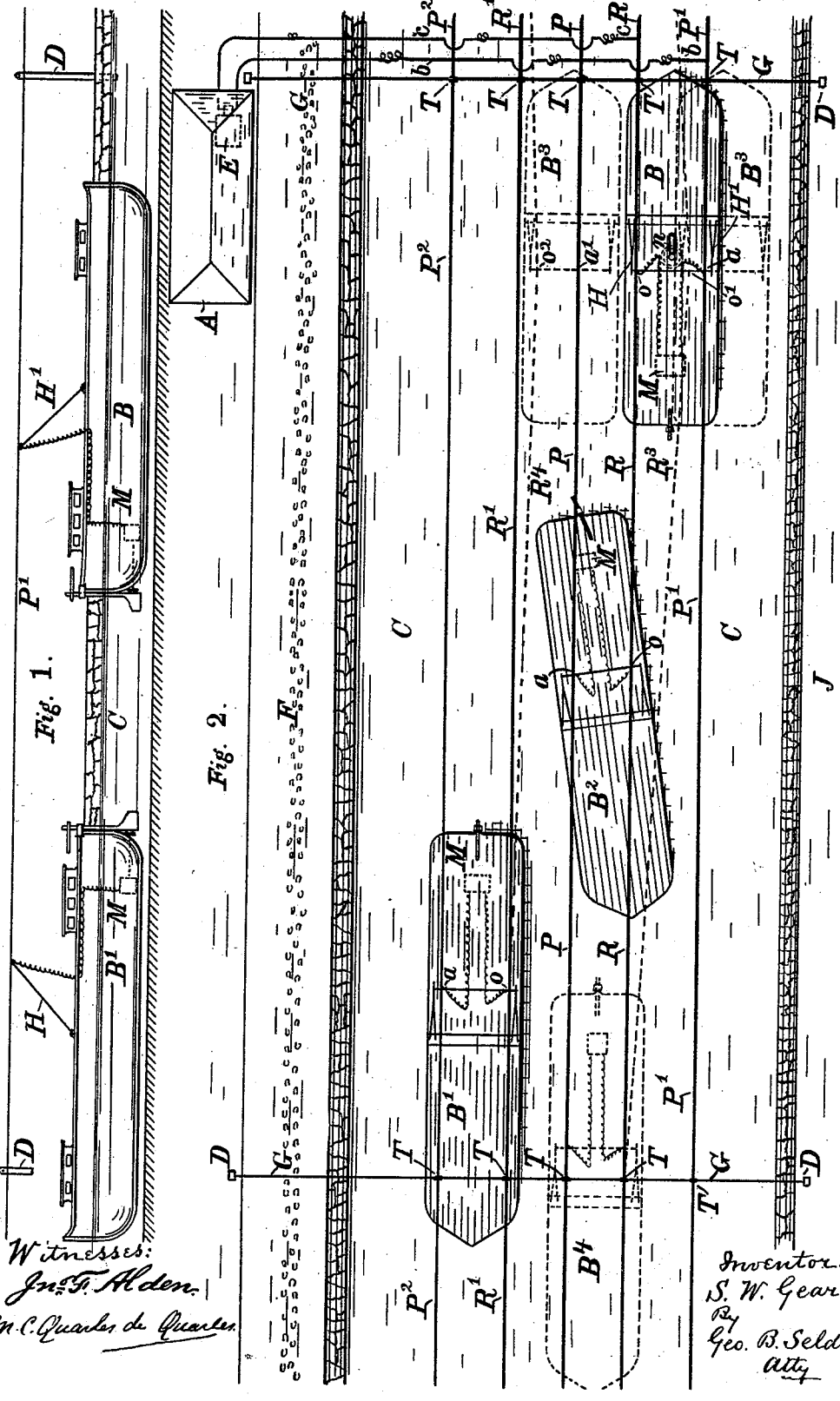
(No Model.) 3 Sheets—Sheet 1.

# S. W. GEAR.

## SYSTEM OF PROPELLING CANAL BOATS BY ELECTRICITY.

No. 499,321. Patented June 13, 1893.

