(No Model.)

2 Sheets—Sheet 1.

L. S. VAN DUZER.

ELECTRIC STEERING GEAR.

No. 493,000. Patented Mar. 7, 1893.

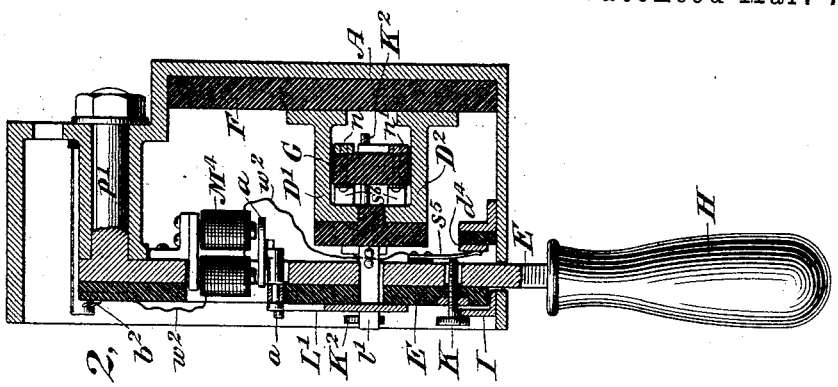

Fig. 2.

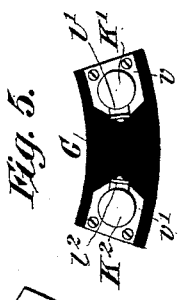

Fig. 5.

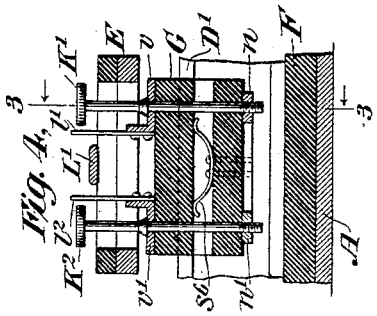

Fig. 4.

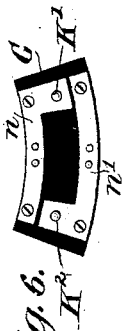

Fig. 6.

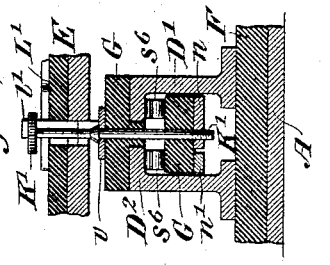

Fig. 3.

Fig. 1.

Witnesses

C. E. Ashley

H. W. Lloyd.

Inventor

Lewis S. Van Duzer

By his Attorney

Charles J. Kintner

(No Model.) 2 Sheets—Sheet 2.

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ELECTRIC STEERING GEAR.

No. 493,000. Patented Mar. 7, 1893.

