points 76 upon the boat leaving the dock, the circuit for the lifting switch 52 was completed and the bridge thereby lifted back to its normal position and until the differential operating means again came to a neutral position and opened the switch 49. Thereafter the position of the float again determines the position of the bridge and maintains the same at a uniform predetermined position above the level of the water.

It will be seen that in the foregoing complete automatic control of the ferry bridge I normally control the operation thereof by means of a float, but that upon the entrance of a boat into the slip and the engagement thereof with the ferry bridge I automatically substitute the boat itself for the float as a means for controlling the operation of the bridge, again reestablishing the float as the controlling means upon the boat leaving the bridge.

It will, of course, be understood that the solenoid operating means shown in Fig. 7 is but one form of the means by which the boat may control the position of the bridge and that many different forms may be employed such as will readily suggest themselves to those skilled in this art. In Fig. 9 I have shown another form thereof, in which the toggle element 93 is permitted a slight rocking movement against the action of a powerful spring 99, the rear end of the

toggle element being shown as provided with a circuit closing element 100 adapted for engagement with contact point 101—102 respectively in accordance with its position. The contact point 101 may connect through a suitable wire with the lowering switch 54 while the contact point 102 may connect with the lifting switch 52, the circuit closing element 100 carried by the toggle element 93 being connected with the line wire 56.

In the foregoing description it was stated that the operating means 72 for the selecting switch 71 might be operated by the boat, by hand, or by the mooring means for the boat. When operated by the boat it may be operated by engagement with any suitable part of the boat properly positioned for the purpose, such part engaging the end of the plunger 73 and forcing the plunger inward against the spring 74 as the boat engages the bridge.

In Fig. 10 I have shown a convenient form of mooring means for the boat comprising a hand operated winch 103 provided with a mooring cable 104. This winch may be provided with a supplemental drum 105 having a cable or cord 106 adapted to be wound thereon, the end thereof being connected to an eye 107 at the rear end of the plunger 73. The rotation of the winch for the purpose of mooring the boat will wind up the cord 106 upon the drum 105 and thus operate the selecting switch by a direct pull upon the plunger 73 as will be well understood. For some reasons the controlling of the selecting switch by means of the mooring means is preferable because in such event the bridge will not be lowered until the boat is secured fast thereto which is, of course, desirable. I have shown a spring 108 as arranged to take up excess movement of the mooring means, this spring being designed to be somewhat stronger than the spring 74 and not to come into operation until after the plunger has completed its movement; some means for taking care of this overthrow is desirable because of the variable movements of the mooring means due to slightly varying positions of the parts with which the mooring cables engage under different conditions.

It will, of course, be understood that the various electrical appliances shown are illustrated diagrammatically. This is quite sufficient for the present specification as their specific construction is not of the essence of the invention, and standard well known instruments now upon the market may be employed. They are in most instances shown conventionally as of the snap or rapid break type because this is desirable to prevent fluttering of the parts and consequent arcing or arcing due to slow movements.

Referring again to Fig. 7, it will be noted

that by reversing the positions of the automatic controlling hand switch levers 58 and 80, the automatic boat controlling device may be cut out entirely, the switch lever 58 being, if desired, connected with the contact point 61 so as to establish a float controlled circuit exactly similar to that shown in Fig. 5 and which may be employed in combination with the manually controlled means including the switch lever 57 as aforesaid. I also preferably interlock the switch lever 80 with the switch lever 57 in the same manner as the switch lever 58 is interlocked with the said lever 57, a construction therefor being shown in Fig. 8.

While for convenience of description herein I have termed the devices 52 and 54 as lifting and lowering switches and have merely shown them conventionally by the conventional representation of electro-magnetic coils, it will be understood that I have used the term as applying to any of the means well-known at the present day by which the operating means for the bridge may be caused to raise or lower the same for so long a time as they are in an operative condition—for instance, they may comprise the common and well-known pole changing switches for the motor by which the motor may be caused to run in one direction or the other in which case they will also, of course, make and break circuit through the motor to stop and start the same, or they may operate clutches by which the motor is caused to raise or lower the bridge, or indeed they may operate in any desired manner to effect the desired result, all as will be well understood by those skilled in this art.

What I claim is:

1. Means for operating ferry bridges and the like comprising a motor for raising and lowering the bridge, a float, means operated by the float in its movement to start the motor, and means operated by the bridge in its movement to stop the motor.