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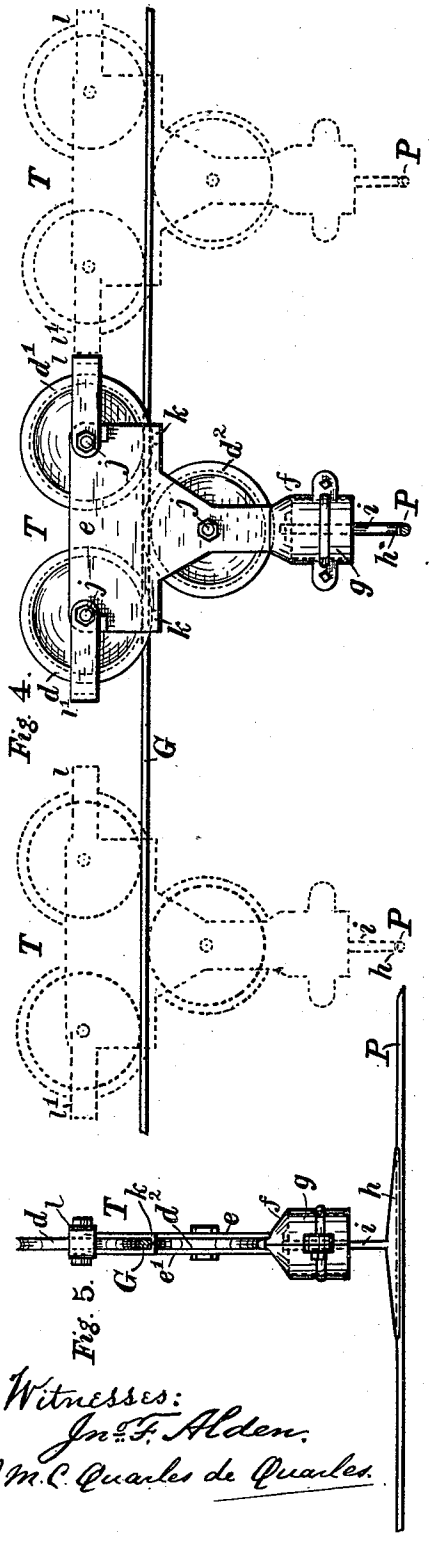


Fig. 4.

Fig. 5.