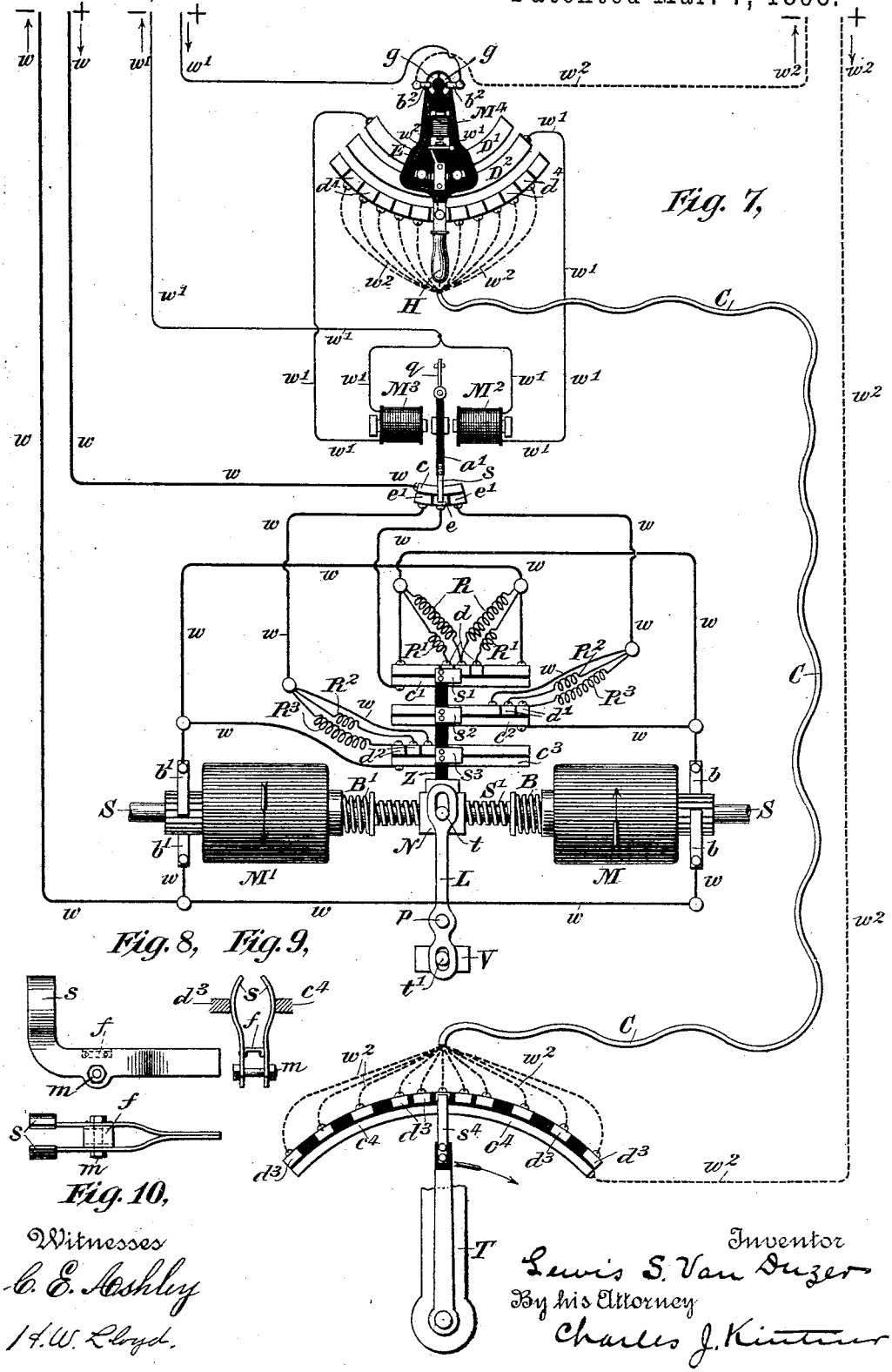

Fig. 7,

Fig. 8, Fig. 9,

Fig. 10,

Witnesses
C. E. Ashley
H. W. Lloyd.

Inventor
Lewis S. Van Duzer
By his Attorney
Charles J. Kintner

UNITED STATES PATENT OFFICE.

LEWIS S. VAN DUZER, OF THE UNITED STATES NAVY, ASSIGNOR OF ONE-HALF TO NEWTON E. MASON, OF THE UNITED STATES NAVY.

ELECTRIC STEERING-GEAR.

SPECIFICATION forming part of Letters Patent No. 493,000, dated March 7, 1893.

Application filed November 26, 1892. Serial No. 453,201. (No model.)

To all whom it may concern:

Be it known that I, LEWIS F. VAN DUZER, a citizen of the United States of America, and an officer in the United States Navy, temporarily residing at the Brooklyn Navy-Yard, in the city of Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Steering-Gear for Vessels, of which the following is a specification.