2. Means for operating ferry bridges and the like comprising a motor for raising and lowering the bridge, a float, and means controlled by the raising and lowering of the float through successive levels in either direction for causing the motor automatically to raise or lower the bridge to successive levels proportionate thereto, whereby the level of the bridge will be caused to substantially correspond with the level of the float through a range of movements thereof in either direction.

3. Means for operating ferry bridges and the like comprising a motor for raising and lowering the bridge, a float, and differentially operated means connected with the said float and with the said bridge for controlling the operation of the motor and causing it to raise or lower the bridge in proportion to the movement of the float.

4. Means for operating ferry bridges and the like comprising a motor for raising and lowering the bridge, a float, means operated thereby at successive levels for successively starting the motor, and means for stopping the motor after it has moved the bridge a relatively short distance whereby the bridge will be moved in successive steps to correspond with successive movements of the float in either direction.

5. Means for operating ferry bridges and the like comprising rotative operating means for raising and lowering the bridge, a float, and differentially operated means connected with the said float and with the said bridge for stopping and starting the said rotative operating means and for controlling the direction of movement thereof.

6. Means for operating ferry bridges and the like comprising a motor for raising and lowering the bridge, a float, means operated by the float in its movement to start the motor, means operated by the bridge in its movement to stop the motor, and manual controlling means for the motor arranged for alternative control thereof.

7. Means for operating ferry bridges and the like comprising rotative operating means for raising and lowering the bridge, means for stopping and starting the same and for controlling the direction of rotation thereof, float controlled means for controlling the said stopping, starting and direction controlling means, manually controlled means for also controlling the said stopping, starting and direction controlling means, and interlocking means for compelling the alternative operation of the said float and manually controlled means.

8. Means for operating ferry bridges comprising an electric motor for raising and lowering the bridge, an electro-magnetic lifting switch, an electro-magnetic lowering switch, float controlled pilot circuit closing means for the said lifting and lowering switches, a hand switch for connecting the said pilot switches in operative relation with the said lifting and lowering switches, and a manual operating switch in parallel with the said pilot switches for directly controlling the said lifting and lowering switches by hand.

9. Means for operating ferry bridges comprising an electric motor for raising and lowering the bridge, an electro-magnetic lifting switch, an electro-magnetic lowering switch, float controlled pilot circuit closing means for the said lifting and lowering switches, a hand switch for connecting the said pilot switches in operative relation with the said lifting and lowering switches, a manual operating switch in parallel with the said pilot switches for directly controlling the said lifting and lowering switches, and interlocking means between the said

manual and hand switches whereby either of them may be operated only when the other is in a neutral position.

10. Means for operating ferry bridges and the like comprising an electric motor, a controlling switch therefor whose operation causes the motor to lift the bridge, another controlling switch therefor whose operation causes the motor to lower the bridge, a float, and electric circuit-controlling means differentially operated by the said float and the said bridge for controlling the operation of the said controlling switches.

11. Means for operating ferry bridges and the like comprising an electric motor for raising and lowering the bridge, a lifting switch therefor, a lowering switch therefor, and float controlled pilot switches for controlling the operation of the said lifting and lowering switches.

12. Means for operating ferry bridges and the like comprising an electric motor for raising and lowering the bridge, a lifting switch therefor and a lowering switch therefor, pilot switches for controlling the operation of the said lifting and lowering switches, a float, and means differentially operated by the said float and the said bridge for operating the said pilot switches.

13. Means for operating ferry bridges and the like comprising means for raising and lowering the bridge, a float, means controlled by the float as it rises and falls for causing the said raising and lowering means to raise or lower the bridge respectively, and means controlled by the bridge in its raising or lowering movement to stop the operation of the said means by which it is being so raised or lowered.

14. Means for operating ferry bridges and the like comprising operating means for raising and lowering the bridge, electro-magnetic means for controlling the same, float controlled means for completing circuit for the said electro-magnetic controlling means and causing the said operating means to raise or lower the bridge in accordance with the raising or lowering of the float, and means controlled by the bridge in its raising or lowering movement to break circuit through the said electro-magnetic controlling means to thereby stop the operation of the said operating means.

15. Means for operating ferry bridges and the like comprising operating means for raising and lowering the bridge, a float, means controlled by the float as it rises and falls for causing the said operating means to raise or lower the bridge respectively, means controlled by the bridge in its raising or lowering movement to stop the operation of the said operating means, and independent manually controlled means for likewise controlling the said operating means.