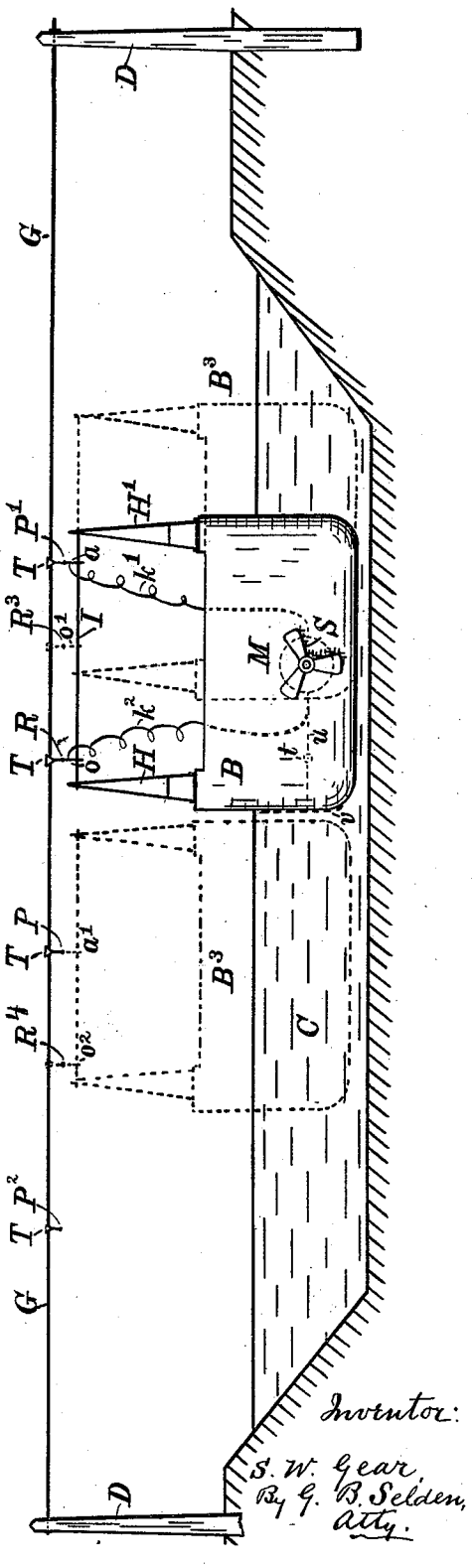


Fig. 3.

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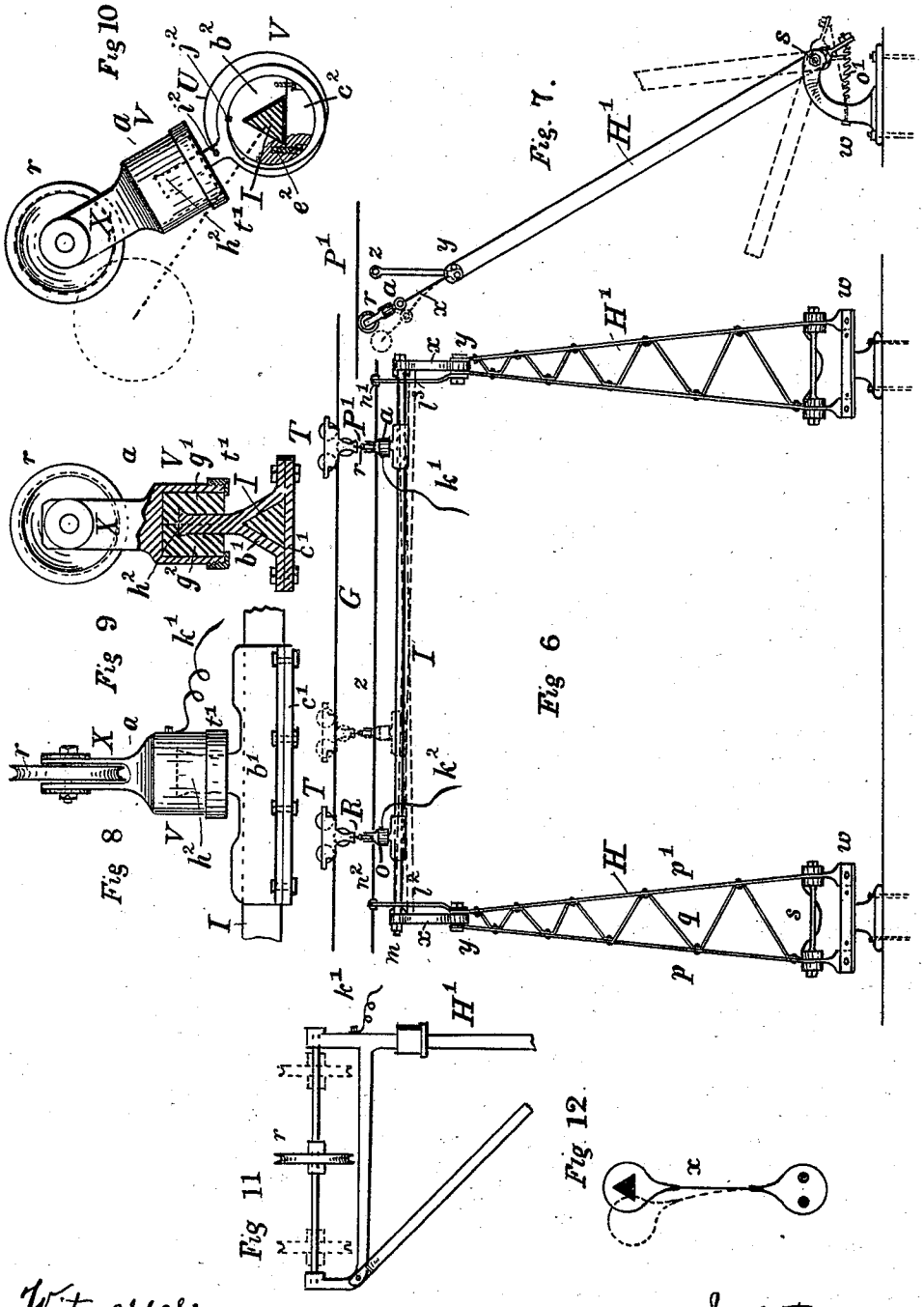