My invention is directed particularly to improvements in that type of steering gear in which the apparatus is controlled through the agency of electricity and its objects are, first to so dispose or arrange the electrical circuits and connections that a minimum portion of such controlling apparatus is located in the pilot house or the vicinity of the steersman thereby avoiding the evil effect of currents of high potentials and large quantity and of the electro-magnetic apparatus controlled thereby upon the compass always preferably located near the steersman: second to place the tiller of the vessel under the absolute control of the steersman through the agency of a simple operating lever which will always indicate to him the true position of the tiller, the latter always following the movements of the controlling and indicating lever and remaining in the position corresponding thereto, until said lever is again moved: third to devise an apparatus of the character indicated which shall utilize an electro-motive device for moving the tiller either directly applied to it or to control the application of steam, compressed air, or other equivalent sources of power for the same purpose, and through the agency of electrical controlling apparatus: fourth to provide means whereby through the agency of electricity, the tiller is moved in either direction caused to remain in any position and its exact position clearly indicated to the steersman by a single operating lever: fifth to devise apparatus of the character indicated having all of the qualifications attributable to the mechanism hereinafter described. These several objects are accomplished by my improved apparatus, for a full understanding of which reference is had to the following specification and accompanying drawings.

Figure 1 is a plan view of that portion of the apparatus which is located in the pilot house or near the steersman, a part of the upper portion of the apparatus being broken away in order to fully illustrate the interior thereof. Fig. 2 is a vertical sectional view of the same portion of the apparatus taken on the broken line 2—2, Fig. 1, and as seen looking in the direction of the arrow at the top of that figure, or from right to left. Fig. 4 is a detail sectional view taken through Fig. 1 on the short curved line 4—4. Fig. 3 is a cross sectional view taken through Fig. 4 on the line 3—3, and as seen looking from right to left in the direction of the arrows on that figure. Fig. 5 is a top plan view of that portion of the apparatus illustrated in Fig. 4, the operating lever and its attached parts being removed. Fig. 6 is a similar plan view of the bottom of that portion of the apparatus illustrated in Fig. 4. Fig. 7 is a general diagrammatic view illustrating the entire apparatus, all of the circuits and connections therefor. Fig. 8 is a detail view in side elevation of the preferred form of electrical contact springs used in connection with my improved apparatus. Fig. 9 is an end elevational view of the same as seen looking at Fig. 8 from left to right, and Fig. 10 is a plan view thereof as seen looking from the top toward the bottom of the drawings.

Referring now to the drawings in detail: T is the tiller of a vessel operatively connected to any well known form of steam or analogous propelling power, not shown, and having a controlling valve of usual pattern connected through a moving valve controller V and pin t' with lever L pivoted at p.

t is a pin secured to a nut N adapted to move back and forth on a screw S′ in alignment with and connected to the axles S of a pair of electric motors M and M′ having circuit connections through commutator brushes b b, b' b' and mains or leads w w with a dynamo or other source of electrical energy not shown. The pins t and t' carried by the nut

N and the valve controller V are adapted to move in slots in the opposite ends of the lever L.

Z is an arm of insulating material also carried by the nut N and supporting contact springs s', s^2, and s^3 adapted to bridge electrically the spaces between the conducting contacts d c', d' c^2 and d^2 c^3, the upper or sectional contact plates d, d' and d^2 being connected as shown, to branch conductors w running to the commutator brushes b b, b' b' and three contact plates e, e', e', as clearly shown in Fig. 7, the upper contact plate c being connected directly to the positive main or lead.

R R, R' R', R^2 R^2 and R^3 R^3 are resistance coils or rheostats for varying the current supply to the motors.

B B' are strong spiral springs operatively connected to the inner ends of each motor shaft and provided with buffer plates against which the nut N will ride when moved in opposite directions to the extreme limit of the motion of the lever L.

M^2 and M^3 are controlling or switching electro-magnets included in circuit with conductors w' w' running to the manually operative circuit controlling steering apparatus located in the pilot house or near the steersman and to the switch board of the dynamo or other source of electrical energy located preferably in the engine room below the water line of the vessel but not shown. The armature lever a' of said electro-magnets rests normally in its central position and is so held by the yielding or spring like extension q, the free end of which lies between a pair of friction rollers as clearly shown.

s is an electrical conducting spring borne by the lower end of the armature lever a' and bridging the space between the contact plate c and the three individual contact plates e, e', e' in accordance with its position.

s^4 is a conducting spring carried by the tiller T and adapted to bridge the space between a conducting sector c^4 connected by a conductor w^2 running to the switch board of the generator and a series of contact plates d^3 connected through insulated conductors w^2 grouped in a cable C and united to a like number of corresponding contact plates d^4 located in the pilot house or near the steersman. The conductor w^2 which runs from the sector c^4 and is shown in dotted lines as constituting a part of the circuit w^2 w^2 might of course and would preferably be inclosed in the cable C but is here shown distinct and separate therefrom to better illustrate the circuit connections.