16. Means for operating ferry bridges to

be employed in connection with ferry boats, comprising operating means for raising and lowering the bridge, float operated controlling means therefor for normally maintaining the bridge at a predetermined distance above a varying water level, which distance is somewhat higher than the level of the deck of the ferry boats employed in conjunction therewith, and manual controlling means for lowering the bridge to the level of the ferry boat deck, at will.

17. Means for operating ferry bridges to be employed in connection with ferry boats, comprising operating means for raising and lowering the bridge, float operated controlling means therefor for normally maintaining the bridge at a predetermined distance above a varying water level which distance is somewhat higher than the level of the deck of the ferry boats employed in conjunction therewith, manual controlling means for lowering the bridge to the level of the ferry boat deck at will, and interlocking means between the float operated controlling means and the manual controlling means whereby one only of the said means can be in operative relation at a time.

18. Means for operating ferry bridges comprising means for raising and lowering the bridge, a float for controlling the operation of the said raising and lowering means, means controlled by a ferry boat employed in connection with the ferry bridge for controlling the raising and lowering of the ferry bridge, and means for substituting the ferry boat for the float, as such controlling means.

19. Means for operating ferry bridges comprising means for raising and lowering the bridge, a float for controlling the operation of the said raising and lowering means, means controlled by a ferry boat employed in connection with the ferry bridge for controlling the raising and lowering of the ferry bridge, and automatic means for substituting the ferry boat for the float, as such controlling means.

20. Means for operating ferry bridges comprising means for raising and lowering the bridge, a float for controlling the operation of the said raising and lowering means, means controlled by a ferry boat employed in connection with the ferry bridge for controlling the raising and lowering of the ferry bridge, and means automatically operated by a part adapted to be engaged by the ferry boat, for substituting the ferry boat for the float, as such controlling means.

21. Means for operating ferry bridges comprising operating means for raising and lowering the bridge, the said bridge being normally maintained thereby at a level above the level of the deck of a ferry boat employed in connection with the bridge, and means controlled by the ferry boat itself for

lowering the bridge to a point substantially level with the deck of a ferry boat and for maintaining it at such level.

22. Means for operating ferry bridges 5 comprising operating means for raising and lowering the bridge, the said bridge being normally maintained thereby at a level above the level of the deck of the ferry boat employed in connection with the bridge, 10 means for controlling the said operating means to cause the bridge to be lowered to the level of the deck of a ferry boat when a ferry boat is in engagement with the said bridge, and means controlled by the ferry 15 boat for controlling the said operating means to cause the same to raise or lower the bridge as the level of the deck of the ferry boat lifts or drops.

23. Means for operating ferry bridges 20 comprising operating means for raising and lowering the bridge, a lifting switch for causing the said operating means to raise the bridge, a lowering switch for causing the said operating means to lower the bridge, 25 float controlled circuit controlling means for the said lifting and lowering switches, other circuit controlling means for the said lifting and lowering switches arranged in parallel with the said float controlled circuit 30 controlling means, and means for connecting the one or the other of the said circuit controlling means in operative relation with the said lifting and lowering switches.

24. Means for operating ferry bridges 35 comprising operating means for raising and

lowering the bridge, a lifting switch for causing the said operating means to raise the bridge, a lowering switch for causing the said operating means to lower the bridge, 40 float controlled circuit controlling means for the said lifting and lowering switches, other circuit controlling means for the said lifting and lowering switches arranged in parallel with the said float controlled circuit controlling means, and automatic means for 45 connecting the one or the other of the said circuit controlling means in operative relation with the said lifting and lowering switches.

25. Means for operating ferry bridges 50 comprising operating means for raising and lowering the bridge, a lifting switch for causing the said operating means to raise the bridge, a lowering switch for causing the said operating means to lower the bridge, 55 float controlled circuit controlling means for the said lifting and lowering switches, other circuit controlling means for the said lifting and lowering switches arranged in parallel with the said float controlled circuit controlling means, and means automatically operated by a part engaged by the said ferry 60 boat for connecting the one or the other of the said circuit controlling means in operative relation with the said lifting and lowering switches. 65

D. HOWARD HAYWOOD.

Witnesses:

F. GRAVES,

LYMAN S. ANDREWS, Jr.