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# UNITED STATES PATENT OFFICE.

SAMUEL W. GEAR, OF BUFFALO, ASSIGNOR OF ONE-HALF TO JOHN F. ALDEN, OF ROCHESTER, NEW YORK.

## SYSTEM OF PROPELLING CANAL-BOATS BY ELECTRICITY.

SPECIFICATION forming part of Letters Patent No. 499,321, dated June 13, 1893.

Application filed January 26, 1893. Serial No. 459,889. (No model.)

*To all whom it may concern:*

Be it known that I, SAMUEL W. GEAR, a citizen of the United States, residing at Buffalo, in the county of Erie, in the State of New York, have invented an Improved System of Propelling Canal-Boats by Electricity, of which the following is a specification, reference being had to the accompanying drawings.

My invention relates to an improved system of propelling canal-boats by electricity, which system is fully described and the means for carrying it into practical effect illustrated in the following specification and the accompanying drawings,—the novel features thereof being specified in the claims annexed to the said specification.

In the accompanying drawings representing my improved system of canal-boat propulsion—Figure 1 is a side elevation showing two canal-boats proceeding in opposite directions. Fig. 2 is a plan view, showing two canal-boats proceeding in opposite directions, and also a fast boat passing a slower one. Fig. 3 is a transverse section of the canal or waterway. Fig. 4 is a side view of one of the travelers on one of the guy-wires, showing its lateral motion thereon. Fig. 5 is a side-view of the same, taken at right angles to Fig. 4. Fig. 6 represents the trolley-mechanism in elevation. Fig. 7 is a side view of the same. Fig. 8 is a side view of the trolley arm, partially in section. Fig. 9 is a side view of the trolley arm, taken at right angles to Fig. 8. Fig. 10 is a side view of a modified form of the trolley-arm. Fig. 11 represents a modified form of the trolley-standards. Fig. 12 is a side view of the springs at the upper ends of the trolley-standards.

My improved system of propelling canal-boats by electricity comprises a suitable generating station, a laterally adjustable conductor arranged over the waterway, and suitable trolley-mechanism on the boat by which the current is conducted to the motor which operates the propeller.

My system also contemplates the use of a laterally adjustable return wire, and suitable connections, by which the current after having passed through the motor, is conducted back to the generator. In order to provide for propelling boats in both directions, two power wires are employed, and also two return wires, if desired. A third power wire is arranged between the others, for certain purposes hereinafter described,—such as to enable a fast boat to pass a slower boat going in the same direction. The power and return wires are supported on guy-wires in such fashion that they can travel laterally to conform automatically to any lateral motion of the boats. The trolley mechanism is also preferably made in some part self-adjusting in the lateral direction.

My invention also comprises various other arrangements and details of construction, all as hereinafter more fully described.

In the accompanying drawings representing the manner of carrying my improved system of canal-boat propulsion into practical effect, C represents the canal or waterway, B B′ $B^2$ canal-boats, G the transverse guy-wires, P P′ $P^2$ the power wires, and R R′ the return-wires.

A represents a power house, in which is located a suitable electric-generator, E, which may be operated by steam or water, which may be taken from the canal itself.

The guy-wires G are arranged across the canal at suitable distances apart,—being supported by posts D D or other structures on the banks of the canal. Provision is made for maintaining suitable tension on the guy-wires by a turn-buckle or a threaded rod arranged in any preferred manner.

F, Fig. 2, represents the tow-path and J the bank on the opposite side of the canal.