All of the apparatus so far described except the conducting plates d^4 d^4 and those portions of the circuits w' w' and w^2 w^2 which run to the pilot house or steersman are located preferably in the engine room or at some point in the lower part of the vessel where they would be little liable to meet with damage and would therefore also offer little or no magnetic disturbance to the compass or other delicate magnetic apparatus used by the steersman. I utilize three circuits, w w, w' w', and w^2 w^2 all of which run to the switch board of the dynamo and are there connected with such well known forms of rheostats as will furnish the required currents for operating the respective apparatus to and through which they are connected. I denominate the circuit w w as the main or operating circuit, and the circuit w' w' as the switching or controlling circuit and the circuit w^2 w^2 as the cut out or releasing circuit.

I will now describe that portion of the apparatus located wholly in the pilot house or near the steersman, wherever he may be situated, and particularly illustrated in Figs. 1, 2, 3, 4, 5 and 6 and diagrammatically in the upper portion of Fig. 7.

A is preferably a metallic box of quadrant shape secured say in the pilot house so that when the operating or steering handle H is in its central position, said handle lies in a plane passing through the stem and stern of the vessel and the tiller T when in the position shown at the bottom of Fig. 7. The operating handle H is connected to a lever E pivoted in the box A by a vertical standard or pivot P', and the conducting portions of the apparatus carried by this lever E are carefully insulated therefrom, as clearly shown in Fig. 2.

D' and D^2 are conducting sectors secured to and insulated from each other and the base of the box A by insulating material F as clearly shown in Figs. 2 and 3.

G is a two-part sliding block, the upper portion of which rests upon and between the upper faces of the curved sectors D' and D^2, its lower portion resting beneath the inwardly extending edges of said sectors and carrying a pair of conducting or contacting springs s^6 s^6 which bear against and make electrical contact with the under faces of said sectors. The two-part block G is held together by a pair of adjusting screw standards K' K^2 which extend through metallic or conducting lugs or ears v v' carrying upright yielding springs l' l^2 and into conducting plates n and n' secured to the bottom of the lower portion of the block G as clearly illustrated in the bottom plan view thereof shown in Fig. 6. One of the springs s^6 is connected electrically to the plate n and the other to the plate n'. This sliding block G is adapted to rest normally in position where it may be left when moved to the right or left by a metallic block or plate L' secured by screws to the upper face of the insulating material carried by the lever E, said metallic block being adapted to contact at the will of the steersman with either of the yielding springs l' or l^2 as is clearly apparent on inspection of Figs. 1, 2 and 4.

I is an indicating dial located directly above

the several contact plates d^4 and divided into an equal number of parts bearing numbers from "0" to 45 or upward.

s^5 is a conducting or contacting spring carried on the under side of the lever E and insulated therefrom, its free end having contact with the conducting piates d^4, and K is an adjusting screw for regulating its pressure on the aforesaid contact plates. The fixed end of this contact spring s^5 is connected through the conductor w^2 with the coils of the cut out electro-magnet M^4 and in turn with a conducting plate g which is connected directly to the conductor w^2 shown in dotted lines at the top of Fig. 7 and as running directly to the generator. The metallic block L′ carried on the upper face of the lever E has at its forward end electrical connection with the free end of the armature lever a of the cut out electro-magnet M^4, the fixed end of said armature being connected by the conductor w' to the right hand conducting plate g and brush b^2 directly with the lead w' running to the switch board of the generator as clearly shown in Fig. 7.