The power wires P P′, $P^2$ receive the current from the generator E through a suitable conductor, as represented at *b*, Fig. 2, and the return wires are connected to the opposite pole of the dynamo through a conductor *c*. The canal or waterway is divided into sections of suitable or convenient length,—each section being provided with its generating station and system of conductors. The generating station may be located at one end of or at any convenient point near the section supplied by it. The power wires are preferably arranged so that the same trolley comes in contact with the power wire, whether the boat is proceeding in one direction or the other. Thus in Figs. 2 and 3, the power wires

P′ P² are located on the outside, and the return wires R R′ on the inside, with the auxiliary power wire P in the center between the return wires. The right-hand trolley *a* consequently receives the electricity from the power wire P′ when the boat is moving in one direction, and from the wire P² when the boat is proceeding in the opposite direction. The other trolley *o* conducts the current to the return-wires.

The travelers or mechanism by which the conducting wires are supported on the guy wires so as to be laterally adjustable thereon, to adapt themselves to the lateral movements of the boat caused by the steering or drifting, will be understood from an examination of Figs. 4 and 5. The traveler T consists of one or more grooved pulleys which run on the guide-wire, a suitable frame, and an insulating device which carries the conductors. In the accompanying drawings the traveler is represented as provided with three pulleys, *d d′ d²*,—two on the upper side of the guy-wires, while the third is placed below the wire. The frame *e e′* is arranged on each side of the pulleys and is provided at its lower part with a socket or other suitable device for receiving an insulator or insulating block. In the construction shown, the frame is given in the shape of a socket, *f*, which incloses a perforated insulator *g*. The conducting wire P is fastened to a clip *h*, having a stem *i* which passes through the insulator and is provided with a nut or other suitable device at its upper end to hold it in place therein. The insulator is provided with a peripheral groove, into which a flange on the interior of the socket projects, to hold the insulator in place. The socket is divided,—one-half of it being formed on each side-frame *e e′*,—the parts being secured together by bolts or other suitable devices. The frames *e e′* are secured together by the bolts or studs *j j*, on which the pulleys revolve. Below the guy-wire, the frames are joined, as represented at *k*, to prevent the pulleys from getting off the wire. Any other suitable form of traveler or insulator may however be employed. All of the conducting wires are supported on the guy-wires by similar travelers. Sufficient slack is left in the conductors *b* and *c*, to permit the lateral movements of the conducting wires.

In order to prevent the conducting wires from approaching too close to each other, the travelers are provided with projecting arms or buffers, *l l′*, which come in contact with each other, as represented on the right hand in Fig. 4, so that the conducting wires are always maintained at the proper distance apart, although permitted to shift laterally on the guy-wires to adapt themselves to the lateral movements of the boat. These buffers are made in any convenient way, being shown in the drawings as formed of loops secured at their ends by the heads and nuts on the bolts of the pulleys *d d′*.

The trolley mechanism consists essentially of two pivoted uprights or standards, H H′ mounted on the boat near the center of its length, and carrying a suitable cross-bar I, on which the trolley-arms *a* and *o* are supported in such manner that they can shift laterally thereon, as indicated by the dotted lines in Fig. 6. This lateral movement assists the lateral movement of the conducting wires, as the boat pursues its more or less sinuous course. For example, if the boat B, Figs. 2 and 3, diverges toward the right hand, as indicated at B³ in dotted lines, the return wire R will shift laterally, toward or up to the position indicated by the broken line R³,—one or more of the travelers sliding on the guy-wires. The power wire P′ however will remain straight,—the trolley arm *a* sliding inward on the cross-bar I,—unless the deviation of the boat should exceed the distance between the trolley standards H H′, in which case the trolley arm *a* will slide on the bar I until it comes in contact with the other arm *o*, after which, if the deviation continues, the wire P′ will also be shifted laterally. The lateral movement of the return wire and its trolley-arm are represented at R³ and *o′*, Figs. 2 and 3, when the boat has diverged toward the right. When the boat inclines in the opposite direction, toward the left-hand, the power wire P′ will be drawn inward by its trolley-arm *a*, toward the center of the canal,—one or more of the travelers which support this conductor sliding along the guy-wires, while the trolley-arm *o* on the return wire R will slide along the bar I until the deviation is equal or nearly equal to the width of the boat,—after which, if the deviation continues, the return wire R will be shifted inward until its traveler comes in contact with the traveler of the central power wire P. The two wires R and P may then be allowed to shift laterally together, but it will be more convenient, when such an excessive deviation occurs, and if it be desired to continue the motion of the boat along the left-hand side of the canal, to connect the trolley arm *a* with the central power wire P and the trolley arm *o* with the return wire R′. The construction of the trolley mechanism permits this to be effected readily,—the trolley-arm *a* being moved inward so that it comes under the power wire P, as at *a′*, Figs. 2 and 3, and the return wire R′ being moved inward if necessary until it comes over the trolley arm *o*. The positions of these parts at this time are represented approximately at R⁴, *o²*, Figs. 2 and 3. It will be observed that this arrangement will enable a fast boat, B³, to pass a boat, B, going in the same direction at a slower rate of speed. At B², Fig. 2, I have represented a boat passing a slower boat B′,—the power to propel the boat B² being derived from the central power wire P, while the return is effected through the return wire R. At B⁴ the boat B² has completed its movement from one side of the canal to the other, and is proceeding to pass the boat B′ in a parallel path, after which it will

again return to the proper side of the waterway.

The current is brought from the trolley arms to the motor M by suitable insulated conductors $k'$ $k^2$. The motor is arranged in any convenient location, preferably in the rear part of the boat,—being connected to the screw S so as to operate the same either directly or by suitable intermediate gearing. In order to provide for reversing the motor, so that the boat can be backed, a suitable switch, *n*, Fig. 2, is introduced between the trolley arms and the motor, by which the direction of the current through the machine can be changed. This switch is preferably located near the trolley mechanism, so as to be conveniently under the control of the man who operates the trolley mechanism. The switch also enables the boat to proceed on the wires $P^2$ R′ in the same direction as on the wires P′ R, or vice-versa,—the trolley arm *o* in this case receiving the current from the power wire P′. It will also enable the boat to proceed or back up on the wires P R. The switch is of any ordinary or preferred construction adapted to the purpose of changing the direction of the current through the motor.

In order to permit the lateral motion of the conducting wires, it should be understood that a slight amount of slack is left in them,—a sag of eighteen inches in one hundred and fifty feet allowing a traveler to move laterally about seven and a half-feet on a length of wire of three hundred feet,—the guy-wires being placed one hundred and fifty feet apart.

Separate guy-wires may be employed for the power and the return wires,—the insulation being introduced in the guy-wires. The conducting wires may be fed at different points along the length of a section by suitable conductors.

Any suitable variable resistance may be employed to vary the strength of the current supplied to the motor.