The operation of the apparatus is as follows: Suppose the tiller T and the steering handle H to be in the position shown in Fig. 7. Under this condition of affairs the vessel is moving in a direct line, no current is flowing from the generator through the controlling or switching electro-magnets M^2 M^3, the circuit being open between the metallic plate L′, the upright springs l' l^2 and the conducting standards K′ K^2, see Fig. 4. This circuit is also open between the free end of the armature lever a and the conducting plate L′ because a circuit is closed from the generator by the conductor w^2 on the right, the conducting sector c^4 at the bottom of the drawings, the contact spring s^4 carried by the tiller, the central conducting plate d^3 and its corresponding conductor w^2 to and through the central conducting plate d^4, the contact spring s^5, (see Fig. 2,) conductor w^2, cut out electro-magnet M^4, conductor w^2, brush b^2, conductor w^2 back to the generator. Comparatively little current is flowing through the motors for the reason that the armature lever a' being in its central position, the main conductor w is connected through contact plate c, spring s and the lower central contact plate e the current passing thence by the conductor w, through the contact plate c', contact spring s' central upper contact plate d where it divides, passing through the two rheostats R of high resistance and in opposite directions by the conductors w to the commutator brushes b b, b', b' by conductor w back to generator. It results therefore that the small amount of current flowing through the rheostats R tends equally to turn the motors M and M′ in opposite directions and consequently the lever L remains in its central position. Suppose now the steersman carries the steering handle H to the right to its extreme position so that the contact spring s^5 (see Fig. 2) rests upon the right hand contact plate d^4 at the top of Fig. 7. The first movement of the steering handle ruptured the cut out circuit between the spring s^5 and the central contact plate d^4 and allowed the armature lever a of the cut out electro-magnet to drop back into contact with the forward end of the metallic plate L′. As the handle H is carried forward the block L′ on the upper side of the lever E is brought into contact with the right hand yielding spring l', and its upper end in turn is caused to bear against the upper end of the conducting standard K′ thereby closing the circuit w' through the right hand switching magnet M^2 and the sector D^2 the current passing from the generator by the conductor w' in the direction of the arrow as follows: through the right hand brush b^2 at the top of the drawings, Fig. 7, contact plate g, conductor w', armature lever a, conducting block or plate L′, yielding spring l', lug v, conducting standard K′, metallic plate n, see Fig. 6, left hand spring s^6, see Fig. 3, rear sector D^2, see Fig. 7, and thence by conductor w' to switch magnet M^2 back to the generator. This causes the armature lever a' to be moved to the right so that the contact spring s bridges the space between the contact plate c and the lower right hand contact plate e'. Consequently the current flows from the generator in the direction of the arrow by the conductor w, through the contact plate c, contact spring s, right hand contact e', right hand conductor w to the left hand upper contact plate d', thence by contact spring s^2 carried by the arm Z to the lower contact plate c^2, by conductor w, commutator brushes b b and conductor w back to the generator thereby throwing all of the current through the right hand motor M and causing it to rotate in the direction of the arrow, thus giving to the nut N movement to the right and carrying with it the lever L and arm Z. As the lever moves to the right the steam steering apparatus operated by the valve controller V is actuated in a well known manner so as to cause the tiller T to move in the direction of the arrow. As this motion continues the contact plate s^2 carried by the arm Z gradually cuts into circuit the rheostats or resistance coils R^2 and R^3 so that when the lever L assumes its extreme right hand position the nut N has come into frictional contact with the buffer spring B and the motor is gradually checked. The steam steering apparatus causes the tiller T to follow in the direction of the arrow until it reaches its extreme right hand position thereby causing the spring s^4 to close the cut-out circuit between the right hand plate d^3 and the curved sector c^4 thus energizing the cut out electro-magnet M^4 and breaking the circuit w' at the contact between the armature lever a and the conducting block L′, thereby releasing the armature lever a' and allowing it to return to its normal position. The steering handle H will remain of course wherever it is left, the frictional re-

lation between the insulating material on the top of this lever and the under side of the dial I being such, owing to the adjustment due to the pressure of the spring K upon the stiff contact spring s^5 which in turn bears upon the conducting contacts d^4 that good contact is maintained between the block L′ and whichever one of the yielding contact springs l' l^2 it may be left in contact with. At the instant that the cut out electro-magnet M^4 ruptured the circuit w' at a point between the free end of its armature lever and the conducting block L′ owing to the closure of the circuit between the sector c^4 and the right hand contact plate d^3 when the tiller T reached its extreme right hand position the upper end of the lever L had been carried as already described to its extreme right hand position so that the upper contact spring s' carried on the upper end of the non-conducting arm Z had been carried to its extreme right hand position thereby bridging the space between the lower contact plate c' and the extreme right hand upper contact plate d. When the circuit w' was ruptured therefore and the armature lever a' assumed its normal position a low resistance or shunt circuit was formed from the generator by the conductor w through the upper contact plate c, spring s, lower contact plate e, conductor w, lower contact plate c', spring s', upper right hand contacting plate d, upper left hand conductor w directly to the commutator brushes b' b' of the motor M′ by the conductor w back to the generator. The result is therefore that the major portion of the current is now turned through the left hand motor M′, the right hand motor M at this time being included in a high resistance shunt through the rheostats R R, and right hand conductor w will exert a minimum pull in opposition to the motor M′. Consequently the tiller T remains where it was last left being held in that position by the steering gear while the left hand motor M′ returns the valve controller V to its normal position, leaving the valves in their normal condition and ready for immediate operation on any change of position of the steering handle H. It will be observed that as the lever L, nut N and arm Z return to normal position the contact spring s^2 passed successively from the right hand contact d' on to the next left hand contact d' connected with the rheostat R^2 of lower resistance than the rheostat R^3 and finally to the normal position, the upper contact spring s' at the same time having passed over the successive contact plates d gradually cutting in the rheostats R′ and R. The lower contact spring s^3 carried by the arm Z and the accompanying contact plates c^3 d^2 and rheostats R^2 and R^3 on the left are disposed and connected in the same relation to the motor M as were the parts just described in connection with the motor M′, the arrangement always being such that after the tiller T reaches the limit set for it by the steersman with the steering handle, the switching circuit will be automatically broken thereby restoring the armature a' of the switch magnets M^2 M^3 to normal position and allowing the proper motor to restore the valves to their normal position.

The operation of the apparatus in a reverse direction may be readily traced on examination of the drawings in view of the foregoing description, it being apparent that when the steering handle H is turned to the left the lever E will close the switching circuit through the block L′, left hand upright spring l', lug or ear v', standard K^2, contact plate n', front spring s^6 and sector D′ by conductor w' to the left hand switching magnet M^3, thereby throwing the switching lever a' to the left and placing the motor M′ directly in circuit through the contact plate c, spring s, contact plate e', conductor w, right-hand contact plate d^2, lower contact plate c^3, conductor w, commutator brushes b' b' and motor M′, the tiller T following to the left in the same manner until the spring s^4 carried by it reaches the contact plate d^3 corresponding to the contact plate d^4 covered by the contact spring s^5 under the steering lever E, the valve controlling lever L and switch carrying arm Z again returning to normal position through the agency of the motor M as is clearly appreciable in view of the foregoing description. It is apparent therefore that with my improved apparatus I am enabled to move the steering handle H to any point of the compass to correspond with any direction in which it is desired to have the vessel move and leave it in such position until it is desired to change the course thereby having in my improvement, not only a steering device, but an indicating apparatus which always discloses the exact course of the vessel for the time being. It will be understood of course that the lever L might be operatively connected directly with the tiller and the power of the motors M and M′ directly utilized, the mechanical and electrical changes for accomplishing this effect being obvious to those skilled in the art in view of the foregoing description.

In Figs. 8, 9 and 10 I have shown a preferred form of contacting or conducting springs for use in place of the contacting or conducting springs s, s', s^2, s^3 and s^4. In this preferred form the conducting springs s are caused to assume a vertical position between the sector c^4 and the contact plates d^3 and are provided with a conducting bridge f about which they hinge, m being a bolt or screw for the purpose of adjusting the pressure between the upper ends of the springs and their contacting surfaces. I prefer this form of conducting springs for the reason that by their vertical arrangement between the contacting parts they carry off any moisture which may accumulate upon their surfaces and also for the reason that I am enabled to render further adjustment and

contact absolutely sure for all parts of their movement. Such an arrangement of contact springs also affords a simple and efficient manner of disposing of the conductors to which they are connected without leaving them unnecessarily exposed, enabling me to locate all of them within the lower part of the box A.