The trolley-mechanism is constructed in such manner as to permit the trolley pulleys to be shifted laterally transversely of the boat, and also to maintain the proper electrical connection with the conducting wires. To effect these results the trolley mechanism may be constructed in various different ways. In the drawings I have represented the trolley-arms *a* and *o*, which carry the grooved pulleys *r* which make contact with the conducting wires, as carried by a transverse bar I, supported by the pivoted standards H H′, but under certain circumstances, such as when a boat steers accurately, the trolley-pulleys may be supported on independent hinged standards,—the lateral movements of the conducting wires being sufficient to compensate for the lateral deviations of the boat from a stright line. A skillful steersman under such circumstances can perform the necessary operations of guiding the boat so as to avoid contact with the banks, to turn out on meeting boats, or, if necessary, to pass a slower boat,—availing himself only of the lateral adjustabilty of the conducting wires. These operations may also be facilitated, when using a single standard for each trolley-pulley, by lengthening the shaft on which the pulley runs, so that it may adjust itself laterally as indicated in Fig. 11. But for ordinary purposes, it is found most satisfactory to employ the double standards and cross-bar carrying the trolley-arms as represented in Figs. 3 and 6. The standards are constructed conveniently of a light frame work, of any suitable material. If made of metal, they may consist of the bars *p* *p*′, with the bracing *q*,—the standards being pivoted on the rod *s* supported by the base *w*. A spring *o*′, Fig. 7, connected to the lower end of the standard and to the base, serves to keep the trolley pulley in contact with the lower sides of the conducting wires. The standards *w* are secured to the deck of the boat, on opposite sides thereof, near the middle of its length,—it being preferable to have the trolleys make contact with the wires as near the center of the length of the boat, as possible. At their upper ends, the standards support the cross-bar I, which carries the trolley arms *a* and *o*, and is preferably triangular or square in shape. The cross-bar may be rigidly secured to the upper ends of the standards, or provision may be made at these points for a certain amount of yielding in the bar. In the construction shown, the bar I is represented as supported on the upper ends of the standards by the springs *x*,—one of which is shown detached in side elevation in Fig. 12. These springs are fastened to the upper ends of the standards by bolts or other suitable devices, and at their upper ends, they receive the cross-bar I in openings of suitable shape,—provision being made to prevent end-play in the bar by collars or in any other suitable way. These springs support the bar in a manner that permits it to yield to compensate for any difference in the heights of the conducting wires, as indicated by the dotted lines in Fig. 7. The trolley arms *a* and *o*, which carry the trolley-pulleys *r*, are arranged to slide lengthwise of the bar I in any convenient manner. A socket *b*′ fitting the bar, is provided with a cap *c*′, by which it is secured in place so that it may slide freely lengthwise of the bar,—as indicated by the dotted lines in Fig. 6,—the flexible connections $k'$ $k^2$ permitting the movement. A suitable insulator is provided between the socket *b*′ and the arm X which carries the trolley-pulley *r*. In the construction shown, this insulator consists of the blocks $g'$ $g^2$, of any suitable insulating material, inclosed in a socket V and secured in place by a screw-ring or other suitable device *t*′. A stem $h^2$ on the socket *b*′ extends into the split insulator $g'$ $g^2$,—its upper end being enlarged to fit a correspondingly shaped recess in the insulator. Any other suitable arrangement may be adopted.

In a modified form of the trolley arm, represented in Fig. 10, the requisite yielding motion is provided for by attaching the arm to the bar I so that it can swing thereon. In this case the socket is made round, and consists of two parts, $b^2$ and $c^2$, held together by the sunken screws $e^2$. The arm X is supported on the insulated stem $h^2$ projecting outward from the sleeve V′ which is fitted on the socket $b^2 c^2$ so as to turn freely thereon. The arm is attached to the socket by the spring U, fastened at one end to the stem $h^2$ at $i^2$, and at the other end at $j^2$ to the socket. This spring permits a certain amount of yielding motion in the arm and pulley, so that the latter is maintained all the time in contact with the conducting wire. Provision is made for preventing lateral motion of the sleeve on the socket in any suitable way,—such as a pin inserted in the socket through a slot in the sleeve, which will also act as a stop to limit the movement of the arm.

In order to prevent any accidental contact between the conducting wires and the cross-bar, I support a guard $z$ over the trolley mechanism by means of the arms $l^2$ $l^3$, attached to the standards. This guard may be made of or coated with insulating material, or is supported in insulated sockets $n'$ $n^2$ on the arms $l^2$ $l^3$. The guard may be formed of an iron rod coated with porcelain or other insulating material.

I hereby reserve to myself the right to claim certain features of my invention herein described and shown but not herein specifically claimed, and for such purpose have filed a divisional application, Serial No. 474,854, filed May 20, 1893.

I claim—

1. In an electrical system of canal-boat propulsion, a conducting wire supported over the waterway and arranged to be shifted laterally in accordance with the lateral movement of the boat, substantially as described.

2. In an electrical system of canal-boat propulsion, a power-wire, and a return wire supported over the waterway and arranged to be shifted laterally in accordance with the lateral movement of the boat, substantially as described.

3. The combination, in a system of electrical propulsion, of a waterway, a series of elevated guy-wires arranged at suitable distances apart across the said way, and a laterally movable conducting wire supported by the said guy-wires, substantially as described.

4. The combination, in a system of electrical propulsion, of a waterway, and a double set of laterally movable power and return wires supported parallel to each other lengthwise of the said way, substantially as described.

5. The combination, in a system of electrical propulsion, of a waterway, a double set of laterally movable power and return wires supported parallel to each other lengthwise of said way and an intermediate power wire, substantially as described.

6. The combination, of a waterway, a power wire and a return wire, one or both of said wires being laterally movable relative to said way, a boat fitted for electrical propulsion, and a power trolley and a return trolley, one or both of the said trolleys being laterally adjustable on the said boat, substantially as described.

7. The combination, with a waterway, of a double set of laterally movable power and return conducting wires,—the power wires being located outside the return wires,—and a boat fitted for electrical propulsion, and carrying suitable laterally adjustable power and return trolleys, substantially as described.

8. The combination with a waterway, of a central power wire, suitable laterally movable return wires, arranged one on each side of the central power wire, and a boat fitted for electrical propulsion and carrying suitable laterally adjustable and return trolleys, substantially as described.

9. The combination, with a waterway, of a double set of laterally movable power and return wires,—the power wires being located outside the return wires,—a centrally located power wire, and a boat fitted for electrical propulsion and carrying suitable laterally adjustable power and return trolleys, substantially as described.

10. The combination, with a waterway, of a double set of laterally movable power and return wires,—the power wires being arranged outside the return wires,—and a boat fitted for electrical-propulsion and carrying suitable laterally adjustable power and return trolleys, and a reversing switch between the trolleys and the motor, substantially as described.

11. The combination, with a waterway, of a double set of laterally movable power and return wires,—the power wires being arranged outside the return wires,—a central power wire, and a boat fitted for electrical propulsion and carrying suitable laterally adjustable power and return trolleys, and a reversing switch between the trolleys and the motor, substantially as described.

12. The combination, in a system of electrical propulsion, of laterally movable power and return wires, a boat fitted with an electric motor and a suitable propelling apparatus on the said boat, a cross-bar joining the upper ends of the standards and suitable power and return trolley-arms on the said cross-bar, substantially as described.

13. The combination, in a system of electrical propulsion, of a conducting wire, a boat fitted for electrical propulsion, two pivoted trolley-standards supporting a cross-bar, a trolley arm on the cross-bar, and a suitable insulating guard to prevent contact of the wire with the cross-bar, substantially as described.

14. The combination, in a system of electrical propulsion of a conducting wire, a boat fitted for electrical propulsion, two pivoted

standards carrying a cross-bar, and a yielding trolley arm supported by the cross-bar, substantially as described.

15. The combination, in a system of electrical propulsion, of a laterally movable conducting wire, a boat fitted for electrical propulsion, two pivoted standards, carrying a cross-bar, and a yielding trolley arm supported by the cross-bar, substantially as described.

16. The combination, in a system of electrical propulsion, of a laterally movable conducting wire, a boat fitted for electrical propulsion, two pivoted standards, carrying a cross-bar, and a yielding laterally movable trolley arm, supported by the cross-bar, substantially as described.

17. The combination, in a system of electrical propulsion, of two or more laterally movable conducting wires, a series of transverse guy-wires, travelers on the said wires, and means for maintaining the conductors at suitable distances apart, substantially as described.

18. The combination, in a system of electrical propulsion, of a waterway, a conducting wire, a transverse guy-wire, and a traveler on the guy-wire supporting the conductor by means of an insulated connection, substantially as described.

19. The combination, with the guy-wire G, of the traveler frame *e e'*, one or more grooved pulleys, socket *f*, insulator *g*, and clip *h i*, substantially as described.

20. The combination, with the guy-wire G, of a series of laterally movable electric conductors, suitable travelers on the guy-wire supporting the conductors by insulated connections, and buffers to maintain the conductors at suitable distances apart, substantially as described.

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