I do not limit myself to the specific apparatus herein shown and described for effecting the results sought as it is obvious that many of the general details of the entire system might be materially departed from and still come within the scope of my invention. To make a single illustration: The two electric motors M and M′ might be replaced by a single electric motor and the switch magnets M^2 and M^3 arranged to operate a pole changing switch which would reverse the direction of the current through said motor in any well known manner and cause it to impart motion in opposite directions to the valve controlling parts in a manner at once obvious to those skilled in the art.

I believe it is broadly new with me to electrically control the steering gear of a vessel through the agency of three distinct circuits, one of which conducts the currents from a generator for controlling the movement of the apparatus, the second of which regulates the application of the first named currents and the third of which controls the application of the second named currents, and my claims are generic in this particular. I believe it is also broadly new with me to cause the tiller to automatically rupture or control the application of the regulating currents at various points of its movement; and to locate the material and essential parts of the operating parts of such a steering apparatus entirely below the water line of a vessel where they will not be exposed in time of conflict to shots from the enemy's guns.

Although I have described the apparatus which constitutes my invention as applicable to steering apparatus for vessels, I wish it understood that my claims hereinafter made contemplate broadly the use of such apparatus wherever it may be applied in the arts, that is to say, they contemplate the use of an operating and indicating lever which electrically controls the movements of a distantly located mechanism a part of which is adapted to move in opposite directions through the arc of a circle and to be automatically stopped at various portions of its movement which correspond to the position indicated by the first named switching or operating lever.

Having thus described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. Mechanism for controlling the movements of the tiller of a vessel consisting of an electro-motive device for regulating the application of power thereto in combination with electro-magnetic switching mechanism for regulating the direction of such motion and an electro-magnetic cut out device having electrical connections with the tiller for regulating the movements of the switching mechanism, substantially as described.

2. Mechanism for controlling the movements of the tiller of a vessel consisting of a source of electrical energy, an electro-motive device in circuit therewith and operatively connected to mechanism adapted to move the tiller, electro-magnetic switching mechanism for regulating the direction of the movement of the tiller and a steering handle or lever having electrical connections with the switching mechanism whereby the tiller may be moved in opposite directions at will, substantially as described.

3. Steering gear for a vessel having an electro-motive device for regulating the power applied to the tiller, a switch for regulating the direction of motion of such applied power and an automatic cut out for disconnecting the electro-motive device when the tiller reaches the desired position, substantially as described.

4. Steering gear for a vessel consisting of two electric motors operatively connected to mechanism adapted to move the tiller, in combination with an electro-magnetic switch having independent circuit connections with each motor and a steering handle or lever located in the pilot house or near the steersman, substantially as described.

5. A steering apparatus for vessels consisting of an electrical generator, an electro-motive device in circuit therewith and operatively connected to mechanism adapted to move the tiller, an electro-magnetic switch having circuit connections with the generator and the electro-motive device and a steering lever having circuit connections with the switch the tiller and an automatic electro-magnetic cut-out, substantially as described.

6. A steering apparatus for vessels having an electro-motive device for regulating the application of power to the tiller, a switch for regulating the direction of the applied power and a steering handle or lever having circuit connections with the switch for regulating its movement, substantially as described.

7. Steering mechanism for a vessel consisting of two electric motors having their armature shafts connected and provided with a screw carrying a nut operatively connected to a source of power for controlling the movements of the tiller and to an arm carrying switching devices for directing the current supply to the motors at will; an electro-magnetic switching apparatus having circuit connections with a switching or steering lever located near the steersman, substantially as described.

8. An electrically controlled steering apparatus having electrical circuits and circuit connections with a steering lever or handle, located near the steersman and including an

electro-magnetic cut out and circuit making and breaking devices controlled by the tiller, whereby it, the tiller, is maintained always in a fixed position corresponding to that of the steering lever or handle, substantially as described.

9. An electrically controlled steering gear consisting of an electro-motive device connected with a generator of electricity and a source of power for moving the tiller, with a steering handle or lever and an electro-magnetic switch having circuit connections with the generator the electro-motive device and the steering handle or lever, substantially as described.

LEWIS S. VAN DUZER.

Witnesses:
C. J. KINTNER,
M. M. ROBINSON.